PARTICIPATION IN MAMMOGRAPHIC SCREENING IN SOUTH AUSTRALIA

Frida Cheok

A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Department of Public Health
Faculty of Medicine
UNIVERSITY OF ADELAIDE

September 1998

TABLE OF CONTENTS – VOLUME I

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The SA Breast X-Ray Service (SABXRS) is the South Australian component of the National Program for the Early Detection of Breast Cancer (NPEDBC). The NPEDBC set a target of recruiting 70% of women aged between 50 and 69 into the Program within five years. This study examines factors that predict attendance to mammography screening in general, and specifically to the SABXRS, by comparing various groups of attenders and non-attenders. This thesis comprises three components. The main component is a case-control study of SABXRS non-attenders (cases) and attenders (controls) conducted in late 1991/early 1992. Samples were drawn from the two recruitment methods used at the time, spontaneous bookings and personal invitations from general practitioners. Attendance/re-attendance to SABXRS for all cases and controls was examined 4 years later (at 31/12/95). The second component examined attenders and non-attenders following an invitation from the SABXRS for an initial screen (using the electoral roll) or a rescreen. Results are presented at baseline (early 1995) and follow-up 27 months later. The third component examines data from five state community surveys (conducted in 1990, 1991, 1992, 1994 and 1995) and two national community surveys (the National Health Surveys conducted by the Australian Bureau of Statistics in 1989/1990 and 1995).

Overall, the conceptual framework for this thesis was supported. The influence of a doctor was found to have the single most positive effect on participation while perceived barriers had the greatest negative effect. Although commonalities were evident across the studies, significant differences were also found in factors that predict attendance for the various sub-groups studied, both across time and over time. Intentions were found to predict actual behaviour both for the SABXRS and the community samples, but the strength of the association diminished over time. These differences were related to the progression of the Program from initiation to maturity. By 1996, a high proportion of women in the target population were having screening mammograms in Australia, but 10% were occurring outside the National program.

Based on the compilation of the results from the various components of this study, and current trends in initial and rescreens within the Program to the end of 1997, it is concluded that BreastScreen SA will not achieve the target of screening participation rate.

DECLARATION AND CONSENT

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except when due reference has been made in the text.

I consent to this thesis, when deposited in the University Library, being made available for loan and photocopying.

Frida Cheok
September, 1998

ACKNOWLEDGEMENTS

I am greatly indebted to Dr Janet Hiller who guided me through this research and provided invaluable advice and encouragement. I am also grateful to Dr Phil Ryan for his time and advice on statistical issues.

I thank Dr Margaret Dorsch, Director of the South Australian Breast X-Ray Service when this research commenced, for her encouragement and support. I also thank the staff of the SABXRS who assisted in extracting and checking data.

I express my special gratitude to Heather Teakle, project officer for the case-control study. Her professionalism, determination and interest contributed greatly to the quality and success of that study.

I am deeply grateful to Lorraine Rayson who provided support throughout this research, both moral and practical. Initially as a staff member at the SABXRS she demonstrated her outstanding skills in understanding and executing my requests for complex matching and extractions of data. She assisted greatly in the formatting and corrections of the final manuscript, showing remarkable patience and care.

I acknowledge the professionalism and skills of the interviewers. In particular, I am indebted to Margaret Hill, supervisory interviewer for both surveys, who provided support to the interviewers in the field and conducted the more difficult interviews. Her interest in the research and her dedication contributed greatly to the high response rates achieved.

I also am grateful to the women of South Australia who gave up their time to participate in the various surveys. Without their willingness to contribute this research would not have been possible.

I thank my son Adrian for inspiring me with the achievement of his own PhD.

Finally, I thank my son Nicholas for his patience and for being an unfailing source of support and encouragement throughout.

PREFACE

This thesis evolved over a period of a world-wide explosion both in the availability and utilisation of mammography screening and in the accompanying literature about participation to mammography screening. The mammography screening program in South Australia commenced taking mammograms in January 1989, and was known as the South Australian Breast X-Ray Service (SABXRS). The SABXRS together with nine other organised screening services being established around Australia at that time, was included as a pilot program for a national evaluation of mammography screening for Australia, which was conducted by the Australian Institute of Health under the auspices of the Australian Health Ministers' Advisory Council. Following the evaluation of the pilot programs a national screening program was established from July 1991 and known as the National Program for the Early Detection of Breast Cancer (NPEDBC). Since January 1997, the name of the national program has changed to BreastScreen Australia and that of the SABXRS to BreastScreen SA.

The proposal that led to the funding of this study, and the initial draft questionnaire, was guided primarily by overseas research papers published prior to 1990, and two Australian community studies in Melbourne and Sydney. Piloting of the main component of this thesis, a case-control study, commenced in late 1990, with the main study conducted during the latter part of 1991. Variables included in the case-control study were informed by the literature available prior to 1991.

The analysis of this case-control study proved more difficult and time consuming than anticipated. It was found that rather than dealing with two sub-populations differentiated by method of entry into the Service (GP invitation or Spontaneous), the two modes of non-attendance (cancel or fail-to-attend) were also found to represent different groups of women. The need to analyse in detail four groups, rather than two as originally planned presented problems of power due to small sample sizes. Further, because the study included a large number of variables, a two stage process of bivariate analysis followed by a single multivariate model proved unworkable. Following extensive discussions with biostatisticians, it was determined that a filtering process of analysis and reporting of the initial set of variables within the six study constructs would be an appropriate way to proceed. The constructs were based on the theoretical framework developed for this research, as outlined in Chapter 1. Following the analyses by construct, an overall model is presented using variables filtered as significant from the construct analyses.

The original proposal for this research included only the case-control study as the main original research by the investigator. This was to be supplemented by the inclusion of a set of mammography questions in a South Australian community survey (the 'Omnibus' survey conducted in late 1990) and data available from the 1989/90 National Health Survey conducted by Australian Bureau of Statistics.

Also, up to the time when the case-control study was conducted, recruitment of new clients at the SABXRS had been based on generalised strategies and the use of GP lists only. It was not until late 1991 that the Service commenced using the electoral roll to send out personalised invitations, when two new clinics were opened. Before this, very few appointments were available for new clients, as the need arose to re-invite women due for their second screen from early 1991. In fact few electoral roll invitations were issued until later in 1992 after the service caught up with the backlog of clients on a waiting list.

Due to the time lapse resulting from the complexity of the case-control study analysis, it was considered necessary to extend the scope of the thesis, to incorporate new and arising issues. Several additional components were added. Firstly, the literature was again reviewed in 1995, and chapters written up to that point were updated. This required considerable effort due to the magnitude of new publications on mammography screening. It should be noted however, that although the amount of literature had exploded since 1991, it did not change the original hypotheses of this research. Basically, the new literature confirmed the findings of the earlier papers, and the gaps in the research were still largely unresolved. Hence, the variables collected in the case-control study prevailed as factors associated with mammography attendance from the available literature.

Secondly, a number of new components were added to the study, to provide a complete profile of screening mammography, particularly in South Australia, but also an overview of mammography in Australia as a whole. Cases and controls from the original case-control study were followed up regarding mammography attendance/reattendance at the SABXRS by the end of 1995. This resulted in a prospective study of predictors of attendance/reattendance using the data collected at base-line. Part II of this thesis presents the results of the case-control study, including the follow-up study.

Also, by this time, the screening program both in South Australia and Australia was expanding rapidly, and the electoral roll was used as the main method of recruitment to fill appointments not taken up by spontaneous clients and those returning for a rescreen. Meanwhile, the response to electoral roll invitations was falling. As a supplementary component to this thesis, a survey was planned and conducted by the investigator in 1995 of non-attenders to the SABXRS following an electoral roll invitation. In addition, samples of non-attenders to a second invitation for an initial screen and non-attenders to an invitation for a rescreen were surveyed. All three groups of non-attenders were followed up after two years, as well as attenders to the original invitations. These results are presented in Part III.

To provide an up-to-date insight about mammography occurring outside the official screening program, new community surveys were added. Data are presented from five community 'Omnibus' surveys conducted in South Australia from 1990 to 1995, rather than the 1990 survey alone as originally planned. Data are also presented on mammography use from the National Health Surveys conducted by the Australian Bureau of Statistics in 1989/90 as well as 1995. These surveys are reported in Part IV.

The final part of this thesis (Part V) draws together the results from the various components and summarises them within the study framework and its hypotheses. Recent relevant literature is incorporated so that the final discussion and conclusions are made in the context of the updated review. The resulting thesis provides a comprehensive study of participation in mammography screening in South Australia from the pilot phase to maturity and beyond, both inside and outside the formal screening program.

PART I

STUDY BACKGROUND AND OBJECTIVES

CHAPTER 1 BACKGROUND AND LITERATURE REVIEW

1.1 BREAST CANCER

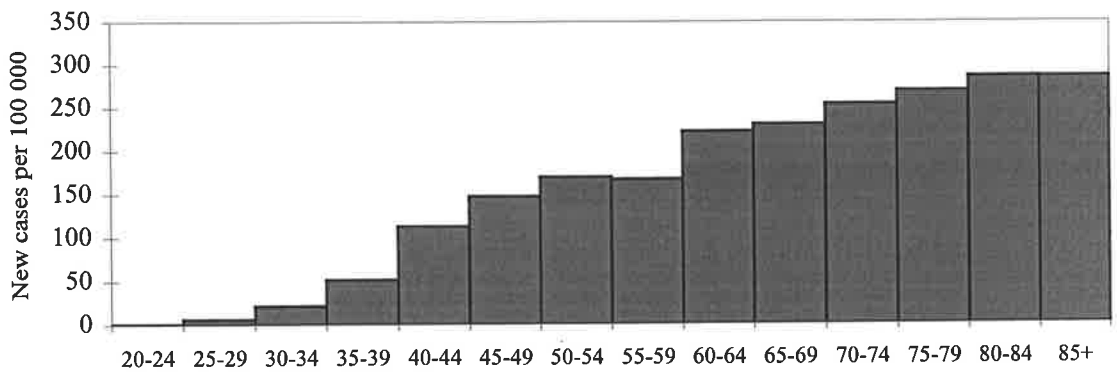
1.1.1 Overview

One in fifteen women in Australia can expect to develop breast cancer during their lifetime (Jelfs*et al.*, 1994). Breast cancer is the most common malignancy in Australian women and the leading cause of death in women aged 45-54 years. Each year, over 6,500 Australian women develop breast cancer, and around 2,500 women die from it. In 1993, 2,641 women died of breast cancer in Australia (Australian Bureau of Statistics, 1994a) (ABS). Breast cancer is two and a half times more common than cancer of the colon, the next most common cancer among Australian women.

Despite technical advances in the treatment of breast cancer, overall survival rates have remained unchanged in the last 50 years (Kearsley, 1986); (Tomatis, 1990). Moreover, survival by clinical stage of detection has not improved either. Controlled clinical trials of various combinations of treatment methods have shown little or no difference in survival (Lundgren, 1988). Further, the death rate from breast cancer has increased world-wide, reflecting an underlying increase in incidence. In Australia breast cancer mortality increased by 13% between 1981 and 1990 (Australian Bureau of Statistics, 1992a).

The incidence of breast cancer rises rapidly with age from the early twenties to about 50 (around menopause), when there is a brief plateau, before it rises again into old age, but at a slower rate of increase (see Figure 1.1.1). This pattern of increase after menopause is a world wide phenomenon, and in some countries, like Japan, the incidence actually flattens after 45-54 years of age (Tomatis, 1990).

Figure 1.1.1 Incidence of breast cancer by age, Australia 1988



Source: Jelfs *et al.*, 1994

High incidence and mortality from breast cancer is a world-wide phenomenon, being the third most common cancer (ranked equal with colorectal cancer), for all persons, after cancers of the lung and stomach (Tomatis, 1990). Overall, cancer of the breast accounts for about 9% of all cancers world-wide, but it strikes predominantly women, making it the most common female cancer. It accounts for nearly 20% of female cancers, but only 0.5% of cancers in males. However, the burden for females varies considerably between nations and between racial groups within nations. In Israel the incidence for Jews is four times that of non-Jews, and in Hawaii there is a marked difference between Hawaiians (high) and Filipinos (low). Regions of the world classified as having "high" incidence rates are North America, Hawaii and Western Europe, where 60-90 new cases per 100,000 women are recorded each year. South America, Eastern Europe and Southern Europe are grouped in the "intermediate" category (40-60 cases per 100,000 per year), and Africa, Asia and Japan in the low category (less than 40 cases per 100,000 per year). The highest recorded annual incidence is for Hawaiian women at 93.9 per 100,000.

The latest available incidence data for Australia (1988) show an age-standardised rate (world standard) of 62.3 per 100,000 women (Jelfs, *et al.*, 1994). By world comparison, this places Australia at the low end of the "high" category. The age-standardised mortality rate for breast cancer in the same year for Australia was 20.7 per 100,000 women. For South Australia the incidence and mortality rates for 1988 were 57.8 and 20.8 respectively.

A more detailed analysis of breast cancer in South Australia is presented below, as more recent data are available for this state.

1.1.2 Breast Cancer in South Australia (SA)

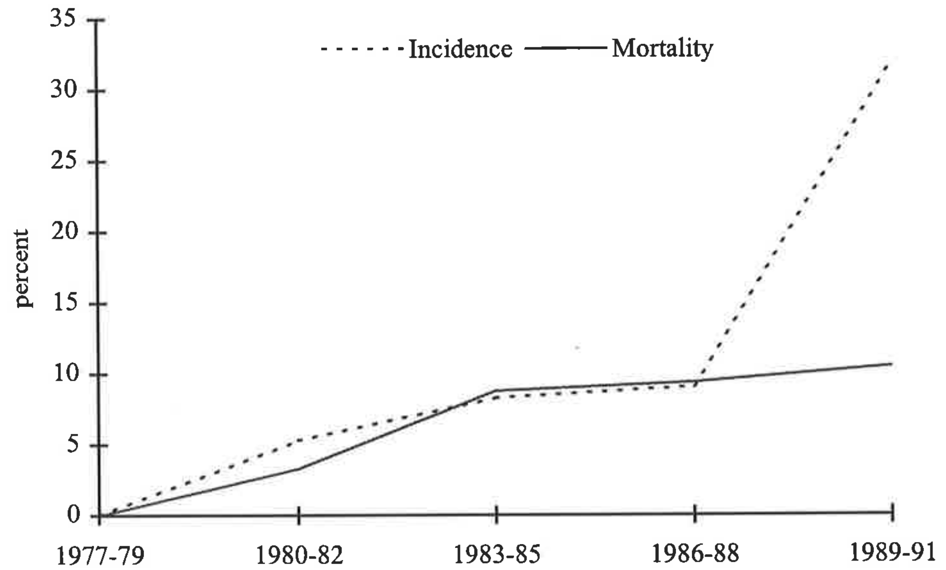
Data presented in this section are derived from the annual reports and other outputs produced by the South Australian Cancer Registry (SACR). The SACR is renowned for its completeness and timeliness, as testified by the fact that data on 1994 cancers were already published in July 1995.

In 1994, there were 808 new cases of breast cancer recorded in South Australia, representing 27% of all cancers notified among females. In the same year there were 229 deaths from breast cancer, representing 19% of cancer deaths in females and making it the leading cause of cancer death. (South Australian Cancer Registry, 1995)

The number of new breast cancers diagnosed increased abruptly in 1989, the year in which the mammographic screening program was introduced in South Australia (SA). The incidence rose from a mean of 549 over the four year period 1985-1988 to 681 in 1989. It plateaued over the next two years, with another sharp increase in 1992; 760, 791 and 808 new breast cancers were diagnosed in 1992, 1993 and 1994 respectively. The increase in 1992 coincides with the screening program's expansion commencing at the end of 1991. Section 1.3.2 describes the development of the mammographic screening program in SA.

As mentioned above, the increases in incidence since 1989 have been largely attributed to the extension of the screening program. The elevations have been particularly marked for women aged 50-69, which is the group targeted by the program. During the early years of mass screening, an artificial temporary increase in incidence is an expected outcome due to the detection of tumours that would otherwise have remained undiagnosed for longer. It is anticipated that mammography screening will begin to have an effect on breast cancer mortality from 1994-95. However, there has also been a real underlying increase in incidence and mortality from breast cancer, a phenomenon noted world wide in western countries. Figure 1.1.2 which shows age-standardised increases in incidence and mortality from breast cancer for the period 1977-1991 demonstrates this phenomenon for SA.

Figure 1.1.2 Female Breast Cancer; increases in age-standardised incidence and mortality compared with 1977-79 baseline rates



Source: South Australian Cancer Registry, 1992a

Between 1977-79 and 1989-1991, there was a 32% increase in the incidence of breast cancer in SA. Most of this increase occurred in 1989-91 (21%), but an increase of 9% was also recorded between the study periods 1977-1979 and 1986-1988, which was most pronounced in women aged 50-64 (43% increase). The mortality rate which increased by 10% (p=0.06) between 1977-79 and 1989-1991 has been attributed to a real increase in underlying incidence. This is similar to increases reported in other western countries. Over the same period, the mortality rate for other female cancers of cervix, uterus and ovary showed decreases of 6.5%, 13.0% and 10.9% respectively. (South Australian Cancer Registry, 1992a)

Comparisons with other common cancer sites in females are represented in Table 1.1.1 using data from the period 1986-88, since the increase in breast cancer incidence since 1988 is artificially inflated. Using data over a three year period smooths out annual fluctuations.

Table 1.1.1 Selected cancer sites: age-standardised mean annual incidence, mortality, and five year survival rates among women in South Australia

Site of cancer	Incidence per 100,000 females* *Year of Diagnosis 1986-88*	Mortality per 100,000 females* *Year of Death 1986-88*	5 year relative survival rate (%) *for women diagnosed in 1985*
Breast	57.5	19.8	74.8
Colon	21.1	9.2	51.9
Lung	13.8	10.7	12.0
Ovary	8.5	5.7	35.3
Uterus (body)	11.0	2.0	78.8
Cervix	10.8	2.3	69.8

* *Standardised to world population*

The age-standardised incidence rate for breast cancer for the period 1986-88 was 57.5, which is 270% higher than the next most common cancer in females - cancer of the colon with an age standardised incidence rate of 21.1.

Despite a comparatively favourable 5 year relative survival rate for breast cancer of about 75%, the mortality rate for breast cancer (19.8) is almost twice the rate of lung cancer, which is the second most common cause of death from cancer (10.7). Yet lung cancer has a very poor 5 year relative survival rate of 12%.

1.2 MAMMOGRAPHIC SCREENING

1.2.1 Options for the Prevention of Breast Cancer

The most significant risk factors for breast cancer are age and gender. The strong association with age is evident from Figure 1.1.1. Over 70% of breast cancers in Australia occur in women who are older than 50, with an annual risk of 1 in 4,700 for women aged 30-34, rising to 1 in 390 for women 70-74. Breast cancer occurs almost exclusively in females. The age-standardised rate for Australian women was 62.3 per 100,000 in 1988 compared with 0.5 per 100,000 males. (Jelfs, *et al.*, 1994).

Risk is also associated with family history, but the association involved is complex and varies according to pattern of disease (number of generations and their relationship), whether it appears in one or both breasts, and age at diagnosis. Overall, the lifetime breast cancer risk of a woman with a first degree relative (mother or sister) who has had breast cancer is about 50%, or 4 times the risk of other women (Tattersall, 1991); (Dawson and Thompson, 1990). However, 85 to 90% of women diagnosed with breast cancer have no close relative with the disease (Morra and Blumberg, 1991).

Prior history of the disease is associated with subsequent risk of developing the disease (Morra and Blumberg, 1991). An increased risk of developing breast cancer has also been associated with a history of benign breast disease, although estimates of relative risk vary widely (Dawson and Thompson, 1990).

Hormonal factors have also been implicated. Early age at menarche and late menopause are positively associated with breast cancer. It has been suggested that the risk is reduced by 20% for each year that menarche is delayed, but the findings have been inconsistent. Women whose menopause occurs before the age of 45 have a 50% less risk than those whose menopause occurs after the age of 55 (Tomatis, 1990). It appears that these factors may be surrogates for the factor 'number of menstrual periods' which has also been linked to an increased risk; women having periods for 40 years or more have two times the risk (Odds Ratio=1.98) of developing breast cancer compared to women who have periods for less than 40 years (Taplin *et al.*, 1990).

Reproductive factors, in particular low parity and age at first full-term pregnancy, are commonly recognised risk factors for breast cancer. A history of lactation is also thought to reduce risk (Dawson and Thompson, 1990). However, this factor is probably related to parity or number of menstrual cycles.

Breast cancer consistently has been found to be more frequent among women of higher socio-economic status. This has been partly attributed to variation in child-bearing history, but this factor does not explain all the difference (Tomatis, 1990). However, survival data from the US shows that while the incidence of breast cancer is higher in the high socio-economic groups, women from low socio-economic groups are twice as likely to die from it (Price, 1994).

Environmental factors have also been implicated as risk factors for breast cancer, as demonstrated by the changes in risk of migrant populations who adopt the rates of the country to which they have moved. The rates of European women who migrate to the USA increase relatively quickly to those of US women, whereas migrants from China and Japan change less rapidly (Tomatis, 1990). It is suggested that this difference may be related to differences in the rate of change in dietary and reproductive behaviours. The convergence of immigrant breast cancer mortality rates to those of the native born population in the destination country was also found in Australia and Canada. This has occurred for both immigrants from originating countries of lower risk and of higher risk, that is, both converged to the rates of the destination country (Kliewer and Smith, 1995). For example, in Australia, the rate for immigrant women from the UK decreased (rate in UK 67.3 per 100,000, rate for UK migrants in Australia 56.7), while the rate for Eastern European women increased (40.1 to 51.5).

In relation to dietary factors, the strongest association has been shown between female breast cancer and a high-fat diet. Obesity has also consistently been linked to breast cancer in post-menopausal women, suggesting a link with a high fat diet. Tomatis (1990, p 208) summarises a number of epidemiological studies (prospective and case-control) on diet and the risk of breast cancer. While an association is evident, the role of diet has not been consistently supported.

A risk factor study was conducted as part of an American Cancer Society's large prospective study which began in 1959. Analysis was conducted of 365,812 white women who were followed for 6 years and did not have breast cancer at entry (Seidman *et al.*, 1982). Ten major risk factors were studied; family history of breast cancer, history of breast operation, early menarche, late menopause, late age at first birth, obesity, marital status, education, alcohol use and religion. The highest relative risk (RR) was 3.5 for women aged 30-54 with a family history who also had two or more of the other risk factors compared with women with none of the risk factors studied. A slightly lower RR was associated with for prior history of breast disease. Most other factors were associated with a RR of 1.8 or less. The study concluded that these ten risk factors combined accounted for 21.1% of "causes" of breast cancer in women aged 30-54, and 29% in women aged 55-84. In other words, all major known risk factors, apart from age, can not account for more than about a quarter of all cases of breast cancer.

In summary, the factors associated with the highest risk, apart from age and sex, are a family or personal history of the disease and hormonal factors. However, these factors are not modifiable. On present evidence, the only well established and potentially modifiable factors for an increased risk of breast cancer are obesity, nulliparity, and a first full-term pregnancy at a relatively late age. It is estimated that about 11% of breast cancers might be prevented by reducing obesity in the population (Tomatis, 1990). Another estimate from the Australian Institute of Health (AIH) predicts that if all women were to reduce their body weight to their ideal weight, and to have at least one full term pregnancy before 25 years, then about 35% of breast cancers could be prevented (Australian Institute of Health, 1990).

Obviously it would be unrealistic to expect such significant behaviour modifications in the population. But, more importantly 75% of breast cancers occur in women with no significant risk factors for the disease, apart from age (Sickles, 1991).

The potential for chemo-prevention of breast cancer is being examined in an international trial, coordinated by the International Breast Cancer Study Group, using Tomoxifen as a possible preventive agent in women with a first degree relative with breast cancer. Three thousand Australian women are enrolled in this trial. However, as indicated above, women with a family history of breast cancer, although at significant risk themselves, account for a relatively small proportion of total breast cancers.

It is evident that primary prevention is not an option for reducing the incidence of breast cancer at this stage. It is also evident that tertiary prevention, which relates to preventive activity aimed at minimising the spread of the disease, is not an option either. As mentioned in Section 1.1.1, improvements in treatment methods over the last 50 years or so have failed to reduce mortality from breast cancer. Further, the case fatality rate has not improved significantly over the period 1977-1990 in South Australia for women aged 55-69; the 5 year survival rate during the period 1977-80 was 73.3% (95% CI, 69.5-77.1) compared with 75.0% (95% CI, 70.7-79.3) for the 1985-90 period. (South Australian Cancer Registry, 1992b) For women aged 40-54 the corresponding survival ratios for the two periods were 74.5 (70.4-78.6) and 81.7 (77.6-85.8). Although, the quality of life of individual women with breast cancer may have improved, due to less invasive treatments, and perhaps increased survival, society as a whole has not benefited. Lundgren (1988) questions the benefit even for individual women. He suggests that some treatment regimens raise ethical questions, and that only marginal benefits in survival are gained from very aggressive treatments. These treatments receive widespread publicity, while the financial and social costs, including quality of life of the patients, are largely ignored. He states that enormous resources have been allocated to improving existing treatment methods and finding new ones, but there has been no breakthrough in this field. Further, he says, the vast majority of patients receive only "intolerable" side-effects and no benefit; while a "barely statistically significant increase in survival .... is hailed as progress."

Since, neither primary nor tertiary prevention is feasible currently, the only possible option is secondary prevention, where disease is detected at a pre-clinical phase. Secondary prevention or screening is only useful if there is a more favourable impact on long term survival by detecting disease, and treating it, at a sufficiently early stage in its natural history. Breast cancer is thought to have a relatively long preclinical phase generally said to be two to three years, during which time a cancer is impalpable and only detectable by mammography (Hamwi, 1990). In 1987 the American Cancer Society reported that the five year survival rate for women with nonlocalised breast cancer was less than 60%, but increased to 91% if detected in a localised stage and approaches 100% if detected in situ (Fox *et al.*, 1987). Data from the Netherlands breast screening trials suggests that the preclinical stage is about two years at age 40 and increases to about five years at age 70 (van Oortmarssen *et al.*, 1990). Given that detection of breast cancer at an early stage does lead to favourable outcomes for women, secondary prevention is certainly an option.

1.2.2 Options for Early Detection

The two most common methods for the early detection of breast cancer used prior to mammography (and still in use) are breast self-examination and physical examination by a doctor. Although these methods have been shown to detect cancer at an earlier stage, neither has demonstrated a reduction in mortality from breast cancer. Nor can these two alternatives detect impalpable cancers, the major requirement before a reduction in mortality is seen (see section 1.2.3).

Other technologies available for early detection of breast cancer include ultrasound, transillumination light scanning, thermography, computerised tomography, magnetic resonance imaging and immunology. None of these compares with mammography at this point in time in terms of efficacy and cost-effectiveness. These other methods suffer, to a varying degree, from problems of low sensitivity and specificity, impracticality of the technique (for example number of views or time required), and lack of evidence on effectiveness from trial data (Isard, 1980); (Sickles, 1987); (Australian Institute of Health, 1990).

The potential of mammography (x-ray examination of the breasts) in visualising breast lesions was first published in 1913 by a German pathologist, Salomon. In the US, Gershon-Cohen and others developed the technique further over a thirty year period starting in the 1930's, and in 1961 reported the potential of mass x-ray surveys to detect early breast cancer. Another American (Egan), working on the technique reported in 1960 that he was able to classify lesions, that had been undetected by a clinician, as malignant through mammography. Others who adapted Egan's technique were able to replicate these results. Meanwhile in Europe a group of radiologists led by Gros, in 1963, reported the potential of mammography in detecting non-palpable breast cancers after investigating a number of techniques for breast diagnosis (Shapiro *et al.*, 1988a).

1.2.3 The Evidence for Mammography Screening

Clinical Trials

The best evidence for determining the value of any procedure is from a randomised clinical trial. The efficacy of mammography screening in detecting breast cancer early, and in reducing mortality, was demonstrated first in a large randomised trial of 62,000 women conducted by the Health Insurance Plan (HIP) of New York. (Shapiro *et al.*, 1971), (Shapiro *et al.*, 1988b). The decision to conduct the trial was strongly influenced by a radiologist in one of the medical groups of HIP who had been successfully testing Egan's technique on small groups of volunteers. The trial commenced in 1963 and offered half the randomised women aged 40-64 both two-view mammography and physical breast examination at yearly intervals for four years. Early results reported in 1971, six years after the trial began, indicated a reduction in breast cancer deaths in the study group compared with the control group. Several years later, the reductions were sustained. After 5 years there were 21% fewer breast cancer deaths in the study group compared with the control group, which increased to 30% after 10 years. Eighteen years after entry to the trial the difference was still 25%. These reductions relate to all women allocated to the study group and not just attenders. Also, despite the relative insensitivity of mammography techniques used, mammography had a significant impact on reducing mortality, and cancers detected by mammography alone tended to be smaller and case fatality rates significantly lower than those detected by physical exam alone or by both examinations. Further, the 10-year mortality rate from all causes of death, excluding breast cancer, was identical in the study and control groups. The HIP trial also shows a reduced mortality (although delayed) for women under 50 which just falls short of statistical significance at 18 years follow up.

On the basis of the early results from the HIP trial, other randomised controlled trials commenced in Sweden and Britain (Edinburgh) and later in Canada. As can be seen from Table 1.2.1 the screening modalities and screening intervals offered in the each of the trials varied. Table 1.2.2 summarises the results of the trials. Separate results are shown for women aged less than 50 as controversy continues about screening women under 50. Also, when the South Australia program was first established these women were not offered screening.

Table 1.2.1 Design of randomised controlled trials of breast cancer screening

Study (year started)	Age at entry (years)	Sample size		Screening modality§	Screening interval (months)
		Study	Control		
HIP[1] (1963)	40-64	30 239	30 756	2-view MM + PE	12
Swedish two-county[2] (1977)	40-74	78 085	56 782	1-view MM	24 (age <50) 33 (age $\geq$50)
Malmo[3] (1976)	45-69	21 088	21 195	2-view MM	18-24
Stockholm[4] (1981)	40-64	39 164	19 943	1-view MM	28
Gothenburg[5] 1982)	40-59	20 724	28 809	2-view MM	18
Edinburgh[6] (1976)	45-64	23 226	21 904	2/1-view MM + PE†	24/12†
Canadian[7] (1980)	40-49	25 214	25 216	2-view MM + PE*	12
	50-59	19 694	19 711	2-view MM + PE*	12

§ MM, mammography; PE, Physical Examination; BSE, breast self-examination
* Control group also had physical exam at entry, then annually only for 50-59 year group.
† 2-view mammography at entry then single-view depending on findings; physical exam every 12 months and mammography every 24 months
[1] Shapiro, 1977; Shapiro, 1989; Shapiro, *et al.*, 1971, Shapiro, *et al.*, 1988b
[2] Tabar and Dean, 1987; Tabar *et al.*, 1985; Tabar *et al.*, 1987; Tabar *et al.*, 1989; Tabar *et al.*, 1992; Tabar *et al.*, 1995
[3] Janzon and Andersson, 1991; Andersson *et al.*, 1988
[4] Frisell *et al.*, 1986, Frisell *et al.*, 1991
[5] Tabar and Dean, 1987
[6] Roberts *et al.*, 1990
[7] Miller *et al.*, 1992a; Miller *et al.*, 1992b

Table 1.2.2 Results of randomised controlled trials of breast cancer screening. Relative risk of breast cancer death in study group compared with control group.

Study	Follow-up (years)	Relative risk (95% confidence interval)	
		All ages	Women aged <50 years at entry
HIP[1]	5	0.62 (0.41-0.91)	0.95 (0.51-1.78)
	10	0.71 (0.55-0.93)	0.77 (0.50-1.16)
	18	0.77 (0.61-0.97)	0.75 (0.52-1.09)
Swedish two-county[2]	6	0.69 (0.51-0.92)	1.26 (0.56-2.84)
	8	0.70 (0.56-0.88)	0.92 (0.52-1.60)
	11	0.71 (0.59-0.88)	1.03 (0.65-1.63)
	13	0.69 (0.57-0.84)	0.87 (0.54-1.41)
Malmo[3]	8.8	0.96 (0.68-1.35)	1.29 (0.74-2.25)†
	11	0.90 (0.67-1.22)	1.08 (0.65-1.79)†
	12*	0.81 (0.62-1.07)	0.51 (0.22-1.17)
Stockholm[4]	7	0.71 (0.40-1.20)	1.09 (0.40-3.00)
	8*	0.80 (0.53-1.22)	1.04 (0.53-2.05)
Gothenburg[5]	7	0.86 (0.54-1.37)	0.73 (0.27-1.97)
All Swedish centres*	7-12	0.76 (0.66-0.87)	0.87 (0.63-1.20)
Edinburgh[6]*	10	0.84 (0.63-1.12)	0.86 (0.41-1.80)
Canadian[7]	7	0.97 (0.62-1.52)‡	1.36 (0.84-2.21)

* Fletcher *et al.*, 1993a (data presented at International Workshop on Screening for Breast Cancer)
† Women <55 at entry
‡ Women 50-59
[1,2,3,4,5,6,7] See bottom of Table 1.2.1

The largest of the randomised trials was the Swedish two-county trial. A reduction of 31% in breast cancer mortality was obtained for all women in the study group compared with the control group after 6 years of follow-up, and after 13 years the reduction was maintained at 31%. As with the HIP trial the overall results are statistically significant, but not those for women under 50.

Other trials have shown similar reductions in breast cancer deaths to the HIP and two-county trials, but the results have not been statistically significant. The Malmo trial, the first of the Swedish trials, reported a 10% reduction in mortality after 11 years of follow-up, but a more recent update showed a 19% reduction after 12 years which fell just short of statistical significance. Some controversy has surrounded the Malmo trial which showed a reduction in mortality of only 4% after 9 years of follow-up. The validity of the results were questioned due to a relatively low compliance among study-group women in taking up the offer of a screening mammogram, while nearly a quarter of the controls obtained a screening mammogram. This poor compliance and treatment crossover led to inadequate statistical power to produce meaningful results. It is notable that results for women in the study group of the Malmo trial are comparable to those of the HIP or Swedish two-county trials, but due to contamination of the control group in the Malmo trial the difference in mortality between the study group and controls was smaller. (Sickles, 1987); (Sickles, 1991)

For the Swedish Stockholm and Gothenburg trials the reductions in mortality were 20% (at 8 years) and 14% (at 7 years) respectively. The Edinburgh trial reported a 17% reduction in mortality after 7 years among women offered screening. Each of these studies showed a lesser reduction, or excess mortality for women under 50.

The Canadian National Breast Screening Study comprises two randomised trials, one for women aged 40-49, and the other for women aged 50-59. Both groups were offered annual screening by mammography and physical examination for five successive years, and for the trial of older women, controls were offered physical exam only. Follow-up data after 7 years showed no benefit for either group. This study has been the subject of considerable controversy regarding study design, implementation problems and poor image quality. Baines (1992) responded to the specific concerns expressed by the American College of Radiology (ACR), suggesting that the criticisms are driven by advocates of screening women in their forties (including the ACR), and that this advocacy is “politically incorrect”. Perhaps the Canadian trial may be more relevant to the Australian program than the randomised trials, as it can be seen as evaluating the effectiveness of offering mammography screening in a normal working environment.

A meta-analysis of all Swedish trials combined reported a statistically significant reduction in mortality of 24% (Fletcher, *et al.*, 1993a). Another meta-analysis by an Australian research group, which combined the HIP, Swedish two-county, Malmo and Edinburgh trials, obtained a statistically significant reduction in mortality of 22% (95% CI 0.10-0.33). This analysis was performed during the evaluation of mammography screening for Australia (Australian Institute of Health, 1990).

In addition to these seven randomised trials, a non-randomised comparison was made between eight districts offering different services for the early detection of breast cancer in the United Kingdom from 1971. Two districts offered screening by mammography and physical examination, two offered training in breast self-examination, and four offered no extra services. After 7 years, women from the two districts offered mammography screening showed a 20% reduction in mortality from breast cancer compared with women from the other six districts, a difference which falls just short of statistical significance (UK Trial of Early Detection of Breast Cancer Group, 1988).

The trials provide substantial evidence for the efficacy of mammography screening in reducing mortality from breast cancer overall. The evidence for women aged 50-69 is particularly convincing, as can be seen from Table 1.2.3 which presents data for the HIP and combined Swedish trials by age group.

Table 1.2.3 **Results of randomised controlled trials of breast cancer screening by age group. Relative risk of breast cancer death in study group compared with control group.**

Study Age at entry	Follow-up (years)	Relative risk (95% confidence interval)
HIP[1]	10	
<50		0.77 (0.50-1.16)
50-59		0.69 (0.46-1.02)
60-64		0.67 (0.34-1.31)
Swedish two-county[2]	13	
40-49		0.87 (0.54-1.41)
50-59		0.66 (0.46-0.93)
60-69		0.60 (0.42-0.82)
70-74		0.79 (0.51-1.22)
Swedish centres combined[1]	12	
40-49		0.87 (0.63-1.20)
50-59		0.71 (0.57-0.90)
60-69		0.71 (0.56-0.91)
70-74		0.94 (0.60-1.46)

[1] Fletcher, *et al.*, 1993a (data presented at International Workshop on Screening for Breast Cancer)
[2] Tabar, *et al.*, 1995

Case-control studies

Three case-control studies have also demonstrated the effectiveness of mammography screening in reducing breast cancer mortality (Table 1.2.4). The relative risk of death from breast cancer for women who were screened relative to those not screened in Nijmegen (Netherlands), Utrecht (Netherlands) and Florence (Italy) was 0.51, 0.30, 0.53 respectively, all three statistically significant (Verbeek *et al.*, 1984); (Collette *et al.*, 1984); (Palli *et al.*, 1986). As with the randomised controlled trials the effect was significant for women over 50 but not for those under 50.

Table 1.2.4 **Study design and results of case-control studies of breast cancer screening by age group. Relative risk of breast cancer death in study group compared with control group.**

Study	Age at entry (years)	Number of cases	Number of controls	Screening modality§ (interval in months)	Relative risk (95% confidence interval)
Nijmegen	35-65	62	310	1-view MM (24)	0.51 (0.26-0.99)
Utrecht	50-64	46	138	MM + PE (12, 18, then 24)	0.30 (0.13-0.70)
Florence	40-70	103	515	2-view MM (about 30)	0.53 (0.33-0.95)

§ MM, mammography; PE, physical examination

Other studies

The Breast Cancer Detection Demonstration Project (BCDDP) in the United States was a prospective study comparing relative survival rates of women with invasive cancers in the study with survival of those diagnosed in the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) program. The study group included over 280,000 women screened by mammography and physical exam in 29 centres from 1973 to 1981. While this was not a randomised trial, the analyses took account of lead-time, length-time, and possible "overdiagnosis" biases. The 5-year and 8-year survival rates were 87% and 81%, respectively, for the BCDDP, compared with 74% and 65% for SEER (Seidman *et al.*, 1987). A high proportion of cancers detected within the program were smaller and localised, with a more favourable prognosis, thus leading to the substantial gains in survival. Of the cancers detected in the program, 42% were found by mammography alone, 9% by physical examination alone, and 47% by both modalities. In particular, mammography alone detected 60% of the localised cancers. These results are impressive given the capabilities of earlier mammography techniques.

Summary of evidence

Mammography is the only means of detecting nonpalpable cancers when they are more likely to be curable. A critical factor contributing to the reductions in mortality for women whose cancers were screen-detected was found to be the size of the lesion; to achieve a substantial reduction in mortality reduction, it was suggested that 50% of screen detected cancers should be less than 15 millimetres in diameter (Tabar, *et al.*, 1992). Another determinant closely related to size is the spread of disease, and these components together are used to stage the disease. Chrvala (1990) reports that the 5-year survival rate of women diagnosed with localised breast cancer is 90%, compared with only 15% for women diagnosed with distant spread of the disease. (Kaufman *et al.*, 1990) report a 98% 5-year survival rate for women with minimal (localised) cancer compared with 10% for women with larger, more advanced cancers with metastasis. The 10-year survival rates are also given at 95% and 2% respectively. Feig (1993) compiled data from a number of sources and graphed survival rates by four pathological stages; minimal carcinoma (less than 1 cm in size with no spread), no nodal involvement, positive axillary nodes and distant metastatic disease. The effect is dramatic. For example, at 20 years almost none of those with metastatic disease survive compared with 23%, 62% and 93% for those with positive nodes, negative nodes and minimal carcinoma.

1.2.4 The Age Debate

Although a few critics, including Skrabanek (1985) in the UK, Wright (1986) in Canada and Bailar (1976) in the US, have argued against all routine mammography screening, there is general universal agreement that women should receive regular mammograms from age 50 for at least 10 years. However the debate continues about the age at which routine screening mammography should commence and cease.

For women over 70, the evidence from the trials is inconclusive due to a lack of power to detect a difference given the small sample sizes available for analysis. While screening would detect a high number of cancers in older women due to the high incidence, other more prevalent competing causes of death substantially dilute the benefits to be gained from screening, and few would argue for routine screening of older women.

The evidence for screening women aged 40-49 is also inconclusive as shown in the previous section. Given that the trials (except the Canadian) were not designed to evaluate the effect of screening women under 50 years of age, it has been argued that the apparent lack of evidence is due to insufficient power. Hence, the combined results have been re-analysed. A meta-analysis of the randomised trials at 7 years of follow-up concluded that there was no evidence (RR = 0.99, CI 0.74-1.32) for a reduction in breast cancer mortality for women under 50 (Elwood *et al.*, 1993). However, the combined data from the five Swedish trials alone show a 13% reduction for women under 50 after 12 years of follow-up, though this is not statistically significant (Fletcher, *et al.*, 1993a). A recent meta-analysis combined the results of the seven randomised trials which included women under 50 (HIP, two-county, Malmo, Stockholm, Gothenburg, Edinburgh and Canada). The estimated relative risk based on 160,000 women followed up over 10 years was 0.95 (CI 0.77-1.18), suggesting no benefit for women under 50 (Glasziou *et al.*, 1995).

Breast cancers are more difficult to detect by mammography in younger women due to denser breast tissue, but there is also evidence that cancers in these younger women may be faster growing (Shapiro, *et al.*, 1988b). In the Nijmegen population screening program, where mammography is offered at two year intervals, it has been reported that the interval cancer rate was twice as high in women aged under 50 compared with older women (Peeters *et al.*, 1989). A more recent re-analysis of the two-county trial by tumour characteristics and interval cancer incidence concludes that the smaller benefit for younger women is due primarily to the rapid development of tumours. On this basis it was recommended that women 40-49 be screened annually to achieve an estimated 19% reduction in breast cancer mortality (Tabar, *et al.*, 1995).

Vigorous debate about screening women in their forties continues. The cost and ethical implications of screening women in their forties are enormous. The National Cancer Institute (NCI) in the US and the National Health and Medical Research Council in Australia have both issued statements to the effect that screening is proven for women aged 50 and over, but not for those under 50. Neither have made recommendations about screening women under 50, whereas in the UK the national screening program is not made available to women under 50.

A large randomised trial to study the effect of offering breast cancer screening at age 40 commenced in the United Kingdom in 1991, with contributions from the NCI in the US, in recognition of the international significance of the trial (Reynolds, 1995). Such a trial could not be launched in the US, or even Australia, given that screening is already widely demanded (and recommended in the US) by women in their forties. The UK screening program is only offered to women aged 50-64, and so far it appears that women from the control group in this new trial are not demanding mammography. It is hoped that this study together with further follow-up and analysis of the other trials will finally resolve the issue of the effectiveness of screening women in their forties.

1.3 IMPLEMENTATION OF MAMMOGRAPHY SCREENING

1.3.1 Implementation of Mammography Screening Internationally

It is now widely accepted internationally that screening by mammography can reduce breast cancer mortality by at least 30% in a population of asymptomatic women aged 50 and over. A review of the randomised control trials and non-randomised studies surmised that "the results to date are convincing enough to justify recommending large-scale mammography screening" (Tabar and Dean, 1987). The World Health Organisation, 1990 International Agency for Research on Cancer publication concluded that "The results (of the trials) demonstrate unequivocally that mortality from breast cancer can be substantially reduced by regular screening" (Tomatis, 1990).

Several countries embarked on mammography screening programs before Australia. However, the recommended guidelines vary about the interval between screens, the number of views taken of each breast, and whether a clinical breast examinations should be routinely conducted as part of the screening test (Table 1.3.1). Recommendations also differ regarding the age group which should be offered screening. Further, although in theory screening involves presumably well women, there is also disagreement about the inclusion of symptomatic women.

Table 1.3.1 Guidelines for Periodic Breast Cancer Screening

	Guidelines for Mammography	Number of views	Inclusion of Clinical Breast Exam
United States	1-2 years for age 40-49; every year for age 50+	2-view	yes
Canada (3 provinces)	2 yearly for ages 50-59	2-view	yes
Iceland	2 yearly for ages 40-69	not stated	no
Netherlands	2 yearly for ages 50-70	2-view 50-55, single-view 55+	no
Sweden	18 months for ages 40-54, 2 yearly for ages 55-75.	2- view 40-54 single-view 50-75	no
United Kingdom	3 yearly for ages 50-64	single-view	no

Source: Shapiro, 1989

Both the US and UK are currently reviewing these original recommendations. In the US the National Cancer Institute now recommends excluding women 40-49 and screening biennially for women aged 50 and over (Cardenosa and Eklund, 1995). However, these recommendations generally have not been supported nor adopted. In the UK, a report on interval cancers from the NHS breast screening program's north western region raised concerns that the three year screening interval is too long (Woodman *et al.*, 1995). The data from this program show that interval cancers after 24 months approach the breast cancer rate in the absence of screening.

1.3.2 The Implementation of Mammography Screening in Australia and South Australia

The National Program for the Early Detection of Breast Cancer in Australia

One of the five priority areas for action in the 1988 Health For All Australians (HFA) report was the prevention of cancer. Cancers specifically targeted were smoking related cancers, breast cancer, cervical cancer and skin cancer (Health Targets and Implementation (Health for All) Committee, 1988). The goal specified in relation to breast cancer was, *to reduce illness and death from breast cancer.* Two specific targets were set: (1) *to reduce the death rate from breast cancer by 25% or more by the year 2005*, and (2) *to increase participation in breast cancer screening to 70% or more of eligible women by the year 1995.* The National Women's Health Policy presented in 1989 (Department of Community Services and Health) also targeted breast cancer as a priority for action.

It was recognised in the original 1988 HFA report that a strategy for achieving the targets for breast cancer was already underway in Australia. Since the effectiveness of mammography in preventing deaths had already been established from overseas trials, a three year evaluation of different methods of delivering mammographic screening had commenced as a joint effort between the Commonwealth and the States under the auspices of the Australian Health Ministers Advisory

Council (AHMAC). The Screening Evaluation Coordination Unit (SECU) had been established at the Australian Institute of Health (AIH) to undertake the evaluation of ten pilot projects around Australia.

The SECU evaluation report concluded that screening mammography could provide benefits to women in Australia in a cost-effective manner and recommended a national program of mammography screening be implemented in Australia. The pilot projects demonstrated that the implementation of mass mammography screening programs was feasible in Australia. It was estimated that a reduction in mortality of 16% could be expected, with a 70% participation rate for women aged 40-69 years, after allowing for deaths in women not targeted, and those who do not participate in screening (Australian Institute of Health, 1990). This would mean over 400 fewer deaths from breast cancer each year. The model used (KNOX) to estimate the effect of screening assumed a 30% reduction in mortality for all women 40-69. More recently the figures have been revised using a different model (MISCAN) with assumptions of an 8% reduction in mortality for women 40-49 and 33% for women 50-69 (Carter *et al.*, 1993). Given that women aged 40-49 are not being targeted in the national program, the overall mortality effect can be expected to be higher than the original 16% estimate, provided high participation is achieved in the 50-69 year age group. The UK has estimated a 25% reduction in breast cancer mortality for women 50-64 invited for screening every three years (Sutton *et al.*, 1994). It should be noted that the SECU evaluation also evaluated cervical screening in Australia and reported a less favourable cost-effectiveness ratio (cost per life-year saved) than for breast cancer (Australian Institute of Health, 1991).

In March 1990, during the national election campaign, the Prime Minister announced that the Commonwealth Government would contribute $64 million over three years towards a National Program for the Early Detection of Breast Cancer (NPEDBC). The program was established in 1991 as a 50:50 cost-shared program between the Commonwealth and the states. Major policy features were specified as follows:-

- Women will be selected of the basis of age alone; in other words symptomatic women are not excluded. (However, at the state level a variation of policies prevail; some states screen out women with symptoms at the appointment-making stage (including South Australia) while others suggest this practice is against national policy.)
- All women aged 40 and over are eligible for screening but recruitment strategies will be targeted at women aged 50-69.
- Screening is offered at two yearly intervals. (Some states have chosen to offer screening at yearly intervals for some women; South Australia for women in their 40's with a strong family history and women with previous breast cancer.)
- Screening will be at minimal or no cost to women, and free of charge to eligible women who would not attend if there was a charge. (All programs currently offer free screening.)
- Screening will employ film screening mammography alone as the principal screening method.
- All women will be screened with two view mammography at the initial screen, but one view may be taken at a subsequent screen if previous mammograms have indicated that two views are not required. (To the investigator's knowledge, all programs continue to take two views at subsequent screens)
- All mammographic films will be read and reported independently by two or more readers, at least one of whom shall be a radiologist.
- The program will take women from screening up to and including histological or cytological diagnosis of breast cancer. (SA does not include open biopsy.)

These specifications still apply. Other features relate to the involvement of women and general practitioners, provision of appropriate and sufficient information, provision of acceptable and accessible services, and follow-up of women with breast cancer.

The ultimate goal of population mammography screening programs is to reduce mortality from breast cancer. The overseas trials have shown that it takes about 5 years before the effect on mortality is evident. Therefore, interim performance measures are required, such as the number and size of cancers detected. The National Program has established a set of standards and guidelines which cover all aspects of the program, from recruitment through to treatment of screen-detected cancers (National Program for the Early Detection of Breast Cancer, 1994a). These include the requirement to detect more than 50 cancers per 10,000 women screened in the first round and more than 20 per 10,000 in subsequent rounds. The recruitment standard is 60% participation by the target group (50-69) by year five of the implementation, reduced in the 1994 guidelines from the original 70%, but the ultimate aim remains 70% participation. All participating screening and associated assessment centres are required to meet these standards in order to be accredited; funding from the Commonwealth is dependent on accreditation. After initial accreditation, assessment for re-accreditation is required every two years.

The national program has been extended for another five years with a budget allocation for 1994/95 - 1998/99 of $467M, comprising $237M from the Commonwealth and $230M from the states. A recent report from the Commonwealth Department of Human Services and Health (1994) endorsed the role of the NPEDBC in achieving the target of a 10% breast cancer mortality reduction for women aged 50-74 by the year 2000.

A senate inquiry has investigated the implementation of breast cancer screening and treatment of breast cancer in Australia (Senate Standing Committee, 1994). This endorsed the continuation of the NPEDBC, while the second addressed the issue of ensuring adequate treatment facilities are available to manage the additional diagnostic and treatment requirements. As a result of these inquiries the Commonwealth Government established the NHMRC National Breast Cancer Centre (contract awarded to the New South Wales Cancer Council in November, 1994) to improve breast cancer control by translating research into action, and the Kathleen Cuningham Foundation for Breast Cancer Research to provide funding for research into breast cancer. These initiatives are indicative of the high political profile of breast cancer in Australia.

This thesis focuses on the targeted population (50-69) in the Australian official screening program, and specifically on the South Australian program. It should be noted however, that while the individual state programs agree that women aged 70 and over should not be encouraged to continue with regular screening, the state policies regarding women in their 40s vary.

The South Australian Breast X-Ray Service

In South Australia a ministerial task force was appointed in 1987 to investigate Gynaecological Cancer and Breast Cancer in Women. This task force reported in late 1988, recommending that a statewide mammographic program be established for women aged 50-64 years, with screening at two year intervals (South Australian Task Force on Breast Cancer in women and gynaecological cancer, 1988). A pilot screening program was established, the South Australian Breast X-Ray

Service (SABXRS), which commenced screening in January 1989, offering two-view mammography to asymptomatic women aged 50-64 years. The SABXRS became one of the ten pilot projects that were being evaluated by SECU. The Commonwealth provided minimum funds for the evaluation component only, while the State covered the full costs of screening. The Service commenced operations with three half-time clinics located in three of the major teaching hospitals in Adelaide, with an annual capacity of around 12,000 screens.

In October 1990, the SABXRS was the first to agree to join other pilot screening programs from around Australia in the first phase of a national screening program. In accordance with the national policy, the age of entry into the program was reduced to 40 and the target population became women aged 50-69. Although the national policy states that entry should be based on age alone, South Australia continues to exclude women with breast lumps, a nipple discharge or a past history of breast cancer; these women are counselled by a specially trained nurse or doctor who recommends and advises them about diagnostic services.

By mid-1995 the SABXRS increased its annual screening capacity to 55,000 women. In Adelaide screening is offered at four full-time dedicated community-based screening units, each with a capacity of 9,600 screens per year, one located in the city centre (targeting women from the near city and eastern suburbs), and the other three in the western, southern and northern areas. Women living in areas of South Australia outside the Adelaide region are offered screening from two dedicated full-time mobile units, each with a capacity of about 6,000 screens per year, except for one town on the eastern border of the State where screening is offered on a continuous basis from the local hospital. Each mobile unit has a predetermined itinerary, and visits each location (which services a specified catchment area) on a two year cycle. The country locations were chosen on the basis of population in the target group and accessibility for women travelling within the region. In deciding on the number of locations, access (the distance it is reasonable for women to travel) was weighed against the cost of frequent moves in terms of lost screening time as well as monetary costs.

Follow-up of screen-detected abnormalities is carried out at the purpose-built assessment centre in Adelaide, which operates as a screening centre when not used for assessment sessions (about half-time). Women screened on the mobile unit usually return to the unit for further mammographic work-up, but are required to attend the assessment centre in Adelaide if further tests are required. Women screened in Adelaide proceed direct to the assessment centre for follow-up, where procedures up to and including cytological diagnosis are carried out, all on the same day. Women requiring open biopsy are referred elsewhere.

The structure of the SA program differs significantly from other states. All states have a coordination unit which defines state policies and is responsible for the implementation of the NPEDBC in the state. In the larger states (New South Wales, Victoria and Queensland) the coordination unit plays no role in direct service provision; a number of separate services provide screening, film reading, assessment, and data and record keeping functions for defined populations within the state. The Tasmanian coordination unit also does not provide direct screening and assessment of women, but maintains the data and record keeping functions. However, in South Australia the one service coordinates and provides screening and assessment to all women in the state. In Western Australia the coordination unit provides screening, but contracts assessment.

Also, while other states established pilot projects in localised areas, in SA a statewide service was offered from the outset. In other states, only women from a localised catchment area were offered screening, and significant effort was concentrated on achieving high participation in those areas. These pilots were important in testing various recruitment strategies (see section 1.5). However, because the SA program was established as a statewide service from the outset, the infrastructure was in place to allow rapid expansion after the national program was announced. The rate of increase in women screened through the program in this state has been considerably greater than in other states. SA is ahead of all other States in the proportion of the target population screened at this point in time (1995).

1.4 REQUIREMENTS OF SUCCESSFUL SCREENING PROGRAMS

1.4.1 Criteria for Success

Wilson and Junger (1968) developed ten criteria for the World Health Organisation (WHO) to assess the suitability of a screening modality before screening programs are implemented: (1) the condition is an important health problem, (2) the natural history of the disease is well understood, (3) there is a recognisable early stage, (4) treatment at an early stage is more beneficial than at a later stage, (5) a suitable test exists, (6) the test is acceptable, (7) adequate facilities exist for diagnosis and treatment of abnormalities detected, (8) the screening interval is determined by the natural history of the disease, (9) the chance of physical or psychological harm is less than the benefit, and, (10) the benefits outweigh the costs. The SECU report in its evaluation of the feasibility of mammography screening in Australia had addressed each of these criteria (Australian Institute of Health, 1990). An analysis of screening for a range of cancer sites by Miller (1989), suggests that population screening is only justifiable for the sites of breast and cervix uterus world-wide, and for stomach in Japan only.

The evaluation of the success of screening programs should not end at the pre-implementation stage. There should be continued assessment to ensure the criteria continue to be satisfied. Arroll (1990) points out that screening for a disease at an early stage is an attractive proposition for both doctor and patient, but may be a “double edged sword”. A conflict can exist for a doctor when individuals request screening, even when the test is not considered efficacious, for example when confronted by a high risk individual or the fear of litigation. This creates a dilemma for doctors, but even where mass screening is recommended, Arroll suggests clinical practices should not encourage the utilisation of screening unless certain conditions are satisfied. Although he refers to individual clinicians or practices, which is the basis for implementation of the screening recommendations in the US, the rationale applies equally to all screening programs regardless of organisational structure. He summarises the seven criteria for assessing the success of a screening program.

1. importance of the problem
2. whether there is a randomised controlled trial
3. accepted treatment
4. suitable test
5. facilities for diagnosis and treatment
6. high participation rate
7. cost and benefit

It is evident that these closely reflect the WHO criteria. The only new criteria relates to participation, which is critical to the success of implemented programs. The WHO criteria of acceptability of a test is a measure of likely participation, but even if a test is acceptable, it does not necessarily mean it will be utilised. Low response may invalidate the effectiveness of screening programs.

In relation to breast cancer screening, earlier sections show that criteria 1 to 5 above have been satisfied; breast cancer is an important problem, randomised controlled trials have been conducted, treatment is available, a suitable test exists, facilities have been established for the diagnosis (*and treatment*) of the disease. For criterion 5, some concern has been expressed regarding treatment facilities, and it has been the subject of a senate inquiry in Australia, as mentioned above. Criterion 7 on cost-effectiveness for Australia was addressed in the SECU report (Australian Institute of Health, 1990) and again in 1993 by Carter *et al.*, (1993) who determined that "screening all women aged 50 to 69 every two to three years is reasonable value for money in Australia". The remaining criterion relating to a high participation rate is the subject of this thesis.

Even if a screening test initially is judged to be suitable for population screening, monitoring procedures should be in place to evaluate these criteria on an ongoing basis. Serious consideration should be given to disbanding programs if the problem is no longer important, performance does not measure up against the results from the trials, better alternate tests and treatments become available, facilities do not expand in line with screening levels, participation rates are low or the costs outweigh the benefits. A critical factor in ensuring success and the ability to satisfy the above criteria appears to be organisation.

1.4.2 Organisation in Screening

Warren (1988), who is involved in the debate about introducing mass screening in the UK warns that "if we do not intend to succeed we should not start". She is concerned that the haste to introduce screening without sufficient planning and resources will result in its failure.

Miller (1989), who analysed a range of cancer sites against the WHO criteria, emphasised that, even if the criteria are satisfied, screening will only make a contribution to reduction in mortality in organised programs with high coverage of the eligible population.

Forrest, the major instigator of mammography screening in the UK, states that the two determinants of the success of screening programs is quality at all stages and high participation, but these can only be achieved with "meticulous organisation" (Forrest and Aitken, 1990).

The importance of quality assurance at all stages is critical to the detection of small cancers, including technical quality of equipment and expertise of personnel. Costanza *et al.*, (1991) warn that with the introduction of third-party reimbursement in the US, combined with the National Cancer Institute calling on all women 50 years and over to have annual mammograms, there is a risk "the mammography system may become totally volume driven without quality control". An economic analysis determined that there was an excess supply of mammography machines in the United States, which apart from increasing the cost per mammogram, may also compromise quality; a report from the General Accounting Office in the US found that high volume screening facilities were significantly more likely to adhere to quality standards (Brown *et al.*, 1990). In the United Kingdom, the Royal College of Radiologists who were called upon to comment on the "Forrest Report" on breast cancer screening presented to the Health Ministers of England, Scotland and Northern Ireland in 1986, insisted that the rate of growth must not outstrip the rate of training of skilled personnel (Wright, 1991).

Forrest's second determinant of the success of screening programs (high participation), is also noted by Tabar *et al.*, (1992) in reporting on the two-county trial. The authors state that while individual women may benefit from mammography, a population effect will not be achieved without high participation. Individual women who are screened regularly can expect about a 60% reduction in risk of death from breast cancer (Australian Institute of Health, 1990). However, at the population level, the benefit of mammography in reducing breast cancer mortality is related to participation by the age group that will benefit most. A survey of women aged 18 to 64 in Italy concluded that 'unplanned screening programs produce a high use of mammography in the wrong age groups" (Perucci *et al.*, 1990).

The need for highly organised programs to gain high participation has been demonstrated in the mammography screening trials. The attendance rates achieved is discussed below in section 1.4.4. However, first the example of cervix screening is used to demonstrate poignantly the link between the success of screening, attendance and organisation.

1.4.3 Cervix Screening: an Example of the Role of Organisation and Attendance

The example of screening for cervical cancer provides strong evidence of the importance of both high attendance levels and good organisation. The efficacy of cervical cancer screening was never proven in a randomised controlled trial. Given the wide diffusion of the technique around the world it is not possible to conduct such a trial.

A study was carried out to assess the influence of attendance on health effects and cost-effectiveness of cervical cancer screening programs in the Netherlands (Koopmanschap *et al.*, 1990). Three screening settings were modelled (organised screening only, spontaneous screening only, and a combination of organised and spontaneous screening), as well as alternative policies regarding screening intervals for the organised programs. The analysis showed that an increase in attendance induces a substantial rise in health effects coupled with a less than proportionate rise in costs, thus improving the cost-effectiveness. The analysis also showed that a greater increase in effectiveness (number of life-years saved) was achieved by encouraging more women to attend than by inviting the same women to attend more often. Further, organised screening was found to be more effective than spontaneous screening, as the latter is characterised by high coverage of younger women and low coverage of middle-aged and older women who have are at higher risk of developing cervical cancer. This study used the same computer model (MISCAN) that was used to estimate the effects of breast cancer screening in Australia (Carter, *et al.*, 1993).

Another evaluation of the mortality reduction from cervical cancer in the Nordic countries found a direct relationship between the level of reduction and the extent and intensity of organisation of the screening programs, which in turn, was related to participation, especially of targeted women (Laara *et al.*, 1987). Over the period 1965-1982, the greatest mortality reduction was in Iceland (80%), which also had the widest population coverage; it had implemented a nationwide program, and reached an 80% compliance of all women aged 25-69 by 1969. Finland and Sweden also implemented nationwide programs with target populations aged 30-55 and 30-49 respectively. Finland achieved 75% compliance by 1970 and Sweden 70% by 1973; mortality fell by 50% and 34% respectively. In Denmark where 40% of women aged 30-50 were covered by organised screening, mortality fell by 25%, and in Norway, where only 5% of women covered by organised programs, mortality reduction was only 10%. Except in Iceland, spontaneous screening is available to women outside the organised screening programs; in Finland and Sweden it is estimated that since about 1970 only 20-25% of smears were taken within organised programs, and in Denmark the proportion is even smaller. In Norway, which has no organised program, it is believed that the actual number of smears taken per woman in the 1970's was similar to that in Finland (spontaneous and organised combined), yet the reductions in mortality are vastly different. The implication is that spontaneous screening does not capture the population that would benefit most - middle aged and older women.

The evidence above clearly demonstrates that for screening to be effective there must be high participation in the target population, which the cervix screening experience shows can only be achieved in organised screening programs. Habbema and van Oortmarssen (1994) conclude from the cervix experience that opportunistic screening outside formal organised programs is inefficient, because women who seek it are too young and receive screening too frequently. Potentially quality issues may also arise in the absence of organised quality assurance measures being in place.

1.4.4 The Role Of Attendance In Mammography Screening

In reporting the results from the randomised control trials from the United States, Sweden and the United Kingdom, the link between high participation rates and improved efficacy and cost-effectiveness of mammography screening has been emphasised (Sickles *et al.*, 1986); (McLelland, 1987); (UK Trial of Early Detection of Breast Cancer Group, 1988); (Tabar, *et al.*, 1992). Participation rates from the trials are summarised below in Table 1.4.1.

Table 1.4.1 Attendance at first and second round of screening for clinical breast cancer trials

Study	Percent screened at first round	Percent screened at second round
HIP	67	80 of 1st round
Swedish two-county	89	83 of study group
Malmo	74	70 of study group
Stockholm	81	80 of study group
Gothenburg	84	not stated
Edinburgh*	61	55 of study group
Canadian	not applicable*	
UK	60 / 72†	not stated

* Study design included randomisation after initial physical examination, therefore virtually all had first screen.

† Attendance for Edinburgh / Guildford

The highest rate of attendance to the first round of screening was achieved in the two-county trial (89%) with a subsequent attendance rate for the second screening round of 83%. Even outside this trial, the Swedish population screening program has achieved high participation rates, for example with an 82% attendance following invitation for women around Gotenborg, and 87% in Uppsala County. Similar rates to the two-county trial have been achieved in Finland and Spain. The Nijmegen and Utrecht programs achieved participation rates of 85% and 72% respectively. (Tabar, *et al.*, 1985); (Tabar and Dean, 1987); (Tabar, *et al.*, 1987); (Tabar, *et al.*, 1992); (Vernon *et al.*, 1990); (Regner, 1990); (Thurfjell and Lindgren, 1994).

It is apparent that the highest participation rates have been achieved in countries using central population registers for recruitment. Individuals involved in the two-county trial acknowledge that "in countries with a population registry, it is easier to reach the women at risk and achieve the necessary high compliance rate" (Tabar, *et al.*, 1992). However, the authors note that "even without a central population registry, reasonably high rates have been achieved in well-organised centres in the United Kingdom and the United States".

In the UK, the two centres offering screening as part of the initial trial, Edinburgh and Guilford, obtained participation rates of 60% and 72% respectively, using general practitioner lists to generate personal invitations (UK Trial of Early Detection of Breast Cancer Group, 1988). Outside the trial a 74% and 75% response rate was reported for two mobile services in the UK (Williams and Vessey, 1990). However, low rates have been reported in other programs, such as 42% attendance to an inner London service (Sutton, *et al.*, 1994). Overall compliance in the UK is lower in socially deprived areas (Fallowfield *et al.*, 1990).

In the US a 67% response rate was obtained in the HIP trial where women in the study were members of the Health Insurance Plan of Greater New York. Elsewhere in the US where organised screening has been offered to defined populations of women belonging to Health Maintenance Organisations or at worksites, participation rates have ranged from 25 to 64% (Vernon, *et al.*, 1990).

1.5 RECRUITMENT STRATEGIES AIMED AT ENCOURAGING ATTENDANCE

1.5.1 Overview

A number of studies which evaluate various recruitment strategies are summarised in Appendix A. Overall, personalised recruitment strategies are recommended internationally, based on the participation rates obtained in the trials, and further studies summarised here.

Studies from Melbourne and Sydney in Australia, show that while invitations from a general practitioner (GP) achieve a higher participation than those sent direct from the screening service, the difference is modest. In Melbourne, GP recommendation resulted in a 41% response compared with 31% to 44% from service invitations, depending on the amount of effort put into follow-up (Cockburn *et al.*, 1990); (Hurley *et al.*, 1992). GP invitation without follow-up in the Sydney study achieved a participation rate of 32% compared with 33% for invitations from the service without follow-up (Irwig *et al.*, 1990); (Turnbull *et al.*, 1991). Follow-up by reminder letter of the GP invited group resulted in a further 18% response. In Adelaide, GP invitations yielded a 69% response (Dorsch *et al.*, 1991). However, the Adelaide trial was not randomised and participating GPs were generally supportive of the SABXRS. Around the same time, service direct invitations were returning a 75% response (see Chapter 2, 2.1.2). Service direct invitations in Adelaide, Melbourne and Sydney used the names of women in the target population obtained from the electoral roll. However, there has been a noticeable drop-off in response over time to service direct invitations in South Australia, to 54% in 1992 and 48% in 1993.

In Australia, the results obtained from personalised invitations have been demonstrated to exceed by far those from generalised strategies. In Melbourne, the measured effect on recruitment from three methods of generalised publicity was shown to be minimal (Hurley, *et al.*, 1992). Specific studies in Sydney of letterbox drops and invitations for friends of screened women found no direct effect (Turnbull and Irwig, 1992).

A workshop on mammographic screening recruitment strategies during the Australian pilot program phase concluded that "a single broad-based recruitment plan for the whole nation would not be feasible. Individualised strategies tailored to specific groups and areas are required" (Australian Cancer Society, 1990).

In New Zealand an invitation from the service that included a letter of support from the woman's GP yielded a response of 56% without follow-up, compared with 43% if the GP letter was excluded (Richardson *et al.*, 1994). Results from one study in Canada indicate a 50% participation rate to GP invitations (Bass *et al.*, 1994). The Canadian National Breast Screening Study which used a variety of recruitment strategies, concluded that personal letters of invitation, preferably with telephone follow-up, are an important supplement to generalised strategies, and an "ideal way to ensure a steady and controlled flow of entrants to a screening program" (Baines *et al.*, 1989).

Invitations from GPs in the UK result in about a 75% uptake (Haiart *et al.*, 1990); (Hobbs *et al.*, 1990); (Williams and Vessey, 1990). In contrast generalised publicity has been reported as achieving a 19% participation rate in women 50-64 in the towns in Edinburgh that relied on opportunistic appointment making. In Aylesbury Vale 28% of women 45-64 were screened in the two year period before the mailing of invitations. It should be noted that these response rates cannot be attributed directly to generalised publicity, as a significant proportion of women would have made the appointment on the recommendation of their doctor or as a result of other recruitment methods. Where the effect directly attributable to generalised publicity has been measured, the results have been disappointing, as in the Australian study reported above. Another study in the UK, while not measuring the effect on participation directly, reported that a publicity campaign over 10 years had little effect on women's knowledge about breast cancer (Waters and Nichols, 1982). The other method evaluated in the UK is that of letterbox drops (Haiart, *et al.*, 1990), which showed no effect, as was the case in Australia.

All the studies reported above relate to recruitment to national mammography screening programs. In the US, mammography screening has not been implemented as a national program. Rather, it is offered through a variety of establishments, usually linked to health insurance (for example, workplace or health maintenance organisations). Most studies on the effect of recruitment strategies have measured the overall effect following a period of intensive campaigning involving a range of strategies. Two randomised controlled trials are listed in Appendix A where intervention towns receiving the campaigning were compared with control towns with no campaigning. One found a statistically significant difference between the intervention and control groups in the proportion of women receiving a mammogram (Fletcher *et al.*, 1993b), while the other found no difference (Zapka *et al.*, 1993). Another intervention strategy which compared various types of mail out material, found no benefit from material designed specifically to encourage mammography (Bastani *et al.*, 1994). However, the offer of an incentive coupon was shown to have a significant impact (Mayer and Kellogg, 1989). In the US, as elsewhere around the world, a positive effect is shown for GP intervention (Nattinger *et al.*, 1989). Further, the conclusion that generalised strategies have only a limited impact is confirmed in the US. One study concluded that mass media, though effective in the short term, was too expensive for routine use, and recommended bulk mailings to targeted populations as the most cost-effective recruitment method (Rubin *et al.*, 1990). An intervention study using comprehensive community education in one community only, concluded that it had little impact, since participation also increased to comparable levels in the control community (Zapka, *et al.*, 1993). Further, it is suggested that reverse targeting occurs with projects aimed to attract women through media promotion, that is, groups most in need of screening mammography are least likely to respond (Roetzheim *et al.*, 1992).

It has been shown that specific news events can have an impact on participation, but the effect is short-term. A study was underway in the US on mammography use when it was announced that ex First Lady, Nancy Reagan, had breast cancer. In the period immediately after, there was a significant increase in women who had heard of mammography and who intended to have a mammogram (Stoddard *et al.*, 1990). The effect of this event on increased participation was also reported across all states in the US (Heath *et al.*, 1989). At the SABXRS, there was a doubling of appointments when it was announced that Australian singer Olivia Newton-John had breast cancer, but the impact was evident for only 2-3 days. Clearly, the effect of such events is short term as reported in the US and from personal experience in the Australian program.

Although generalised recruitment campaigns are useful in increasing the level of awareness about screening in the community, they cannot be relied on to achieve the level of participation required to achieve the ultimate objective of reducing deaths from breast cancer. Hence, screening programs need to find other cost-effective ways of achieving high participation.

Clearly, personalised invitations to women offer the greatest return in terms of subsequent participation, particularly if women who do not respond to the first letter are followed up. However, it is important to consider the cost of various strategies as well as outcomes in terms of participation rates. The study by Hurley *et al.*, (1992) found that the highest participation rate (44%) was achieved with a personalised invitation that included a specified appointment time followed by a reminder letter. However, this option cost $19.99 per woman recruited. The most cost-effective option at $10.52 per woman recruited was a personalised invitation without a specified appointment time followed by a reminder letter, which achieved a 36% participation rate. The additional cost of the former option arises from the cost of reserving an appointment for women that do not attend. These could possibly be reduced by double-booking some appointments, but while an average rate of missed appointment could be determined, the effect on daily operations is unpredictable. The SABXRS has abandoned the use of a letter with a specific appointment time for this reason.

1.5.2 The Need for Population Registers

It is universally recognised that to be effective population screening programs need to use some form of population register to recruit women, given that generalised strategies alone cannot achieve the required level of recruitment. The best participation rates have been obtained in countries which use up-to-date registers with good population coverage. In Sweden, recruitment is based on the national population register, which is updated weekly. The Finnish program also uses a national population register, and in the Netherlands, municipal population registers are used. In the US, the main method of recruitment based on the literature, appears to be personalised invitations to women registered with health insurance groups.

In the United Kingdom women are identified from Family Practitioner Committee Registers (UK Trial of Early Detection of Breast Cancer Group, 1988). However, these registers have been reported as grossly inaccurate and a threat to the success of the screening program. The level of inaccuracy has been found to increase with age, partly explained by increased mortality, but also for reasons applying to other age groups such as change of address (Bowling and Jacobson, 1989); (Calnan *et al.*, 1985). This is particularly relevant to mammography screening. Bowling and Jacobson (1989) predict that the "breast screening program, like the cervical screening program before it, will fail unless this problem *(of inaccurate lists*) is solved". Fallowfield *et al.*, (1990) also asserted that the situation with the registers needed urgent attention, and attributed the low response of only 8% to a mail survey of non-attenders to screening partly to this problem.

Further, it should be noted that although reasonably high response rates are often reported in the UK, these are calculated on the basis of presumed delivered letters only, excluding those returned unopened. One service in the UK reported that 9.2% of letters were returned unopened (Williams and Vessey, 1990). An inner city service in London found that 15% of letters were returned unopened. Follow-up of non-responders (excluding those whose letters were returned), found that a further 20% had moved or the address was not found. Thus a total of 35% of women did not receive invitations due to inaccuracies in the family practitioner lists (McEwen*et al.*, 1989). The problem of registers in the UK has also been reported for other forms of screening; in a study which used GP registers to send letters for cervical screening in London, nearly one third of the letters were returned by the post office (Shroff *et al.*, 1988). A more recent study (Sutton, *et al.*, 1994) also obtained a low response of 36% to a postal survey, mailing forms to half the women from family practitioner lists who were due for screening. The other half were checked against the electoral register first, resulting in no match for 24% of the names. Unfortunately, it appears that this problem may not have been accorded the necessary priority.

In Australia, there is no readily accessible register of all eligible women. The Health Insurance Commission Medicare file is the most complete population register. It contains the names of all persons in Australia who have registered with Medicare. The extent of inaccuracies in addresses is unknown; a person's address is checked when a claim is made, but this excludes persons who have not made a recent claim, or whose doctors bulk-bill. Another known problem with the register is its overcoverage resulting from the inclusion of deceased persons; 102% of the resident population registered on June 30, 1989 (*pers comm*). The provision of the Medicare database to a third person is prohibited by section 130 of the Health Insurance Act 1973, except in the public interest. It is unlikely to become available for recruitment purposes to the screening program in the foreseeable future.

The electoral roll is a register of Australian citizens aged 17 and over, as well as some British citizens who are eligible to vote. The roll is updated on the basis of deaths, and citizens are required by law to notify the Electoral Commission of a change of address within one month. An evaluation of responses using the electoral roll at one of the pilot screening programs in Victoria, Australia estimated that only 6.5% of the addresses on the electoral roll were incorrect for women in the target age group of 50-69 years (Hurley, 1990). The main problem in using the electoral roll relates to coverage, particularly in its under-representation of non-English-speaking persons who are not citizens. The failure of young persons to register is not an issue for screening programs, while the problem of the inclusion of deceased persons can be minimised by matching against the Registry of Births, Deaths and Marriages. Names and addresses from the electoral roll are publicly available, but for recruitment purposes, the date of birth is also required. Until recently, the Electoral Commissioner at the national level prohibited the provision of birthdate to the national screening program, under the Privacy Act 1988. This caused some anguish, especially for the states that were unable to receive the information through their state electoral offices. Fortunately the information is now available nationally, following the Privacy Commissioner's approval under guidelines prepared by the National Health and Medical Research Council for the protection of privacy in the conduct of medical research.

The use of General Practitioner records have been trialed in a number of services in Australia, including the SABXRS. Although the SABXRS achieved a high attendance rate from this method (Dorsch, *et al.*, 1991), these registers alone, would not be adequate due to problems of inaccuracy and coverage. Even in the UK which has a nationalised primary health care system, these GP registers have been demonstrated to be very problematic for the screening services which rely on them.

No single register will ensure that all women are reached in Australia, although at this stage it appears that the electoral roll will form the basis of recruitment. It is most fortunate that approval has been granted to use the electoral roll, because without access to the Medicare database, the national program would have been in an extremely difficult position. Even so a multiplicity of registers and recruitment methods will be required to target women not on the electoral roll or who do not respond to calls based on their identification from the electoral roll.

1.6 THE NEED TO STUDY FACTORS ASSOCIATED WITH PARTICIPATION IN MAMMOGRAPHY SCREENING

To achieve the results gained in the randomised controlled trials it is critical that the attendance rate is high. The ultimate aim of introducing population mammography screening is to reduce mortality from breast cancer but, it is some years before this can be measured. In the interim other outcome measures, as determined from the clinical trials, should be monitored. These include the rate, size and stage of cancers detected, the incidence of interval cancers and the participation rate. As stated by Day *et al.*, (1989), the rationale for measuring compliance is that "mortality reduction is directly related to percent compliance".

An international workshop determined that in order to evaluate screening services, information was required on who is being reached and at what rate, how women are being reached and what effect facilitating factors and barriers have on participation in screening (Shapiro, 1989).

Despite the availability of mass screening to women in some parts of the US and the UK, overall breast cancer mortality has not declined (Table 1.6.1). It has been alleged that one of the main contributing factors to the failure of mammographic screening has been low participation (McLelland, 1990); (Fink, 1989). In the US, the Surveillance, Epidemiology and End Results (SEER) program of the National Cancer Institute has collected population-based data on incidence and mortality of cancer since 1973. The adjusted mortality rates from breast cancer have remained constant to 1989, with little change since 1930 provoking "concern and pessimism about the health impact of both prevention and treatment advances" (Newcomb and Lantz, 1993). However, these authors suggest that this concern may be premature since widespread use of mammography did not occur until 1985-1987. More recent data shows a decline in 1991-92, with a greater decline in Wisconsin which has had high mammography utilisation rates (77% of women 40 and over reported ever having a mammogram in 1992). Without screening it is likely that the data would have shown a real increase in incidence and mortality as observed in section 1.1.

Table 1.6.1 Female Breast cancer mortality rates in the UK and US

UK		US	
Year	Rate*	Year	Rate*
1987	52.4	1985	32.7
1988	52.3	1986	32.8
1989	53.4	1987	32.8
1990	51.6	1988	33.5
1991	52.2	1989	33.7
1992	51.4	1990	34.0

* Age-standardised rate per 100,000 females
Source: (World Health Organization, 1986-1993)

In the US a mortality reduction was seen for first time in 1994, but it is not known at this stage whether this represents a trend or an aberration (*pers comm*, AIHW)

The SECU report, on which was based the decision to implement mammography screening in Australia, estimates that 100% participation of women aged 40-69 in Australia will result in a 23% reduction in mortality, while a 70% participation will lead to a 16% reduction, and 55% participation to a 13% reduction (Australian Institute of Health, 1990). The original target of screening 70% of women aged 50-69 in the National Program after five years will not be achieved. Given that the National Program officially commenced in July 1991 then the 70% target should be achieved by mid-1996. Although 70% participation remains the goal of the overall Program, for accreditation purposes individual Screening and Assessment Services are required to have a 60% participation by women aged 50-69 after 5 years in the Program. This recognises the fact that not all Services had commenced by July 1991, and some parts of Australia are yet to be serviced. However, for South Australia which was established prior to this date, the expectation would be that it meet the requirement of 60% participation by mid-1996 and 70% thereafter. Can these targets be achieved? This is the major focus of this study. To attempt to answer this question information is needed on predictors of attendance and reasons for non-attendance. Continued funding of the screening program can only be justified on the basis of an expectation of reduced mortality, and this has been clearly demonstrated to be linked to participation.

1.7 THEORETICAL FRAMEWORK FOR THE STUDY OF FACTORS ASSOCIATED WITH PARTICIPATION IN MAMMOGRAPHY SCREENING

1.7.1 Background

In the last few years there has been a plethora of research studies, large and small, on factors that differentiate attenders and non-attenders to mammography screening services. Much of the research on risk factors for attendance to mammography screening has been based on cross-sectional studies that compare women in the community who had participated, or intended to participate in mammography screening, with those who had not participated or did not intend to participate. More recently as screening programs have been implemented, studies on attendance to particular screening programs have become more common. The results of the review of literature is summarised in section 1.8 below.

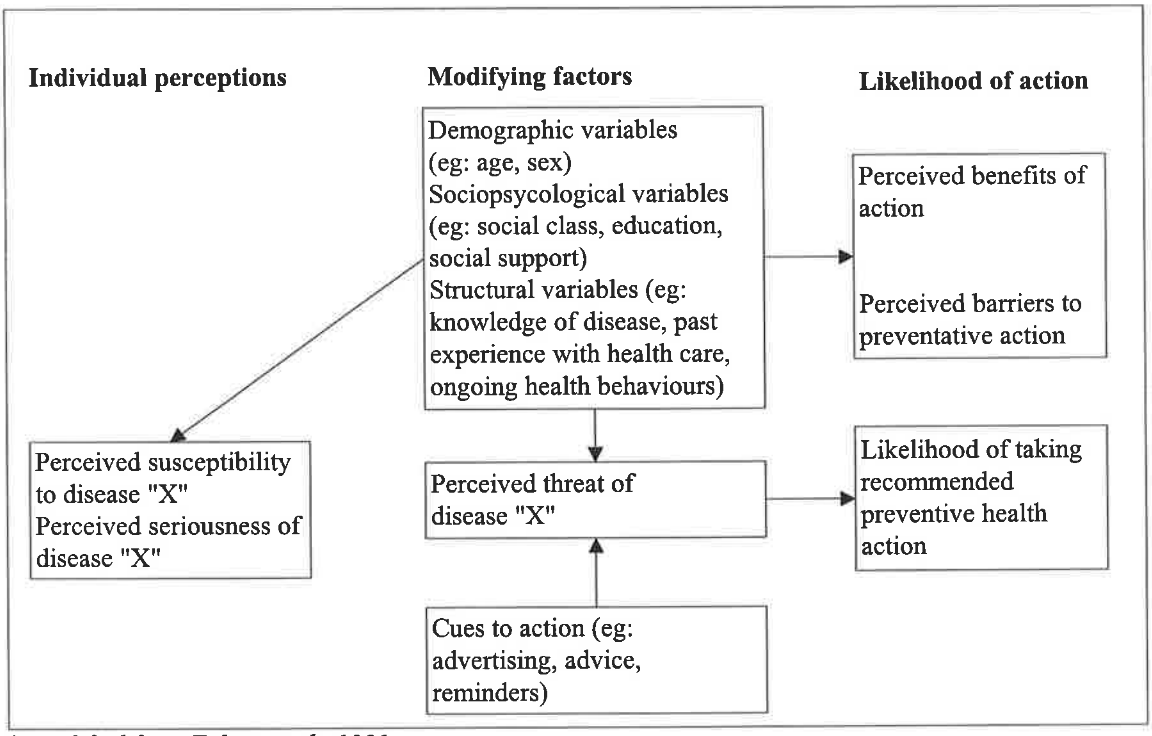
Implicitly or explicitly, Rosenstock's Health Belief Model (HBM) has guided much of the research on predictors of attendance to mammography screening (Rosenstock, 1974a) and (Rosenstock, 1974b). The model has sometimes been applied as an autonomous conceptualisation, but more often expanded to include items from other behavioural theories, which although encompassed within the HBM, are more clearly defined by other theorists.

The section below includes a description of the HBM as well as a review of a number of studies which specifically set out to test the HBM or a version of it.

1.7.2 The Health Belief Model

The HBM is a psychosocial model which was developed first in the 1950's in an attempt to understand the failure of the public to accept preventive measures (those that maintain health, prevent disease or detect disease in asymptomatic individuals). According to the model a preventive health behaviour is more likely if an individual feels susceptible to the condition, believes that it is a serious condition, and perceives benefits in taking the action while perceiving relatively few barriers to adopting the behaviour. Rosenstock proposed that the perceived susceptibility and perceived seriousness provide the "energy force", or critical *individual perceptions* as depicted in Figure 1.7.1 below. The other two perception factors of benefits and barriers are depicted under *likelihood of action* since the perceived benefits must outweigh the perceived barriers for the action to be contemplated. Several background or *modifying factors* influence these perceptions, and hence the likelihood of taking action. Cues to action are also included under *modifying factors*. The sociopsychological variables would include such factors as general health motivation or concern for one's health, as well as perceived personal control over health outcomes.

Figure 1.7.1 The Health Belief Model and preventive health action*



* *Modified from Fulton et al., 1991*

Note: Fulton includes other health behaviours as cue to action, but these are more frequently included in general background characteristics by other researchers

The types of beliefs implied by the HBM for mammographic screening are summarised by Fallowfield *et al.*, (1990) as:

- belief in personal susceptibility to breast cancer
- belief that breast cancer would have at least a moderately severe impact on some component of life
- belief that attending for mammographic screening would have beneficial impact
- belief that disease can present without experiencing symptoms
- belief in the efficacy of treatments, and
- belief that the potential benefits outweigh the costs.

A number of researchers have expanded the HBM to include elements of Bandura's Social Learning Theory (Bandura, 1985) and Fishbein's Theory of Reasoned Action (Fishbein and Ajzen, 1975) to test predictors for attendance to screening.

According to the Social Learning Theory, self-efficacy in obtaining a mammogram should increase the likelihood of having one. Self-efficacy refers to the belief in one's ability to succeed in performing the appropriate behaviour. Therefore, in the case of cancer screening, if the notion of self-efficacy is incorporated into the HBM, the concept of efficacy becomes two-faceted. Firstly, a woman must believe that the screening test itself is efficacious, and secondly that she is confident in her ability to obtain the test.

Fishbein's Theory of Reasoned Action assumes people make rational decisions about whether or not to engage in a behaviour, and an important determinant of actual behaviour is intention to perform the behaviour. Behavioural intention is in turn determined by attitudes toward the behaviour and the social normative influence of significant others. The 'attitudes' component is similar to the 'beliefs' component of the HBM, while social normative influence is determined by the person's perception about how salient others believe they should behave (normative belief) and their motivation to comply with those others. This would suggest that important others like doctors and family members play a powerful role in motivating action.

1.7.3 Support for the Health Belief Model

Many studies on predictors of mammography screening have expressly set out to test the theories described above, but it is evident from the variables selected in other studies, that much of the research has been guided by the models, even where this is not explicitly stated. Support for the four main belief constructs of the HBM are reviewed below, followed by review of studies (and their predictive power) which expressly set out to test the HBM or expansion of the model. A wider review of the literature is presented in section 1.8.

Perceived susceptibility

Perceptions of susceptibility to breast cancer has been consistently shown to be higher for attenders. Appendix B, Tables B4.1 to B4.5 list the studies that have included susceptibility variables. Studies that found an association between higher susceptibility and mammography use on the basis of a specific "susceptibility" construct or scored item in bivariate analyses include, Bastani *et al.*, (1991), Calnan (1984), NCI Breast Cancer Screening Consortium (1990), King *et al.*, (1993), Rutledge *et al.*, (1988), Stein *et al.*, (1992), Vaile *et al.*, (1993), Vogel *et al.*, (1990), Savage and Clarke (1995a) and Sutton *et al.*, (1994). However, where multivariate analysis has been performed to adjust for potential confounders, this association often disappeared (Bastani *et al.*, 1991); (Calnan, 1984); (King *et al.*, 1993); (Sutton, *et al.*, 1994). Further, some studies have reported no association (Fajardo *et al.*, 1992); (Turnbull *et al.*, 1995); (Miller and Champion, 1993); (Price, 1994); (Hammond and Stewart, 1994); (Hyman *et al.*, 1994).

Several other studies examined susceptibility on the basis of other proxy variables, such as concern that they may get breast cancer, worry about breast cancer, or knowledge of someone with breast cancer. Generally, an association has been found between concern/worry and mammography use, but as with the susceptibility construct, this association is not universal (see Appendix B, Table B4.4).

As one would expect, perceived susceptibility has been linked to actual susceptibility. An analysis of subgroups of attenders by breast cancer risk status (calculated on the basis of number of risk factors including family history, history of benign disease, reproductive history, obesity, age) showed that those at higher risk did in fact consider themselves more susceptible, and in turn were more likely to have a mammogram (Chrvala, 1990). Rutledge *et al.*, (1988) found a positive but weak association between actual risk factors and perceived susceptibility. A recent study found that women with a family history of breast cancer actually had exaggerated perceptions of their own risk (Lerman *et al.*, 1995). Several studies have used actual risk instead of, or in addition to perceived risk; generally a positive association has been found, but often this is not the case (see Appendix B, Table B4.5).

Hyman *et al.*, (1994) found, contrary to most other research, that women in their study with a family history were *less* likely to follow through a referral for a mammogram. A possible explanation offered is that a high-threat situation may lead to avoidance behaviour, and mediating variables such as self-efficacy may play a role in determining whether a threat becomes a motivating or immobilising force.

Perceived benefits

Perceptions of the benefits of mammography have also been shown to be higher for attenders (Appendix B, Table B5.4 and B5.5). Studies that found an association between higher perceived benefits and mammography use on the basis of a specific "benefits" construct or scored item in bivariate analyses include, Hyman *et al.*, (1994), Champion (1992), Kee *et al.*, (1993), Rutledge *et al.*, (1988), Price (1994), Stein *et al.*, (1992) and Zapka *et al.*, (1989). Miller and Champion (1993) did not find an association.

Several individual variables have been used as proxies for perceived benefits including; a positive attitude towards mammography, perceived safety or efficacy of mammography and belief that breast cancer is curable.

Perceived barriers

Generally perceptions of barriers to obtaining a mammogram have been shown to be higher for non-attenders, although one study has found that a perception of high barriers was associated with lower mammography use (Hyman, *et al.*, 1994).

Most studies reviewed that included a composite barrier item (Appendix B, Table B5.1) found that a high score was associated with low attendance in bivariate analyses (Kurtz *et al.*, 1993); (Miller and Champion, 1993); (Rimer *et al.*, 1989a) and (Rimer *et al.*, 1989b); (Stein *et al.*, 1992); (Zapka *et al.*, 1989). In multivariate analysis the association disappeared in the studies by Kurtz *et al.* and Zapka *et al.* Two studies did not find an association (Champion, 1992); (Price, 1994); the study by Price was restricted to women of low socio-economic status, suggesting that barriers may have been a universal issue.

As with the other constructs, although barriers in general are associated, individual barrier variables were often not predictive of behaviour, particularly when adjusted for the effect of other variables (see Appendix B, Table B5.2 and B5.3). These include concern about radiation, pain, discomfort, embarrassment, fear of finding cancer and anxiety. The single variable most found related to mammography use has been concern over radiation.

Perceived seriousness

The association with perceived seriousness has not generally been statistically significant, and for this reason several studies excluded this variable. Four studies were reviewed that included a specific construct for perceived seriousness (Appendix B, Table B4.3). One found that it predicted actual compliance, but not intention to comply (Champion, 1992), while the other three found no association (Rutledge *et al.*, 1988); (Zapka, *et al.*, 1989); (Price, 1994). This finding is not surprising, as perceived severity has been found to be the least predictive of the four major belief constructs of the HBM in other preventive health behaviours as well (Janz and Becker, 1984).

Two possible explanations for this observation have been suggested. Janz and Becker (1984) proposed that when individuals are asymptomatic and health threats are believed to be long term, they may find it difficult to conceptualise the dimension of seriousness. Owen and Long (1989), suggest that an alternative explanation might be that the perceived seriousness is so great that *denial* takes over behaviour, similar to the explanation offered above by Hyman *et al.*, (1994) in relation to avoidance behaviour and perceived susceptibility.

Another explanation may be that no effect is detectable because the disease is perceived as equally serious by both attenders and non-attenders.

Overall Predictive Power of Behavioural Models

A number of studies have been selected below which specifically set out to test the HBM or an expanded/modified model, incorporating the additional elements of Bandura's Social Learning Theory (self-efficacy) and Fishbein's Theory of Reasoned Action (TRA) described above. The studies are reported chronologically.

(Calnan, 1984) used a prospective design to test the power of the HBM for breast screening and attendance to a BSE class. A modified version of the model was tested which included the factors of locus of control and social supports and networks. The best discriminators for breast screening attendance were intention, previous use of dentist for checkups and use of cervical smears. That is, none of the demographic, belief, control or social support variables entered the final model. It was suggested that the intention variable may have concealed the effects of other health belief variables. When intentions was removed from the model, perceived vulnerability (the highest predictor), perceived benefits and barriers entered the model. However, overall the predictive power of the model was very low for both behaviours examined, as indicated by the high figures for Wilk's Lambda in the discriminant analysis performed. In the discussion, this author suggests that this study lends support to the TRA model proposition that behaviour is determined by intention, and further suggests that the measures of attitude and subjective norms (determinants of intention), which were measured rather crudely in this study, should be explored further. Basically, this author surmised that the HBM alone was not sufficient to explain screening behaviour.

A study which tested the HBM in relation to BSE found that it only explained 25% of the variance in behaviour. The authors postulated that the HBM only accounts for 'private' beliefs, and that a large part of a person's reasoning in deciding on a behaviour is missing, namely the role of the normative influences described in Fishbein's theory (Calnan and Rutter, 1986).

A UK study that examined the HBM constructs found that differences between attenders and non-attenders in beliefs and knowledge did not remain after controlling for age and social class (Owens *et al.*, 1987). That is, none of the belief variables were predictive.

Another study based on the HBM constructs compared attenders and non-attenders following the offer of low cost mammography. It found that perceived susceptibility, perceived benefits, knowledge of breast cancer and other health actions predicted attendance, while perceived severity did not. Perceived barriers were not included in the analysis (Rutledge, *et al.*, 1988).

Zapka *et al.*, (1989) found no independent association between mammography use and barriers to mammography (radiation, pain, cost, and embarrassment), perception of severity, or risk factor knowledge, but found a weak association with knowledge and the beliefs about the benefits of mammography. However, the effect of these belief variables was modest in comparison to the importance of having a regular physician.

An intervention study based on the HBM, evaluated an education program designed to increase the perceived susceptibility and seriousness of breast cancer, to increase the perceived benefits of mammography, and to reduce the perceived barriers to obtaining a mammogram (Reynolds *et al.*, 1990). After the intervention, no significant differences were found between the intervention group and the control group in perceived susceptibility, severity or barriers. Although significant differences were found between the two groups in perceived knowledge and benefits, it made no difference to actual behaviour, that is, in obtaining or scheduling a mammogram at the three month follow-up. However, there was a significant difference in *intention* to obtain a mammogram. It was suggested that a possible reason for not detecting an effect on behaviour might be that the sample size may have been too small (total study group = 83). Given that significant differences were detected in some beliefs and intentions however, other reasons were postulated. It was suggested that follow-up period may have been too short, given that in the US most women would first visit their doctor for referral. However, it was also postulated that the model of health behaviour, which concentrated almost exclusively on changing beliefs may have been too limited, and other components that could have been addressed include social support, perceived social norms and self-efficacy, as well as possible structural barriers.

Bastani *et al.*, (1991) also based their study on the HBM. Even though several variables were entered into the model, the only independent predictors of ever having had a mammogram were concern over radiation, cost, family history and doctor's recommendation. For having a mammogram according to the guidelines, the same four variables predicted attendance, as well as age and knowledge of the guidelines.

A study by Fulton *et al.*, (1991) guided by the HBM found that a provider's recommendation (cue to action) was by far the greatest predictor. The only belief variable to show an independent effect was perceived safety of mammography (included as a barrier variable).

Rimer *et al.*, (1991) based their study on an expanded model and developed questions based on the HBM, social learning theory (self-efficacy) and normative influences. A doctor's recommendation was the strongest predictor of having a mammogram in the last year. Frequency of doctor visits, cost and future intentions regarding mammography use were also predictive. However, none of the other belief variables, demographics or other health related behaviours showed an independent effect.

In a prospective study reported by Montano and Taplin (1991), the *Expanded Theory of Reasoned Action* was tested. Three additional factors were added to Fishbein's TRA: (1) *habit* (measure of whether the behaviour was carried out in the past); (2) *facilitating conditions* (characteristics of the individual and the environment that make it easy or difficult to carry out the intended behaviour); and, (3) *affect* (a measure of an individual's emotional reaction to thoughts of the behaviour). According to the TRA, behavioural intention is the most important determinant of behaviour, which in turn is influenced by attitudes and social normative influences. In the expanded model it was postulated that *habit* and *facilitating conditions* would be additional determinants of actual behaviour, while *affect* would be an additional determinant of intention. In the final analysis, affect was not found to be a determinant of intention, but attitude and subjective norm were (as postulated by the TRA); that is, there was no support for the expanded theory in relation to intentions. In the final model for actual behaviour, predictors were attitude, affect and facilitating conditions. Habit was found to have a low correlation with behaviour. It was postulated that the expanded TRA would be sufficient to explain behaviour and other variables were secondary in that they influenced behaviour through the main model components; for example, subjective norm was highly correlated with attitudes and affect. However, it was found that the demographic variables of age, education and marital status significantly improved the model. Other demographic variables, health behaviours and the belief variables of the HBM did not. Although a wide range of variables were entered, the final models explained 39% of the variance for intentions, and only 20% of the variance in behaviour. The low prediction implies either measurement error in the components of the model, or that a major construct is missing. The authors suggest that a separate construct for perceived barriers should be developed, to determine if it predicts intentions and behaviour independently from the negative facilitating conditions and negative beliefs already included in the model.

In Australia Cockburn *et al.*, (1991a) reported that the HBM constructs explained 20% of variance for intention to have a mammogram. Another paper by the same study group assessed predictors of the constructs themselves (Irwig *et al.*, 1991).

One US study developed a survey instrument based on the conceptual framework of both the HBM and health locus of control. Some weak associations were found with individual belief variables, while all variables about other health-related behaviours, except for smoking, were positively related to having a mammogram, as was previous experience with breast cancer. The relationship between mammography use and locus of control was positive, but weak. When asked what prompted women to have a mammogram, a doctor's recommendation was mentioned overwhelmingly. (Fajardo, *et al.*, 1992)

Stein *et al.*, (1992) assessed the influence of HBM constructs on both mammography use and intentions, and developed constructs for socio-economic status, perceived susceptibility, perceived seriousness, perceived barriers, perceived benefits, and cues to action. Cues to action (operationalised as physician influence) was the most significant predictor of use, while perceived susceptibility was the most powerful predictor of intentions. In the final model perceived benefits was excluded for actual mammography use, and socio-economic status for both use or intentions. Overall, the variables included in the model explained 47% of the variance for past mammographic behaviour, and 27% of the variance for future intentions.

Hyman *et al.*, (1994) tested the HBM in a prospective design. Perceived susceptibility was not found to be predictive, while both greater perceived benefits and *greater* perceived barriers were associated with use. It should be noted that the association with barriers is opposite to that predicted by the model. This study also excluded perceived seriousness. The discriminant model was able to correctly classify 77% of non-compliers and 58% of compliers.

Champion (1994c) tested the combined framework of the HBM and TRA, but addressed barriers separately from other beliefs, either as attitudes or experiences. In the multivariate model for having a mammogram in the last five years for women aged 50 and older, the variables of barriers, health motivation, having a mammogram suggested by a health professional and previous pap smear were predictive. For compliance in the last year a different set of variables was significant; seriousness, having a mammogram suggested by a health professional, having regular health checks, education, and socio-economic status.

An Australian study (Savage and Clarke, 1995a) also used the theoretical framework of the HBM and TRA to test intentions to have a mammogram. Of the belief variables, only perceived susceptibility was found to have a direct effect on intentions; neither perceived benefits nor perceived barriers were predictive (perceived seriousness was omitted). Previous preventive behaviours and knowing a woman who had had a mammogram were also predictive. Overall, the model explained 47% of the variability in mammography intentions.

Summary

There is general support for the constructs of these behavioural theories at the broad level; in particular perception of susceptibility to breast cancer and perceptions of benefits of mammography have been shown to be higher in attenders, while perceptions of barriers to obtaining a mammogram have been shown to be higher in non-attenders. Perceived severity has generally not been found to discriminate between attenders and non-attenders, and has consequently been omitted from several studies. However, the single most consistent predictor has been a doctor's recommendation. This variable comes under "cue for action" in the HBM, or more explicitly separated out under "normative influences" in the TRA.

Overall, the predictive ability of the HBM has been disappointing. While better results have been obtained in the expanded versions of the model, at best, half the variance has been explained, but it is usually much less. From the studies reviewed above the explanatory power ranges from 20% to 47%. Further, the results have sometimes been contrary to those predicted by the model.

Why then do researchers continue to develop their questionnaires around variables suggested by the HBM? Montano and Taplin (1991), propose that mammography behaviour is more difficult to predict, as it is more emotionally charged than other health behaviours for which these models have been tested. They suggest that more work needs to be done to measure the emotions and fears surrounding mammography, and explore their interacting role with beliefs and attitudes that determine participation.

Another dilemma is that the HBM does not specify the measurement of the various components or specific interrelationships between them. The various researchers applying the HBM have individually developed factors to represent the constructs of the HBM, or used those developed by others. Often only individual variables within the constructs have discriminated and not the composite construct. However, as the studies reviewed above indicate, the effect of the belief factors, either as a composite construct or individual variable has often disappeared in multivariate analysis. The weak predictive power of the model may reflect the inadequacy of the model itself, or measurement problems. Hence further work is required in refining and standardising the measures.

1.7.4 Theoretical Framework for Thesis

The expanded Health Belief Model, augmented by the main elements of the Theory of Reasoned Action (normative influences) and Social Learning Theory (self-efficacy) currently offers the best theoretical framework for the study of risk factors associated with mammography screening. The HBM, which focuses on behavioural aspects in the adoption of preventive health actions, should in itself be complete as it covers both internal and external aspects of behavioural decision-making as depicted in Figure 1.7.1. Other factors such as socio-demographic and environmental circumstances are incorporated as modifying factors which influence behaviour. The expanded models merely make more explicit the constructs included in the original model. However, as shown in the review of these models above, even the expanded models have low predictive power.

The framework used in this research on predictors of non-attendance to mammography screening loosely incorporates the essence of the expanded HBM, but without hypothesising causal relationships between the various groups of factors studied. This research also adopts the view that barriers have an independent effect on action, and particular attention is focussed on barriers, both psychological and structural. In the HBM in Figure 1.7.1 structural barriers are included as modifiable variables, but this research hypothesises that both perceived and structural barriers have a direct impact on whether a health behaviour is adopted.

The need to better focus on barriers is indicated by the literature review. The concept of barriers is taken to include the "emotions and fears" referred to by Montano and Taplin (1991). Although mammography screening has been promoted for some years now, some women are still resisting the messages impelling them to attend. Because mammography has not been utilised at the recommended rates by targeted women, a substantial part of the literature on mammography is increasingly being devoted to identifying factors that act as barriers and facilitators to participation. Although a number of health belief variables have been shown to predict screening mammography, the processes that lead to adoption of the behaviour are still not clear. More attention is required on the barriers to participation. Barbara Rimer and her colleagues, prominent researchers in the area of participation in mammography screening in the US have specifically concentrated on patient-related barriers (Rimer, *et al.*, 1989b). More recently, Champion, (1994c), addressed *barriers* as a separate construct within her model which combined the HBM and the TRA. That is, rather than viewing barriers as part of a component of the model where a person balances the benefits and barriers to determine whether on balance the behaviour should be pursued, the barrier construct itself is seen as a strong entity. Moreover, a broad view is taken as to what constitutes barriers. In this study perceptions about the positive aspects of mammography are included in the barrier construct, on the premise that not perceiving the positive aspects presents a barrier. Some other studies have taken this view, including, Fulton *et al.*, (1991) where perceived safety of mammography was included as a barrier.

This research also adopts the view that women go through various stages before adopting screening behaviour; from precontemplation, to contemplation, to action and maintenance, and that modification of perceived and structural barriers over time predict the stage of adoption. Further, it is suggested that part of the reason for the disappointing results in support for the HBM has been that earlier studies compared all participants with non-participants, and these two groups comprise several sub-groups with different risk factors and at varying stages of readiness for adoption. This research will study a number of different groups of attenders and non-attenders within the proposed framework.

The framework for this study incorporates a wide range of variables which are grouped into factors or constructs, based on the evaluation of the results from the literature review, and suggestions by other researchers as to how their own research might have been improved. As indicated above, causal relationships between the various constructs are not hypothesised. Neither are the groups of variables studied as composite constructs. Rather the independent effect of all variables on the final outcome measure of participation in mammography screening will be studied. This allows for reconstruction of the groups and elucidation of the critical paths through which the impact of each variable or group of variables is effected.

Table 1.7.1 lists the constructs used in this study, and the variables included as predictors in the case-control study, the main component of this research. The variables are not listed in detail, as some have several components. For example education comprises three variables assessing age left school and qualifications, while health behaviours include both practice and timing of the behaviour. It can be seen that the constructs of the expanded HBM are all incorporated, but not necessarily as defined by the models. For example, family history is included as a background structural variable in the health belief model, but here it is included under susceptibility, on the evidence from other research that shows that perceived and actual susceptibility are associated (see section 1.7.3).

Table 1.7.1 Study Constructs

CONSTRUCT	VARIABLES INCLUDED IN CASE-CONTROL STUDY
1 SOCIO-DEMOGRAPHIC	age, marital status, education, employment status, occupation, partner's occupation, country of birth, language spoken at home, household size and composition, number of children, income and source of income, religion, and socio-economic status.
2 HEALTH MOTIVATION AND CONTROL	Other health behaviours (pap smear, breast examination by professional, breast self examination, smoking, exercise, diet control, dental check-ups), self-rated health, disabilities, use of health services, general concern about health, self-esteem, locus of control, previous mammography behaviour (ever had mammogram, when and where last mammogram, whether for diagnostic or screening purposes, reasons for not using SABXRS).
3 KNOWLEDGE (about breast cancer and mammography)	knowledge of: most common cancers, symptoms/signs of breast cancer, breast cancer incidence, age most at risk, checks for breast cancer in general, existence and purpose of mammography.
4 SUSCEPTIBILITY	
• perceived	perceived susceptibility, concern that may have breast cancer and action taken, persons known with breast cancer, closeness to them and outcome of others breast cancer.
• actual	family history, personal history of breast cancer, personal history of breast disease/past symptoms.
5 BARRIERS	
• perceived	perceive advantages of finding breast cancer early and specification of advantages, perceived benefits of mammography and specification of benefits, perceived problems with mammography and specification of problems, concern over radiation, pain, accuracy, embarrassment, fear of result and consequences, anxiety about further tests, belief that important for their age.
• structural	cost, access problems (other commitments, including work and family, distance, transportation).
6 INFLUENCES	social supports and networks, including involvement in clubs/charities, sources of information about mammography, prompts received (eg, letter) and acceptance of them, recommendation/advice from doctor/relative/friend, who would influence, intention to have mammogram in next 2 years (with SABXRS or other), what would prompt to obtain mammogram.

The next section summarises the results of the literature review based on these constructs.

1.8 REVIEW OF LITERATURE ON FACTORS ASSOCIATED WITH PARTICIPATION IN MAMMOGRAPHY SCREENING

1.8.1 Overview

Over 400 articles describing to factors associated with mammography screening have been reviewed. From this extensive and comprehensive review, individual variables analysed in the studies were compiled into separate tables for each of the six constructs listed above. Only about half the articles reviewed are specifically referenced given the volume; those included are the larger studies and those with well-developed research design and analytical methods. The findings are catalogued in Appendix B in a series of tables organised by key variables within these constructs. Each table lists the studies which specified that the particular variable was analysed and whether bivariate/multivariate analysis was used. Studies where the variable was not found to be significant are also listed, but it should be appreciated that this information is often not reported. To assist in comparisons between studies on particular variables, the studies have been grouped by broad design categories.

Cross-sectional studies refers to those where a random general population sample was drawn from a community. These are retrospective surveys which ask about previous mammographic behaviour and collect data on possible correlates. A major limitation of this design is that the correlates may have been influenced by the mammographic experience itself. It should be noted that many of these samples were not necessarily representative of the whole population, as some of samples were drawn from defined population subgroups such as worksites or health centres. Most of these studies used the telephone interview method.

Attender studies interviewed only attenders to a specific screening program. These studies are weak in that there is no non-attender comparison group, hence the main benefit is to elicit information on reasons that led to women accepting a mammogram. The studies in which attenders were compared to the general population (mostly using census data), are included in this design type.

Case-control studies compare attenders and non-attenders to a specific screening service, usually following an invitation to the service. This design is superior to the *cross-sectional* design in that mammographic attendance status is not based on self-report, and mammography relates to a screening mammogram only (not diagnostic as may be the case in community surveys). The main disadvantage of this design is that predictor information is collected retrospectively.

Cohort studies provide the strongest evidence as measurement of potential predictors is made before active recruitment to a screening program. Subsequent screening behaviour is then monitored and attenders compared with non-attenders. Hence, screening behaviour cannot influence the predictor variables being compared. However, while this design is considered superior to others, it is possible that the process of collecting the potential correlates may affect mammographic behaviour, that is, act as a cue.

Intervention studies are those which measure participation after an intervention, for example an education strategy aimed at increasing participation, to test the effectiveness of the intervention. The other study types are often the precursors of intervention studies, that is, the interventions tested are based on the outcomes of these observational studies. Several researchers reported a *cross-sectional* study which was followed by an intervention study some time later. Both studies would be included in the tables; the initial survey under *cross-sectional.*

Also listed in the tables is the outcome measure or dependent variable used in the study; in some cases more than one outcome was measured. The most common outcomes tested were “ever had a mammogram” and “compliance to regular mammography”. In the US, screening mammography is recommended every 2 years for women aged 49-49 and yearly for women 50 and over. Several of the studies reviewed tested compliance to screening, measured as having a mammogram in the last year for women aged 50 or over.

The tables in Appendix B refer to individual studies. A number of other authors have reviewed the literature on recruitment to mammography screening in the past. Three reviews ((NCI Breast Cancer Screening Consortium, 1990); (Smith and Haynes, 1992); (Behavioral Risk Factor Surveillance System, 1993)) report on the combined findings of large surveys conducted in the US. These are not included in Appendix B and are summarised next, followed by the review of studies in Appendix B. Other authors have also conducted reviews, but these include the individual studies included in Appendix B and therefore not are reported separately here.

The review by the NCI Breast Cancer Screening Consortium (1990) evaluated data from seven large cross-sectional studies sponsored by the National Cancer Institute (NCI) in the US, comprising six state surveys and a survey supplementary to the 1987 National Health Interview Survey (NHIS) that examined cancer control. It found that in all studies women with lower education and income levels were less likely to have had a mammogram in the last year than women with higher education and income. Also, having a regular source of medical care was strongly associated with attendance in all studies, while family history of breast cancer was weakly associated. Younger age was found to be a significant determinant of attendance in two of the studies, and practice of BSE in last month in three studies. The two most common reasons for not having mammogram were "not knowing they needed it" and "physician had not recommended it". The supplement to the NHIS was repeated in 1992. The percent of women who had had a screening mammogram in the last three years increased from 23% in 1987 to 49% in 1992 (Anderson and May, 1995).

Smith and Haynes (1992) reviewed large national and state surveys on compliance to the guidelines regarding utilisation of mammography screening in the United States. They concluded that age, race and sociodemographic factors were consistently found to be related to compliance; women aged 40-64 were more likely to have had a recent mammogram than those 65 and older, white women more likely than black, and women with higher education and higher income more likely than those with lower education and income. Some studies showed that marital status was a factor; married women being more frequent users than never married women. Less strongly associated factors, which were not found consistently in all studies, relate to beliefs about the value of mammography, perceived vulnerability to breast cancer, history of breast disease, family history of breast cancer, and having previously had an abnormal mammogram. The two main explanations provided by women for not having a mammogram from the surveys reviewed in this paper were "lack of perceived need" and "absence of doctor recommendation". Less important explanations were found to be "put it off", cost, embarrassment, concerns about radiation, fear of the test, lack of regular doctor, or doctor counselling not to have a mammogram.

The Behavioural Risk Factor Surveillance System (1993) relates to several large cross-sectional surveys conducted in 48 states in the US. Analysis of mammography data collected in 1992 found that the percentage of women aged 50 and over who reported having a mammogram in the preceding year in each state ranged from 32% to 60%. Overall, levels of mammography use were lowest amongst women who were older, less educated (less than high school) and with lower income; moreover these trends persisted across ethnic groups.

The next section summarises the individual studies detailed in the tables within Appendix B. Tables relate to a single variable where several references are available, but for variables which were reported only in a single or a few studies, similar variables are grouped into a single table. The review below summarises each table within the six study constructs.

It should be emphasised that a lack of association between the dependent and independent variables being reviewed does not necessarily mean that one does not exist. The review does not include an analysis of the strength of the study in terms of study design and sample size. Hence, it should be borne in mind that a lack of effect may be due to a lack of power. Further, adjustment for confounding effects in multivariate analyses varied markedly, from the inclusion of a few variables only within the same construct to the inclusion of a wide range of factors. Hence, even where an independent effect is reported, it may still be a confounder for a variable not included in the analysis.

1.8.2 Socio-demographic

Table B1.1 Age

Generally younger women were more likely to have ever had a mammogram, to have repeat mammograms and to intend to have a mammogram in the future. Three *cross-sectional* studies reviewed found the reverse relationship (one for Ever had and two for Had in Last Year), as did the two intervention studies. Several found no association. Where multivariate analysis was performed, the effect usually remained, indicating that there is a direct association between age and attendance; of the eighteen multivariate analyses reported, the age effect disappeared in five of these after adjusting for other factors.

Interestingly age was not found to be significant in all four *cohort* studies reviewed. Also, for two out of three *intervention* studies where an association was found, it was in the opposite direction to the other types of studies - older women were more likely to attend following the intervention.

Two Australian studies were reviewed which included this variable; the *attender* study found an inverse relationship for English-speaking women, but the reverse for non-English speaking, while the *cohort* study found no association.

Table B1.2 Marital Status

Overall, about as many studies were reviewed that reported an association as those that reported no association. Married women were more likely to have ever had a mammogram and to have repeat mammograms, except in one *cross-sectional* study which found that women who were never married were more likely to attend. The one study (*cross-sectional*) which used intention as the dependent variable also found that married women were more likely to intend complying. Several studies found no relationship. Where multivariate analysis was performed, the effect usually disappeared, indicating that it was a confounder for another factor.

Table B1.3 Ethnicity

Most studies were from the US and compared white women with black women; in all except one, white women were more likely to attend for both measures of mammography use (ever had and repeat mammograms). However, where multivariate analysis was performed, again the effect usually disappeared. The one study (*cross-sectional*) which used intention as the dependent variable also found that white women were more likely to have the intention to comply in bivariate but not multivariate analysis. The Australian study comparing English speaking with non-English speaking women found no association.

Table B1.4 Education

Higher education was associated with higher attendance in all but two of the 30 analyses where a significant association was found. This applied to measures of mammography use (ever had, had repeat mammogram) and intention. However, the effect invariably disappeared after adjusting for other factors. As with the age variable, education was not found to be significant in the four *cohort* studies reviewed, nor in an *attender* study.

Table B1.5 Employment status

Employed women were more likely to ever have or have repeat mammograms than those not employed in all studies where an association was reported. Two studies examined intention; one found an association while the other did not.

Table B1.6 Income

In all studies where an association was found, women on higher income were more likely to ever have or have repeat mammograms. Further, most studies that included this variable did find a significant association. The one study (*cross-sectional*) that examined intention also found an independent association after adjusting for other factors.

Table B1.7 Socio-economic status or Proxy

More often than not, this variable was significantly associated with attendance (ever and repeat), except in the *cohort* studies where no association was found in three of the four studies. In all studies where an association was found, attendance was higher among women of higher status, whether measured directly as socio-economic status or as a related variable used as a proxy (suburb, car, telephone or home ownership). Two *cross-sectional* studies measured intention, one finding an association in bivariate analysis only, while the other found no association. In five of the 11 analyses where multivariate analysis was performed, the effect disappeared.

Table B1.8 Other socio-demographic variables

Occupation was included in three studies reviewed; two *case-control* studies reported that attenders were more likely to be in professional occupations, while a *cohort* study (Australian) found no association. Several other variables were found to be significantly related to attendance (ever and repeat) and intention, even after adjustment for other factors. These include religion (Jews and Catholic more likely than Protestant), family or household size (both positive and negative relationship found), geographic location, and residential type (single home more likely than unit or mobile home). Apart from 2 *case-control* studies (which found a significant association for religion and geographic location), all other studies relate to the *cross-sectional* design. As with all other socio-demographic variables, a number of studies did not observe any relationship.

Summary

Overall, several socio-demographic variables have been found to be predictors of attendance. Women are more likely to attend for the first time, or have repeat mammograms if they are younger, married, better educated, employed in professional occupations, have higher incomes, and higher socio-economic status. However, except for age, other variables did not usually show an independent effect after adjustment for the effects of other variables. Also, these variables more often were associated with attendance in cross-sectional studies, which compared women in the community, not taking account of where they had their mammogram, and sometimes also including diagnostic mammograms. Other study designs that examined attendance to particular screening services did not find these variables to be strong predictors. One reason may be that women targeted by specific screening services are more homogeneous in regard to these variables than the general community population, as for example, women listed with a particular general practitioner.

1.8.3 Health Motivation and Control

Table B2.1 Health status

Only a few studies were reviewed that included health status. In general those women who rate their health as good and who are not limited by disability or illness were more likely to attend (ever or repeat) or intend to have a mammogram. However, one large study (US National Health Survey) found higher attendance in women who had an acute or chronic condition for 'Had in last 2 years' and 'Intends to have rescreen'.

Table B2.2 Other health behaviours -pap test

Having a previous pap smear was usually associated with higher attendance, reattendance and future intention. All studies except one *case-control* study reported a bivariate association, and most an independent effect. One *case-control* study (Spanish) found no independent effect for first or second screen; in this study the bivariate association for second screen was negative, contrary to other studies.

Table B2.3 Other health behaviours - breast self-examination (BSE)

Women who practice of BSE regularly were more likely to attend (ever had) in a US *cross-sectional* study but not in an Australian one. Knowledge of BSE was also found to be an independent predictor in another large US study (National Health Survey) for "ever had", "had in last two years", and "intend to have rescreen". An association was also found in a *case-control* study from Norway comparing non-attenders to the general population, but a difference was not found between attenders and non-attenders. In a Spanish *case-control* study BSE was associated with adherence (having a second screen) but not initial attendance. Two other *case-control* studies from the US found no association. Two *cohort* studies, both from the UK, included this variable and only one found a bivariate association which disappeared in multivariate analysis.

Table B2.4 Other health behaviours - clinical breast examination (CBE)

Having a CBE was found to have an independent effect in one of the two US *cross-sectional* studies reviewed. Other studies that examined this reported only bivariate analyses; an effect was reported for one *case-control* and one *cohort* study.

Table B2.5 Other personal health maintenance behaviours

Exercise was associated with higher attendance in two US *cross-sectional* studies. The large US National Health Survey also found an independent effect for ever had, had in last two years and intention. This variable was included in a *case-control* study from Canada and a *cohort* study from the UK, neither of which found an association.

For smoking behaviour, the US studies reviewed found that non-smokers had higher attendance for ever had, re-screen and intention from three *cross-sectional* studies (independent effect), a *case-control* study (no adjusted analysis), and an *intervention* study (adjusted). A *cohort* study from the UK found no association between smoking and attendance after invite.

Diet control was included in three studies reviewed. A *cross-sectional* and *case-control* study both found attenders were more likely to use specifically healthy products (no adjustment), while a *cohort* study found no association.

Use of a dentist was examined in the UK in one *case-control* and two *cohort* studies. All found that women were more likely to attend if they visit the dentist for check-ups (versus never or for problems only). For the *cohort* studies the effect was independent of other factors.

Use of seat belts and actively seeking a chest x-ray was included in two *case-control* studies from the UK. Both found attendance was associated with higher use (neither reported adjusted analyses).

Some studies used a composite personal health practice score. The number of variables included in such scores varied, but usually included smoking, diet, alcohol use, BSE, pap smear and dental checks. Women who had a higher score were more likely to "have a mammogram in the last year" and "ever have a mammogram" from two US *cross-sectional* studies. No association was found in an Italian *case-control* study, and in a *cohort* study from the UK reported a bivariate but not an independent effect.

Table B2.6 Use of health services

Variables included under this title include having regular general physical checks, having a regular doctor or health centre, visiting a gynaecologist and frequency of visits to the doctor. In 13 of the 16 *cross-sectional* analyses and eight of the ten *case-control* analyses, higher utilisation was associated with higher attendance and compliance. The effect remained an independent predictor in half the adjusted analyses.

Table B2.7 Previous and Intended mammography behaviour

As expected, previous mammography behaviour was found to be an independent predictor of current behaviour and intentions. However, this was not universal. An Australian *cohort* study found no association with having a previous screening mammogram, while a US *intervention* study found no relationship with number of previous mammograms. It may be that no effect was found because a proportion of women who had a previous mammogram had done so recently and were therefore not due for their next mammogram. This was found to be the case in a UK *cohort* study where women who had a mammogram more than two years ago or had never had one were more likely to attend after invite than those who had one within two years. This study reported findings of first invitation from the UK trial, which had a screening interval of two years.

Five studies used the independent variable ‘intention to have mammogram in future’. Three US *cross-sectional* studies used this to predict if women “ever had a mammogram”, “had one in the last year”, “had for last 3 years” and “had more than one”. A bivariate association was found for all variations of the dependent variable, but an independent association was found only for “had in the last year”. A US *intervention* study found an independent effect on attendance within 12 months of the intervention. A UK *cohort* study found a bivariate association with attendance after invite, but not an independent effect.

Table B2.8 Other Health Motivation and Control variables

Health motivation as a scored factor was studied in two *cross-sectional* studies and an *intervention* study (all by the same researcher) and found to be related to “had in last year”, “compliant for five years”, and “intent” in bivariate analyses, but in the adjusted analyses was significant for “compliant for five years” only. Concern about health was not shown to be related in any of the three studies reviewed (one *cross-sectional* and two *cohort*). Related health motivation variables include perceived importance of having regular pap smears or breast screens, and expression of interest in attending screening if offered. These were included in a UK *cohort* study; an independent effect was established for perceived importance of pap smears and breast screens versus those who said neither were important or did not have a view.

Control over health in general or over the effects of breast cancer was shown to be related to attendance in three *cross-sectional* studies (independent effect in the two that adjusted). A US *cohort* study found a bivariate association, while one from the UK did not. Related to ‘control’ is attribution of health responsibility (independent effect in *intervention* study), general locus of control (no effect in *case-control* study), self-esteem (bivariate but not independent effect in *case-control* study), psychological profile (independent effect in *case-control* study), and optimism (no effect in *attender* study).

Other variables examined include satisfaction with health care; some support was found for specific care for breasts and feelings of being treated with respect from the doctor, but not for general satisfaction with medical care.

Summary

The most consistent predictor of health motivation and control factors was having a previous pap smear. Some evidence was found for the effect of other health behaviours such as breast self-examination, smoking, exercise, alcohol consumption, and diet control, but these were generally not strong. A possible explanation for no association between mammography behaviour and breast self-examination in the studies reviewed (especially in the US and Australia) may be that BSE is practiced widely amongst all women. A strong association was found in a large US study using the variable 'knowledge of BSE', but this does not necessarily relate to practice of BSE. Interestingly use of a dentist for check-ups was found to be a stronger predictor than these other health behaviours in a number of studies from the UK where this was examined.

Utilisation of health services (including previous mammography use) was also usually related to attendance, as were feelings of control over one's health. However, the effect of general health motivation and concern about health was weaker.

1.8.4 Knowledge

Table B3.1 Knowledge score

Overall, knowledge score is not strongly associated with attendance. Eight *cross-sectional* analyses were reviewed that used a composite knowledge variable, but only three of these showed a significant bivariate association (two for 'compliance for 5 years' and one for 'intention'). In adjusted analyses for these three, the effect remained for compliance but not intention. An Australian cohort study found no association, unlike two US studies, one *case-control* and the other *intervention*.

Table B3.2 Single knowledge items

For the *cross-sectional* analyses, there was more support for a link between knowledge and attendance (ever, re-screen and intent) than for knowledge score, with 25 of 37 analyses showing a bivariate effect for the following variables; knowledge - of the guidelines, that mammography is best for early detection, of the incidence of breast cancer, of the age most at risk, that one can have breast cancer without symptoms. However, in most cases the effect disappeared after adjustment for non-knowledge variables. Further, knowledge of the risk factors for breast cancer was not found to be associated with recent use of mammography.

There was less support for single knowledge items in *case-control* studies; four of the 11 analyses showed a bivariate effect. None of the 5 *cohort* analyses (all from the same Australian study) found an association for a range of knowledge variables. One *intervention* study included knowledge of the guidelines; a bivariate association was found which did not persist after adjustment.

Summary

While individual knowledge variables were shown to predict attendance, overall the effect appears to be weak. The strongest individual predictor is knowledge that the risk of breast cancer increases with age. In a UK study which found that knowledge was significantly associated with attendance, the effects disappeared when age and social class were controlled. This study also found age and social class were confounders for health beliefs.

1.8.5 Susceptibility

Table B4.1 Perceived susceptibility score

In *cross-sectional* studies this variable was associated with ever having a mammogram, compliance and intention in nine out of 17 analyses. It was also an independent predictor in five of the eight multivariate models, again predicting ever having a mammogram, compliance and intention. One *attender* study measured rescreening and found a significant association. Two case-control studies included this variable; one found a relationship (US) while the other did not (Canada), both reporting bivariate analysis only. Three of the five *cohort* studies reviewed found a bivariate association, but there was no independent effect in the two which adjusted for other factors. One *intervention* study found an association with intention but not compliance, while a second *intervention* study found no association. No association was evident in the *attender* study reviewed.

Table B4.2 Perceived susceptibility - knows someone with breast cancer/breast problem

Women who knew someone with breast cancer were more likely to attend. This variable was associated with ever having and compliance in three *cross-sectional* (independent in two), three *case-control* studies and one *cohort* study. A lack of association was reported in four *cross-sectional studies* and one *cohort* study.

Table B4.3 Perceived seriousness

Perceived seriousness was not generally found to be associated with mammography behaviour. Only one *cross-sectional* study found an independent effect for "compliant in last 5 years" and for "had in last year" for women aged 50 and over, but not younger women. This same study found no relationship to "intent to have in next year". Only one *case-control* study examined this variable and found it to be unrelated to attendance. One *intervention* study also examined it for compliance and intention and found it to be significant for both (only bivariate analysis reported).

Table B4.4 Concern/worry about breast cancer

Mostly, concern was associated with attendance; women who were more concerned were more likely to attend or intend to participate. Two *cross-sectional* studies used 'ever had' as the dependent variable; one found an association while another did not. Both *cross-sectional* studies which measured intention found a positive association.

Two *case-control* studies examined this variable, the US study reporting an association (not independent), while the UK study did not. Two *cohort* studies, both in the UK also found an association, which was independent in only one. An Australian *cohort* study found no association for any of the three concern variables tested.

Table B4.5 Actual risk - family history

Family history was associated with attendance in 13 of the 16 analyses from *cross-sectional* studies for "ever had", "compliance" and "intention", and the effect was mostly shown to be independent of other variables. However family history was a significant predictor in only three of the seven *case-control* studies reviewed (independent in two), one of the three *cohort* studies, and one of the three *intervention* studies. It was not significant in the two *attender* studies that measured mammography in the last year, intention in the next year, and re-attendance after a first screen.

Table B4.6 Actual risk - previous breast symptoms/breast disease/other

The pattern for the breast symptoms/breast disease variables was similar to that of family history in that they were usually an independent predictor in *cross-sectional* studies but not other design types. These were significant in two of four *case-control* studies reviewed, neither of the two *cohort* studies, nor the one *intervention* study.

Only two studies (both from the UK) were reviewed which looked at other factors, neither finding an association with attendance after an invite. One was a *cohort* study which included 'late age at menopause' and 'obesity', and the other was an *intervention* study including 'menstrual status', 'number of pregnancies', and 'age at first pregnancy'.

Summary

Actual susceptibility to breast cancer, in particular family history or prior breast symptoms or disease were more strongly associated with attendance than perceived risk or concern, and perceived seriousness. While there is some support for higher attendance being associated with higher perceived seriousness the effect appears to be weak and inconsistent. However, family history was shown to be a strong predictor in studies of cross-sectional design, but not of other design types. The most likely explanation is that the other designs relate to attendance at specific screening programs, while the community studies would often include mammography performed at diagnostic mammography services. Women with a family history may choose to use diagnostic services even if they are not symptomatic, or may be excluded from the free or subsidised programs. This is certainly the case in Australia where a Medicare rebate is available to women with a family history, but not for women screened without a family history of breast cancer or personal history of breast disease. Women who are not eligible for the rebate either pay the full cost themselves if they use a private facility or attend the free national screening program.

1.8.6 Barriers

Table B5.1 Perceived barriers (composite score)

Several studies used a scored barrier factor comprising three or more items including, worry about mammography in general or concern over specific aspects like radiation, pain, embarrassment and cost. Ten of the 16 *cross-sectional* analyses that used a scored item found the higher the barrier score the less likely were women to attend or re-attend, usually as an independent predictor. The two *cross-sectional* studies which measured intention found this factor to be an independent predictor. One *case-control* study, three *cohort* studies and one *intervention* study used a scored factor, and all found a significant association in bivariate analysis. The *intervention* study measured both compliance with US guidelines and future intention. Multivariate analysis was performed only for the *cohort* studies, but the factor remained an independent predictor in only one. The *attender* study reviewed found an independent association for both "had in last year" and "future intention".

(Note: cost was included as an item in several of the scored factors, but where it was studied as a single variable it has been reviewed as a structural barrier below.)

Table B5.2 Perceived barriers - concern over radiation

In all but two of the 14 analyses including this variable an association was found, and it remained as an independent predictor in five of the nine multivariate analyses. Women who were concerned about radiation were less likely to have mammogram (ever or repeat). Intention was not measured for this variable.

Table B5.3 Perceived barriers - other perceived barriers (single items)

Concern over pain was included in two *cross-sectional* studies and one *case-control* study. The latter found no association while the former found women were less likely to attend (ever and repeat) if they were concerned about pain. This remained an independent predictor in the study that conducted a multivariate analysis.

Embarrassment was included in three *cross-sectional* and two *case-control* studies. The latter found no association, while an association was found in two of the three *cross-sectional* studies (independent predictor in one for "ever had").

Fear of finding cancer was associated with lower attendance in all nine bivariate analyses, but did not remain an independent predictor in the three multivariate analyses.

Anxiety about mammography itself or tests in general was included in nine analyses. In the six *cross-sectional* analyses, it was significant in five of the bivariate analyses (for ever had and repeat) and two of the four multivariate analyses (for repeat mammography only). In three *case-control* studies that included this variable it was significant in two from the US and Canada (both did bivariate analysis only for variables "involves physical discomfort' and "fear of medical tests"), but not a UK study (anxiety about mammography).

Other perceived barrier variables found to be significant include the belief that mammography is only required for symptomatic women (*cross-sectional* for repeat mammogram and *case-control*), belief that mammography is too much trouble or a feeling that one should not go looking for trouble (*both case-control)*, and perceived control over the outcome of breast cancer (*intervention study* for compliance with guidelines*)*. This last variable was also analysed in the same study for "intention to have next year", but was not found to be significant. Adjusted estimates of effect are not available.

Table B5.4 Perceived efficacy/benefits of early detection and mammography

Twenty eight bivariate analyses included this variable in *cross-sectional* studies. It was significant in 16 of these (ever had and re-screened), but only in four of the 15 that adjusted for other factors. This was studied in four *case-control* studies and found to be associated with attendance after invitation in three of these (bivariate only reported). In the two *cohort* studies reviewed both found a bivariate association but only one an independent association. One *intervention* study found an association with perceived efficacy of mammography (not maintained in adjusted analysis) but not perceived efficacy of early detection. Another *intervention* study found an association with perceived benefits of mammography for both compliance and intention (no adjusted analysis).

Table B5.5 Other attitudes to mammography or breast cancer

Belief that breast cancer can be cured was included in several studies. Overall there does not appear to be a strong association between this variable and attendance. One *cross-sectional* study found an association with "had in last year" (bivariate only), but not for "had more than one". Another *cross-sectional* study that used "ever had" as the dependant variable found no association. A *case-control* study that included this variable also found no association. This study also found no association for 'believes breast cancer can be prevented' or 'felt risk of cancer can be reduced'.

A number of studies tested variables relating to a positive attitude towards attending for screening, including feelings that one should participate in screening, and that scheduling a mammogram would bring peace of mind. A bivariate association was found in three of the five *cross-sectional* analyses; three reported adjusted results and two found an independent association. Three of the ten *case-control* analyses found a bivariate association, one also reporting an independent effect, and two of the three *cohort* studies found a bivariate effect, but in the one which reported multivariate results, this effect disappeared. Not surprisingly, having a good opinion of the program was found to have an independent effect on attending for a second screen, but having an interest in information about mammography was not (both *case-control* studies)

Table B5.6 Structural barriers - access/cost/health insurance

Cost is shown to be a barrier to attendance and reattendance in all ten analyses for *cross-sectional* studies (all from the US), and in all ten, cost remains a significant predictor when adjusted for the effects of other variables. However, cost did not predict attendance in the two US *case-control* studies, and in one intervention study that included this variable.

Related to cost, and also of particular importance in the US, health insurance status has also been studied in several *cross-sectional* studies and mostly found to be significant in bivariate analysis (in 8 of 10) for both attendance and re-attendance, but an independent predictor in only three of the eight analyses. This was also found to be an independent predictor in an *intervention* study in the US.

Other structural barriers relate to access problems. Significant associations were found with car ownership, distance and time to get to service, inconvenience, location of service, and waiting time at the centre. In most cases only bivariate analysis was performed, but a range of study types is represented. Waiting for the results and for an appointment were not significant (each included in only one study).

Summary

While perceived barriers come under the general ambit of attitudes or beliefs in the HBM, several studies have focussed specifically on attitudes that act as barriers to attendance, because earlier studies found these attitudes to be stronger predictors than others about mammography or screening. The most consistent single perceived barrier is concern over radiation. Others such as concern over pain, embarrassment, fear and anxiety about mammography or the results have shown inconsistent results. More consistent results have been obtained when a multi-item barrier score was used, indicating that the concept of perceived barriers is important, but measuring this can prove difficult.

The effect of other attitude variables framed in a positive manner, including perceived efficacy of mammography and early detection, a belief that breast cancer can be cured and positive attitude towards screening, was generally weak and inconsistent.

Structural barriers have also been found to be important, including access problems and cost. It should be noted however that cost is largely an issue in the US, where it has been consistently shown to act as a barrier to attendance. However, as the review above revealed this was the case only in cross-sectional studies. It has been suggested that cost is not an important factor until a mammogram is actually considered necessary or desirable by women, hence studies that follow-up non-responders to invitations generally do not find cost to be important as many are not at the stage of wanting to have a mammogram (Fetting, 1991). However, for those ready to attend, the offer of low cost mammography becomes an important predictor. A study of women on low-incomes demonstrated that a higher proportion would attend if screening were offered free of charge; women on low incomes offered free screening at a health centre had higher attendance rates than low income women in the community (31% versus 14 %) (Lane *et al.*, 1992). However, although the removal of the cost barrier increases participation, it does not explain a significant proportion of non-attendance. One service in the US that offered free mammography to women belonging to a Health Maintenance Organisation received about a 30% response, inferring that significant barriers to participation remained. In this study cost was not significantly associated with compliance (return of authorisation form for a free mammogram), whereas being white, married, having a supportive doctor, and having a family history were significant in the multivariate analysis (Rimer, *et al.*, 1989b).

1.8.7 Influences

Table B6.1 Normative influence - doctor/health professional

A doctor's recommendation or advice is not only the most significant influence on a woman's decision about mammography from the variables included in this section, but also the strongest influence overall in many studies. In general the highest odds ratios have been obtained for this factor.

This variable is often asked in terms of likelihood of obtaining a mammogram if a doctor recommended it, the answer usually collected on a likert scale. One *cross-sectional* study found increased likelihood was associated with ever having a mammogram, but not having one in the last year, suggesting a doctor's recommendation is more important in initial participation. However, the other 12 *cross-sectional* analyses did find an association for all variations of the dependent variable (ever had, had in last year, had for last five years, had more than one, complied to guidelines), and the effect was usually independent of other factors. A UK *cohort* study found that women who initially stated they would 'definitely' or 'probably' attend if recommended by a doctor, were more likely to actually attend, the effect remaining after adjustment. However, in a US *intervention* study it was only related to attendance in bivariate analysis.

The likelihood variable relates to future intentions to accept advice from a doctor if it was given. Another variable used is whether a doctor actually made a recommendation or talked about mammography in the past. In all 13 *cross-sectional* analyses attendance was higher for women whose doctor had discussed mammography, in most cases an independent predictor for each variation of the dependent variable. One study used the more general variable 'doctor talking about early detection' and found it related to "having a mammogram in the last year" but not for "ever had", suggesting women who have never had a mammogram require a more specific recommendation. Actual recommendation was also included in an *attender* study and found to be an independent predictor for both compliance in the last year and future intention. It was also included in two *case-control* studies, but significant in one only (bivariate analysis only reported). The study which found no relationship also found that the woman herself asking the doctor for information on mammography was not significant.

One *case-control* study used the variable 'doctor counselling against mammography' and found it was associated with lower attendance (bivariate only reported).

Table B6.2 Normative influence - social networks/other prompts/sources of information

The effect of social networks has been studied either as a scored factor based on the number of influences, or as a single item of family member or friend recommending/encouraging attendance to mammography. It appears to be more significant in influencing the decision about having a first mammogram, but the effect on repeat mammography and compliance is less certain.

Knowing another woman who had a mammogram was shown to have an independent effect in an Australian *cross-sectional* study but not a UK *cohort* study. Discussing mammography with a friend had an independent effect for "ever had" but not "had in last year" in one study.

Other variables studied which focussed on social networks include having a close network of friends, a confiding relationship or feeling significant others would want them to attend. These factors were usually associated in bivariate analysis, but the effect did not remain after adjusting for other factors.

Other influences include source of information about mammography. A UK study found material obtained in a doctor's surgery was related to attendance, but not other sources of information about mammography (broadcast and print media, friends/relatives). However, a US study did find that the broadcast media influenced attendance. The influence of information source on attendance to the Canadian National Breast Screening study was found to be related to education level, that is, the type of information most likely to have an effect varied by education level. An Australian *cohort* study found no effect on attendance for hearing about screening mammography nor for the amount of information about screening mammography.

Two *intervention* studies found that the type of invitation letter used and use of reminders influenced attendance, but the signatory of the letter did not (doctor versus the HMO director).

Summary

The strongest single predictor is the influence of a doctor in recommending or advising a woman to have a mammogram. Other normative influences have also been shown to be related but none as consistently or strongly as that of a doctor's recommendation.

1.8.8 Summary Of Australian Studies On Risk Factors For Attendance

While individual Australian studies were included in the review above by individual risk factors, it is also worthwhile to bring these together to show the combination of variables studied and shown to be related to screening mammography in Australia. Further, while overseas studies on determinants of attendance are informative, their direct application to Australian screening programs may be limited due to differences both in availability and accessibility of screening services and in the health systems generally.

Prior to the introduction of mass screening and before intensive community recruitment strategies, a number of baseline surveys were conducted as part of the pilot screening programs. These studies formed the basis for prospective studies aimed at investigating changes in knowledge and attitudes to mammography and breast cancer, as well as actions taken.

An Australia wide study was conducted in 1988 which found that 77% of women had heard of a mammogram, and 12% had had a mammogram overall; 18% of women aged 40-49, 19% of those aged 50-59, 20% of those aged 60-69, and 6% of those aged 70 or over (Hill *et al.*, 1991).

The baseline survey conducted in central Sydney prior to the implementation of the screening program, found that over 80% of women had some experience with breast cancer (knew someone who had it). Also, most women knew that it was the most common cancer for women in their age group, but only 6% knew that women in their 60s were at greatest risk (versus 40s or 50s). Only half the women had heard of mammography used for screening, and 22% of women considered themselves susceptible, this proportion being lower in women over 60 than those in their 40s. About a quarter of the women were either very or quite concerned about exposure to radiation, and this concern was associated with attitude to screening mammography. This study showed that women in Sydney had some misconceptions about risk, although knowledge of risk did not predict attitudes or personal susceptibility (Irwig, *et al.*, 1991). Two years after this survey, and following an intensive promotional campaign, a second survey showed that most women were aware of the service (a mobile van), and there was an increase in the women who knew about screening mammography to 81%. However, the proportion of women who knew risk increases with age remained at 6%. The results also showed that non-attendance was not related to lack of information, since 73% of non-attenders were aware of the van's existence compared with 83% awareness overall. Nevertheless, there was a group of women who still reported no exposure to information about the service despite an intensive campaign (Turnbull *et al.*, 1992). A follow-up study found that 30% had subsequently attended the mobile van, but none of the following variables predicted attendance; age, education, occupation status, language, knowledge, attitudes, prior experience, perceived susceptibility, morbid concern about breast cancer or the amount of information on screening to which a woman is exposed (Turnbull, *et al.*, 1995).

Another report of recruitment to this Sydney mobile service, compared attenders (to the service in the area targeted by an intensive promotional campaign) with women in the general population (using data from the Australian Bureau of Statistics 1986 census for the latter). Although the number of variables for comparison was limited, this study found that higher education was related to attendance, but employment status and racial origin was not - women from non-English speaking backgrounds were just as likely to attend as women from English speaking backgrounds (Adelson *et al.*, 1992).

A study relating to a fixed-site service in Melbourne, found that beliefs in the desirability and efficacy of mammography, feelings of susceptibility, and a belief that health is controlled by chance, predicted intention to attend (Cockburn *et al.*, 1991a).

A recent study in Victoria specifically examined the effect of socio-economic status on screening behaviour. It found that although status predicted knowledge and beliefs, it had no effect on actual or intended mammography behaviour (Savage and Clarke, 1995a) and (Savage and Clarke, 1995b).

A survey of knowledge, attitudes and behaviour prior to the implementation of the screening program in Cannington, Perth found high levels of awareness about mammography and a positive attitude towards screening, with nearly 80% expressing a willingness to participate in free screening (Fitzgerald and Moore, 1990). Another paper on this study identified the need to translate these positive attitudes to behavioural action and to better educate women about risk factors. It was suggested that further research was required specifically on non-attenders some time after programs had been implemented (Diamond *et al.*, 1990).

1.8.9 Summary of research on predictors of attendance

Although the research shows some commonalities, important variations are also apparent. The numerous studies reviewed are an indication that much still needs to be understood about predictors of attendance, and in particular barriers to screening mammography. These studies seek to explain why the uptake rates are not higher. The intervention studies reviewed show the extent to which attempts have been made to increase utilisation. The success of these interventions varies. Although some factors have been shown to consistently predict initial attendance, re-attendance or uptake after an intervention, the results are rarely universal. It is often the case that just as many studies report a lack of an effect as those that show an association. Making comparisons is further complicated by classification variations, such as the precise age range being studied and which group is defined as 'younger' or 'older', the type of study design and the specification of the predictor groups ("ever had" versus "never had", "had in past year" versus "did not have in past year", etc).

Further, even where a significant effects were detected, some studies have found an association opposite to that found in most other studies. Reasons for apparently opposing findings or inconsistent findings include variations in definition and in study design. However, some variations may reflect real underlying differences. It is clear that further work is required to tease out real effects from those of sample design, and the effect of situational factors.

Comparison of participants and non-participants in the HIP trial, found that participants tended to be younger, better educated and more likely to be Jewish (than Catholic) compared with non-participants. It was suggested that the socioeconomic differences observed were likely to be understated since only women with telephones were included in the sample on non-participants (Fink *et al.*, 1968).

There also appears to be some national or cultural differences. For example, cost was found to be a significant barrier in the US, but is not an issue in other countries where screening mammograms have been provided free or at low cost. Cultural variations are demonstrated by the types of factors reported as relevant in different countries. For example, a study in Italy reported that God and Destiny were seen as important in matters of health by both attenders and non-attenders (Gordon*et al.*, 1991). This contrasts with other countries where women generally feel more in control of their own health, and moreover the level of control distinguishes attenders and non-attenders.

A major problem with many of studies reviewed was small sample sizes and therefore lack of power to detect differences even if they existed. Also, the response rate was often very low which would contribute to the problem of small sample size, but also possibly introduce bias. If survey non-responders are different from responders, then differences between attenders and non-attenders may be greater than depicted by the women surveyed. It is reasonable to assume that non-responders to surveys about mammography screening are more likely to be non-attenders, and in particular the least likely to be encouraged to attend. Hence, attempts to increase response rates to such studies are critical.

Overall, the variables listed below usually were found to be associated with participation to mammography screening. However, as shown in the more detailed analysis above, by individual variables, the results are far from consistent. For example, no clear socio-demographic profile of attenders versus non-attenders is evident, while for other characteristics, particularly knowledge and beliefs, there is evidence of overlap between attenders and non-attenders. The beliefs that act as barriers have been found to have more discriminatory power, and have therefore been separated out in the review. The variable with the highest odds ratios and therefore the single strongest predictor associated with mammography use is a doctor's recommendation. A recommendation from a doctor emerged as the most important reason for having a mammogram and lack of recommendation was a very important reason for non-adherence. However, the strength of the association varies. One study reported that women of higher socioeconomic status (defined by higher education and income) were much less likely to report doctor influence as an important factor than women of lower socioeconomic (Kruse and Phillips, 1987).

The italicised notation in brackets shows the group most frequently associated with higher participation.

- sociodemographic: age (*younger*); marital status (*married*); education (*higher*); employment (*employed*); occupation (*professional*); income (*higher*); social class (*higher*); ethnicity (*white Caucasian*); religion (*Jews and Catholics)*, household size (*inconsistent*), residential type (*single home*)
- health status: self-rated health (*higher rating*), limitations on activities, disabilities, acute and chronic conditions (*fewer limitations/disabilities/conditions*)
- other health behaviours; pap smears, breast self-examination, dental check-ups, smoking, exercise, diet control, seat belt use, clinical breast examination, utilisation of medical services (*more likely to use other preventive measures and health services*)
- experience with mammography: previous mammogram, future intention to have mammogram, experience of last mammogram (*had previous mammogram and experience good*)
- motivation and psychological health: self-esteem (*higher*), sense of control over health (*believe have control*), satisfaction with health care (*satisfied*), psychological profile (*less anxious, more in control*)
- knowledge about breast cancer and mammography; knowledge that risk increases with age, knowledge of incidence of breast cancer, knows purpose of mammography and that symptoms not needed to have a mammogram, knowledge of screening guidelines (*generally greater knowledge, but often both attenders and non-attenders lack knowledge of risk factors especially age most at risk)*
- perceived vulnerability to breast cancer: perceived susceptibility (*feel more susceptible*), perceived seriousness *(perceive as serious)*, concern or worry about breast cancer (*more concerned*)
- experience with breast cancer: personal and family history of breast cancer or breast disease, relative/friend with breast disease, discussing breast cancer with friends/others (*had contact with women with breast disease or personal experience and discussed with others*)
- perceived barriers: fear of finding cancer, fear of radiation, embarrassment, concern about pain or physical discomfort, anxiety about mammography, not wanting to 'look for trouble' (*less concerned, less anxious, perceive fewer barriers*)
- other attitudes/beliefs about mammography: perceived efficacy and safety of mammography, belief that mammography beneficial and necessary, belief that breast cancer curable, wanting reassurance (*mammography efficacious and benefits outweigh costs, wants reassurance*)
- structural barriers: cost (*not concerned about cost*), health insurance coverage (*insured*), access - convenience, distance, transport (*have greater access or perceive services as accessible*)
- normative influences: recommendation of important others - especially doctors, social networks/pressure, source of information (*more likely to have recommendation or be influenced by important others*)

1.9 DEFICIENCIES IN CURRENT RESEARCH

1.9.1 Research on Differences by Type of Attender and Non-attender

Most studies compare all attenders with all non-attenders, but neither group is homogeneous. In the US where several studies have measured compliance to the guidelines, it is should not be overlooked that the comparison groups vary from study to study, and both compliers and non-compliers form diverse groups. Some measure compliers as women who have had a mammogram in the last year (US guideline for women 50 and over). In this case, non-compliers would include women who have never had a mammogram as well as those who have had one or more greater than a year ago. Others measure compliance over a number of years. Again the non-compliers range from women who have regular mammograms, but not annually to those who have never had one, nor intend to have one. Where various levels of compliance were examined within studies, clear differences were evident. One such study found that different variables predicted attendance in the last year (complied to guidelines) from attendance in the last five years (Champion, 1994b).

The lack of consistency in the research results can be partly attributed to treating attenders/non-attenders or compliers/non-compliers as homogeneous groups. However, the few studies that have studied various sub-groups have demonstrated clear differences between them, and that further research is required in this area.

A UK pilot study of mammography compared three groups of women; attenders after invitation to mammography screening, non-attenders (rejectors) after a second invitation, and self-referred attenders. (Hobbs *et al.*, 1980). Differences were found between all three groups, and the clear differences shown between acceptors of invitations and self-referred show that invitations encourage attendance from women who might not otherwise use the service. It was suggested that use of personalised invitation strategies can reduce the effects of age and eliminate the effect of social class, since self-referred women are clearly not representative of the population. Another UK study found that women who made an appointment but failed to keep it differed from other non-attenders, and suggested they may be under considerable social strain (Hunt *et al.*, 1988).

A study in Israel compared three groups of women - self-referred or spontaneous attenders, induced attenders (through personal invitation) and non-attenders. The focus of this study was on psychological factors. The researchers found that the scores obtained on a range of psychological tests (broadly grouped as emotions, personality traits, self-concept, mental health and health attitude) were similar for both groups of attenders, indicating that women who subject themselves to breast-screening tests have a specific psychological profile. However, on a number of these tests the induced sample had more extreme scores than the spontaneous group. In particular, the induced group had higher anxiety levels than both other groups, but were also found to be at higher risk; 61% had first-degree relatives with cancer, compared with 28% for spontaneous attenders and 35% for non-attenders. The authors postulate that these women repress their anxiety, become defensive and avoid screening. The personal invitation with messages of "we care about *you* personally" was said to reduce their level of anxiety (Chaitchik and Kreitler, 1991).

A study in the US on attendance to mammography screening compared self-referred women with physician-referred women (Reynolds and Jackson, 1991). The self-referred women were more likely than the physician-referred women to; have a higher income, be college graduates, consider their health as good or excellent, have a friend with breast cancer, believe that breast cancer could be cured, be less worried about radiation, to consider $50 an appropriate charge for a screening mammogram. They were also more likely to perform other health promoting practices, but this did not reach statistical significance.

A study which compared participants in the HIP trial according to the amount of effort required to recruit them, found that women in the minimum effort group (requiring only one mailing) were more likely than the increased effort group (requiring additional letters and/or telephone contact) to participate in all four screenings offered (Fink and Shapiro, 1990). No difference between the groups was found in relation to age, race, employment status, or travel time to the screening site. Nor were there differences in beliefs about screening generally, although the minimum effort group was more likely to express concerns about breast cancer and to report breast symptoms. However, women in the increased effort group were more likely to have lower education and income levels, and to have received fewer medical services in the previous year. They also reported poorer health status and were less likely to have a regular physician. All groups were familiar with the setting in this study, possibly explaining partly why greater differences were not found between the groups. It was suggested that when screening is offered in unfamiliar settings the differences may be greater between ready and reluctant participants.

Another study, found it useful to differentiate between two groups of non-participants following an offer of low cost screening in the workplace - those who had had mammogram in last three years and those who had not; differences were found between all three groups, that, is, the two groups of non-participants and participants (Rutledge, *et al.*, 1988).

1.9.2 Repeat Screens

It is important that women are not only encouraged to attend for screening mammography in the first instance, but to return for repeat screens regularly. There is a dearth of research investigating the continued adherence to repeat mammography. A number of overseas studies reviewed conducted separate analyses for having a repeat mammogram, but these were mostly of cross-sectional design. A US study reported in 1991 found that even then 70% of women aged over 50 had had a mammogram, but only 20% had regular mammograms, defined as two in the last two years (Zapka *et al.*, 1991). The problem with the US studies that measure compliance to the guidelines in relation to repeat screens is similar to that noted above, in that compliers and non-compliers each comprise a diverse group. Some compliers will have only had one mammogram while others would have had several repeat mammograms. If compliance is measured in terms of annual screens (as was the case in some studies), then women having regular biennial screens, as recommended in Australia, would be considered non-compliers.

As would be expected, a factor that has consistently predicted re-attendance from studies that have specifically studied this, is previous mammography screening experience. However, more information is required on why women do not re-attend after an initial screen. No Australian studies have been reviewed on factors that predict whether women have repeat mammograms.

A Canadian study explored women's attitudes to breast screening after participation in the Canadian National Breast Screening Study. A comparison of active respondents (attending 2 to 5 screens) and dropouts after the first screen found that the dropouts were more likely to complain about pain from mammography, be less interested in BSE, and in screening. Dropouts were also more likely to report distance as a problem, and expressed more negative comments about the competence, courtesy and promptness of the screening visit (Baines *et al.*, 1990b).

A study in Britain examined how women's previous mammography screening experiences impact on their responses to an invitation to a second screen. Although more non-attenders (34%) than attenders (25%) found the previous experience painful, the difference was not statistically significant. Compared with women who re-attended, women who did not re-attend were significantly more likely to report that the previous screening test was embarrassing or distressing, and less likely to have found the clinic staff helpful or the visit worthwhile or reassuring. Attenders were more likely to agree with the statement that screening can detect problems at an early stage, and more likely to disagree with the statement that it is not important to be rescreened. Previous screening results did not have an effect on attendance status (Orton *et al.*, 1991). Another UK study suggests that compliance to the second round of screening varies by initial recruitment to the first screen; reattendance was higher amongst self-referred women that invited women (Williams and Vessey, 1990).

1.9.3 Reasons for Non-attendance

The literature review showed that the most important factor in determining attendance was a doctor's recommendation. Yet even after a doctor's endorsement a significant proportion of women failed to attend, as evidenced by randomised intervention trials of active encouragement by doctors and the issue of invitation letters direct from doctors.

To supplement the statistical analysis of predictors of attendance, the value of qualitative information should also be pursued, in particular to investigate the underlying reasons for non-attendance. Such information, obtained through focus groups or open-ended questions at interview, can then be used to develop quantitative analytical studies. Studies which elicited reasons for attendance or non-attendance in a less structured format are summarised below.

Women who declined an invitation to the UK Edinburgh trial gave the following main reasons for non-attendance; practical problems (domestic situation, transport, work); psychological (fear, worry, anxiety; feeling mammography was not necessary, fatalism); dislike of all things medical; procrastination (Maclean *et al.*, 1984). It is also important to ask women why they do attend. Another early UK study found the main reason given for attendance was to seek reassurance, while the main reason for non-attendance was practical difficulties, followed by 'lack of interest/not needed' (French *et al.*, 1982). A prospective UK study showed that non-attenders to screening mammography (usually studied as a homogeneous group in most studies) form a heterogeneous group with quite different reasons for non-attendance. The group who made an appointment but subsequently failed to attend were more likely to report health problems than attenders, those who declined the invitation and those who did not respond at all; it is suggested that these women may be under considerable social strain making it difficult to keep appointments. Those who declined the invitation considered themselves in very good health, suggesting that they may consider screening unnecessary since they feel well. However, a problem with this study was that, as expected, the return of questionnaires was also related to attendance status (Hunt, *et al.*, 1988).

The NCI Breast Cancer Screening Consortium (1990) which reported on seven large studies in the US found reasons for non-participation varied for different groups of women, particularly those of varying education and income levels.

A study in Norway found that most frequently reported reason for non-attendance was lack of opportunity. Other reasons given, in order of frequency, were; not wanting to participate, fear of x-rays, concern about pain, not receiving the invitation, fear of discovering breast cancer, and the potential of having a male examiner (Gram and Slenker, 1992). A study in Italy found that the most common reasons for non-attendance were; belief that screening is unnecessary (38%), practical reasons (19%), fear of cancer being found (16.5%), and postponement and laziness (13%). Non-attenders also reported that mammography was painful, dangerous, troublesome, and embarrassing (11-22% response to each of these). Access was not considered a problem, and most of the non-attenders were not interested in future invitations. The authors suggest that attitudes and behaviours may be difficult to change, since their program had been ongoing for 20 years, and the only way to increase participation may be through coercion. They also state that local factors play a role in non-attendance, and should be evaluated in each local setting (Ciatto *et al.*, 1992). In another study in Italy, the principle reasons given for not attending were lack of interest/no breast symptoms, lack of information, fear/worry/anxiety, practical (work or family commitments, health problems, away at time of invitation), and recent physical/mammographic breast examination (Donato *et al.*, 1991).

In the US a randomised study was unable to show any benefit from a mail-out intervention in terms of encouraging attendance in the 12 month intervention period, even after adjusting for the effects of other variables (Bastani, *et al.*, 1991). It was suggested that before an intervention could be effective, underlying barriers needed to be addressed. Information was elicited from both the intervention and control groups on reasons for adherence/non-adherence, and the combined information reported. This showed differences between attenders and non-attenders (from either the intervention or control group) which were not found between the intervention and control women. The main self reported reasons for adherence, in order of importance, were; recommendation from a doctor (46% gave this reason), breast problems or symptoms, (19%), and routine check-up (17%) , age (3%), family history (2%), and influence of the print and broadcast media (2%). The main reasons for non-adherence considered very or fairly important were; perceiving oneself as asymptomatic and healthy (60%), cost, inconvenience, lack of recommendation from a doctor, concern over radiation, and fear of finding cancer. Contrary to expectation, nearly 90% stated that pain or embarrassment were not at all important. This shows that despite intensive efforts to promote screening, some women are not getting the message about the need to have a screening mammogram in the absence of symptoms.

A survey of non-participants in the organised screening program in New Zealand showed that apathy, lack of concern and lack of perceived need were the main reasons for non-attendance. Others included fear of a positive result, lack of encouragement from a doctor, and lack of knowledge about screening (Munn, 1993).

The qualitative studies of attenders or non-attenders are useful in helping to better develop the underlying constructs being tested in comparative analytical studies. They also supplement the comparative analyses, and can provide useful additional information, since statistical modelling requires reduction and categorisation of data. However, these studies alone are not sufficient in eliciting potential factors which predict attendance to mammography screening, since it is not known if factors considered important by women targeted by a specific screening program, also apply to the group not studied.

Clearly, a multi-faceted approach is required to provide a complete evaluation of predictors to mammography screening, and the recognition that the population being targeted is not homogeneous. This thesis aims to study the various subgroups, within the broad group comprising those being targeted by the national screening program. While the study focuses on the South Australian component of the program and populations specifically targeted by the SABXRS, populations and mammography outside the program are also examined to provide a comprehensive overview of factors that may impact on the success of the program.

CHAPTER 2 STUDY CONTEXT AND OBJECTIVES

2.1 CONTEXT

2.1.1 General Overview

Chapter 1 ascertained that breast cancer is the most common malignancy in Australian women with no improvement in survival rates over the last 50 years. It is now widely accepted that screening mammography can reduce the breast cancer mortality rate by at least 30% in asymptomatic women aged 50 years and over. Published results from the first screening programs in Victoria (Essendon) and South Australia indicate that key process qualitative standards, such as detection of small cancers, the positive predictive value of an abnormal mammogram and the number of benign to malignant biopsies, are being met (The Essendon Breast X-Ray Program Collaborative Group, 1992; SA Breast X-Ray Service, 1995). In order to achieve the reduction in mortality from breast cancer shown in the randomised controlled trials overseas, it is critical that attendance rates are high. No screening service in Australia has yet achieved a participation rate of 70% of target women, defined in the National Program for the Early Detection of Breast Cancer (1994a) as the proportion of the target population screened within the previous 27 months (allowing some leeway around the 24 month screening interval).

While mammography has been shown to benefit those who attend in terms of less drastic treatment and reduced mortality from breast cancer, the success of an organised screening program at the population level depends on the overall participation rate. It became evident during the early implementation phase of the SABXRS that it could not rely on 'spontaneous' bookings to achieve acceptable participation rates. Thus, the Service moved towards personal invitation strategies, initially using general practitioner (GP) lists and later the electoral roll, for recruitment. It has been suggested that only 15 to 30% of women will voluntarily attend for breast screening (Chaitchik and Kreitler, 1991).

The literature shows that most women know about mammography, yet a significant proportion are not presenting for it. Policy makers need to better understand which women are not presenting and why. Although the literature on participation is extensive, it is clear that further research is needed that will inform on the best strategies to motivate women in the target population to participate initially and on a continual basis in organised breast cancer screening programs. Having a mammogram requires a healthy asymptomatic woman to actively submit herself to the procedure in the belief that it will be beneficial. Hence, much of the research has focussed on behavioural models of preventative health behaviour.

It is evident that non-attenders are not a homogeneous group and reasons for not presenting vary for different groups (see Chapter 1, 1.9.1 & 1.9.3). Apart from understanding the users (and potential users) of screening services, attention must also be focussed on the providers. Screening services differ markedly from diagnostic services in that they are for apparently well women. The vast majority of the population will not attend voluntarily without prompting. Providers must incorporate into their policies the needs of the clients to ensure the services entice women to attend and return for their mammograms.

The application of mass screening in the Australian setting and its cost-effectiveness are still issues for debate. Low participation has implications for both overall effectiveness and the cost-benefit ratio. While screening in Australia was determined reasonable value for money on the basis of the pilot studies in the SECU report (Australian Institute of Health, 1990), any divergence from the assumptions made regarding participation (70% for women aged 40-69) would invalidate the estimates.

Although a national screening program has been established in Australia, some women choose to be screened outside the program. It is crucial that account of these women is taken when calculating participation rates. At present the only estimate of the extent of this is from Medicare claims for radiographic examination of both breasts. In theory, women cannot claim on Medicare for screening, unless they have a family history of breast cancer; in the absence of symptoms this is in effect screening, but more importantly the level cannot be gauged since the definition of "family history" is loose, allowing a varied interpretation. Also, it is suspected that some of the "diagnostic" cases are in fact screens, only requiring a doctor to certify that a "problem" needs investigation. It is difficult to ascertain the extent of such informal screening outside the program.

The SECU evaluation (Australian Institute of Health, 1990) reported that between 1985 and 1989 there was a rapid rise in the Medicare claims for mammography, especially in women aged 40-49. In the four years prior to implementation of the national program, there was a 400% increase in Medicare claims for bilateral mammography for women in their forties. Thus, the decision to include these women in the program was a pragmatic one, given that a high proportion were being 'screened' anyway. The NPEDBC released an information statement in 1992 which stated that while women aged 40-49 comprised 36% of women aged over 40, they accounted for 48% of the Medicare claims for bilateral mammography.

A recent evaluation of these Medicare claims found a steady increase from 1988-89 to a peak in 1992-93 for Australia as a whole, with a decline for the first time in 1993-94 (National Program for the Early Detection of Breast Cancer, 1994b). In South Australia the peak was in 1990-91, reflecting the more rapid and geographically extensive implementation of the program in this state. Nevertheless, it is evident that a significant amount of informal screening occurs outside the program. This can only be measured by knowing the reason for which mammography was requested, which is not available from the Medicare data. The example of cervix screening demonstrates that screening outside the formal organised programs is inefficient (Chapter 1, 1.4.3). This thesis includes a series of state surveys which will show to what extent women are having screening mammograms outside the accredited national program. This may indicate a need to educate women and doctors about the importance of participating in an organised program that provides specialist expertise and can ensure adequate quality assurance standards are met.

The SA Breast X-Ray Service (SABXRS) is the South Australian component of the National Program for the Early Detection of Breast Cancer (NPEDBC). Apart from specifying a target of recruiting 70% of women aged between 50 and 69, a major aim of the NPEDBC is that attendance by women from Aboriginal and non English speaking backgrounds should be in proportion to their representation in the population. From a public health perspective, it is important that both high participation rates are achieved, and a cross-section of the population is recruited. The literature shows that women at high risk of breast cancer on the basis of family history of breast cancer or personal history of breast disease do feel more susceptible, and are more likely to attend for mammograms (Appendix B, Tables B4.5 and B4.6). However, since no more than 25% of women who develop breast cancer have any of the known risk factors (apart from age), reducing breast cancer mortality will not be possible by targeting only high-risk women. There is a need to increase the appropriate perception of risk among the general population of women, since the most important risk factor is age.

2.1.2 Recruitment to the SABXRS

During the first two years of operation, the SABXRS had limited screening capacity with only three clinics, each offering screening on four half-day sessions a week. Yet after only a few months the Service found that it could not rely on 'spontaneous' bookings to achieve acceptable participation rates. These slowed down even in areas with relatively intensive broadly based, non-personalised strategies such as media promotion, talks to women's groups and general practitioners, letter-box drops and displays in surgeries and other health or retail outlets. Hence, the SABXRS moved towards more active and "individualised" recruitment strategies using registers such as GP listings and the electoral roll.

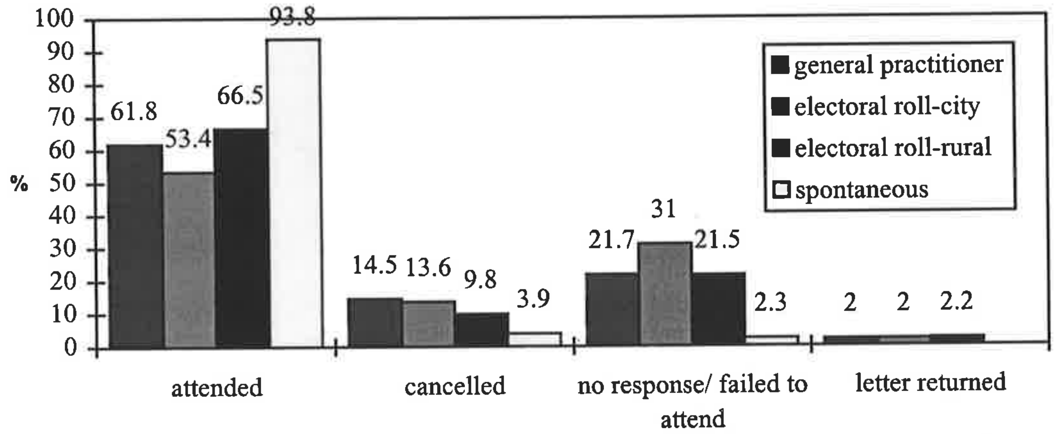
In South Australia, the first personalised method of recruitment tried by the SABXRS was the use of GP listings. Women aged 50-64 (the target population at the time) were mailed a personal letter of invitation on the general practice letterhead which included a message of support for the SABXRS and basic information about screening mammography. They were offered a specific appointment date and time at the nearest screening clinic, and a pamphlet about the Service was enclosed. The first invitations from the initial GP practice that cooperated with the SABXRS in this manner were sent from September 1989, six months after the Service commenced operation. Four additional GP practices joined in February 1990, March 1990, July 1990 and November 1990. A total of 2 200 GP invitations were issued, the last of these being mailed in March 1991.

In November 1990, the SABXRS commenced using the electoral roll for recruitment purposes. A personalised letter of invitation is sent to women direct from the SABXRS. Initially an appointment time was offered as with GP invitations, but since March 1991 only a date has been specified and women are required to telephone for an appointment time. Although specific appointment times on the letter resulted in marginally better response rates, the fluctuation in response made organisation of service provision less than optimal. More letters were issued than available appointments to allow for a certain level of non-acceptance, however this could only be based on average turn-out. Hence, on some days more than the expected number would attend while on other days the response was lower than expected. As the need arose to re-invite women due for their second screen early in 1991, very few personalised invitations using the electoral roll were sent out until late 1991 when the Service opened two new screening services.

Figure 2.1.1 below shows the overall response for new clients by recruitment type, from the commencement of the program in January 1989 to 30 June, 1992. This earlier data is used in this graph to examine the response at the time when the SABXRS did not rely disproportionately on any one strategy. That is, during this period a range of strategies was tried by the Service. The data in Figure 2.1.1 relate to the first outcome after the initial contact with the service. Because the initial contact is different for spontaneous clients and invited clients (invitees), the meaning of the categories along the X-axis necessarily differs. For spontaneous clients whose initial contact was to make an appointment, 'responded' refers to those who kept their appointment. For invitees whose initial contact is a letter from the SABXRS, 'responded' refers to those who rang the service and made an appointment (however, they may have later cancelled this appointment or failed to attend on the day). For spontaneous, those who 'cancelled' refers to those who rang to cancel their appointment, while invitees rang to cancel the invitation (that is they do not wish to make an appointment). For spontaneous clients, 'failed to attend' means they did not keep their appointment, while for the invitees it relates to those who made no contact with the Service (did not respond to the letter). 'Letter returned', applies to invitees only and relates to those cases where the invitation letter was returned to the Service. Some of those who failed to attend may also have failed to receive their letter, but the Service has no information about this. It should be noted that the invitation outcomes of 'cancelled' and 'failed to attend' includes women who would not have been eligible for the service at the time (mostly because they had had a recent mammogram).

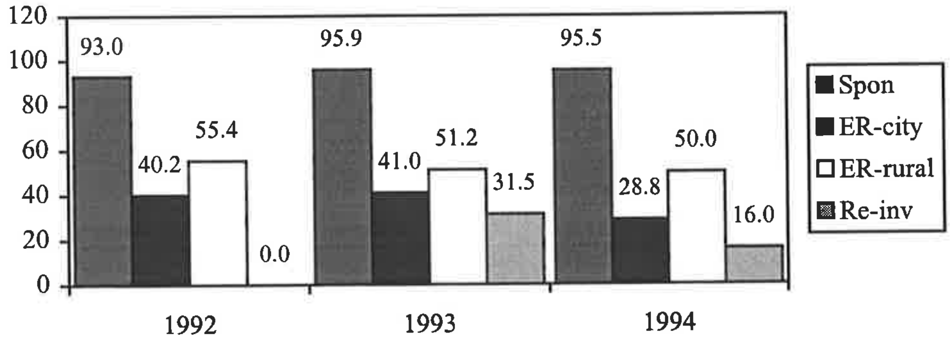
Data for electoral roll invitations are shown separately for women invited to attend clinics in the city (Adelaide) and those invited to attend the mobile service in country areas. General practitioner invitations were only issued to women residing in Adelaide. For GP invitees, about 62% of women sent an invitation actually made an appointment. Electoral Roll invitations yield lower acceptance rates in the city than GP invitations, but in the country the participation rate is similar.

Figure 2.1.1 Initial Response by recruitment strategy for new clients to the SABXRS (Jan 1989 - June 1992)



A proportion of those shown as 'responded' in Figure 2.1.1 do not actually attend. Figure 2.1.2 shows the proportion actually attending within 90 days of the appointment date for the Spontaneous clients or 90 days from the date invited to attend for Invitees. An additional category has been included (Re-invitees) so that all methods of recruitment for new clients are covered. Re-invitees include 2 groups; those sent a second invitation a year after failing to respond to a GP or an electoral roll invitation, and spontaneous clients who did not keep their appointment (also sent a year later). Only data from 1992 are shown, as the limited capacity prior to this often meant delays of more than three months, reflecting Service not client problems. In fact, during the middle of 1991, the waiting time was as long as 6 months. As indicated earlier a major expansion occurred in late 1991. It can be seen that most women who book spontaneously actually attend within 3 months. A higher proportion of electoral roll invitees attend in the country (invited to the mobile service) than the city, and the response in the city declined markedly in 1994. Also, it can be seen that the re-invitation a year later is effective in recruiting more new clients, but the success was halved in 1994. These data suggest that by 1994, the population of women who could be recruited readily was already being depleted, and those who have not yet attended the SABXRS may be difficult to recruit.

Figure 2.1.2 Attendance by recruitment type at the SABXRS by year



Unless women who initially do not respond to an invitation attend, the Service may exhaust the supply of potential recruits from the electoral roll. In most areas of the state, all women on the roll have already been invited at least once. Updates of the roll will provide some new potential clients, but not sufficient to maintain an acceptable level of participation in the future. The time is imminent when more specialised recruitment strategies will be necessary to attract initial non-responders to invitations. Already one of the full-time screening centres opened in October 1994 is unable to fill the available appointments.

The success of an organised screening program depends not only on the initial recruitment of women into the program, but also the ability of the program to ensure they return for repeat mammograms. The SABXRS invites women (not found to have breast cancer) to return for a repeat mammogram every two years. A small proportion are invited annually - women in their 40's with a strong family history[1] and any woman with previous breast cancer. Without invitation, it is suggested that few would reattend voluntarily (Chaitchik and Kreitler, 1991). Yet even by invitation a significant proportion fail to return. For women aged 50-69 who had their first screen in the period 1/1/91 to 30/4/92, 77.5% had returned for a second screen within 27 months, the National program's definition of a rescreen (24 month screening interval plus 3 month window). For women aged 50-69 who had their second screen during the same period, 87.4% had returned for their third screen within 27 months. On this basis, it can be expected that about 67% of women recruited will remain clients of the Service at Round three (87.4% of 77.5%). The rescreening rates for the second screen are comparable to those obtained in the HIP trial, but not as high as the Swedish two-county trial (Table 1.4.1).

2.1.3 Rationale for Study

Irrespective of mode of booking with the SABXRS, a significant proportion of women do not attend. Among women who receive unsolicited invitations, a significant number fail to attend

[1] Strong family history is defined as follows: has first degree relative (mother sister or daughter) with a) cancer diagnosed before age 50, or b) bilateral cancer at any age, or c) more than one first degree relative with breast cancer

without notice or cancel their appointment. This occurs to a lesser extent among women who book of their own volition, but nevertheless a proportion of these women also fail to attend without notice or cancel their appointment; it has been suggested that this group of non-attenders may be under particular social strain (Hunt *et al.*, 1988). The literature suggests that non-attenders should not be treated as a homogeneous group, and that further research is required in this regard (Chapter 1, 1.9).

From the research overseas, as well as that conducted in Australia to date, it is evident that different strategies will be required for different groups of women, and for women at different stages of readiness. For example, it was found that different variables predict the behaviour of younger and older women, women of different educational levels, and women from different socio-economic groups and so on. Further, from the few studies that have not treated attenders and non-attenders as homogeneous groups, it is evident that there are significant inter-group differences. From this variation we can conclude that various recruitment strategies attract different groups of women, and more research is required to differentiate these groups in Australia. If non-attenders are to be encouraged to attend, their diversity needs to be better understood. Surveys of non-attenders indicate at least some of these women can be encouraged to attend (Rimer *et al.*, 1988), but more research is required to identify these women. Some may be encouraged with little effort while others may never be encouraged. The authors of a paper describing the Florence screening program in Italy, after it had been operating for 20 years, suggest that it may be difficult to recruit those who had still not attended at that point (Ciatto *et al.*, 1992).

Even prior to the implementation of the NPEDBC in Australia, it was recognised from the experience of the pilot programs that "a single broad-based recruitment plan for the whole nation would not be feasible. Individualised strategies tailored to specific groups and areas are required" (Australian Cancer Society, 1990). Even with intensive promotion campaigns in localised areas in Sydney, Melbourne and Perth, these programs fell well below the 70% target (Chapter 1, 1.5.1).

While studies from other countries which have embarked on national screening programs are informative, the results cannot be applied directly to the Australian situation given the contextual variations as well as cultural differences. The US from which most of the research originates, has an entirely different model of service provision, hence the validity of the US studies for Australia needs to be questioned. The US does not have a universal national screening program, but a series of programs offered in a variety of situations, mostly arranged by health insurance organisations, but also by other organisations to cater for the non-insured such as health or community centres. The funding arrangements also vary significantly from those in Australia, as well as the recommended screening guidelines, thus studies on compliance will have a different time reference. It is likely that a different group of women will be compliers to biennial screening (Australian recommended interval) than to annual screening (US). Variations also apply to other overseas countries from which the literature has been drawn. The UK for example, offers three yearly screening and recruits largely from GP registers.

The results from the literature review are ambiguous. This ambiguity was evident both within and between countries. Factors found to be usually significant in determining screening behaviour in the US for example, were either not significant, or had the opposite effect in the UK. Information about existing attitudes, knowledge and experience from previous research has been used to develop intervention strategies, but these have had varying degrees of success. Further clarification is required in order to translate the results of research studies into interventions. The comparison of all participants and non-participants as homogeneous groups is suggested as a major problem in the applicability of much of the research into planning. Further research is required by various groups of attenders and non-attenders, and more detailed information on reasons for non-attendance both to initial screens and repeat screens. These issues will be incorporated into this study.

Other Australian studies provide a good basis on which to build. The application of the results to the SABXRS is limited however, as these studies have usually focussed on localised populations. Moreover, the SABXRS differs from other Australian screening programs in significant ways. In particular, a state-wide service was offered from the start, and the organisational structure of the South Australian program is quite different from others as outlined in Chapter 1, 1.3.2. To the investigators' knowledge, no Australian studies have been conducted in the areas identified as deficient in the research in section 1.9, that is to evaluate various groups of attenders and non-attenders in a systematic way, and determine more detailed information as to why women do not attend. Nor have previous Australian studies examined in detail re-attendance after a first screen.[2]

The research from the Sydney studies reported in the literature review found that there was a group of women who despite an intensive campaign still reported no exposure to information about the screening service. The authors state that "it will be necessary to investigate why these women have not been reached", and suggest that qualitative studies that identify their social networks would be useful (Turnbull *et al.*, 1992). The researchers in Western Australia also suggested that further research was required specifically on non-attenders some time after programs had been implemented (Diamond *et al.*, 1990). This study will address these issues.

2.2 STUDY AIMS AND COMPONENTS

2.2.1 Aims and Hypotheses

The aim of this study is to determine profiles of women not attending for mammography screening, both in general and specifically to the SABXRS. It evaluates predictors of attendance to mammography screening using various sources of information and examining different subgroups and approaches to recruitment.

Given the general consensus about the value of screening mammography in women aged 50 years and older, the issue is no longer whether mammography is effective, but how to encourage women to participate. This study provides the most comprehensive assessment of recruitment to mammography screening in Australia, and is a timely initiative given that the National Program for the Early Detection of Breast Cancer is about to embark on a significant expansion phase.

A range of studies will be used to examine predictors of attendance both to the SABXRS and to all breast cancer screening. Data from community surveys will determine whether particular segments of the population are not being successfully recruited and analyse general predictors of attendance. They will also show if a significant proportion of the target population is receiving screening

[2] More recent Australian research has been published since this chapter was written. Given that the studies comprising this thesis were informed by the state of knowledge at the time, it was not considered appropriate to update this chapter. Rather, the more recent Australian research will be incorporated into the final chapter.

mammograms outside the nationally funded program. Screening outside the program impacts on the ability to recruit the target population; screens performed outside the program must be taken into account in calculating participation rates.

However, given that Australia has established a national program to provide screening mammograms to all eligible women in Australia, and that screening is not (ostensibly) available within the Medicare system, it is critical to focus on predictors of attendance to this program. Many of the women defined as "non-attenders" in the community surveys (those who have not taken advantage of screening services offered) may need little or no prompting to attend. Therefore, a detailed analysis of women who have made a conscious decision **not** to attend (after making an appointment themselves or being offered one from their doctor), is critical in developing specifically targeted strategies, and is the focus of this research. Fallowfield*et al.*, (1990) state that a woman's decision not to attend is made in the context of her social circumstances, attitudes and beliefs, and the interplay of the factors affecting compliance and regular attendance are fundamental issues which must be thoroughly investigated if the national screening program in UK is to be successful. These issues are just as fundamental in Australia.

The various studies include surveys using instruments that include both structured questions, as well as open ended questions that seek reasons for attendance and non-attendance and general comments to help develop recruitment strategies and improve the service provided. Intention to participate will also be asked since the literature review found that intentions predict actual behaviour. In one of the studies, it will be possible to validate intentions against behaviour. Mammography utilisation outside the Service will be based on self-reports in face-to-face interviews in women's homes. Evidence from the US shows that self-reports of mammography use are reliable (King *et al.*, 1990); (Fox *et al.*, 1991). Another study in the US found that interview data estimated significantly higher proportions receiving mammograms than a medical records audit in poor areas of Chicago (Whitman *et al.*, 1993). This study used two separate samples to draw this conclusion; one estimate was made from an audit and another from interview (women's answers were not checked against records). If this result was in fact valid, it suggests that the reliability of self reports may vary by population groups. For the surveys of SABXRS clients in this study, self-reports can be validated against client records.

This thesis will discuss how the SA breast X-ray Service can utilise the results generated to achieve and maintain high attendance by women who will most benefit from the program. By ascertaining reasons for non-attendance amongst various groups recruited from a range of methods, it can advise on ways of reaching particular segments of the population. A range of acceptors and rejectors of the Service will be studied. Rejectors include those who may require little effort to recruit (for example those unable to keep an appointment due to ill health or absence) through to those who have already declined an invitation on two separate occasions.

Personalised invitations are recognised both in SA and interstate as the only way to achieve high attendance rates in the target population. However, unless some of the 50% or so of women who initially choose not to attend are eventually recruited to the program, it will fail to achieve the target of reducing mortality from breast cancer. Acceptance rates from GP and electoral roll invitations are generally lower in other states (Chapter 1, 1.5.1). Thus the results of this study will also directly benefit the program nationally.

The theoretical framework for this study and rationale for the grouping of factors for analysis is detailed in Chapter 1. The framework primarily utilises the expanded Health Belief Model, supplemented by two other models in areas where the HBM is not explicit enough; the Theory of Reasoned Action (normative influences) and Social Learning Theory (self-efficacy). Within this framework, the thesis postulates that women go through various stages of adoption from precontemplation, to contemplation to action and maintenance. Further, it is hypothesised that this relationship is not linear and a woman who has had a bad experience can slip back to an earlier stage.

Particular emphasis is given to barriers to attendance in this thesis. From the literature it was seen that although mammography use has increased, and women generally have positive attitudes and knowledge about mammography, major impediments to participation remain. Nationally, significant effort has been devoted to communicating to women the message about the effectiveness of mammography through the media, public and general practitioner education, conferences, and other public forums. There is a growing awareness and acceptance of mammography and a dramatic increase in the proportion of women reporting having a mammogram. Yet despite these efforts not all women are being reached, suggesting that the barriers are not being addressed successfully.

This study has evolved over a number of years. The main component is a comprehensive case-control study planned and implemented in 1991. At that time, very few electoral roll invitations had been issued, and the study focussed on the two main recruitment methods used at that time, spontaneous bookings and invitations from general practitioner listings. However, as the service developed it was considered important to expand the scope of the study. An additional survey of non-attenders to an electoral roll invitation was added to ensure a complete representation of the various sub-populations, as well as further community studies to monitor overall participation rates. Also, given that the SABXRS is one of the most mature programs in Australia, a significant proportion of appointments are for re-screens. Hence, a survey of non-responders to a re-screen invitation has also been added to the study. A review of Australian research into the behavioural aspects of screening mammography noted that little is known about factors associated with rescreening and recognised the need for research in this area (Cockburn and White, 1994a).

With the additional components, this study will inform on the effectiveness of all the various recruitment strategies used by the SABXRS. In addition, a series of community surveys over five years will provide data on the extent of screening outside the formal screening program. This will enable an appraisal as to whether a 70% participation rate in the target population of women aged 50-69 is achievable.

The main hypothesis to be tested are that:

1. Attenders and non-attenders to the SABXRS will differ with regard to six broad constructs;
    - Socio-demographic
    - Health Motivation and Control
    - Knowledge about Breast Cancer and Mammography
    - Susceptibility to Breast Cancer (perceived and actual)
    - Barriers (perceived and structural)
    - Influences (significant others, networks, sources of information).

2. The various sub-groups of attenders and non-attenders to the SABXRS (based on recruitment method) will differ with regard to the six broad constructs.

3. Overall, the barrier construct will have the greatest impact on participation.

4. Individually, a doctor's influence will have the greatest impact on participation.

5. Non-attenders will comprise women at various stages of readiness for adoption of mammography.

6. Intention regarding mammography predicts actual behaviour.

7. The profile of women in the community receiving mammograms will differ from the SABXRS clients.

8. A level of "screening" occurs outside the National screening program to an extent that will impact on the ability of the program to gain a 70% participation rate in the target population of women aged 50-69.

2.2.2 Overview of Structure of Thesis

This thesis comprises three major components presented as Parts II, III and IV. Each comprises a number of sub-studies which will be drawn together to provide a composite evaluation of screening mammography utilisation in South Australia. The components are summarised below, but methodological details for each is provided within the respective Part.

The number of variables that could be incorporated within each component and sub-study varies according to funding and the level of control of the investigator. For example, no direct control was exercised over the study used to examine participation in mammography screening at the national level, the Australian Health Survey run by the Australian Bureau of Statistics. The mammography questions incorporated in the Health Omnibus Surveys were developed to monitor the use of mammography in this State, to determine the proportion of the target population screened outside the SABXRS, and to analyse predictors of attendance. The questions were developed by the investigator, but the level of questioning was limited by the available funding. A range of socio-demographic and health behaviour variables are available for analysis in the first of the omnibus surveys as additional funding was available to include several barrier and knowledge variables not included in the later surveys. The surveys of SABXRS clients have focussed heavily on barriers and reasons for non-participation. In addition to the structured questions, open ended questions on reasons for attendance and non-attendance and suggestions for improvement are included in these surveys. All these studies will help better understand how participation can be encouraged in an Australian context, and suggest areas of future research in Australia.

The SABXRS Advisory Committee endorsed this project, and ethics approval was granted by the University of Adelaide Ethics Committee.

Part II Case-control study of Attenders and Non-attenders to South Australian Breast X-Ray Service (SABXRS)

The most comprehensive study in this research is a case-control study of Service non-attenders (cases) and attenders (controls). This study includes a much wider range of variables than most previous studies reviewed. The theoretical framework will be tested most comprehensively from this research, as a range of possible predictor variables (drawn from the literature) have been included for each construct of the framework.

This study also provides the opportunity to study within a single population group a number of attender and non-attender groups. Separate samples were drawn from two population sub-groups based on the two main recruitment methods used at the time; a) women who booked of their own volition, and b) women who received a personal invitation through their GP. Cases are women who were booked with the SABXRS for a mammogram, but cancelled their appointment or failed to attend without notice. Reason for not attending (Cancelled versus Failed-to-attend) will also be examined.

Separate logistic regression analysis will be performed initially for each of the constructs outlined above, before a final model is fitted for each of the sub-groups.

In addition both cases and controls will be followed for four years after the initial data collection (in late 1991, early 1992) to determine which women have since attended/reattended the SABXRS.

This study was supported by the General Practitioners (GPs) from the practices that sent personal invitations for their patients to attend the SABXRS.

Part III Study of Invitees to SABXRS

The main focus of this study relates to surveys of non-attenders to the SABXRS, using samples drawn from three invitation types; 1) invitations for a first screen using names from the electoral roll, 2) re-invitations to women who did not respond to an electoral roll invitation or failed to keep their appointment (sent out 12 months later), and 3) invitations for a re-screen to women already screened. Separate samples are drawn from two distinct geographic areas, one a country area (Pt Augusta) and one from the city where response to invitation is lowest (western suburbs). The surveys focus on reasons for non-attendance, and are supplemented with comparisons between attenders and non-attenders using available system data.

Part IV Cross-sectional studies

To complement the studies of clients of the SABXRS, data will also be examined from five state community surveys, and two national community surveys, to gauge overall knowledge and predictors of attendance.

The state surveys are the "Health Omnibus Surveys" conducted on behalf of the South Australian Health Commission in 1990, 1991, 1992, 1994 and 1995. The SABXRS included a number of questions relating to mammography screening in these surveys of all South Australians. The Omnibus surveys will show to what extent women are having screening mammograms outside the accredited national program in South Australia.

The data from the National Health Surveys conducted by the Australian Bureau of Statistics in 1989/1990 and 1995 will provide an overview of screening and mammography from a national perspective.

Addendum

In describing the theoretical framework for this study in Chapter 1 and in the summary above (section 2.2.1) the various stages of readiness for adoption were described as precontemplation, contemplation, action and maintenance. When analysing the follow-up of the case-control subjects in Chapter 5, Rogers (1983) theory of the *Diffusion of Innovations* was found to better describe the stages of readiness for the various groups of attenders and non-attenders in this study and was thus incorporated into the study framework. In later chapters, which reported the follow-up of the subjects from the Invitee surveys (Chapter 7) and trends over time from the Omnibus surveys (Chapter 8), Rogers classification was also found useful. 'Diffusion' by Rogers is described as the process by which an innovation is communicated (information exchanged) over time among members of a social system (p 5). The process of diffusion can be examined at the community level and the individual level. Within the community at a given point in time different groups of individuals will be in various states of readiness to adopt new behaviours, from those eager to adopt to those who would only adopt once it is entrenched in the community. Rogers classifies members of a community according to five adopter categories; innovators, early adopters, early majorities, late majorities and laggards. Innovators and early adopters are described as more active information seekers, as having a more favourable attitude and wide interpersonal networks, whereas the late adopters and laggards are said to be more economically and socially disadvantaged. For early adopters mass media alone may lead to adoption. The *rate of adoption* is the relative speed with which an innovation is adopted. The theory also describes the role of *opinion leaders* in influencing other individuals' attitudes and behaviours.

Clearly Rogers theory has much in common with the expanded HBM incorporating the Theory of Reasoned Action and Social Learning Theory on which this thesis is based. The elements are basically similar, the differences being largely in emphasis and scope rather than substance. Specific factors described by Rogers as related to adopter category and rate of adoption are already incorporated in the study constructs for this study, and hence within the general framework of this study. However, Rogers categorisations provide a more explicit framework for examining change or diffusion over time for the study groups which evolved in this research. Another useful concept which Rogers describes is *disenchantment discontinuance* which is the decision to reject an idea as a result of dissatisfaction with its performance (Rogers 1983, p 187); in relation to mammography screening this could be applied to women who fail to return for rescreening. It is postulated that late adopters are more likely to discontinue than early adopters.

PART II

CASE-CONTROL STUDY:

ATTENDERS AND NON-ATTENDERS TO SOUTH AUSTRALIAN BREAST X-RAY SERVICE

CHAPTER 3 CASE-CONTROL STUDY METHOD

3.1 SURVEY DESIGN

3.1.1 Survey Method

A case-control study was chosen as the study design for this research. Cases were women who did not attend for a mammogram at the SABXRS after making a booking of their own volition, or following a personal invitation through their GP. Controls were women who did attend through these two recruitment modes.

The method of interview chosen for this study was face-to-face in the subject's own home. All subjects were interviewed by professional interviewers contracted from the Australian Bureau of Statistics (ABS). It was considered that this method would achieve a higher response rate taking into account the length and complexity of the questionnaire, particularly for the non-attenders.

The questionnaire contained several questions which required respondents to answer on a four or five point Likert scale or select from a range of pre-specified responses. These types of questions had been successfully applied in satisfaction surveys of attenders to the Service prior to this study, using both the telephone and mail-back methods, but with a relatively short questionnaire. The interviewers who carried out a telephone satisfaction survey reported that the interview was more difficult to conduct than face-to-face, as they needed to repeat the categories constantly. In addition, some new concepts were being investigated, and it was important that respondents were clear about which invitation/appointment they were being asked about. Also, the personal interview method made it easier for the interviewer to prompt and probe (within strict guide-lines) to elicit further information when an answer was incomplete or the respondent had misunderstood the question.

This method of interview also permits the inclusion of questions that would be very difficult with any other method, particularly when complex sequencing is required, to ensure respondents are only asked questions appropriate to them. This study contains a number of subgroups; there are the attenders and two types of non-attenders (cancelled or failed to keep an appointment), and each of these three groups are categorised by two recruitment methods. Particular questions in the study pertained to only one or more of these groups. Within the questionnaire these groups were further sequenced according to whether they had a mammogram, whether they attended the SABXRS, whether they intended to have a mammogram in the future, and so on. While different questionnaires could have been developed for major sub-groups, most of the sequencing depended on previously unknown information revealed at the interview. Further, the use of multiple questionnaires complicates the processing and analysis of data.

However, the most compelling reason for choosing personal interview was to increase the response rate for the cases in this study - women who had made a conscious decision not to attend the service. Although the response rate for controls (attenders) may have been high using other methods of data collection, and therefore less costly, it was not appropriate to use a different method of interview for controls, as this would confound the results to an unknown degree.

A telephone survey in Sydney on women's perceptions of screening mammography in the community obtained a response rate of 56% (Irwig *et al.*, 1991). While such a response rate may be acceptable for a general community survey, it would be unacceptable in this study which aims to investigate "rejectors" of the screening Service who are likely to be a biased group of "hard-core" non-attenders. While other studies have obtained higher response rates from telephone or mail surveys, they relate to the general community or samples from supportive populations. One US study that compared telephone and mail methods to collect data on mammography utilisation in the community, obtained reasonably high response rates (69 and 67 percent respectively), and comparable data in both methods. (Polednak *et al.*, 1991) The authors suggest that the interest and timeliness of the survey topic contributed to the good response. However, when specific studies of women who have rejected invitations to mammography screening have been conducted, the personal interview method has generally been used.

Overseas studies that compared attenders and non-attenders following invitation, as is proposed here, confirm that survey methodology is critical in achieving good response. Two surveys of non-attenders to GP invitations in the UK, one in South London and the other in Edinburgh, obtained response rates of 88% and 90% respectively by method of home interview. (Austoker and Sharp, 1991; Clark, 1992) However, an earlier study in Edinburgh, which first sent a letter requesting consent for an interview, obtained a response rate of 75% for attenders and only 49% for non-attenders. (French *et al.*, 1982) It appears that no further contact was made if the woman did not reply to the initial letter. Another South East London study compared attenders with women who failed to attend during the same period, following an invitation by their GP. Attenders were given a questionnaire at the clinic and asked to return it in a pre-paid envelope, while those who failed to attend were posted a questionnaire. Although 93 percent of the former group returned their questionnaire, only 8 percent of the latter did so. (Fallowfield *et al.*, 1990) Again, it is evident that lack of follow-up or contact with the non-attender group contributed to this poor result. With such a meagre response, one cannot hope to find answers as to why these women did not attend, or develop strategies for women that screening programs will have most difficulty in recruiting.

A study in northern Italy which conducted interviews with women representative of the "cases" in the current study, and using in a similar methodology, obtained a 70 percent response rate. (Donato *et al.*, 1991)

3.1.2 Training and Implementation

The nine interviewers were fully briefed on the questionnaire during a full day's formal training session, after first being sent a questionnaire and written instructions. Given that trained ABS interviewers were used in this study, it was not necessary to cover interviewing technique in detail during the training, but the importance of not introducing interviewer bias was stressed. Interviewers were not told about the study hypotheses to avoid possible bias. They were also not given the correct responses to knowledge questions to enable them to honestly tell respondents they did not know when asked, and were instructed to never reveal the answer even if they did know. The questionnaire is included in Appendix G along with other questionnaires used in the various studies comprising this thesis.

Subjects were first approached by letter explaining the survey and reasons for their inclusion, and notifying them that an interviewer would call in the next week to conduct the interview. For GP invitees, the letter was printed on the practice letterhead and signed by one of the doctors in the practice. For women who booked themselves the SA Breast X-Ray Service (SABXRS) letterhead was used, signed by the director. The letter described the survey as a Women's Health Survey interested in women's views about various aspects of health that relate to women. A specific contact person was nominated in the letter should they have any queries or wish to be excluded from the study. During the pilot studies the investigator was nominated as the contact person, but during the main study a research assistant who had worked on both pilot studies was nominated due to the frequent absence of the investigator from the office. No woman was pressured in any way to participate in the study, but it was explained that each woman's views were valuable regardless of her attitude.

The survey was conducted under the auspices of the then named Department of Community Medicine, University of Adelaide. For the sections of the questionnaire dealing with mammography and the SABXRS, it was made clear that the researchers were not there to "sell" the Service, but rather to understand the woman's attitude to the Service to help plan for the future. Also, it was stressed that data forms were anonymous and strictly confidential.

Interviewers carried an official identification card, as research assistants from the Department of Community Medicine, University of Adelaide. For each potential participant, the interviewer was given a Household Data Sheet with the name, address and unique identifier for the selection. This form was used for recording all calls made to the dwelling, including date, time and outcome of each call, with a section to make comments as required (for example to explain reason for refusal or non-contact). If the woman was not home, the interviewer left a slip with her private telephone number as well as the office number with the name of the investigator and research assistant. Once contact was made, the face-to-face interview was conducted immediately or an appointment made for the interviewer to return if the time was inconvenient. The average interview time was 44 minutes (standard deviation 11.4 minutes, range 15 minutes to 156 minutes).

The performance of the interviewers was monitored by the investigator who accompanied them on a number of interviews, of both case and control subjects.

Interviewing commenced the week of 2 September, 1991 and the first round of interviewing (where the initial interviewer attempted to make contact) was completed by the end of the year. Follow-up interviews were conducted primarily by one of the ABS interviewers experienced in this type of work, as well as the investigator and research assistant. Cases where follow-up interviews were attempted comprised:

- subjects not contacted by the initial interviewer
- subjects requiring an interpreter
- some refusals, depending on the reason (for example unavailable when the initial interviewer called due to impending holiday, illness of self or others, lack of time)

For women identified as non-English speaking, a proxy was used where the interviewer was confident that the person could interpret the questions successfully. In some cases the attitudinal questions were not asked; proxys could often fully interpret factual questions but commented that the concepts of some attitudinal questions required a higher level of language ability. In most cases the proxy was an English-speaking and Australian-educated child (usually daughter) of the respondent. Where a suitable proxy was not available, attempts were made to conduct the interview in the language of the respondent. For the Italians and Vietnamese, two professional ABS foreign language interviewers speaking the respective languages conducted the interviews after briefing. For the Greek respondents an interpreter accompanied the interviewer. Seven interviews were completed in by foreign language interviewer, and a further 10 with the assistance of an interpreter for the English-speaking interviewer.

3.2 THE SAMPLE

3.2.1 Selection of Cases and Controls

The cases and controls in this study originated from a common sampling frame. Therefore this study does not suffer the common problem of selection bias that affects case-control studies.

The study population comprised women recruited to the Service via two recruitment methods:

- those issued invitations from their general practitioner (GP) to attend the SABXRS
- women who made appointments spontaneously without special invitations

Women invited from the three most recent participating GP practices were included. Spontaneous selections relate to women who had booked over the same period as those invited from these practices. Because independent analyses were required by mode of recruitment, two independent samples of cases and controls were selected for each of these two modes of recruitment. Women sent a letter of invitation from their doctor to attend the SABXRS are referred to as a "GP Invitee" and those who rang of their own volition to make an appointment are referred to as "Spontaneous".

The GP study population comprised women who were invited to attend from March 1990 through to March 1991; women from Practice 1 were issued invitations from March to October 1990, Practice 2 from July to November 1990, and Practice 3 from November 1990 to March 1991. During this period 1 600 women were invited to attend the SABXRS for mammogram from these three practices. Only women aged 50-64 were included on the GP listings as this was the target population of the SABXRS prior to October 1990.

At the time that these invitations were issued, the SABXRS was operating from the three part-time hospital-based screening clinics in Adelaide. Only women residing in the Adelaide Statistical Division (ASD), as defined by the ABS, were included in the population frame. The cost of interviewing country women by personal interview would have been prohibitive. Also, country women were not specifically targeted at the time the selections were made, and the numbers attending the SABXRS Adelaide clinics were relatively small. A mobile service for country women did not commence operating until March 1992.

Cases, or 'non-attenders', are women who:

1. rang to cancel an appointment, and
2. a) failed to attend on the day after making an appointment, or
   b) did not respond to a letter of invitation (no contact made with the Service)

Group 1 are referred to as "Cancel"; for the Spontaneous group these are women who rang to cancel an appointment they had previously made, and for GP Invitees these are women who rang to decline the offer of an appointment, or later rang to cancel after accepting an appointment. Group 2 are referred to as the "FTA"; for the Spontaneous group only group 2a applies, whereas for GP Invitees both 2a and 2b apply.

Controls were matched to cases by recruitment method and screening clinic to ensure that they were drawn from the same population as cases. For Spontaneous women one control was be selected for each case. All cases in the period were selected, and the control was the next woman on the list who booked spontaneously, and who kept her appointment.

For GP invitees, it was hoped that sufficient numbers of Cancel and FTA cases would be available to permit separate analyses by case type. Since the controls for both types of GP cases were from the same population, only half the number of controls were selected, with the view to using the same controls for comparison with each case type. One control was selected for every alternate case in the same manner as for Spontaneous women; the control was the next woman on the list who was invited and who kept her appointment, matched by GP practice.

3.2.2 Response Rates and Sample Size

Section 3.2.3 below details the method of calculating the sample size required to detect expected differences between comparison groups. This relates to the actual sample take, or cases available for analysis. To determine the size of the initial sample that needs to be selected, consideration must be given to expected response rates, to ensure the final sample take provides sufficient numbers to conduct the analyses with reasonable power and confidence.

Prior to the pilot, when seeking funding for this study, the estimated response rate for controls (women who attended) was expected to be high (at least 90%) since they had had prior involvement with the Service. A client satisfaction survey conducted by the SABXRS prior to this study yielded a response rate of over 90%. For cases it was expected that the response rate would be lower than for controls, but still reasonably high due to the personal interview method and the skill of the interviewers - an 80% response rate was assumed. The results of the two pilot studies that were conducted are reported below in section 3.5. The first had a poor response rate. A number of factors were thought to contribute to this result, and indeed when procedures were changed in the second pilot, a 75% response rate was achieved for cases.

The response rates actually achieved in this study were 74.6% for cases and 92.1% for controls. The detailed analysis of response provided in section 3.2.4 shows that these are conservative estimates as the denominator includes cases that would have been ineligible for inclusion in the study.

3.2.3 Sample Size Calculation

In determining the sample size required, the level of significance or confidence level for evidence against the null hypothesis, and the power of avoiding falsely negating the alternative hypothesis need to be specified. For this study a significance level of 95% and power of 90% was set for the most critical variables which may influence policy decisions, but power of 80% was considered acceptable for more peripheral variables. The initial sample sizes were calculated to enable the detection of an odds ratio (OR) of 2 or doubling of risk (or OR = 0.5 for variables hypothesised to have a 'protective effect' or inverse association with non-attendance), for the major variables to be examined for each of the two samples, GP and Spontaneous. If the samples were found not to differ, then analysis of all cases combined and all controls combined could be performed; this would provide the power to detect smaller differences.

Table 3.2.1 at the end of this chapter shows the odds ratios from other studies for predicting "ever having a mammogram", while Table 3.2.2 shows the odds ratios for "having a mammogram in the last year". As can be seen, it is not unreasonable to expect a doubling of risk between cases and controls for a large number of the variables. Most of the published data are from overseas studies, and most compare attenders with non-attenders in the community. As this study compares attenders and non-attenders from within the screening program, it is likely that any differences would be even greater.

Having specified the level of significance and power required, and expected Odds Ratios, an estimate of the distribution of key variables in the comparison groups for which tests will be applied, is also necessary for the calculation of the required sample size. Data from other Australian studies, summarised in Table 3.2.3, were used in estimating these proportions. The data in this table largely relate to women in the community. To calculate the sample size required for a case-control study, one needs to estimate the prevalence in the control group (attenders). These estimates can be made using the data in Table 3.2.3 and information extracted from the literature regarding differences between attenders and non-attenders. For example, it is reasonable to expect that women who attend for screening would for be more knowledgeable, feel more at risk, perceive fewer barriers than the average woman in the community, and so on. From the table, about 20.0 percent of women in the community thought about breast cancer a lot or some of the time, thus it would be expected that this proportion would be higher in women who attend for screening. Conversely, about 25 percent of women in the community fear radiation or feel embarrassed, thus it would be expected that these proportions would be lower for women who attend, perhaps as low as 10 percent. Where it was not possible to infer how controls may differ from the community samples reported, then the proportions in the table were taken as indicative of controls.

Table 3.2.4 shows the sample sizes necessary to detect differences at confidence level/power combinations of 95/90% and 95/80%. The program used for these calculations is the Statcalc option of EpiInfo V5, Sample Size and Power for Unmatched case-control (see Fleiss, pp, 38-45, 1981). Figure 3.2.1 below shows the final sample interviewed in this study for the various levels of analysis.

Figure 3.2.1 Sample sizes achieved by recruitment type and case type

Spontaneious 390	*cases*	175	*FTA-cases*	56
			Cancel-cases	119
	controls	215		
GP Invitee 597	*cases*	343	*FTA-cases*	175
			Cancel-cases	168
	controls	254		
All 987	*cases*	518	*FTA-cases*	231
			Cancel-cases	287
	controls	469		

From Table 3.2.4, the sample achieved for GP invitees will enable the detection of a doubling of risk (OR = 2) for variables with 20 percent exposure in the control group at the 95 percent confidence level and 90 percent power. For a variable with 10 percent exposure an OR of 2.5 can be detected at the same level of confidence and power. A reduction in power to 80 percent enables the detection of an OR = 1.75 for a variable with 30 percent exposure.

In the Spontaneous sample, an OR of 2.5 can be detected at 95 percent confidence and 90 percent power for a variable with 20 percent exposure. A doubling of risk (OR = 2) is detectable at 80 percent power for variables with 30 percent exposure in the control group. These levels also apply to any analyses where the two types of cases within the GP Invitee group are analysed separately; ie cancel cases compared with controls and FTA cases compared with controls. However, the small number of cases (particularly FTA) in the Spontaneous sample precludes the detection of differences by case type unless the differences are quite large.

If all cases (518) and all controls (469) were to be compared, the numbers available for the analysis would enable the detection of a doubling of risk (OR = 2) with 95 percent confidence and 90 percent power for variables with a 10% prevalence in the control group. For a variable with a 20 percent prevalence, an OR of 1.75 can be detected at the same level of confidence and power. A reduction in power to 80 percent enables the detection of an OR of 1.5 for a variable with 30 percent exposure.

In summary, the sample sizes obtained satisfy this study's initial objective of testing hypotheses that cases are twice as likely to be at "risk" (OR = 2) compared with controls, for a variable that 20 percent of the population (control) are "exposed" to, with 95 percent confidence and 90 percent power, by recruitment method. Smaller differences can be detected for all cases and controls.

3.3 SURVEY RESPONSE AND DESCRIPTION OF STUDY POPULATION

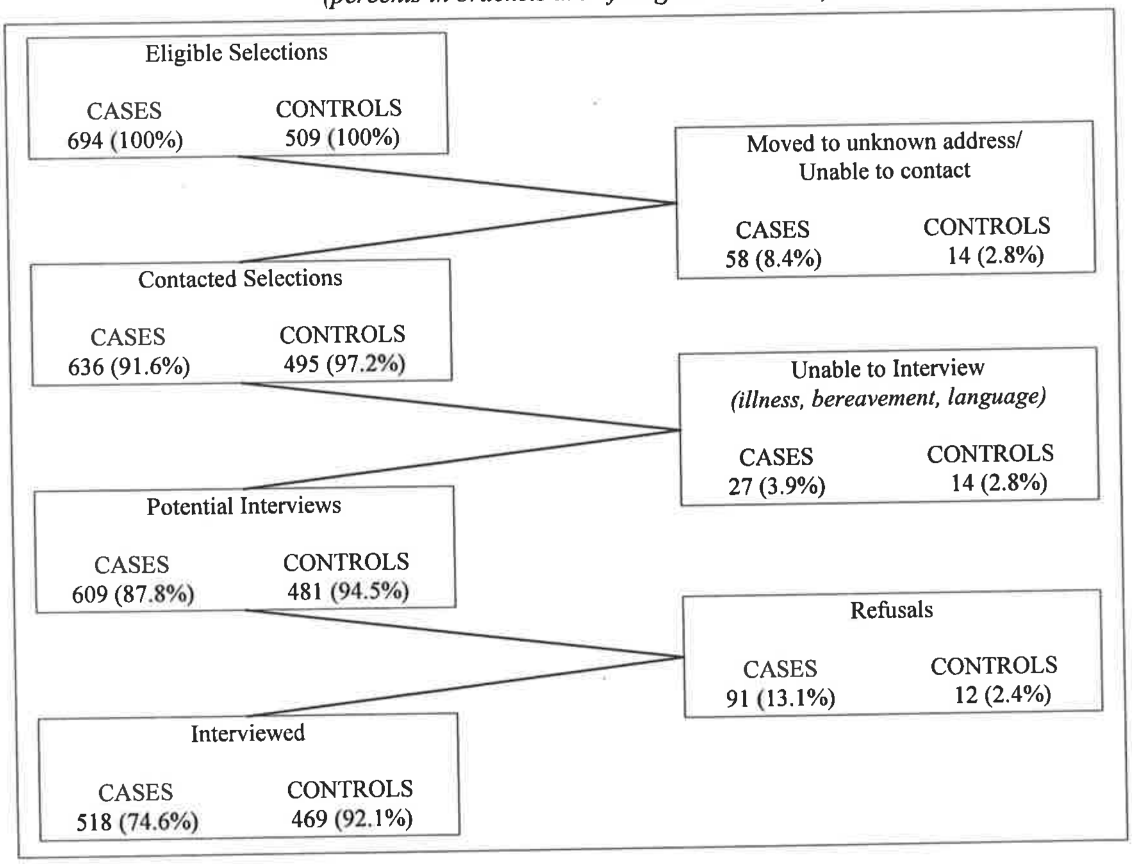
3.3.1 Response Rates

Initially 720 cases and 511 controls were selected, but twelve of the cases were found to be deceased and were excluded from the study. These cases were incorrectly included on the GP listings and should not have received an invitation in the first instance. Since the purpose of this study is to find the determinants of attendance to screening mammography for women sent an invitation or who booked of their own volition, these deceased women were not eligible for entry to the study.

In addition, 16 selections (14 cases and 2 controls) were excluded from the study because the address was located outside the Adelaide Statistical Division (ASD). Thus, in total the study comprised 694 eligible cases and 509 eligible controls. Figure 3.3.1 below summarises the sample loss and final response for these.

Figure 3.3.1 Case-control study initial sample and response - overall response

(percents in brackets are of Eligible Selections)



Those not contacted include moved to an unknown address, address incorrect, and unable to contact after repeated attempts (this latter group may have also moved, but no definite information was obtained). As can be seen from the chart, the proportion of selections not contacted was considerably higher for cases than for controls. Some of the no contact selections may be deceased or have moved outside the ASD in which case they would be excluded from the eligible population, but as no definitive information was ascertained to determine which selections should be excluded, all were included in the eligible population numbers in Figure 3.3.1. Given the likelihood of the eligible population being inflated means that the actual response rates were in fact higher than shown. If all non-contacted selections are excluded, the response rate for cases is 81.4 percent and 94.7 for controls (using contacted selections as the denominator). The true response rates would be between these figures and those shown in the 'Interviewed' box in Figure 3.3.1.

Additional breakdowns of response rates by sample type and case type are included as Appendix C, Figures C1.1 to C1.3. It can be seen that the proportion not contacted was low in both samples for the controls, 3.0% for Spontaneous and 2.5% for GP, but for cases the proportions were 6.1% and 9.4% respectively (Figures C1.1 and C1.2). The higher proportion in the GP sample suggests the GP lists included women who had moved. The next two Figures (C1.3 and C1.4) show that the sample loss in the cases is largely due to the FTA cases. It is likely that some of the FTA cases did not receive notification about the study, and with the GP Invitees may also not have received the initial invitation. For the GP sample, the FTA cases are women with whom the SABXRS has had no contact at all. However, with the Spontaneous group, all selections, including FTAs had made contact with the SABXRS when making the initial appointment. These differences account for the lower response overall in the GP sample (80.6) than the Spontaneous sample (84.4%). Given that it is highly probable that some cases would have been out of the scope of the study, the response rates, even for cases, are good in comparison to most studies.

Within the GP Invitee sample the overall response (cases and controls combined) for the three GP practices were 79.6%, 82.1%, and 75.4%, the latter being the smallest practice contributing 20% of the total GP sample. These differences are not statistically significant. However, the differences in response within the Spontaneous sample, for the three SABXRS clinics at which appointments were made, (79.9%, 84.1% and 90.3%) were significant ($p = 0.03$).

3.3.2 Description Of Study Population

Table 3.3.1 shows the distributions of the demographic variables for the study population of women interviewed. The Spontaneous population has a higher proportion of women in employment and with post-school qualifications comparison to the GP population. Notable proportions of Spontaneous women are also in their 40's, an age group not encouraged to attend the SABXRS. A lower proportion of Spontaneous women are on government pensions, and thus have higher incomes, reflecting both their younger age and employment status. More Spontaneous women have no children, and a higher proportion fall into the high socio-economic status class across all groups. Hobbs *et al.*, (1980) also found that self-referred women were of higher class than invited women.

The Spontaneous sample also differs significantly ($p< 0.001$) on all other socio-demographic variables except country of birth, language and religion. Self-referred women (Spontaneous sample) are more likely to be married, leave school at a later age, have post-school qualifications, be employed, work in managerial positions, have spouses who work in managerial positions, live in larger households, have fewer children, have higher income, not be on a government pension, and, be of higher socio-economic status. These are traits which separate attenders from non-attenders in the literature. Clearly, the method of entry to the Service is determined by socio-demographic characteristics, thus supporting the selection of independent samples. The aim of this study is to determine what factors then predict which women keep their appointments within each of the recruitment based populations. Given the differences shown in Table 3.3.1 it would not be appropriate to conduct overall analyses of all cases and controls combined.

It should be noted that GP invitations were only sent to women aged between 50 and 64, the SABXRS target group at the time, whereas for the spontaneous group screening has been made (since October 1990) available to all women over 40 who request it, hence, the difference in age distributions between the two samples. Table 3.3.2 shows the age distribution for each of the subsamples. For the GP population it can be seen that the two case groups and the controls have a similar split between the two relevant age groups. For the Spontaneous population the controls show a similar distribution to the Cancel cases, while the FTA group has fewer younger women (40-49) than both these groups.

3.4 THE QUESTIONNAIRE

3.4.1 Design and Development of Questionnaire

Having had extensive experience in developing questionnaires both within and outside the ABS, the investigator was well aware of the importance of a good questionnaire to the success of a study. The major problems with faulty questionnaires, such as leading, double-barrelled or unreliable questions, can invalidate survey results, and are often not given the necessary attention. As a consultant on questionnaire design, the investigator often reminds other researchers that *NO DATA IS BETTER THAT WRONG DATA*, since the consequences could be quite drastic.

Other issues that need to be considered include the length of a question. Where possible questions should be kept short. However, long questions are sometimes necessary, particularly as a lead-in, to ensure the respondent clearly understands what is being asked. It should be made clear when a precise answer is required, and when this is not necessary; for example, in this study the month of the previous mammogram is required, but not the date - having a precise date would not add to the analysis. However precise date of birth is required so that age at the time of appointment can be calculated.

The hypotheses to be tested were paramount in determining which questions to include in the study. Once the questionnaire was put together, a check was made that 1) each hypothesis could be tested, and 2) each question related to a specific hypothesis. A few additional questions were included at the request of the GP practices participating in the study, to ask women how they felt about receiving the invitation. This was considered a reasonable request, since it would also be useful information to the SABXRS given that the underlying purpose of this study is to increase attendance to the SABXRS. Along the same lines, further information was sought by the SABXRS on satisfaction with the service, and suggested improvements from women.

Coding conventions used in the questionnaire were as follows:

- Blank if the question was legitimately skipped
- For don't know, 8 for single digit fields, 98 for two digit fields, 998 for three digit fields
- For missing (interviewer inadvertently missed question, respondent refused to answer), 9 for single digit fields, 99 for two digit fields, 999 for three digit fields

3.4.2 Source of Questions

Health Locus of Control Scale

The Multiple Health locus of Control (MHLC) Scale was developed for prediction of health-related behaviour by Wallston *et al.*, (1978). The scale aims to distinguish people who think their own behaviour is responsible for their health ("internals" with a low score) from those who believe their health is dependent on other people ("externals" with a high score). The scale comprises 18 items which subjects rate from 1 (strongly agree) to 6 (strongly disagree). One paper that evaluated this and other locus of control scales with other data from a number of studies and found that "individuals' expectations about control over their health are related to their preferences for control over their health care." (Wallston *et al.*, 1983) The MHLC Scale which is a measure of expectancies for control of one's health is labelled an outcome while preference for control of health care a process. It is hypothesised that there is a relationship between the MHLC score and attendance to mammography screening (a process), and specifically that cases will have higher score.

Self Esteem Scale

This scale provides a measure of global self esteem. The instrument used is a modified version by Bachman *et al.*, (1978) of the original scale developed by Rosenberg (1965).

It is hypothesised that there is a relationship between the Self Esteem score and attendance to mammography screening, and specifically that cases will have lower self-esteem.

Remainder of Questionnaire

Wherever possible questions were selected from other major studies conducted by reputable researchers. Information was sought from the researchers regarding the reliability and validity testing performed on the questions, although this was sometimes difficult to obtain. Using questions from other studies, reduces the time and effort in developing a questionnaire, and also permits comparability with these studies. If possible the questions were used verbatim, but sometimes it was necessary to change the wording either before or after pilot testing. In some instances, the original question did not meet all the criteria for good question design described above, but in other instances the question was modified to suit local conditions, for example, local terminology.

As a starting point, questions developed by the investigator as an employee of SABXRS for inclusion in a Health Omnibus Survey were included. This survey was conducted by the ABS in October 1990 on behalf of the SA Health Commission. The questions in the Omnibus survey were asked of all women aged 20 years and over in the community (population was all South Australia), and provides a basis for comparison with the current study. The Omnibus survey was repeated in later years, but only a sub-group of the questions pertinent to the SABXRS from the original Omnibus were included in the later surveys.

The questions developed for the SABXRS component of the first omnibus survey related to hypotheses on differences between attenders and non-attenders in the community, formulated on the basis of the literature available at the time. Questions relating to women's knowledge, history, and perceived risk of mammography and breast cancer were taken from a questionnaire used by the Department of Public Health, University of Sydney for a prospective study of attenders and non-attenders in the community (permission granted by Professor Les Irwig).

A major segment of the SABXRS questions included in the omnibus survey, referred to above was the "Barrier Scale". This refers to a series of barrier statements to which agreement is sought on a four-point scale; the items can be analysed separately or summed to give a total barrier score. This scale was described in a published paper. (Rimer *et al.*, 1989b) One of the authors was contacted by the researcher regarding the use and analysis of the scale, and for permission to use it.

The questionnaire from the University of Sydney referred to above was also a major source of additional questions for this study, particularly those relating to knowledge, history, and perceived risk of mammography and breast cancer, as well as questions on other health-related behaviours.

Another significant source was a questionnaire used in a study of non-attenders by the Faculty of Medicine, Discipline of Behavioural Science in relation to Medicine, University of Newcastle, again with the permission of the researchers. 'Non-attenders' were defined as eligible women in the community who did not take advantage of a mobile screening unit when it visited their town.

Standard ABS questions were used to elicit socio-demographic information, such as marital status, income, education and employment. A number of questions, especially those relating to health behaviours were extracted from the Australian Health Survey conducted by the ABS in 1989-90. The rationale for using ABS tested questions is evident, given that the ABS is the largest data collection organisation in Australia, which conducts extensive pre-testing of any new questions.

In addition, a client satisfaction questionnaire was left with subjects who had attended the SABXRS to complete and return in a pre-paid envelope after the interview. This questionnaire included a Client Satisfaction instrument developed by a joint research team from the Department of Public health, University of Sydney and the centre for Behavioural Research in Cancer, anti-cancer Council of Victoria. (Cockburn *et al.*, 1991b) This was included to provide the SABXRS with information on client satisfaction and not intended to be analysed as part of this thesis. The opportunity was seized to collect additional valuable data at relatively little cost financially, and by leaving it with respondents to complete in their own time client burden was reduced.

The final questionnaire is at Appendix G. The variables included within each of the six study constructs are listed in Table 1.7.1 in Chapter 1.

3.5 PILOT STUDIES

3.5.1 Background

All procedures were tested in two pilot studies, referred to as Pilot 1 and Pilot 2. Interviewing for both Pilot studies were conducted by a supervisory ABS interviewer (one who also supervises other ABS interviewers), a research assistant from the SABXRS (who was an ABS supervisory interviewer) and the investigator. Interviewers were asked to record any prompts they needed to use in order to elicit information and note any changes they made to the wording of questions or comments from respondents to assist in the development of the final questionnaire.

3.5.2 Pilot 1

Most interviews were conducted during the week commencing 17 December 1990. Twenty five selections were made from each of two GP practices which invited women to the SABXRS and 40 from the Spontaneous bookings. For the first practice women had been invited towards the end of 1989 and for the second practice early in 1990. The lengthy time period was chosen intentionally to test whether women remembered receiving the invitation and whether they were able to answer the questions, since the period from invitation to interview for the main study was planned to range from a few weeks to over 12 months to provide the numbers required. Table 3.5.1 below shows the number of selections and the percent who declined an interview. From the apparently appalling results indicated in this table, particularly amongst the GP selections and the Cases, the investigator might have been inclined to abandon the study.

Table 3.5.1 Number of selections in Pilot 1 and Percent who declined an Interview

	GP Practice 1		GP Practice 2		Spontaneous	
	selected	% declined	selected	% declined	selected	% declined
Cases, Cancelled	10	60.0	10	40.0	15	13.3
Cases, FTA	10	40.0	10	50.0	15	13.3
Controls	5	20.0	5	20.0	10	20.0

However, a number of factors contributed to this result. Firstly, the timing of the Pilot, a week prior to Christmas, was considered to be an important factor contributing to the high non-response rate. Four of the 30 respondents who declined specifically said it was a bad time, and would consider an interview in the new year. Another four had language difficulties, and it was decided not to follow them up. Three others had a recent death or illness in the family. That leaves 19 or 21% who can be classified as true "refusals". A further 9 (10%) could not be contacted.

Both the research team and the GPs felt that the letter sent to women explaining the survey also contributed to the high refusal rate. In this letter, women were asked to notify the practice if they did not "wish to take part". It was felt that some women may have wanted more information before deciding to participate, and this was not forthcoming from the receptionists at the clinics. Even though the study was explained to the receptionists personally by the investigator, they were not inclined to take the time to explain to women who called while also running a busy practice. It was decided that an alternative approach should be tried whereby women were given a specific contact name for further information.

For the 51 women who participated, the reaction to the survey was very positive and encouraging. Women appreciated our interest in their views. The other two interviewers who conducted the interviews reported that they enjoyed working on the survey. They also felt that the personal approach was critical to the overall response, as they could convey to the respondent that they were not being checked on in any way, and that their opinions were important, regardless of the status of their appointment with the SABXRS.

A debriefing session was held at which GPs from the practices concerned were invited to send a representative. One practice took up the offer, which was useful when evaluating the questions pertinent to the GP invitation.

In general, the questionnaire worked well. Suggestions were made as to items that needed clarification either in the questionnaire itself or in the interviewer instructions. For example in the question "Do you have any long-term illness or disability?", 'long term illness' needed to be defined. On the basis of queries from the Pilot, the following prompt was added to the final questionnaire for this question: "This includes conditions such as asthma, hay fever, arthritis, back problems and high blood pressure". In addition, some wording changes were suggested and implemented. For example the question ,"Do you know of any tests or checks that a woman or her doctor can do to see if she has breast cancer?" was changed to "Do you know of any tests or checks that can be done to see if a woman has breast cancer?", because most women did not mention mammography with the initial question. The original question was taken from an interstate study also aiming to test women's knowledge of tests for breast cancer, and in particular mammography, therefore one must question the validity of the results if one of the main tests was under-reported as it was for this pilot sample.

The Pilot also identified response categories for some questions on the basis of the open ended answers. This also identified that a 'don't know' category was needed in questions where it would not be appropriate to force a woman to give a specific response; eg "Out of every 10 lumps discovered in the breast, how many do you think turn out to be cancer?" and "How many cancers out of one hundred do you think mammography misses?" The wording of this latter question was also changed from "What proportion or percentage of breast cancers do you think mammography misses?" as some women had difficulty with these concepts.

Apart from the questions themselves, suggestions were also made regarding the order of questions or groups of questions to achieve a better flow and avoid apparent duplication. For GP Invitees, and in particular the cases, it appeared that certain questions were repeated. In one section they were asked about having mammograms generally and in another about having mammograms with the SABXRS which caused some confusion. They sometimes reported having mammography with the SABXRS when in fact it was with a private radiology practice, which they were asked about later in the survey. In the final questionnaire these sections were combined and the distinction made more lucid.

All the suggested changes were tried in the field by the three interviewers conducting the interviews. As all interviewers were experienced, the wording was altered as deemed necessary and appropriate for questions that did not work well, and the wording used was noted on the questionnaire. It was no surprise to find that all had problems with the same questions and found similar solutions.

One set of questions was disliked by both interviewers and respondents. This was a Morale scale developed by Lawton (1975) and used previously in an ageing survey by the investigator. It was found that some items were inappropriate for this relatively young (mostly 50 to 65) population, especially the item, "Although it is sometimes strenuous, you try to do the household tasks by yourself". It was decided that alternative questioning related to psychological health would be investigated. Following consultation with a lecturer in psychology at Flinders University and a researcher working on smoking behaviour in the SA Health Commission, it was decided that the Health Locus of Control Scale and Self Esteem scale were appropriate measures for this study. These scales were tested in Pilot 2.

3.5.3 Pilot 2

A second pilot was conducted during the week commencing April 18 1990, which was a scaled down version of Pilot 1.

The purpose of the second pilot was to test the changes that resulted from Pilot 1, particularly the new letter of introduction and the psychological scales. Apart from these difficulties, the main problem in Pilot 1 related to obtaining details of mammography experience from the GP selections. Hence, this second pilot was only carried out on a sample from GP invitees, and only on sections of the questionnaire requiring further testing. As mentioned above, minor changes to individual questions had already been largely tested in the field during the first pilot.

Ten selections were made for each of two practices, one in the original pilot and a new practice that was to be included in the main study. Five FTA cases and five Cancel cases were selected from each. No controls were selected as the problems identified in Pilot 1 only related to cases.

The letter of introduction asked women who had any queries about the survey to contact the researchers. This made a significant impact on response rates - interviews were obtained from 70% of women from one practice and 80% of women from the other practice. As suspected, a number of women were curious to find out more about the survey before committing themselves, but were happy, or even keen, to participate after it was explained to them. Not having the benefit of this information in the first Pilot, women chose to exclude themselves from something they knew nothing about.

3.6 DATA ANALYSIS

3.6.1 Overview

The SPSS software was used for data management and most statistical calculations, Version 4.0 initially (SPSS, 1990), then upgrading as new versions became available. Data were transformed from the questionnaire forms to computerised format using the Data Entry module of SPSS for Windows, and 100% verification was performed on the accuracy of the data entered.

The main methods of statistical analysis are summarised below. Additional methods used for specific purposes are described within the relevant results section, for example, factor analysis to extract the "Barrier score" is described in the Barrier Construct results section in Chapter 4, 4.6.

During the initial phase of data editing and validation of responses it was discovered that 40 cases (22 GP cancel cases and 18 GP FTA cases) had attended the SABXRS for a mammogram. These were excluded from the analysis. Hence the number of GP cases analysed were 148 for GP cancel and 155 for GP FTA and not the 170 and 173 interviewed as shown in Appendix C, Figure 1.4.

Initially, descriptive statistics are presented for each variable. Secondly, bivariate analysis are conducted. Association between non-attendance to mammography screening at the SABXRS and each of the categorical variables is investigated using the chi-square test of independence, except for tables with cells of < 5, in which case Fisher's Exact Test is used. The t-test or Mann-Whitney U-test is used to compare means. Finally, logistic regression is used to examine the independent effects of the selected variables (on the basis of the bivariate analysis) on the likelihood of not attending the SABXRS to determine the best predictive model. Continuos variables are categorised for the multivariate analysis. As far as possible the split is made at the point that would yield approximately equal categories. For the GP sample, the dependent variable refers to non-attendance to the SABXRS following an invitation from the woman's general practitioner, with a specified appointment time nominated in the letter. For the Spontaneous sample, the dependent variable refers to attendance to the SABXRS following a self-initiated appointment.

The measure of association used is the relative risk, as estimated by the odds ratio (OR). Variables with a bivariate P-value of < 0.25 are entered into the logistic regression models (Hosmer and Lemeshow, 1989, p86). These authors state that the use of lower levels often fails to identify variables known to be important.

Appendix D shows the percent distributions for each variable and the bivariate P-value for its association with the dependent variable. Only valid categories are listed, therefore the percent may not sum to 100% due to missing data.

3.6.2 Analysis Groups

The study design and sample sizes were determined on the premise that two major analyses would be performed based on recruitment method, that is, separate analyses for the Spontaneous and GP samples. It was also expected that sufficient numbers would be available to conduct separate analyses for major differences by case type for the GP sample, but the small number of cases for the Spontaneous sample would preclude this level of analysis. However, early in the data examination it was evident that the differences between the two case types was quite marked on several of the independent variables for both samples, and that it would be inappropriate to continue the analysis on the original basis. That is, the combined effect of the FTA cases and Cancel cases failed to detect factors that predicted non-attendance, but which were only relevant to one of the case types. The dilemma posed by splitting the cases, was a reduction in the power to detect differences. However, it was determined that it was the only option that could be pursued for the research to be considered credible. Due to the loss of power a *P-value* of 0.10 was used rather than the conventional 0.05 as the test of significance.

Given that the dependent variable now comprised three categories (FTA, Cancel and Control) rather than the initial two (Cases and Controls), consideration was given to performing polychotomous logistic regression. However, SPSS does not allow this form of analysis, and it would have been necessary to have access to, and learn an alternative statistical package. Following discussions with statisticians, including international advice (via the internet), it was determined that the advantages would be minimal. Separate models for the FTA and Cancel cases would yield similar results and would be easier to interpret.

Hence, separate models were fitted for the two recruitment methods (Spontaneous and GP Invitee) by the two types of cases (FTA and Cancel), yielding four models.

A further factor that increased the complexity of the analysis was the vast number of variables collected, making it difficult (impossible using the available statistical package) to conduct the logistic regression analysis as a single stage, incorporating all variables significant at $P < 0.25$. Various methods of modelling were tried, including backward and forward as well as forced entry of all variables. Following further discussions with various statisticians, it was decided that the best way to proceed would be to perform multivariate analysis for each of the study constructs (see Table 1.7.1, Chapter 1), then utilise the results of these as a method to select variables for an overall model.

An issue discussed in the literature in relation to multiple comparisons for large data sets is the need to make adjustments in statistical analysis to avoid rejecting the null hypothesis too readily. That is, it is suggested with a large number of statistical tests, the probability of finding a statistically significant result increases by chance, even when the null hypothesis is true. Hence, adjustment is recommended by some (Jones and Rushton, 1982); (Savitz and Olshan, 1995). However Rothman (1990) argues against adjustment on the basis that reducing type I error for null associations increases type II error for associations that are not null, and recommends a policy of not making adjustments for multiple comparisons. No adjustments were made by the investigator.

Table 3.2.1 Results of bivariate and logistic regression analyses predicting likelihood of "ever" having had a mammogram

VARIABLE	STUDY: country/year (author & outline in footnotes)	ODDS RATIO bivariate analysis	ODDS RATIO logistic regression
Socio-demographic			
• marital status	US/1990 [1]	2.1	
• age	US/1990 [1]	1.3 (<60 vs 60+)	
• education	US/1990 [1]	2.1 (high vs low)	
	US/1991 [2]		2.92 (high vs low)
(s=secondary, t=tertiary, d=diploma)	AUST/1992 [3]	1.5 (5-6s vs 1-4s)	
	"	2.5 (t vs 1-4s)	
	"	4.4 (d vs no d)	
• children	US/1991 [2]		3.14 (has vs none)
• religion	US/1989 [4]		3.14 (Jewish)
			0.91 (Catholic)
Experience with breast disease			
• family history	US/1991 [5]		3.18
	US/1990 [1]	1.9	
	US/1989 [4]		2.59
	US/1991 [2]		7.27 (mother only)
• history of breast problems	US/1989 [4]		5.4
	US/1991 [2]		5.2 (has abnormality)
• friend with breast cancer	US/1990 [1]		1.8
Knowledge of breast cancer			
• know of risk without symptoms	US/1990 [1]	1.6	
	US/1989 [4]		2.15
• know older women at risk	US/1990 [1]	1.8	
Beliefs about benefits and barriers			
• concern over radiation	US/1991 [5]		0.42
	US/1990 [1]	0.8	
• cost (as a barrier)	US/1991 [5]		0.48
	US/1990 [1]	0.7	
• belief in efficacy/ beneficial	US/1990 [1]	1.8	
	US/1989 [4]		1.7
• belief in curability	US/1990 [1]	1.3	
• embarrassment	"	0.5	
• anxiety/worry	"	0.6	
Structural/other factors			
• if doctor recommended	US/1991 [5]		1.79
	US/1990 [1]	25.1	25.5
	US/1991 [2]		8.53
• has regular doctor	US/1989 [4]		2.13
• encouragement by friend	"		1.85
• discussing with friend	"		2.04

[1] Lerman *et al.*, 1990; community survey, women 50 years and over, telephone interview of randomly selected members of a health Maintenance Organisation, N = 910

[2] Fox *et al.*, 1991; community survey, women 35 years and older, random digit dial telephone interview, N = 1 057 (results in tables relate only to women 50 - 64)

[3] Adelson *et al.*, 1992; comparison of data collected from attenders to mammography screening unit in central Sydney with census data of women aged 45 - 70 in catchment area

[4] Zapka *et al.*, 1989; community survey, women 45 - 75 years, random digit dial telephone interview, N = 1,184

[5] Bastani *et al.*, 1991; community survey, women 40+ years, random digit dial telephone interview, N = 802

Table 3.2.2 Results of bivariate and logistic regression analyses predicting likelihood of having had a mammogram according to US guidelines/in last 12 months

VARIABLE	STUDY: country/year (author & outline in footnotes)	ODDS RATIO - bivariate analysis	ODDS RATIO - logistic regression
Socio-demographic			
• age	US/1991 [5]		0.40
	US/1990 [1]	1.2	
• education	"	1.6 (high vs low)	
• income	US/1991 [2]		2.80
	US/1990 [6]		2.0 (>35,000 vs <10,000)
• marital status	US/1990 [1]	1.8	
Experience with breast disease			
• family history	US/1991 [5]		2.20
	US/1990 [1]	1.9	1.8
Knowledge/experience of mammography			
• knowledge of guidelines	US/1991 [5]		1.81
• intention to get mammogram in next year	US/1991 [2]		2.16
• had diagnostic mammogram	US/1991 [7]		2.32
• had screening mammogram	"		18.77
	US/1989 [4]		2.31 (reason was routine)
• mammogram satisfaction	"		1.17 (high)
Knowledge of breast cancer			
• know of risk without symptoms	US/1990 [1]	1.3	
	US/1989 [4]		1.45
• know that older women at risk	US/1990 [1]	1.5	
Beliefs about benefits and barriers			
• concern over radiation	US/1991 [5]		0.58
• cost (as a barrier)	"		0.59
• belief in efficacy	US/1990 [1]	1.5	
• perceived safety as high	US/1991 [7]		1.93
• belief in curability of BC	US/1990 [1]	1.8	
• embarrassment	"	0.6	
• anxiety/worry	"	0.6	
Structural factors			
• has regular doctor	US/1989 [4]		3.02
	US/1991 [7]		2.63
• doctors recommendation	US/1991 [2]		4.34
	US/1990 [1]	13.9	9.5
• media exposure	US/1989 [4]		2.15 (greater)
• personal health practice score	US/1990 [6]		1.6 (highest vs lowest)

[1] See table 3.1
[2] See table 3.1
[4] See table 3.1
[5] See table 3.1
[6] Anda *et al.*, 1990; used data from large community study in 33 states of US, women 50 years and over who had visited physician in last year and did not have breast problem or family history of breast cancer, random selection of residents with telephones, N = 8 402
[7] Fulton *et al.*, 1991; community survey, women 40 years and older, random digit dial telephone interview, N = 852

Table 3.2.3 Proportion of women in categories of relevance to this study from other Australian studies

VARIABLE	STUDY: Year (reference in footnote)	POPULATION	PROPORTION OF WOMEN
Socio-demographic • education	1991 [1] 1992 [2]	community (Sydney) attenders	0.15 (no secondary) 0.51 (1-4 years secondary 0.78 (1-4 years secondary) 0.13 (5-6 years secondary) 0.07 (tertiary)
• occupation status	1991 [1]	community	one third in each of high, middle and low groups
Experience with breast disease • family history of BC	1991 [1] 1989 [3]	community " (Melbourne)	0.08 0.08
• knew someone with BC	1988 [4] 1991 [1] 1989 [3]	community community "	0.85 0.73 0.79
• had breast lump	1991 [1] 1989 [3]	community "	0.24 0.18
Knowledge of mammography • heard of mammography	1988 [4] 1989 [3] 1991 [1] 1992 [5] 1992 [6]	community " community as above, 2 years later community (rural Vic)	0.67 0.68 0.78 0.90 0.93
• heard of screening mammography	1989 [3] 1991 [1] 1992 [5] 1992 [6]	community " as above, 2 years later community (rural Vic)	0.49 0.56 0.81 0.63
Knowledge of breast cancer • knows risk increases with age *(identified correctly age range at greatest risk)*	1988 [4] 1989 [3] 1991 [1]	community community "	0.07 0.08 0.06
• knows BC most common cancer	1989 [3] 1991 [1]	community "	0.59 0.71
• knows correct lifetime risk	1989 [3] 1991 [1]	community "	0.34 0.66 (reported as 2/3rds)
• believes removal of breast only treatment	1988 [4] 1989 [3]	community "	0.23 0.29
Beliefs about benefits and barriers • important to have mammogram at their age	1991 [1]	community	0.70
• better not to know if have BC	1991 [1]	community	0.17
• screening mammography can save lives	1988 [4] 1991 [1]	community	0.88 0.91
• screening mammography more trouble than it is worth	1991 [1]	community	0.12
• believe early detection good	1989 [3]	community	0.98
• believe mammography accurate	1989 [3]	community	0.65 (0.23 extremely/0.42 quite)

Table 3.2.3 continued

VARIABLE	STUDY: Year (reference in footnote)	POPULATION	PROPORTION OF WOMEN
• concern about radiation	1991 [1] 1989 [3]	community community	0.27 (very/quite) 0.24 (very/quite)
• feel embarrassed	1989 [3]	community	0.07 (extremely/quite) 0.27 (if add 'little' to above)
• perceive themselves as personally susceptibility to BC	1989 [3] 1991 [1]	community community	0.09 (high/fairly high chance) 0.38 (if add 'slight' to above) 0.22 (composite scale)
• thought about BC in last year	1988 [4] 1989 [3]	community community	0.51 (at all) 0.19 (a lot/some of the time)
• concerned about getting BC	1988 [4]	community	0.18
Other Health Behaviours • changed diet in last two years	1989-90 [7]	community (50-64)	0.33 (non-medical reason)
• exercised in last 2 weeks	"	"	0.69
• non-smoker	"	"	0.83
• had pap smear in last 3 years	"	"	0.62 (.034 in last year)
• had breast examination	"	"	0.95 (ever)
• examines own breasts regularly	"	"	.080
• self-assessed health status	"	"	0.72 (excellent/very good)
• self-assessed happiness			0.24 (very happy)

[1] Irwig *et al.*, 1991
[2] Adelson *et al.*, 1992
[3] Cockburn *et al.*, 1989
[4] Irwig, *et al.*, 1988
[5] Turnbull *et al.*, 1992
[6] Cockburn *et al.*, 1992
[7] Australian Bureau of Statistics 1989-90 National Health Survey, 1992 (special tables requested by investigator); The proportions in the table relate to women in the community aged 50-64 who have had a mammogram, ie similar to control population in this study
BC, breast cancer

Table 3.2.4 Sample size requirements

Odds Ratio	Proportion in controls (%)	Sample required for 95% Confidence/90% Power	Sample required for 95% Confidence/80% Power
3.0	10	146	112
"	20	93	72
"	30	80	62
"	40	79	61
"	50	85	65
"	60	98	76
2.5	10	218	168
"	20	136	105
"	30	115	88
"	40	110	85
"	50	116	89
"	60	132	102
2.0	10	402	307
"	20	244	186
"	30	200	153
"	40	188	144
"	50	194	148
"	60	216	165
1.75	10	638	485
"	20	381	290
"	30	308	234
"	40	285	217
"	50	290	220
"	60	319	243
1.5	10	1265	957
"	20	742	562
"	30	590	446
"	40	538	407
"	50	538	407
"	60	583	441

Table 3.3.1 Demographic characteristics of study population by recruitment type - % frequencies and P-values

VARIABLE NAME Variable Categories	Recruitment Type Spontaneous	 GP invitee	 *(P-value)*
AGE			
40-49	36.2	0.0	*(<0.001)*
50-59	43.3	67.3	
60+	20.5	32.7	
MARITAL STATUS			
Married/defacto	76.4	67.7	*(<0.001)*
Widowed	8.5	16.3	
Separated/divorced	10.5	14.5	
Never married	4.4	1.4	
AGE LEFT SCHOOL			
14 or less	27.7	40.0	*(<0.001)*
15 or 16	53.8	46.9	
17 or more	18.2	12.7	
QUALIFICATIONS POST-SCHOOL			
Yes	45.1	25.9	*(<0.001)*
No	54.6	73.8	
HIGHEST QUALIFICATION			
Degree or higher	5.6	2.7	*(<0.001)*
Trade or Apprenticeship	4.9	3.4	
Certificate or Diploma	34.1	19.6	
No post-secondary qualification	55.1	74.0	
EMPLOYMENT STATUS			
Employed FT	24.9	12.7	*(<0.001)*
Employed PT	22.6	12.9	
Not employed	52.3	74.1	
LIFETIME OCCUPATION			
Manager/Prof	21.0	12.2	*(<0.001)*
Clerk/Sales/Service	31.3	23.3	
Trade/Manual	10.0	22.4	
Home duties	37.4	41.8	
PARTNER'S OCCUPATION			
Manager/Prof	35.1	29.4	*(0.003)*
Tradesperson	28.5	26.2	
Clerk/Sales/Services	10.8	11.1	
Manual	19.7	30.0	
No partner/Unknown	5.9	3.2	
COUNTRY OF BIRTH			
Australia	61.0	67.0	*(0.13)*
Other English speaking	21.3	15.3	
Southern Europe	8.5	7.0	
Northern Europe	5.4	6.1	
Other	3.8	4.7	
SPEAK OTHER LANGUAGE			
Yes	14.1	17.2	*(0.20)*
No	85.9	82.8	
LANGUAGE SPOKEN			
Italian	5.6	3.8	*(0.09)*
Greek	1.8	3.1	
Other NES	6.7	10.1	
English	85.9	83.1	
HOUSEHOLD COMPOSITION			
Husband only	35.4	42.2	*(<0.001)*
Husband and other	41.8	25.5	
Son/s only	2.6	3.2	
Daughter/s only	2.1	3.1	
Lives alone	13.6	18.0	
Other	4.6	8.1	

Table 3.3.1 continued

VARIABLE NAME Variable Categories	Recruitment Type Spontaneous	 GP invitee	 *(P-value)*
PERSONS IN HOUSEHOLD			
One	13.6	18.0	*(<0.001)*
Two	41.5	52.1	
Three	20.3	20.8	
4 or more	24.4	9.2	
SOURCE OF INCOME			
Wages/Salary	48.2	33.6	*(<0.001)*
Private	23.6	19.7	
Govt pension	27.9	46.3	
INCOME			
≤$20,000	34.1	56.6	*(<0.001)*
$20,001-30,000	17.7	19.7	
>$30,000	40.3	18.9	
Not stated	7.9	4.8	
RELIGION			
Anglican/C of E	28.5	25.5	*(0.25)*
Catholic	24.6	24.6	
Orthodox	2.8	3.8	
Uniting	20.3	19.4	
Other Christian	12.1	17.2	
None/other	11.8	9.5	
SOCIO-ECONOMIC STATUS			
Low	24.1	36.4	*(<0.001)*
Medium	39.2	45.6	
High	36.7	18.0	

Table 3.3.2 Cases (by type) and Controls by recruitment type and age

	FTA		CANCEL		CONTROL	
	Spontaneous	GP invitee	Spontaneous	GP invitee	Spontaneous	GP invitee
Age	N=56	N=155	N=119	N=148	N=215	N=254
40-49	28.6	na	38.7	na	36.7	na
50-59	55.4	66.5	40.3	68.2	41.9	67.3
60+	16.1	33.5	21.0	31.8	21.4	32.7

na, not applicable

CHAPTER 4 CASE-CONTROL STUDY BASELINE RESULTS

4.1 INTRODUCTION

This chapter summarises the bivariate and multivariate baseline results examining predictors of non-attendance to the SABXRS. Separate analyses are first presented for each of the six study constructs: Socio-demographic; Health Motivation and Control; Knowledge; Susceptibility; Barriers; and, Influences. As explained in Chapter 3, within each of the two samples - Spontaneous and GP Invitee - two case types - those who failed to attend without notice (FTA) and those who telephoned and cancelled their appointment (Cancel) - are compared with the appropriate control group. Hence, analyses are performed for four separate case groups for each construct; Spontaneous-FTA, Spontaneous-Cancel, GP-FTA, and GP-Cancel.

Detailed tables and models are included as Appendices in Volume II, while summarised tables are included at the end of the chapter. Tables found at the end of this Chapter all commence with 'Table 4.' (the '4' referring to Chapter 4), while those in the appendices are prefixed with 'Appendix D' or 'Appendix E'.

Appendix D includes a table for each of the constructs, listing the variables included in the study and *P*-value for each of the bivariate cross-classifications, comparing cases with controls. Association between non-attendance to mammography screening at the SABXRS and each of the study variables was investigated using the Pearson chi-square test of independence, except where the minimum expected frequency was < 5, in which case Fisher's exact test was used. The *P*-value is shown in the case column below the frequencies of the variable in question. For example, in Appendix D1, Table D1.1, the first *P*-value of 0.194 below the frequencies for AGE in the FTA-case column is the probability associated with comparing the age distribution of Spontaneous FTA-cases and Spontaneous Controls. The *P*-value of 0.940 under the frequencies for AGE in the Cancel-case column is the probability associated with comparing Spontaneous Cancel-cases with Spontaneous Controls by age.

The six sections 4.2 to 4.7 below summarise the bivariate and multivariate analyses for each of the six study constructs. Three common tables, located at the end of the chapter, are included within each section. The first table in each section (4.2.1 to 4.7.1) lists variables associated with non-attendance to SABXRS at $P < 0.10$ level in at least one of four case-control bivariate analyses.

The second table in each section (4.2.2 to 4.7.2) shows the variables which were entered in at least one of the four multivariate models. Variables with a *P*-value of < 0.25 from the bivariate chi-square test were entered into the logistic regression models (see Chapter 3 for rationale). Variables which entered at least one of the four models based on this criterion are listed in these tables, a ✓ denoting which model(s) included the variable. A ✗ denotes that the variable was not entered. The final multivariate logistic regression models for each construct are included in Appendix E.

The third set of tables (4.2.3 to 4.7.3) lists the independent variables from the logistic regression analysis that were found to be significant predictors (at $P < 0.10$) of non-attendance to the SABXRS in one or more of the models. Variables with more than two categories were included in these tables if at least one of the category comparisons was significant, even for variables that were not significant overall (this occurred infrequently). For example, in Table E1.1.4 in Appendix E, the variable HOUSEHOLD COMPOSITION did not achieve overall significance ($P = 0.25$), but the comparison of the category 'Husband and other' with the reference category 'Husband only' was significant ($P = 0.05$).

The category used as the reference group in the logistic regression analyses is shown in this third set of tables next to the variable name, and all other categories are listed below the variable name. The reference category selected was either the group found to be most likely to attend mammography screening from the literature review (Appendix B), or the category with the greatest proportion of responses (where the literature was inconclusive or unavailable at the time). The odds ratio reflects the estimated odds of not attending the SABXRS after adjusting for the confounding effects of other variables included in the model. Odds ratios of less than 1.00 indicate a lower likelihood of being a case; odds ratios greater than 1.00 indicate a greater likelihood of being a case.

Section 4.8 draws on the results from the logistic regression models for each construct to develop an overall model for each of the four analytic groups; Spontaneous-FTA, Spontaneous-Cancel, GP-FTA, and GP-Cancel.

4.2 RESULTS - SOCIO-DEMOGRAPHIC CONSTRUCT

4.2.1 Bivariate Results

This section evaluates the association between non-attendance to mammography screening at the SABXRS and socio-demographic variables.

No bivariate association (at $P < 0.10$) was evident in any of the four analyses for the following variables; AGE, AGE LEFT SCHOOL, QUALIFICATIONS POST-SCHOOL, HIGHEST QUALIFICATION, EMPLOYMENT STATUS, LANGUAGE SPOKEN, SOURCE OF INCOME, RELIGION, and SOCIO-ECONOMIC STATUS. (Appendix D, Table D1.1)

Significant bivariate associations at $P < 0.10$ in at least one of the four analyses are listed in Table 4.2.1. The two occupation variables, LIFETIME OCCUPATION and PARTNERS OCCUPATION refer to the main occupation of the subject and her partner during their lifetime. Thus, it may or may not be the current occupation.

For the Spontaneous-FTA analysis, PARTNER'S OCCUPATION and NUMBER OF CHILDREN were significantly associated with non-attendance at the SABXRS. The partners' of cases were more likely to have worked in manual jobs as their main lifetime occupation, but less likely to have worked as tradespersons, clerks, or salesmen. The proportions from managerial or professional occupations were similar, but more cases were in the 'Not stated/no partner' category; this corresponds with fewer cases being married (64.3% of cases compared with 79.1% of controls). With regard to number of children, cases showed higher proportions at the extremes (none and 5 or more) compared with controls.

For the Spontaneous-Cancel analysis, the only significant variable was INCOME. The association observed is similar to what might be expected from the literature, that is non-attenders have lower incomes; 57% of cases had incomes of $30,000 or less compared with 48% of controls.

In the GP-FTA analysis, four variables exhibit significant bivariate associations - MARITAL STATUS, LIFETIME OCCUPATION, HOUSEHOLD COMPOSITION and NUMBER OF CHILDREN. Cases were less likely to be married, thus more likely to be widowed, separated, divorced or never married. Given that the age distributions were very similar, this difference in marital status supports the findings from the literature review that non-attenders are less likely to be married (Appendix B, Table B1.2). A similar difference was observed for the Spontaneous-FTA analysis ($P = 0.109$), but not for either of the Cancel analyses. For the LIFETIME OCCUPATION variable, GP-FTA cases were more likely to have worked in trade/manual occupations. As expected, given the marital status differences, cases were more likely to live alone or with persons other than husband. Cases were also more likely to have 3 or more children; 66.5% compared with 55.4% for controls.

For the GP-Cancel analysis, LIFETIME OCCUPATION, COUNTRY OF BIRTH, SPEAKS OTHER LANGUAGE, HOUSEHOLD COMPOSITION and PERSONS IN THE HOUSEHOLD showed significant associations. Women who cancelled were more likely to have worked in managerial/professional or clerk/sales/service occupations, be born in Australia, and thus speak English at home, all characteristics in the opposite direction to those predicted from the literature. They were also more likely to live in households with husband only, thus also more likely to live in a 2-person household. The finding that women who cancel their appointment were more likely to be English speaking than both the controls and FTA cases is not surprising, since it necessitates making a telephone call to the Service. One reason for the non-English speaking FTA-cases not telephoning may be that they did not understand the invitation letter and therefore ignored it.

4.2.2 Multivariate Results

Variables which entered at least one of the four models based on a P-value of < 0.25 are listed in Table 4.2.2. The final models are included in Appendix E, Tables E1.1.1 to E1.1.4.

Although MARITAL STATUS was initially entered in both the FTA models, it was excluded from the final models due to its high correlation with household composition. Models were examined using both variables together and each variable on its own. The model with HOUSEHOLD COMPOSITION alone gave the best fit. Similarly, LANGUAGE SPOKEN was excluded from the final GP-Cancel model, due to high correlation with COUNTRY OF BIRTH.

Because there are no women aged 40-49 in the GP sample, the reference group for the AGE variable was made 50-59 (rather than the youngest as elucidated from the literature) for comparability across the two samples.

Table 4.2.3 lists the independent variables from the logistic regression analysis that were significant predictors of non-attendance to screening at the SABXRS for one or more of the final models at $P < 0.10$.

For the Spontaneous-FTA model, three variables predicted non-attendance; LIFETIME OCCUPATION, PARTNER'S OCCUPATION and NUMBER OF CHILDREN. Compared with women in managerial or professional occupations, those who did not work during their lifetime were three times *less* likely to miss their appointment, or conversely, housewives were three times more likely to attend. Partner's occupation was used as a proxy for socio-economic status. Compared with women whose partner's worked in managerial/ professional occupations, those whose partner's worked in manual occupations were nearly two and a half times more likely to FTA. For NUMBER OF CHILDREN the reference category was None, on the basis of the only study in the literature (Fox *et al.*, 1991) which found a significant association (Table B1.8 in Appendix B), and this suggested that women with children were more likely to be non-attenders. However, the results here found that women with 1-4 children were *less* likely to be non-attenders (only significant for 1-2) compared to those with no children, while those with five or more children were more likely to be non-attenders (this association was not significant).

For the Spontaneous-Cancel analysis it can be seen from Appendix D, Table D1.1 that the only variable with a P-value of < 0.25 from the bivariate analysis was INCOME. Hence, this variable was not adjusted for the confounding effects of other variables, and the odds ratio shown in Table 4.3 in this instance is unadjusted. Women whose income was \$20 001-\$30 000 were twice as likely to be non-attenders than women whose income was over \$30 000. However, there was no difference between the highest and lowest income groups.

For the GP-FTA analysis, two variables remained independent predictors of non-attendance to the SABXRS; LIFETIME OCCUPATION and HOUSEHOLD COMPOSITION. Women with occupations other than managerial/professional (including home duties) were significantly *less* likely to be non-attenders. Women who lived in households with only sons were four times more likely to be non-attenders than women who lived with their husbands, and those living alone were twice as likely to be non-attenders.

Three variables remained independent predictors for the GP-Cancel analysis; LIFETIME OCCUPATION, HOUSEHOLD COMPOSITION and INCOME. Women who worked in trade/manual occupations were three time *less* likely be non-attenders than women who worked in managerial positions. Compared with women who lived with husbands alone, those who lived with husband and others were four times less likely to cancel a GP invitation. The INCOME variable showed the same pattern as for the Spontaneous-Cancel analysis; women whose income was \$20 001-\$30 000 were nearly twice as likely to be non-attenders than women whose income was over \$30 000

4.2.3 Discussion

It can be seen from Table 4.2.1 that age was not associated with non-attendance to SABXRS in any of the analyses, whereas the review of the literature in Chapter 1 suggests that age would be inversely associated with attendance (Appendix B, Table B1.1). Table 4.2.4 shows statistics on age for each of the predictor groups, confirming that the mean is similar for all groups within each sample. The age variable refers to age at appointment date for both samples. The Spontaneous FTA-cases have a mean age of slightly more than one year higher than the Controls. A comparison of means (Mann-Whitney test of independence) shows that this difference is not statistically significant. The mean age for the Spontaneous Cancel-cases is virtually the same as the Controls.

For the GP sample there is very little difference between both types of cases and controls. This is confirmed by the Mann-Whitney test of independence.

From the review of the literature in Chapter 1 it was hypothesised that married women would be more likely to attend mammography screening, or conversely non-attenders would be not married. This was the finding for the two FTA analyses, but for Cancel analyses the cases were found to be similar to the Controls. On the other hand income predicted attendance for Cancel cases in both samples but not FTA cases. For both Cancel models the pattern was the same in that those on middle incomes were more likely to be cases; that is, the non-attenders to the SABXRS who cancelled were not those on the lowest incomes as expected from the literature, but neither were they on the highest income group.

LIFETIME OCCUPATION was found to be an independent predictor in three of the models; in both the GP models and the Spontaneous-FTA model. The direction of the relationship was the same in all three models, that is, women whose main lifetime occupation was in the managerial or professional occupations were more likely to be cases than any other occupational group, including home duties. This relationship contrasts with that expected from the literature, where the higher level occupations are usually found to attend for screening. However, the dependent variable in this study relates to attendance specifically to the SABXRS, a government funded free service. The results may be different for attendance to screening mammography per se. This may also explain the result found for INCOME that women in the middle income range were more likely to be Cancel-cases. Although these women cancelled their appointment with the SABXRS, they may have chosen to be screened privately. The next chapter which reports on attendance at the SABXRS by the follow-up date (4 years after interview) includes a prior history of mammography at baseline as an independent variable in the analysis comparing cases who had attended four years on with those who had still not attended.

Ethnicity, which was measured by country of birth and language spoken at home was entered only in the GP-Cancel model, but was not found to be an independent predictor. From the literature, the main differences in relation to ethnicity were found in USA studies comparing blacks and whites. The equivalent in Australia may be a comparison between aboriginals and non-aboriginals, but this was not asked in the current study as numbers would have been too small for a valid analysis.

Education was not entered in any of the four models. However, there is a significant difference ($P < 0.001$) between the two samples overall, that is all Spontaneous compared with all GP subjects. Over 45% of the spontaneous sample had post-secondary qualifications compared with 26% for the GP sample. The homogeneity within the two sample groups is not surprising. Women who attend particular GP practices are likely to be more homogeneous than the general population. Also, it would be expected that women who make an appointment on their own volition would be more highly educated than the general population. Adelson *et al.*, (1992) compared attenders to a central Sydney mobile screening unit with the general population and found attendance to be associated with education (relative risk of 1.5 for 5 to 6 years secondary and 2.5 for tertiary education compared to those with less than 5 years secondary).

The homogeneity within the two samples is also reflected in the INCOME and SOCIO-ECONOMIC STATUS variables. Over 40% of the Spontaneous sample had incomes of >$30,000 compared with 19% for the GP sample ($P < 0.001$). The proportions in the high socio-economic status category were 37% and 19% for the Spontaneous and GP samples respectively (P < 0.001). It should be noted that SOCIO-ECONOMIC STATUS was based on postcode, as coded by the Australian Bureau of Statistics. The proportion of postcodes in the low, medium and high classification for Adelaide and Outer Adelaide combined are 24%, 35%, and 40% respectively. For the GP sample the postcodes are clustered around the GP practices, whereas the Spontaneous sample is spread throughout Adelaide and its environments. These sample differences are evident in other related variables; a greater proportion of the Spontaneous sample were employed (48% versus 26%) and work in managerial/professional occupations (21% versus 12%) while fewer rely on a government pension (28% versus 47%), all differences significant at $P < 0.001$.

Thus, while socio-demographic variables clearly differentiate the two samples, which in turn represent method of entry to the SABXRS, they mostly failed to predict non-attendance by case type. The literature shows that a high proportion of studies also failed to find an association between attendance and socio-demographic variables, particularly when adjusted for the effects of other variables (Appendix B, Table B1.1 to B1.8). However, the literature mostly refers to non-attenders as a homogeneous group. This set of analyses suggest that the Cancel cases may more closely resemble the Controls rather than the FTA cases, particularly for the Spontaneous-Cancel analysis where only one variable was significant even at the bivariate stage.

For the variables that remained in the final models, the overall level of prediction for cases ranged from 22% to 37% in the four final models (Table 4.2.3). Controls were better predicted, ranging from 83% to 97%. The statistical significance of the final models ranged from P =0.002 to P = 0.043, the highest level of significance being for the GP-FTA model.

4.3 RESULTS - HEALTH MOTIVATION AND CONTROL CONSTRUCT

4.3.1 Bivariate Results

This section evaluates the association between non-attendance to mammography screening at the SABXRS and health motivation and control variables.

It is hypothesised that cases (non-attenders) are less likely to engage in other health behaviours, or conversely women who are motivated to attend for screening mammography also engage in other health enhancing or protective behaviours. In addition to those variables listed in Appendix D (Table D1.2), the questionnaire included questions about visits to the following health professionals in the last year; physiotherapist, chiropractor, acupuncturist and naturopath. However, due to an error in the sequencing, this set of questions was missed for a significant proportion of responders, and therefore excluded from the analysis. If the subjects for which this data is available are representative of the various study groups, then the only significant association found at $P < 0.10$ was for visiting a naturopath in the GP-FTA group; cases were *more* likely to have visited a naturopath.

No bivariate relationship (at $P < 0.10$) was evident in any of the four analysis for the following variables; DO BSE (Breast Self Examination), EXERCISE, EXERCISE FREQUENCY, DON'T SEE DOCTOR WHEN SHOULD, HEALTH STATUS, LONG TERM PROBLEM, DISABILITY INTERFERES, SELF

ESTEEM, AND, MHLOC (MULTI-DIMENSIONAL HEALTH LOCUS OF CONTROL). (Appendix D, Table D1.2)

Significant bivariate associations ($P < 0.10$) are listed in Table 4.3.1.

For the Spontaneous-FTA analysis the three variables about pap smears were significantly associated with non-attendance at the SABXRS, as well as smoking behaviour and the dentist variable. The direction of association for all these variables is as hypothesised. Cases were less likely to have had a pap smear. Amongst women who did have a pap smear, cases were less likely to have had their last one within the previous two years or to have initiated it themselves. Nearly twice as many cases 'Smoke now', and a higher proportion smoked in the past. The dentist variable asked if subjects visited the dentist regularly for checkups or only when there was a problem; a higher proportion of cases never visited the dentist or only visited for specific problems.

For the Spontaneous-Cancel analysis the two variables relating to breast examination by a doctor, were significant. In contrast to the predicted relationship, cases were more likely to have had their breasts examined by a doctor, and to have had an exam in the last year. Two other significant variables were LIFESTYLE AFFECTS HEALTH and DENTIST. The former asked for the level of agreement to the statement "The main thing which affects people's health is their own lifestyle habits". A lower proportion of cases agreed with this statement. The relationship for the DENTIST variable was similar to the Spontaneous-FTA analysis.

In the GP-FTA analysis six variables were significant; FREQUENCY OF BSE, LAST BREAST EXAM, WHO INITIATED LAST PAP SMEAR, SMOKING, LAST TIME SAW DR and DENTIST. More cases practised BSE monthly, and more had a recent breast examination by a doctor, in contrast to the hypothesised relationships for these variables. Fewer cases initiated a pap smear themselves, as hypothesised. A higher proportion of cases saw a doctor within the 3 months prior to interview, whereas the literature suggests that attenders (controls in this study) visit more frequently. The relationship for the DENTIST variable was similar to both Spontaneous analyses.

For the GP-Cancel analysis, no variables were significant at $P < 0.10$, indicating that on this set of variables Cancel cases resemble Controls.

4.3.2 Multivariate Results

Variables which entered at least one of the four models based on a P-value of < 0.25 are listed in Table 4.3.2. The final models are included in Appendix E. Tables E1.2.1 to E1.2.4.

It should be noted that for the GP-FTA model, the variables DO BSE and DOCTOR CHECKED BREASTS were entered (even though they were not significant at P <0.25) because they were the lead-in to the questions that followed on FREQUENCY OF BSE and TIME OF LAST EXAM.

Table 4.3.3 lists the independent variables from the logistic regression analysis that were significant predictors of non-attendance to screening at the SABXRS in one or more of the models at $P < 0.10$.

For the Spontaneous-FTA analysis, three variables predicted non-attendance, all in the direction hypothesised; EVER HAD PAP SMEAR, SMOKING and DENTIST. Cases were nearly four times more likely to be have never had a pap smear, twice as likely to be a current smoker, and nearly three times as likely to visit a dentist only when problems arose. These results indicate that women who participated in other preventive health behaviours also participated in screening mammography with the SABXRS.

Three variables also predicted non-attendance for the Spontaneous-Cancel analysis, but only the DENTIST variable was common to both Spontaneous models. A significant dose-response relationship is seen with the DENTIST variable; compared with women who visit regularly for check-ups, women who visit the dentist only when problems arise were nearly two times more likely to be a case, while those who never visit were nearly three times more likely to be a case (as hypothesised). The other significant predictors were the two variables about breast exam by a doctor, but cases were *more* likely to have had a breast exam, and to have had one recently, contrary to the hypothesised result.

For the GP-FTA analysis, seven variables remained independent predictors of non-attendance to the SABXRS; DO BSE, FREQUENCY OF BSE, DOCTOR CHECKED BREASTS, LAST BREAST EXAM, SMOKING, LAST TIME SAW DR, and DENTIST. Women who performed BSE less than once a month were *less* likely to be cases than those who do BSE monthly, contrary to the expected result. The variables on breast exam by a doctor also show that cases were more likely to have had a breast exam, and that it occurred recently, again contrary to the expected result. As with the Spontaneous-FTA group, smokers were more likely to be cases; both women who smoke now or have smoked in the past were nearly twice as likely to be cases. Women who visited a doctor more than 12 months ago were more likely to be cases (3.5 times) than those who visited within the previous three months, but those who visited 6 to 12 months previously were less likely to be cases. The dentist variable conforms with the pattern seen in the previous two models; women who never visit the dentist were nearly twice as likely to be cases compared with those who visited just for check-ups. The association for those who visited when problems arise only is positive, but not statistically significant.

For the GP-Cancel analysis only one comparison showed significance at $P < 0.10$; compared with women who last saw a doctor within the last 3 months, those whose visit was $\geq$ 12 months ago were two and a half times more likely to be cases. The variable LAST BREAST EXAM (when last exam occurred) reached significance overall ($P = 0.07$), but none of the category comparisons with the reference group were significant. As noted above no variables showed bivariate significance for this group.

4.3.3 Discussion

The MULTI-DIMENSIONAL CONTROL scale and its sub-scales were included in this study on the premise that promotional materials would need to take account of whether internal and external attribution differently influence the performance of health behaviours. Rothman *et al.*, (1993), found that emphasising a woman's responsibility in promotional material will significantly increase mammography use. Although no relationship was found in this study, it may be that differences exist among particular cultural groups not represented in the SABXRS samples taken at that time.

Overall, the study sample showed neither high levels of internal nor external control. Similarly no association was found with self-esteem, both samples showing an overall high level of esteem.

In general, variables related to the breast (both examination by self and doctor) were negatively associated with actual attendance, contrary to expectation. Women who performed regular BSE and had their breasts examined by a doctor were not the controls as predicted. Further, for those who did have an exam, it was the cases who had had one most recently. The literature shows that women who practice BSE and have regular breast exams are more likely to attend for screening, but this mostly relates to screening per se. However, this study examines attendance to the SABXRS, hence non-attenders may have been screened elsewhere. It may be that women who cancelled had a recent breast exam because of breast problems rather than routine checking for preventive purposes. This will be explored in Chapter 5 which examines whether cases had a mammogram outside the service and whether it was a screening or diagnostic mammogram.

The finding that women who last saw a doctor $\geq$ 12 months ago were more likely to be cases (non-attenders) is supported by an Australian trial of GP invitations to a Sydney screening program (Irwig *et al.*, 1990). In that study, 38% of women who had consulted a GP in last 6 months attended for screening compared with 15% if the last consultation was more than 2 years ago. In the current study this relationship was significant amongst the GP sample but not the Spontaneous.

Smoking was a predictor for both the FTA models but neither of the Cancel models, while behaviour relating to dental care predicted non-attendance in three of the models. The strength of association for these variables was greater for the spontaneous sample. Overall, fewer Spontaneous subjects smoked than GP subjects. This suggests that women who book spontaneously are more likely to engage in other preventive behaviours, as might be expected given that they themselves made the decision to have a screening mammogram, rather than being prompted by a letter from a doctor.

Overall, the variables included in the final models were poor to reasonable predictors of caseness, ranging from 5% for the Spontaneous-FTA model to 46% for the GP-FTA model, but good predictors of controls. The statistical significance of the models was high except for the GP-Cancel model at $P = 0.50$ (others were < 0.001 to 0.007).

From the literature the Health Motivation and Control variables were generally found to predict attendance, overall, but to a lesser extent in case-control studies. Only one case-control study was reviewed for the HEALTH STATUS variable, and that also failed to find an association. PAP TEST was found to be significant in the bivariate analyses, but most studies did not report adjusted results. One case-control study which reported a multivariate result found no independent association for pap test, but did find that BSE was predictive. The results for breast exam by a doctor or visits to the doctor in general were mixed. No case-control study reported an association with smoking behaviour. However, all reviewed case-control studies (and cohort studies) which included a variable related to the use of a dentist for check-ups, found an association with attendance. These studies were conducted in the UK and related to government-funded screening programs as in the current study. (Appendix B, Tables B2.1 to B2.8).

4.4 RESULTS - KNOWLEDGE CONSTRUCT

4.4.1 Bivariate Results

This section evaluates the association between non-attendance to mammography screening at the SABXRS and the knowledge variables. It is hypothesised that cases (non-attenders) would be less knowledgeable about breast cancer and mammography.

No bivariate association (at P < 0.10) was evident in any of the four analyses for the following variables; CANCER-2ND MOST COMMON, LUMP IN BREAST, NIPPLE CHANGE/RETRACTION, CHANGE IN BREAST SHAPE, ARMPIT SWELLING, PAIN/SORE BREAST, OTHER SYMPTOMS/SIGNS, LUMPS TO BREAST CANCER, and OTHER CHECKS FOR BREAST CANCER. (Appendix D, Table D1.3) The first variable relates to a question about knowledge of the most common cancer for women in their age group in Australia (this was followed by knowledge of the second most common cancer). The other variables listed (except for LUMPS TO BREAST CANCER) relate to knowledge about symptoms or signs of breast cancer and checks or tests that can be done to detect breast cancer. This group of questions was unprompted; that is women were asked to reveal any symptoms/signs/test they knew about, following an affirmative response to a lead-in question 'Do you know any…..' The LUMPS TO BREAST CANCER variable asked women how many lumps (out of every 10 discovered) they thought turned out to be breast cancer.

Significant bivariate associations (P < 0.10) are listed in Table 4.4.1.

For the Spontaneous-FTA analysis five variables were significant; PUCKERING/DIMPLING, INCIDENCE OF BC, EXAMINE OWN BREASTS, NO. OF CHECKS KNOWN, and KNOW MAMMO FINDS BEFORE DR. Cases were significantly less likely to mention puckering or dimpling as a sign of breast cancer. However, overall knowledge about signs of breast cancer did not differ; that is, the majority of both cases and controls were knowledgeable. Cases were less likely to know the correct incidence of risk of breast cancer (1 in 15), but they also over-estimated the incidence overall (23% of cases answered 1 in 5 compared with 14% of controls). Regarding specific (unprompted) tests or checks known to detect breast cancer, cases were less likely to mention self breast-examination and knew fewer checks overall. Cases were also less likely to know that mammography can detect breast cancer before a doctor can feel a lump (this was a prompted question).

For the Spontaneous-Cancel analysis, only two variables were significant; NO. OF CHECKS KNOWN, and HEARD OF SCREENING. Cancel cases also knew fewer checks for breast cancer (as for FTA cases), and were less likely to have heard of screening mammography.

In the GP-FTA analysis seven variables showed a significant bivariate association; CANCER-MOST COMMON, NIPPLE BLEEDING/DISCHARGE, AGE MOST AT RISK, EXAMINE OWN BREASTS, DOCTOR EXAMINE BREASTS, KNOWS MAMMO FINDS BEFORE DR, and HEARD OF SCREENING. Cases were less likely to know that breast cancer is the most common cancer in older women. Although there was no difference in overall knowledge about signs of breast cancer, fewer cases mentioned bleeding or discharge from the nipple. More cases incorrectly stated that women in their 40's were most at risk of developing breast cancer, and a higher proportion answered 'Don't know'. Cases were less likely to mention breast self-examination as a check for breast cancer, but more likely to mention breast examination by a doctor. Cases were also less likely to know that mammography can detect breast cancer before a doctor can feel a lump or to have heard of screening mammography.

Four variables were significant for the GP-Cancel analysis; KNOWS SIGNS OF BC, PUCKERING/DIMPLING, NO. OF SYMPTOMS/SIGNS KNOWN, and MAMMOGRAPHY/X-RAY. Cases were *more* likely to know of any signs or symptoms of breast cancer, to know more specific signs, and to mention puckering or dimpling as a sign. Whereas for the previous 3 analyses the direction of association was as predicted (that is, cases being less knowledgeable), for this analysis the effect was opposite for all four significant variables.

4.4.2 Multivariate Results

Variables which entered at least one of the four models based on a *P*-value of < 0.25 are listed in Table 4.4.2. The final models are included in Appendix E, Tables E1.3.1 to E1.3.4.

It should be noted that for the Spontaneous-FTA model, the variable KNOW SIGNS OF BC was entered (even though it was not significant at P <0.25) because it was a lead-in to NO. OF SIGNS KNOWN. Also, the variable LUMP IN BREAST was excluded from the GP-Cancel model due to numerical problems; the exclusion of cases from the model that did not have a valid response to all variables entered resulted in a zero cell for this variable.

Table 4.4.3 lists the independent variables from the logistic regression analysis where at least one of the variable categories was a significant predictor of non-attendance to screening at the SABXRS for one or more of the models at P < 0.10.

For the Spontaneous-FTA analysis no variable remained an independent predictor of non-attendance to the SABXRS.

Three variables remained independent predictors in the Spontaneous-Cancel analysis: CANCER MOST COMMON, CANCER-2ND MOST COMMON and NIPPLE BLEEDING/DISCHARGE. Cases were less likely to know that breast cancer is the most common cancer for women of their age; compared with women who knew breast cancer was the most common, those who nominated lung cancer were 12 times more likely to be cases. Similarly for the second most common cancer, those who specified cervix were twice as likely to be a case than those who correctly nominated bowel. Contrary to the hypothesised result, cases were more likely to know that nipple bleeding or discharge is a sign of breast cancer,.

For the GP-FTA analysis four variables remained independent predictors; CANCER MOST COMMON, NIPPLE BLEEDING/DISCHARGE, DOCTOR EXAMINE BREASTS and HEARD OF SCREENING. As with the previous analysis cases were most likely to nominate lung as the most common cancer. In this analysis cases were less likely to know that nipple bleeding or discharge is a sign of breast cancer, but more likely to know about breast exam by a doctor as a test for breast cancer. As hypothesised women who had not heard of screening were more likely to be cases.

Four variables also predicted non-attendance in the GP-Cancel analysis; NIPPLE CHANGE/RETRACTION, PUCKERING/DIMPLING, INCIDENCE OF BREAST CANCER and HEARD OF SCREENING. Only the last shows the hypothesised direction of association. The first two variables relate to signs of breast cancer known, both showing cases as more knowledgeable of these specific signs. Also, cases were more likely to correctly specify the risk of breast cancer during a woman's lifetime as 1 in 15; those who nominated 1:60 as the incidence were three times *less* likely to be cases, against the hypothesised direction.

4.4.3 Discussion

Overall, knowledge was high amongst all groups for several variables as can be seen from Appendix D, Table D1.3, hence it is not surprising that these variables failed to predict non-attenders. A knowledge score (1-4) was calculated but excluded from the analyses, as the individual items provided better fitting models. This score was based on the four variables CANCER-MOST COMMON, AGE MOST AT RISK, INCIDENCE OF BREAST CANCER and KNOWS MAMMO FINDS BEFORE DR, where a score of 1 was allotted for a correct answer and 0 for an incorrect answer. A significant difference was found only for the GP-FTA analysis (P=0.043); 48% of cases were correct on 2 or more items, compared with 58% of controls. From the literature review, it can be seen that a composite knowledge score also generally failed to predict attendance (Appendix B, Table B3.1)

The problems caused by this study being retrospective in nature are particularly evident for this set of variables. It is not known how and when these women gained their knowledge. Most women had received a brochure from the SABXRS which included information about breast cancer being the most common cancer, incidence and age at risk. The group with the lowest percentage (still at 54%) of women knowing that breast cancer was the most common was the GP-FTA cases, which is the group least likely to have read the brochure. Knowledge about the second most common cancer was poor amongst all groups. This information was not in the brochure, and while this suggests the brochure may have been a source of knowledge about breast cancer, a direct link cannot be assumed.

Most women across all groups knew of at least one sign or symptom of breast cancer, and most nominated (unprompted) a lump in the breast, hence the finding of no difference between cases and controls. However, some differences were found with less commonly known symptoms. Interestingly, the most knowledgeable about nipple bleeding/discharge and nipple change/retraction being symptoms were the Cancel cases with from both samples. The Cancel cases for both samples were also more likely to choose the correct incidence of breast cancer, the latter achieving statistical significance.

Almost 100% of the Spontaneous sample as well as the GP-Cancel cases knew of checks a woman or her doctor could do to detect breast cancer. However, about 5% of the GP-FTA's and GP-Control's said they did not know any. That is, even women who had a screening mammogram answered 'no' to the question 'Do you know any tests or checks that a woman or a doctor can do to see if she has breast cancer'. No prompting was used, and this question was asked before mammography was mentioned, assuming that women who knew about mammography would offer it as a response. However, it appears that some women may have interpreted this question as meaning hands-on tests. This example demonstrates the care that needs to be taken both in framing and analysing questions.

Just as several variables showed good knowledge amongst all groups, a number also showed poor knowledge amongst all groups. Even though these do not differentiate between attenders and non-attenders they should not be ignored. For example, the proportion of women who correctly specified the older group as the most at risk ranged from 3% to 7%, thus even women who attended were ignorant in this regard. This is despite the fact that they would have received information about age as the greatest risk factor. The review of the literature also shows that knowledge of the age at risk did not generally differentiate between attenders and non-attenders (Appendix B, Table B3.2). Knowledge of the age at risk remained an independent predictor in only one study reviewed (cross-sectional). The dependent variable was 'Had a mammogram in the last year', and the factor predicted attendance for older women (65+) only, not those aged 50-64 (Fox *et al.*, 1991). Intuitively one would expect that older women who present regularly for a screen would know they are at risk. This same study also provided results for the dependent variable 'Ever had a mammogram', and found no relationship for either age group. No case-control studies were reviewed for this factor.

Although higher proportions across all groups correctly nominated that the lifetime risk of breast cancer was 1 in 15 (33% to 42%) than any of the other categories, it remains an issue that the majority of women did not know the correct incidence. Stager, (1993) also found that women were fairly knowledgeable about curability but lacked knowledge of risk factors and incidence, especially of the increased risk with advancing age. In Australia, Irwig *et al.*, (1991) also found that women lacked knowledge about age being the most important risk factor.

Also, despite the explanation of screening mammography in the brochure, a high proportion of women said they had not heard of screening. Although cases were more likely to state that they had not heard of screening (significant for the GP-Cancel analysis), a high proportion of the Controls also said they had not heard of screening mammography (15% of Spontaneous sample and 31% of GP sample). Chapter 8 which reports on the Omnibus Surveys (cross-sectional community surveys) explores knowledge about screening mammography and attendance over the period 1990 to 1995. As one of these surveys was conducted around the time of the baseline interviews for this study, a comparison can be made between these study samples and a community sample.

Overall, these variables were not strong predictors in the final models for cases, ranging from 7% for the Spontaneous-FTA model to 29% for the GP-FTA model, with overall model *P*-values from 0.004 (GP-Cancel) to 0.140 (Spontaneous-FTA). No variable remained an independent predictor in the Spontaneous-FTA analyses and few in the other analyses.

As Kendell and Hailey (1993) point out, knowledge does not necessarily result in action, referring to a national survey that found that 85% of women were familiar with mammography guidelines, but only 50% had ever had one. In an intervention study, Reynolds *et al.*, (1990) found no significant difference in actual compliance between groups despite measured changes in knowledge. Nevertheless, it is important that women receive correct information, particularly about risk so that they can make informed decisions.

4.5 RESULTS - SUSCEPTIBILITY CONSTRUCT

4.5.1 Bivariate Results

Appendix D, Table D1.4 lists the susceptibility variables investigated in this study. It is hypothesised that cases (non-attenders) would feel less susceptible to breast cancer, and therefore be less inclined to attend.

No bivariate relationship ($P < 0.10$) was evident for any of the four analyses for the following variables; EVER HAD BC, KNOW ANYONE WITH BC, ACQUAINTANCE HAD BC, OTHER RELATIVE HAD BC, MOST SEVERE OUTCOME OF BC, OUTCOME OF EXPERIENCE WITH BC, HIGHEST CLOSENESS TO PERSONS WITH BC, and CLOSENESS TO PERSONS WITH BC. Only a very small proportion of all groups had had breast cancer, but it was unexpected that more than 1 or 2 (if any) of the controls would have had breast cancer, as the Service actively dissuades women with breast cancer from making an appointment: only women who are not under the care of a doctor, or unlikely to take action to see a doctor, are accepted. Between 73% and 80% of all case and control groups knew someone personally who had breast cancer.

MOST SEVERE OUTCOME OF BC and OUTCOME OF EXPERIENCE WITH BC were derived from a series of questions relating to persons known with breast cancer. The first relates to the worst outcome of all persons known with breast cancer, and ranges from the worst outcome of 'Died' to 'Recurred/still treated' to 'Cured/remission'. Women were included in the first category if at least one person they personally knew died from breast cancer, in the next category if no one they knew died from breast cancer, but at least one person they personally knew was still being treated or the breast cancer had recurred, and so on. The experiences of both cases and controls were similar in this regard. OUTCOME OF EXPERIENCE WITH BC differs from the previous variable in that it summarises each woman's experience of others' outcomes with breast cancer; women were included in the category 'Died of BC only' if they only knew a person or persons who had died of breast cancer, whilst the category 'Combination' refers to those who had varied experiences. The last two variables listed in Appendix D, Table 1.4 relate to the closeness of the relationship with persons known with breast cancer. As with the previous set of variables, one relates to the closest relationship, while the other to overall closeness. It can be seen from Appendix D, Table D1.4 that around 15% of all six groups were in the category 'Extremely only', that is they were extremely close to the person known (or all persons if there was more than one). Due to collinearity, only the second variable from these two sets was included in the final analyses as these were determined to be more informative.

Significant bivariate associations with a P-value < 0.10 are listed in Table 4.5.1.

For the Spontaneous-FTA analysis four variables showed a significant association with non-attendance; PERCEIVED SUSCEPTIBILITY, HOW OFTEN THINK ABOUT BC, CLOSE FRIEND HAD BC, and NUMBER KNOWN WITH BC. The perceived susceptibility variable was asked as 'How likely do you think it is that you will suffer from breast cancer at some time in your life'. Contrary to the hypothesised result, cases were *more* likely to feel susceptible and also more likely answer 'Don't know'; 10.7% of cases said they were 'very likely' to get breast cancer compared with 6.0% of the controls. This result is reflected in the higher proportion of cases who stated that they thought about breast cancer 'A lot of the time', but cases were also more likely to answer 'Never', suggesting they represent both extremes. The other two significant associations both show the hypothesised result; cases were less likely to have a close friend with breast cancer and knew fewer people with breast cancer.

Six variables showed a significant bivariate association for the Spontaneous-Cancel analysis; THINK ABOUT BC, CONCERNED MAY HAVE BC, SPOKEN TO DR ON BC, EVER HAD LUMP, LUMP IN LAST 12 MONTHS, and 1ST DEGREE RELATIVE HAD BC. In the previous 12 months, cases were more likely to have spent time thinking about breast cancer, be concerned about the possibility of getting breast cancer, spoken to a doctor about it, and to have had a breast lump. They were also more likely to have a first degree relative (mother, sister or daughter) who has had breast cancer. These results indicate that cases felt more susceptible and possibly had a higher actual risk of developing breast cancer, all against the hypothesised direction of association.

For the GP-FTA only one variable showed a significant bivariate association, CLOSE FRIEND HAD BC; a lower proportion of cases had a close friend with breast cancer, as hypothesised.

Similarly in the GP-Cancel group, one variable showed a significant bivariate association, THINK ABOUT BC. As with the Spontaneous-Cancel group, cases were more likely to think about breast cancer.

4.5.2 Multivariate Results

Variables which entered at least one of the four models based on the criterion of P-value < 0.25 are listed in Table 4.5.2. The final models are included in Appendix E, Tables E1.4.1 to E1.4.4.

Table 4.5.3 lists the independent variables from the logistic regression analysis where at least one of the variable categories was a significant predictor of non-attendance to screening at the SABXRS for one or more of the models at $P < 0.10$.

For the Spontaneous-FTA analysis three variables remained independent predictors of non-attendance; HOW OFTEN THINK ABOUT BC; KNOW SOMEONE WITH BREAST CANCER, and NUMBER KNOWN WITH BC. Compared with the category 'A lot of the time' cases were seven times *less* likely think about breast cancer 'Rarely'. Despite spending more time thinking about breast cancer, cases personally knew fewer people with breast cancer; compared with women who knew two or more, cases were nearly 4 times more likely to know none or one.

For the Spontaneous-Cancel analysis, four variables remained independent predictors, all against the direction hypothesised; CONCERNED MAY HAVE BC, SPOKEN TO DR ON BC, EVER HAD LUMP, and LUMP IN LAST 12 MONTHS. Cases were twice as likely to be concerned they may have breast cancer, three times more likely to have spoken to a doctor about it, four times more likely to have ever had a lump, and three times more likely to have had a lump in the last year.

Five variables were independent predictors for the GP-FTA analysis, LUMP IN LAST 12 MONTHS, KNOW SOMEONE WITH BC, 1ST DEGREE RELATIVE HAD BC, OTHER RELATIVE HAD BC, and CLOSENESS TO PERSONS WITH BC. Cases were two and a half times more likely to *not* have had a lump in the last 12 months, as hypothesised, but contrary to the result for the Spontaneous-Cancel analysis. They were also 3 times more likely to know someone with breast cancer, and to be extremely close to the person/s known (both results contrary to hypothesis). However, those known were not relatives, as women who stated they did not have a first degree relative with breast cancer were 4 times more likely to be cases, and nearly three times for 'Other relative'. From the frequencies in Appendix D, Table D1.4, it can be seen that cases were more likely to have a close friend with breast cancer, and although this was entered into the model, it was not statistically significant as an independent predictor.

None of the susceptibility variables were statistically significant independent predictors for the GP-Cancel analysis.

4.5.3 Discussion

Across all groups cases were found to think about breast cancer more often (contrary to the hypothesised result), although this variable reached statistical significance only for the Spontaneous-FTA analysis. The Spontaneous cases were also more likely to be concerned that they may have breast cancer themselves, but this was significant only for the Spontaneous-Cancel analysis. Given these results, the obvious question is why did these women not attend if they felt more susceptible to breast cancer. Two explanations are suggested; they felt so concerned that they went elsewhere to have a mammogram or did not have a mammogram at all possibly due to fear of the outcome (denial). The mammographic history of cases at baseline and reason for mammography outside the SABXRS is explored in Chapter 6.

Regarding actual symptoms of breast cancer, the Spontaneous-Cancel cases were more likely to have had a lump (both ever and in the last 12 months). In contrast, the GP-FTA cases were less likely to have had a lump in the last 12 months or to have relatives with breast cancer (measures of actual risk), and, as hypothesised less likely to attend. Thus it appears that the Spontaneous-Cancel cases who were more at risk women may have cancelled the SABXRS appointment due to breast problems, while the less susceptible GP-FTA cases merely ignored the appointment. The majority of women who had a lump (all but 2) in the last 12 months had had it examined by a doctor. Hence, the Spontaneous-Cancel cases may have been referred for private mammography.

The specific PERCEIVED SUSCEPTIBILITY variable, where women were asked directly to assess their own risk of getting breast cancer was not an independent predictor in any of the analyses. The literature on this variable does not provide a great deal of support either (Appendix B, Table B4.1). Two case-control studies were reviewed which included a perceived susceptibility variable. One found no association at all (Hammond and Stewart, 1994), while the other found that non-attenders who had a mammogram outside the screening program felt more susceptible than non-attenders who had not had a mammogram (Rutledge *et al.*, 1988). The latter reported bivariate results only. As indicated above differences in cases by mammography behaviour outside the SABXRS will be investigated in Chapter 6. An Australian cohort study found no association between perceived susceptibility and later attendance to a mobile screening service (Turnbull *et al.*, 1995). Further, PERCEIVED SUSCEPTIBILITY does not necessarily relate to actual risk or experience with breast cancer. Table 4.5.4 below cross-tabulates perceived risk with several actual risk factors. PERCEIVED SUSCEPTIBILITY was significantly associated with CONCERNED MAY HAVE BC and 1ST DEGREE RELATIVE HAD BC across most groups, but EVER HAD LUMP, KNOW ANYONE WITH BC and

CLOSE FRIEND HAD BC was not associated with perceived risk in any of the groups. It may be that women with a prior breast lump felt reassured that all was well (benign lump).

The literature review also showed varied results for other variables included in the susceptibility construct, including knowing others with breast cancer, family history and concern or worry about breast cancer.

Overall, the final models were poor predictors for cases, ranging from 9.09% to 28.95%. For controls the range was 88.58% to 98.60%, and overall significance of the models ranged form <0.001 (Spontaneous-Cancel) to 0.018 (Spontaneous-FTA).

4.6 RESULTS - BARRIER CONSTRUCT (PERCEIVED AND STRUCTURAL)

4.6.1 Bivariate Results

Appendix D, Table D1.5 lists the barrier variables investigated. It is hypothesised that for cases (non-attenders) more barriers will be present, both perceived and structural. Perceived barriers include negative attitudes to mammography and screening, fewer perceived advantages/benefits of early detection and mammography and apathy towards the need for screening, while structural barriers focus on access difficulties, both in terms of time and transport.

No bivariate relationship ($P < 0.10$) was evident for any of the four analyses for the following groups of variables;

1. EMOTIONAL FACTORS, CANCER LESS LIKELY TO SPREAD, LESS BREAST REMOVED, LESS LIKELY TO NEED TREATMENT; these relate to advantages nominated by women (unprompted) of 'finding breast cancer while it is still small'. EMOTIONAL FACTORS comprise responses which were grouped due to the sparse frequency of the responses (peace of mind, handle situation better, less pain /trauma). It should be noted that for the Spontaneous-FTA analysis a statistical test could not be performed for EMOTIONAL FACTORS due to a zero cell (none of the cases specified this advantage of early detection).
2. FIND BC EARLY, FIND LUMPS CANT FEEL, INCREASE CHANCE OF CURE, OTHER BENEFITS, UNCOMFORTABLE; the first four relate to benefits of having a mammogram and the last to problems with having a mammogram (both unprompted).
3. SAVES LIVES; level of agreement with statement that finding breast cancer early saves lives (over 93% of all groups agreed).
4. PUBLIC TRANSPORT PROBLEMS, HOUSEHOLD MEMBER DISABLED, OTHERS DISABILITY INTERFERES; structural barriers.

Significant bivariate associations with a P-value < 0.10 are listed in Table 4.6.1. Several variables showed significant bivariate associations for this construct for all four analyses, and therefore only key findings will be drawn out here.

Although a high proportion of both cases and controls in both FTA analyses agreed that finding breast cancer early had advantages (range 92.3% to 99.5%), the difference was nevertheless statistically significant. Similarly, overall a high proportion of both cases and controls across all groups perceived benefits of mammography, but the difference between cases and controls was significant in all four analyses; the greatest difference was between GP-FTA cases (80.6%) and GP-Controls (98.0%).

There was a statistical difference in the proportion who perceived problems with having a mammogram in three of the analyses, and all four showed a highly significant difference in the proportion who said the perceived problems would stop them from having a mammogram; 7% to 14% of cases said the problems would stop them against 1% and 2% of controls.

CANCERS MISSED was significant for the two FTA analyses and refers to the number of cancers (out of 100) that subjects expected mammography to miss (preceded by a question as to whether they expect mammography to detect all breast cancers).

The level of embarrassment in having a mammogram only showed a significant difference for the Spontaneous-FTA analysis; cases were more likely to be embarrassed by a female radiographer, and while the overall proportion embarrassed by a male radiographer was similar for cases and controls, the degree of embarrassment was greater for cases.

The items from need symptoms to painful, are barrier statements adopted from those used in a US study (Rimer *et al.*, 1989b) as described in Chapter 3. This study added several other barrier statements (accuracy concern plus those from means mastectomy to more trouble than worth) and agreement was sought on the same four-point scale. Factor analysis on all items was performed (in SPSS) using the method of principal components analysis, which resulted in the extraction of only one factor, labelled barrier score in Appendix D, Table D1.5, and comprising the items need symptoms to accuracy concern. As in the Rimer *et al.*, 1989b study, the factor items have been analysed both individually and as a barrier score. The barrier score was highly correlated with attendance to SABXRS ($P < 0.001$ in all four analyses). Most of the individual items in the factor also showed highly significant differences across all four analyses, with cases more likely to perceive these barriers, whereas, for items not included in the barrier score (means mastectomy to more trouble than worth) the results were varied.

The variable asked back for tests was also significant across all analyses; cases were less likely to be aware that having a mammogram may require further tests.

Only the two FTA analyses showed bivariate differences in any of the structural barriers; access to car and how often access to car were significant for both.

It can be seen from the table that several other variables were significant in one, two or three of the bivariate analyses. A significance test was not possible for the Spontaneous sample for the variable ASKING FOR TROUBLE (that is, by having a mammogram) due to a zero cell; none of the controls (attenders) agreed with this statement.

4.6.2 Multivariate Results

Variables which entered at least one of the four models based on $P < 0.25$ are listed in Table 4.6.2. Apart from the set of items relating to advantages of finding breast cancer early and benefits of mammography (ADVANTAGES OF FINDING BC to NO. OF PERCEIVED BENEFITS in Appendix D, Table D1.5), almost all of the remaining variables (which depict barriers more directly) in this construct were found to be significant at $P < 0.25$ in at least one of the four analysis groups, and thus were included in one or more (frequently all four) of the models.

Due to numerical problems caused by small numbers, the variables ADVANTAGES OF FINDING BC and BENEFITS OF MAMMO were excluded from the final Spontaneous models.

The final models are included in Appendix E. Tables E1.5.1 to E1.5.4. Two sets of models are included. One set (Tables E1.5.1a to E1.5.4a) replaced items NEED SYMPTOMS to ACCURACY CONCERN (Appendix D, Table D1.5) with the BARRIER SCORE. The second set (Tables E1.5.1b to E1.5.4b) shows the models with the individual significant items.

Table 4.6.3 lists the independent variables from the logistic regression analysis where at least one of the variable categories was a significant predictor of non-attendance to screening at the SABXRS for one or more of the models at $P < 0.10$. This table relates to the models with BARRIER SCORE, as the models with the individual items have extremely wide confidence intervals for some items due to the small number of subjects (particularly control subjects) who agreed with the barrier statements. The problem of small numbers is also evident for some of the other barrier items not included in the scored factor.

For this set of analyses several variables remained independent predictors of non-attendance to the SABXRS at $P < 0.10$, as identified in the Table 4.6.3.

For the Spontaneous-FTA analysis five variables remained independent predictors, three perceived barriers and two structural barriers; PROBLEM WOULD STOP, BARRIER SCORE, ASKED BACK FOR TESTS, DIFFICULTY WITH COMMITMENTS, and ACCESS TO CAR. Compared with women who said the problem or problems they perceived with having a mammogram would 'Definitely not' stop them from having one, women who said "Yes/maybe" it would stop them were 12 times more likely to be cases. The BARRIER SCORE showed a response-dose effect; those with the lowest score (most perceived barriers) were 8 times more likely to be cases compared with the referent group (highest score and least perceived barriers), with an odds ratio of 3.43 for the intermediate score. Cases were nearly 5 times more likely to be unaware that mammography may entail further tests. This variable was included principally as a lead-in to the next variable, which asked subjects whether they believed that being asked to return necessarily meant breast cancer. Although this follow-up variable (MORE TESTS MEAN BC) was entered in all the models, it did not remain an independent predictor. DIFFICULTY WITH COMMITMENTS relates to how difficult it was for subjects to get away during the day; compared to women who said it was 'Not difficult', those who said it was 'Very difficult' were 8 times more likely to be cases. A dose response relationship is also evident for this variable, although the other categories ('Quite difficult' and 'A little difficult') did not reach statistical significance. Women who did not have access to a car were 6 times more likely to be cases.

Given that eleven variables were independent predictors for the Spontaneous-Cancel analysis, only the key findings will be extracted here. It is interesting that cases were able to specify more benefits of mammography than controls (NO. OF PERCEIVED BENEFITS). Although cases were also more likely to perceive problems with mammography (PROBLEMS WITH MAMMO) as hypothesised, they actually specified fewer problems (NO. OF PERCEIVED PROBLEMS). However, as for the previous analysis, the effect of perceived problems on behaviour was significantly different, and in the direction hypothesised; cases were 10 times more likely to say the problem/s would stop them from having a mammogram. The BARRIER SCORE also showed a dose-response relationship, with cases being 4 times more likely to be in the lowest score category (highest barriers) compared with the reference category. ASKED BACK FOR TESTS shows that Cases were two times more likely to be unaware that mammography may entail further tests.

For the GP-FTA analysis seven variables remained independent predictors. Women who did not perceive any benefits in having a mammogram were 4 times more likely to be cases. The BARRIER SCORE again showed a dose-response relationship, with cases being 12 times more likely to be in the lowest score category (highest barriers) compared with the reference category; the odds ratios for the other levels by dose were 4.88 and 2.79, both statistically significant. Cases were 4.5 times more likely to disagree with a statement that screening mammography was important for their age group. ASKED BACK FOR TESTS shows that Cases were 3.5 times more likely to be unaware that mammography may entail further tests. Two structural variables were significant, HOURS WORKED and ACCESS TO CAR.

Four variables remained independent predictors for the GP-Cancel analysis; PEACE OF MIND (cases were less likely to state this as an advantage of early detection), MEANS MASTECTOMY (cases *less* likely to agree that this is the only outcome for breast cancer), IMPORTANT FOR AGE (cases more likely to disagree), and, ASKED BACK FOR TESTS shows the same pattern as other three analyses, that Cases were more likely to be unaware that mammography may entail further tests(OR = 2.35).

4.6.3 Discussion

Unlike some of the other constructs, the direction of association for most variables in this construct is in the direction hypothesised; that is, cases are likely to experience more barriers, both perceived and structural.

The finding for both Spontaneous analyses that PROBLEM WOULD STOP was an independent predictor suggests that promotional strategies need to address the problems women associate with mammography. The wide confidence interval around this and other variables, arises from the fact that it was almost a perfect predictor. Although the controls also knew of problems (probably from the experience of having a mammogram), the problems were not likely to stop them from having another mammogram. It appears that for them the benefits outweigh the problems, whereas cases may have an exaggerated perception of the problem or problems.

The BARRIER SCORE remained significant in three of the four analyses, with high odds ratios and a dose-response effect. Some of the confidence intervals are wide due to small numbers, but this should not be a reason to dismiss the result. For the GP-FTA analysis for example, the lower limit of the confidence range is 4.13, still a remarkable difference given the small sample size. The BARRIER SCORE comprises a range of barrier items, including perceived barriers relating to the procedure itself (embarrassment, radiation, pain, accuracy), perceived access barriers (inconvenience, too much trouble), as well as perceptions about the need to have a mammogram (requires symptoms) or avoidance (rather not think about it). Several composite barrier factors (comprising several scored barrier items) were also used in other studies, as seen from the literature review (Appendix B, Table B5.1). These show a higher level of association than other barrier variables (as well as most variables in other constructs), but several studies also failed to find an association. The one case-control study reviewed did find that attendance after an offer of a free screen was associated with fewer perceived barriers (Rimer *et al.*, 1989b). The items included in the BARRIER SCORE were adopted from that study.

The variable IMPORTANT FOR AGE was a significant predictor for both GP analyses. Cases were more likely to disagree that mammography was important for women of their age. The Knowledge construct showed that a high proportion of women did not know that older women have a higher risk of developing breast cancer. The IMPORTANT FOR AGE variable in this analysis indicates that lack of knowledge about the age at risk can act as a barrier and needs to be addressed.

As expected, cases across all analyses were more likely to be unaware of the fact that a proportion of women who have mammograms have further tests. Although this information was provided to all subjects in the form of a brochure, the high proportion of controls who said they did not know is surprising, given that this information was also provided to them at the screen as part of the consent procedure. The main purpose of including this variable was to determine whether women perceived the need to return for further tests as a barrier. The next question asked whether they thought returning for further tests necessarily meant breast cancer; although this variable (MORE TESTS MEAN BC) was significant in all the bivariate analyses, it did not remain an independent predictor for any group.

Although this study focuses on predictors of non-attendance, certain variables that did not distinguish between cases and controls can still inform policy decisions. For example the variable EMBARRASSED BY MALE shows that a high proportion of women across the all groups stated that they would be embarrassed by a male radiographer (range 39% to 50%).

The results for the structural barriers were varied. One variable (ACCESS TO CAR) showed an independent effect for the two FTA analyses, with an odds ratio of 6.3 for the Spontaneous sample and 1.9 for the GP sample. This may have been a reason for the failure of women to attend without prior notice on the day of their appointment. Much of the literature on structural barriers relates to cost and insurance cover which are not issues with regard to attendance at the SABXRS. Two case-control studies which investigated distance and inconvenience did find an association (Appendix B, Table B5.6)

To inform on specific barriers to mammography attendance, it would have been preferable to present results from the models with the individual barrier items rather than the BARRIER SCORE. However, some of these variables contained cells of only one subject (Appendix D, Table D1.5), and as explained in Chapter 3 variables with small numbers, particularly zero cells cause numerical problems in logistic regression. Nevertheless models which replaced the BARRIER SCORE with the individual items were also run and included in Appendix E (Models E1.5.1b to E1.5.4b), but caution needs to be exercised in interpretation. From these models, the items TOO MUCH TROUBLE and PAINFUL were independent predictors for the Spontaneous-FTA model; cases were more likely to agree that having a mammogram would be too troublesome and painful. For the Spontaneous-Cancel model none of the individual items remained significant predictors on their own despite the BARRIER SCORE overall being predictive. For the GP-FTA model three items were predictive;

NEED SYMPTOMS (belief that a mammogram is not needed because they have no symptoms), TOO MUCH TROUBLE, and INCONVENIENT (having a mammogram would be inconvenient). For the GP-Cancel model, two barrier items were independent predictors alone, although the model with the overall BARRIER SCORE was not; NEED SYMPTOMS and INCONVENIENT. These items give some clues as to specific barriers that prevent participation. Apart from dealing with mis-information, for example, in relation to mammography being for asymptomatic women, the issue of apparent apathy about organising a mammogram needs to be addressed. From the literature (Appendix B, Tables B5.2 and B5.3) it can be seen that while the individual items usually show a bivariate association, this often disappears in the multivariate analysis. Thus, the items that remained predictors in the current analyses provide important information, especially given the proportions involved. From Table D1.5 in Appendix D, it can be seen that from 8% to 26% of cases perceived that a mammogram was not needed without symptoms, 6% to 16% perceived it as being too much trouble, and 10% to 16% agreed that having a mammogram would be inconvenient.

The problem of small numbers with regard to the individual items in the BARRIER SCORE also applies to other variables in this construct, as can be seen from the frequencies (Appendix D, Table D1.5). From the point of view of determining predictors of non-attendance, variables with small cells for both cases and controls do not present a dilemma. For example, with the variable FINDING EARLY SAVES LIVES almost all women in the Spontaneous sample agree that finding breast cancer early can save lives. The dilemma is how to make meaningful conclusions about variables that are perfect, or almost perfect predictors in the bivariate analysis, but need to be excluded from the final multivariate analysis. A perfect predictor for the Spontaneous-FTA analysis was EMOTIONAL FACTORS (peace of mind, handle situation better, less pain /trauma); none of the cases mentioned these as an advantage of early detection. The variable ADVANTAGES OF FINDING BC was also an almost perfect predictor for this analysis; while 3.6% of cases believed early detection offered no advantages, only 0.5% of controls did. BENEFITS OF MAMMO was excluded from both Spontaneous analyses, but was also an almost perfect predictor; only 0.5% of Spontaneous controls believed that mammography offered no benefits compared with 7.1% of FTA-cases and 5.0% of Cancel-cases.

Other variables excluded from the multivariate analyses on the basis of small numbers related to benefits of mammography: 7% of Spontaneous-FTA cases and 7% of Spontaneous-cancel cases did not believe that mammography was beneficial, compared with 0.5% for Spontaneous-controls. Although these proportions are not large, they could make an important difference to overall participation and efforts should be made to target these women. Table 4.6.4 below shows that the Spontaneous cases who did not believe mammography was beneficial were also more likely to perceive other barriers. Marked differences are evident for the variable IMPORTANT FOR AGE, indicating that women who saw no benefits in mammography also disagreed with the statement that mammography is important for women in their age group ($P = 0.003$). Women who saw no benefits were also significantly less likely to have heard of screening ($P = 0.018$), and to believe they did not need a mammogram without symptoms ($P = 0.034$). The lack of statistical significance for some of the other barriers in this table is likely to be due to small cell sizes. Given that the Spontaneous sample represents women who were motivated to make an appointment on their own volition, the proportions in the general population who do not perceive benefits of mammography (as well as other barriers) could be much higher.

Overall, at this stage of the analysis, the barrier set of variables seem to hold the most promise for developing strategies to increase uptake of screening mammography, as indicated by the number of variables that remained independent predictors and the overall fit of the models. All four models correctly predict over 89% of controls and between 42% and 63% of cases. However, more detailed discussion will be deferred until the final models are produced which adjust the barrier variables for the effects of other factors found to be significant from these analyses by construct.

4.7 RESULTS - INFLUENCE CONSTRUCT

4.7.1 Bivariate Results

Appendix D, Table D1.6 lists the Influence variables investigated in this study. It is hypothesised that women would be influenced to attend by salient others, and further, that the extent of social networks and relationships also contributes to their decision about whether to attend; that is, the effect of additional influences is cumulative. To test this latter hypothesis a number of variables have been derived which count the number of each type of influence.

The first two variables, EMOTIONAL SUPPORT FROM PARTNER and CONFIDANT, relate to support and relationships at the emotional level. The next set of variables from BELONGS TO CLUB to HOURS SPENT VOLUNTEER/CLUB relates to the extent and nature of contacts outside the home. The variable MEMBER OF CHARITY CLUB includes organisations such as Rotary, Apex, Returned Servicemen's League and Meals on Wheels. TUTOR/SCHOOL includes tutoring of adult migrants to speak English, belonging to school/educational committees or providing help to schools. OTHER CLUBS include non-sport recreation groups, and others with low frequencies such as Neighbourhood Watch. The next set of variables from FRIENDS/FAMILY to NO. OF SOURCES ABOUT MAMMO provide details about sources of information about mammography, and were included to determine the most influential. These are followed by variables which canvass who had actually suggested having a mammogram and who would influence them to have one. The variable OTHER WOULD INFLUENCE includes non-person specific influences (in contrast to the preceding 6 variables) such as 'if family member got breast cancer' or 'a public talk'. The variables at the end of the table from GP LETTER to HAPPY ABOUT GP APPOINTMENT were relevant only to the GP sample.

Several of the variables relating to membership of clubs, charity and social organisations were not statistically significant at $P < 0.10$ in any of the four analyses. Overall, between 34% and 39% of the six case-control groups belong to a club or organisation, and between 23% and 32% do voluntary work. The variables FRIEND/FAMILY to OTHER SOURCE relate to sources of information about mammograms, most of which did not differentiate between cases and controls. WHO ELSE SUGGESTED MAMMO (apart from a doctor) was also not significant in any of the analyses.

Significant bivariate associations with a P-value < 0.10 are listed in Table 4.7.1.

The variable EMOTIONAL SUPPORT FROM PARTNER shows a significant result for the two FTA analyses, but the difference is due to the greater proportion of cases having no partner, as indicated also by the MARITAL STATUS variable in the Socio-demographic construct. FRIEND/FAMILY shows that a significantly lower proportion of cases stated friends or family as a source of information in the Spontaneous-FTA analysis. This variable was also significant for the two GP analyses, but in the opposite direction.

The two variables relating to the influence of a doctor, DR SUGGESTED MAMMO and WOULD HAVE SX ON DR RECOM, were both significant in all four analyses. The first refers to whether a doctor had suggested a mammogram in the past, and the second to whether they would have a screening mammogram if a doctor recommended it. Two of the analyses (Spontaneous-Cancel and GP-FTA also showed a significant result for the variable WHO SUGGESTED MAMMO (No-one, Doctor only, Doctor and other, Other only).

The group of variables from NO-ONE WOULD INFLUENCE to NO. OF INFLUENCES relates to the question 'Who, if anyone, would influence you in deciding whether or not to have a mammogram?' As can be seen from Table 4.7.1, it is only in the GP-FTA analysis that significant results were obtained for several influences.

SHOULD GP TELL ABOUT SABXRS asked subjects if they thought it was part of a doctor's job to tell patients about services like the SABXRS. A significant bivariate association was found only in the Spontaneous-Cancel analysis with a lower percent of cases in favour, as hypothesised. SHOULD ALL GET INVITE asked subjects if they thought it was a good idea for all women to receive a personal invitation from the SABXRS, with a significant result in three analyses, each finding a lower proportion of cases in favour. USE ELECTORAL ROLL, which asked whether subjects would be happy for their name to be selected from the electoral roll, was significant for both GP analyses, again the cases being less likely to be happy about this. At the time of the baseline survey the SABXRS had not yet used the electoral roll for recruitment purposes.

The additional variables which applied only to the GP sample were all found to have a significant bivariate association with non-attendance for both analyses, except for WANTED MORE INFO, which asked whether they wanted more information at the time of receiving their invitation.

4.7.2 Multivariate Results

For this set of variables two models are presented for the GP sample. The first includes only the variables also applicable to the Spontaneous sample to enable comparisons across all four analytical groups (Appendix E, Tables E1.6.3a to E1.6.4a). A second model for the two GP analyses adds variables relevant to the GP sample only (Appendix E, Tables E1.6.3b and E1.6.4b). The final models for the Spontaneous sample are Tables E1.6.1 and E1.6.2 in Appendix E.

Variables which entered at least one of the models based on $P < 0.25$ are listed in Table 4.7.2.

Table 4.7.3 relates to the four models comparable across all four groups. It lists the variables from the final logistic regression models where at least one of the variable categories was a significant independent predictor of non-attendance for one or more of the analyses at $P < 0.10$.

It should be noted that due to numerical problems the variables SHOULD GP TELL ABOUT SABXRS and WHO ELSE SUGGESTED MAMMO were excluded from the GP-Cancel analysis; the former due to a zero cell and the latter was highly correlated with WHO SUGGESTED MAMMO (which was in fact partly derived from its correlate). WHO ELSE SUGGESTED MAMMO was not entered in any of the other models, as it did not reach bivariate significance at $P < 0.25$.

Only one variable remained significant at P < 0.10 across all four models, WOULD HAVE SX ON DR RECOM. Moreover, the level of significance was P < 0.01 for all comparisons, and a dose-response effect is evident for all four models. Compared with women who said they would 'Definitely' have a screening mammogram if a doctor recommended it, those who said they 'Probably' would were significantly more likely to be cases (OR 3.07 to 13.06), while those who said 'No' or were uncertain were even more likely to be cases (OR 7.23 to 42.88). Although the confidence intervals are wide due to small numbers, the effect is nevertheless convincing given the lower limits of the confidence range (for example, about 4 for the Spontaneous-FTA model).

The variable DR SUGGESTED MAMMO was a predictor for three of the models. For the two Spontaneous models the result was not as hypothesised, showing that cases were *more* likely to say that a doctor *had* suggested a mammogram. The GP-FTA model shows the predicted result with cases being 3 times more likely to say a doctor *had not* suggested a mammogram. The other doctor variable, SHOULD GP TELL ABOUT SABXRS, was significant in the Spontaneous-Cancel model; cases were 5 times more likely say that telling women about the SABXRS was not a doctor's role.

Other variables that remained independent predictors in the Spontaneous-FTA analysis were FRIEND/FAMILY, and OTHER WOULD INFLUENCE. Cases were twice as likely to mention a friend as a source about mammography, and to say persons other than those mentioned in the five preceding variables would influence them.

Additional predictors for the Spontaneous-Cancel analysis were TUTORS/SCHOOL HELP, MEMBER OF CHURCH GROUP and MEMBER OF ETHNIC CLUB (cases were more likely to tutor but less likely to be members of a church group or ethnic club). From the socio-demographic distributions (Appendix D, Table D1.1), Cancel cases from both samples were less likely to speak a language other than English, hence less likely to belong to an ethic club.

FRIEND/FAMILY was also predictive for the two GP analyses, but in the opposite direction; cases were more likely to say they had heard about mammography from a friend. For the GP-FTA analysis the variables SHOULD ALL GET INVITE and USE ELECTORAL ROLL were significant, as hypothesised, with cases more likely to be non-supportive of these methods of recruitment.

Table 4.7.4 shows the results of the logistic regression analyses for the GP models which included the additional variables relevant to the GP sample only. As for Table 4.7.3, it lists variables significant at $P < 0.10$ for either of the two analyses.

The variables relating to the influence of a doctor, DR SUGGESTED MAMMO and WOULD HAVE SX ON DR RECOM show an even stronger relationship in these expanded models. For the GP-FTA model three of the seven additional variables were independent predictors of non-attendance; GP LETTER, HOW MAMMO SUGGESTED, and HAPPY ABOUT GP APPOINTMENT. Cases were two times less likely to specify the letter of invitation as a source of information about mammograms (unprompted), or to mention the letter as the method by which a doctor suggested a mammogram. Further, cases were 6 times more likely to say they were not happy about the doctor making an appointment for them with the SABXRS.

For the GP-Cancel model too, three of the seven additional variables were independent predictors of non-attendance; HOW MAMMO SUGGESTED, ONLY PRACTICE VISITED (that is, visits only the GP who sent the invite) and HAPPY ABOUT GP APPOINTMENT. Cases were 8 times less likely to mention the letter as the method by which a doctor suggested a mammogram, and 2 times less likely to say that the practice which sent the letter was the only practice visited. Also, cases were 3 times more likely to say they were not happy about the doctor making an appointment for them with the SABXRS.

4.7.3 Discussion

This construct included a range of variables estimating social networks, social supports, and other influences, including sources of information and recommendations about having a mammogram. Subjects were probed in detail about who recommended or discussed mammography with them in the past and who would influence them in the future. The strongest predictor, and the only variable significant across all four models was WOULD HAVE SX ON DR RECOM. Cases were significantly more likely to state that they would either not take the advice of a doctor to have a screening mammogram or be indecisive about it. Moreover a dose-response relationship is evident. This indicates that a doctor's endorsement is not enough to encourage non-attenders.

Only a very small proportion of controls (4 subjects) said they would 'Probably not' or 'Definitely not' have a mammogram if a doctor recommended it. In response to a subsequent question about whether they would re-attend the SABXRS within the next two years, 3 of these women answered *definitely not* and the fourth answered *probably not*, indicating dissatisfaction with the previous experience. Thus while this analysis is primarily concerned about first attendance to the SABXRS, re-attendance is also critical to the success of the program. This is addressed in later chapters.

The variable DR SUGGESTED MAMMO relates to whether a doctor suggested a mammogram in the past. For the two Spontaneous models cases were more likely to have had a doctor suggest a mammogram, whereas it was hypothesised that the opposite would be true. It could be speculated that the spontaneous attenders did not need a doctor to prompt them, that is, they were motivated to take action themselves. The GP sample on the other hand shows the expected result that cases (non-attenders) were less likely to say they had mammography suggested by a doctor in the past. Spontaneous attenders were more likely to state that FRIEND/FAMILY had suggested a mammogram to them, whereas the opposite holds for the GP sample.

In an open-ended question about who would influence them in having a mammogram, 'Doctor' was the most frequently reported response. From Appendix D, Table D1.6, it can be seen that a high proportion of both cases and controls reported a doctor, hence it was not a predictor of non-attendance.

The variable SHOULD GP TELL ABOUT SABXRS generally shows strong support by all women about the role of the doctor in bringing services like the SABXRS to the attention of patients. However, for each of the six groups from 1% to 6% did not see this as part of a doctor's job.

Subjects were also asked about their attitude to two other forms of recruitment, a letter of invitation from a doctor and the use of the electoral roll to select names of potential clients. From 3% (GP controls) to 24% (Spontaneous-Cancel cases) were against a GP invitation. Even 14% of Spontaneous controls were not in favour, a further indication of their self efficacy. Overall the personal approach is preferred, but as a means of recruitment this would mean that women who do not have a regular doctor frequently would not be reached. For the sample in this study, Table 4.7.5 shows that a high proportion of women from both samples (for both cases and controls) visited a doctor within the last 6 months. Further, this pattern persisted despite their view about doctors sending out invitations. It should be noted that screening with the SABXRS does not require a doctor's referral, whereas mammography outside the program does. 40% of FTA cases and 63% of Cancel cases had in fact had a mammogram outside the Service (this will be further explored in Chapter 6), which would have required a doctor consultation. However, data collected from attenders to the SABXRS at their first screen suggests that a high proportion of women do seek a doctor's advice before making an appointment to have a mammogram.

The influence of a doctor was even stronger in the expanded GP models, not an unanticipated result given the method of recruitment. Those who did take up the doctor's invitation (GP Controls) were clearly more likely to say that a mammogram was suggested by a doctor in the form of a letter (HOW MAMMO SUGGESTED), that the practice that sent the letter was the only practice they used, and that they were happy about the doctor making the appointment. It should be noted that HOW MAMMO SUGGESTED was an unprompted question which was asked before any mention was made by the interviewer about the SABXRS or GP invitations. Further, the interviewers introduced themselves as employees of the University of Adelaide. Although a higher proportion of controls in the GP sample had heard of the SABXRS before receiving the letter of invitation, this was not an independent predictor in either model, indicating that awareness of the Service alone was not a sufficient cue.

The importance of doctors in mammography attendance is supported conclusively from the literature. Table B6.1 in Appendix B, which summarises the literature on the influence of doctors shows that for all studies reviewed, variables relating to a doctor advising or recommending mammography remain strong predictors after adjustment for covariates. Further, the odds ratios are higher than for other independent predictors. Lerman *et al.*, (1990) found that doctors had the strongest influence on first time users of mammography; the adjusted odds ratios for *Ever had*, *Had in past 12 months*, and *Had repeat mammogram* were 25.5, 9.5 and 2.2 respectively. One study that presented separate models by age (50-64 and 65+) obtained an adjusted odds ratio of 4.3 for the younger women and 7.2 for the older women in relation to whether they would have a mammogram on a Doctor's recommendation (Fox *et al.*, 1991). Another study that sampled only women aged 65+ obtained an adjusted odds ratio of 29.0 in relation to the influence of a doctor's recommendation on having a mammogram in the last 2 years (King *et al.*, 1993). This suggests that older women may be more responsive to a doctor's advice than younger women. From Appendix D, Table D1.1 it can be seen that there was no difference in response to the GP invitation by age (50-59 compared with 60+) in King *et al.*, (1993) study.

The other influence variables cited in the literature relating to social networks and influences, other than that of a doctor, show mixed results, with more showing no relationship at all or only a bivariate relationship than those showing an independent effect (Appendix B, Table B6.2). This study also found that no influence variables consistently predicted across the models either in the bivariate or adjusted analyses.

Suarez *et al.*, (1994) found that mammography use increased with an increase in social networks, including, the number of confidants, number of close friends, frequency of contact with close friends or relatives per month, church membership, and church attendance in a study of Hispanic women. That study suggested that interventions could include activities to increase social network size or frequency of contact. One intervention planned was the use of peer role models in the media and recruitment of peer volunteers to work within their existing social networks. Perhaps social networks are more important with non-English speaking persons; the sample of non-English speakers in this study is too small to test this hypothesis.

The only variable on source of information that was an independent predictor in this study was FAMILY/FRIENDS in three of the models, showing a positive association with attendance for spontaneous women, but the reverse for the GP sample. The literature regarding sources of information about mammography was also inconclusive. (Appendix B, Table B6.2). A case-control study by Kee *et al.*, (1993) did not find any association between source and attendance following an invitation. A report on sources of information for participants of the Canadian mammography screening program found that the source specified as the main influence varied with education status, but not by age. It was found that lower educated women were more likely to report radio and television, whereas those with post-secondary education were more influenced by newspapers, mailings and general publicity; friends and doctors were reported equally by all groups (Baines *et al.*, 1989).

Such findings infer that various strategies are required for different groups of women. Table 4.7.6 cross-classifies source of information by AGE, AGE LEFT SCHOOL, and POST-SCHOOL QUALIFICATIONS separately for the two samples. A *P*-value of 0.05 was used to determine significant associations. For AGE, the only association found was for the GP sample in relation to the source GP SURGERY (younger women were more likely to specify this source). For AGE LEFT SCHOOL, three associations were found, again in the GP sample. Women who left school at an older age (17+) were more likely to specify GP LETTER, NEWSPAPER and TELEVISION as a source. POST-SCHOOL QUALIFICATIONS show significant associations with NEWSPAPER, TELEVISION and SABXRS PAMPHLET for the Spontaneous sample and TELEVISION for the GP sample; women who had a qualification were more likely to quote these sources. It seems also that higher educated women are more likely to take notice of the Service's own promotional pamphlet which is left at surgeries, community centres, libraries, and other public places. Perhaps the Service needs to conduct focus groups with lower educated women to ensure the information provided is geared to their level. This would apply to both the English pamphlets and those in other languages. Although the finding that more educated women reported television as a source seems to contrast with the results of the Baines *et al.*, (1989) study, the result needs to be assessed in the context of media promotion at the time of the baseline interviews. While a major advertising media campaign has been launched by the National Program over the last year or so, televised information at the time of interview would have been mostly in the form of current affairs or educational programs, more likely to be viewed by the better educated.

The study by Baines *et al.*, (1989) recognised that a major limitation in their study was not having information on source of awareness for non-attenders. However, the current study generally did not find that source of information differentiated between attenders and non-attenders.

A study that evaluated communication channels for general cancer-related information found a trend for a random population sample to rate doctors and organisations above friends/family and the media (Johnson and Meishcke, 1992).

Overall, the influence models correctly predicted over 89% of controls and between 31% and 59% of cases for the four common models, with P-values for all models at < 0.001. However, unlike the barrier construct where several variables remained independent predictors, the outcome here clearly supports the finding from the literature of the overwhelming influence of a doctor on attendance to mammography screening.

4.8 RESULTS - FINAL OVERALL BASELINE MODELS

4.8.1 Introduction

This section presents the results of the final overall models drawing on the results of the previous six sections which presented separate analyses for each of the study constructs (Socio-demographic, Health Motivation and Control, Knowledge, Susceptibility, Barriers, and Influences). The variables investigated in this section are those found to be significant at $P < 0.10$ from the final logistic regression models for each of the constructs. For the GP sample two sets of models were performed. One set includes variables common to all subjects so that comparisons can be made across all four models. A second of GP models include variables that were relevant only to the GP sample (from the Influence construct, section 4.7 above).

4.8.2 Results

Variables entered into the overall models are listed in Table 4.8.1 on the criterion of statistical significance at $P < 0.10$ in the final construct models.

It should be noted that for the Spontaneous-FTA analysis the variable BENEFITS OF MAMMO from the Barrier construct was not entered in the final model due to numerical problems in the original analysis. Similarly, the variables EMOTIONAL SUPPORT FROM PARTNER and SHOULD GP TELL ABOUT SABXRS from the Influence construct were excluded from the GP-FTA and GP-Cancel models respectively.

Further, due to small cell sizes as a result of the large number of variables included in these models, numerical problems necessitated the exclusion of additional variables in the final models presented here. Only subjects with valid responses for all variables are included in the analysis, thus as more variables are included, the possibility of exclusion increases if the additional variables have invalid responses. This is particularly problematic for the Spontaneous-FTA analysis which has only 56 cases in total. Had the analysis focused only on these overall models, then it may have been possible to further collapse some categories. However, comparability with the construct models was considered important, hence the variable categories were not changed. The final outcome is that some variables have very wide confidence intervals.

Table 4.8.1 also indicates which of the variables that were independent predictors at $P < 0.10$ in the final construct models (denoted by ✓) remained independent predictors in the final overall models. As explained above, two sets of models are presented as for the Influence construct above; one model includes the Influences variables common to all four analyses, and a second set for the GP sample only, includes additional Influence variables relevant only to that sample. A ♣ notates that the variable remained an independent predictor in the final overall model comparable across all four analyses, using the Influence variables from the final Influence construct models E1.6.1., E1.6.2, E1.6.3a and E1.6.4a in Appendix E, and summarised in Table 4.7.3. A ♦ notates that the variable remained an independent predictor in the final overall model using the Influence variables from the final Influence construct models E1.6.3b and E1.6.4b in Appendix E, summarised in Table 4.7.4.

It can be seen from Table 4.8.1 that most variables that were found to be predictors in the models by construct remained predictors in these final overall models. The final overall models are included in Appendix E, E1.7.1 to E1.7.4.

Table 4.8.2 shows the odds ratios and confidence intervals for the four models comparable across all sub groups (E1.7.1, E1.7.2, E1.7.3a and E1.7.4a). It lists the variables from the final overall logistic regression models where at least one of the variable categories was a significant independent predictor of non-attendance for one or more of the analyses at $P < 0.10$.

From the Socio-demographic construct one variable LIFETIME OCCUPATION remained significant at $P < 0.10$ for three of the models (Spontaneous-FTA and both GP) all showing that women whose main lifetime occupation was managerial/professional were more likely to be cases. INCOME, which was the only Socio-demographic variable entered in the Spontaneous-Cancel model, remained an independent predictor.

From the Health Motivation and Control construct SMOKING and DENTIST remained significant in each of the respective models where they were entered, in all instances showing the predicted result, that cases were less likely to engage in preventive health behaviours. The most pronounced effect is for the Spontaneous-FTA analysis where it was shown that women who were current smokers were 9 times more likely to be cases, and those who visited a dentist only when problems occurred were 3 times more likely to be cases.

No Knowledge variable entered the Spontaneous-FTA model, and very few of the Knowledge variables remained predictors. Only one variable, CANCER-MOST COMMON, was found to be significant in more than one model. In both cases women who chose lung cancer as the most common for women in their age group were more likely to be cases (compared with those who correctly chose breast).

No Susceptibility variables were entered into the GP-Cancel model. Compared to Spontaneous Controls, Spontaneous-FTA cases were more likely to think about breast cancer, while Spontaneous-Cancel cases were more concerned that they may have breast cancer. This concern coincides with the finding that the concerned women were also more likely to have had a breast lump in the last 12 months. These findings contrast with the hypothesis that cases would be less susceptible. The analysis that best fits the hypothesised result in relation to susceptibility is the GP-FTA group, where cases were cases were 3 times less likely to have had a breast lump in the last year, 6 times less likely to have had a first degree relative with breast cancer and 3 times less likely to have had another relative with breast cancer.

From the Barrier construct the BARRIER SCORE remained an independent predictor in two models, Spontaneous-Cancel and GP-FTA. For the Spontaneous-Cancel analysis women who perceived the most barriers were 7 times more likely to be cases compared with those who perceived the fewest barriers (odds ratio = 6.9). The corresponding odds ratio for the GP-FTA analysis is 9.3, being the highest odds ratio in that model. Both also show a dose-response effect. The Spontaneous-FTA model showed the same dose-response effect but did not reach statistical significance. For this latter model the most significant barrier variable was PROBLEM WOULD STOP; those who said the problems they perceived would stop them from having a mammogram were 22 times more likely to be cases.

The variable WOULD HAVE SX ON DR RECOM from the Influence construct, which was the only common variable entered in all four analyses, remained a significant predictor in three models; women who said they would not take a doctor's advise to have a mammogram were significantly more likely to be cases. Further, a dose response relationship is evident. For the fourth model (GP-FTA) that did not show a significant result for this variable, the variable DR SUGGESTED MAMMO was predictive; women who said they had not had a mammogram suggested by a doctor were 3 times more likely to be cases. Further evidence that cases were less likely to take their doctor's advice emerges from the Spontaneous-Cancel analysis where cases were 9 times more likely disagree with the view that doctors should tell patients about the SABXRS.

Table 4.8.3 shows the results of the logistic regression analyses for the GP models which included the additional Influence variables relevant to the GP sample only. As for Table 4.8.2, it lists variables significant at $P < 0.10$ for either of the two analyses.

For the GP-FTA analysis only one variables was no longer a significant predictor compared with the reduced model in Table 4.8.2 (LUMP IN LAST 12 MONTHS), while for the GP-Cancel analysis the three variables HEARD OF SCREENING, PEACE OF MIND, and GP SURGERY were no longer significant. As with the expanded models in the Influence construct (section 4.7), the additional variables directly associated with the invitation itself were shown to be important. In both models cases were significantly more likely not to mention the GP letter (unprompted) as the method by which a doctor suggested having a mammogram. An obvious reason for not mentioning the letter would be that they did not receive it. This appears to be true for a substantial proportion of FTA cases (40% of those who did not mention the letter, in a later question also said they had not received it), but not for cancel cases (the corresponding figure was only 7%). Cases in both analyses were also not happy about the doctor making an appointment for them (OR = 16.7, CI 5.7-9.0 for GP-FTA). Being the woman's only practice remained predictive for the GP-Cancel analysis; Cancel cases were two times more likely to report that the practice from which the letter was sent was not the only practice visited.

Overall, the variables included in these models are good predictors of non-attendance with the P-value for the overall significance of all models being < 0.001. The 4 comparable models summarised in Table 4.8.2 correctly predicted from 59% to 74% of cases and between 87% and 94% of controls. The expanded GP models had even higher predictive values; 75% and 82% of cases for the FTA and Cancel models respectively, and 91% of controls for both models.

4.8.3 Discussion

The case-control design used in this study was chosen as the best method to specifically determine factors associated with non-attendance to the SABXRS. The majority of studies reviewed in the literature in Chapter 1 are of cross-sectional design, and the comparison of attenders and non-attenders made from these studies are to mammography in general. A cross-sectional study would not have provided sufficient numbers of non-attenders and attenders to the SABXRS, particularly by the recruitment and case-type sub-groups studied.

A criticism of case-control studies (as with cross-sectional studies) is that the 'exposure' or risk factor may not have preceded the 'disease' (in this study the 'disease' being non-attendance to SABXRS). A cohort study would have required the collection of the risk factors (independent variables) from a sufficiently large cohort of women, who were then observed to ascertain which women attended the SABXRS, and to permit the level of analysis conducted in this study, also the method of recruitment and whether they FTA'd or cancelled an appointment. Clearly such a study was not feasible nor practical. Even if it were feasible (that is, a large enough cohort could have been recruited and followed), it is possible that follow-up may change behaviour; that is, act as a cue to action in relation to a study on mammography behaviour. Also attitudes may have changed due to other factors, in the period from the initial interview to follow-up.

Another fundamental aspect of this study is to question women in detail about their reaction to an invitation, and reasons why they did not attend after an invitation or after a self referral. This information can only be collected retrospectively.

As indicated above, the problem of small numbers was exaggerated in these analysis due to the large number of variables. A major outcome of this study has been to recognise that non-attenders cannot be treated as one generic group. While the difference between the two samples, or two recruitment types, was always included as part of the original study plan, the extent of differences between the FTA cases and Cancel cases was not anticipated. Hence, by further dissecting the analysis by case type, the power of the study to detect differences was reduced, particularly the Spontaneous-FTA group. Nevertheless, significant risk factors were detected even in that analysis, which differed from those in the other 3 analyses. It is likely that several of the other variables included in the study would have been shown to be predictors with a larger sample. Despite the sample size problem, some worthwhile results emerged to inform on strategies to increase participation.

Overall, the Socio-demographic, Knowledge, and Susceptibility constructs did not contribute much to the final models either in terms of predictive value or emerging patterns that might provide some clues as to which women should be targeted. One variable that did remain an independent socio-demographic predictor in three of the models was lifetime occupation, showing that women in managerial or professional occupations were more likely to be non-attenders. The only knowledge variable that remained significant in more that one model was CANCER MOST COMMON. These results suggest that strategies should be targeted towards women in managerial or professional positions, and methods developed to get the message to women about breast cancer being the most common for women in their age. However, it may be that professional women do have screening mammograms, but not with the free government Service. This possibility will be investigated in Chapter 6.

Susceptibility variables that were significant show that Spontaneous-FTA cases thought about breast cancer more often, which also corresponds with the finding that they were more likely to know someone with breast cancer. The Spontaneous-Cancel cases were more concerned that they may have breast cancer, understandably since they were also more likely to have had a lump. No susceptibility variable was entered into the GP-Cancel analysis; in fact as can be seen from Table 4.8.1 that very few other variables entered the final overall model for the GP-Cancel from any construct other than the Influence construct. The GP-FTA analysis generally found that cases were less susceptible as predicted, unlike both Spontaneous cases which appear to be more susceptible.

Three general themes emerge from the other three constructs. Firstly, women who do not engage in other preventive behaviours (particularly non-smoking and preventive dental care) were more likely to be cases, that is non-attenders to the SABXRS. This appears to be more so for the FTA cases in both samples, with both SMOKING and DENTIST being significant, whereas only DENTIST was significant for Spontaneous-Cancel and neither for GP-Cancel However, preventive behaviours related to the breast such as BSE were not found to be predictive.

Secondly, both perceived and structural barriers were found to be important explanatory factors for both Spontaneous groups, but only the GP-FTA group. The results for these three groups suggest strategies that address the apparent view of cases that the problems associated with mammography outweigh the benefits (and most cases did perceive benefits). Further, access to a car was a problem for both FTA cases suggesting strategies to make access easier.

Thirdly, this study, in line with other Australian and international research, confirmed the major effect of variables related to encouragement by a doctor in predicting attendance. The significant variables in relation to doctor in this study were whether a doctor had suggested a mammogram in the past and whether women would (in future) take the advise of a doctor to have a mammogram. Women who had not had a mammogram suggested by a doctor or reported that they would not be influenced by a doctor were highly likely to be non-attenders.

Other variables in the study provide further evidence of the role of doctors in promoting screening mammography. For example, subjects were asked an open ended question about who would influence them in having a mammogram, and allowed to nominate multiple responses. The most common response was doctor (variable DOCTOR WOULD INFLUENCE, Appendix D, Table D1.6). Between 47% and 65% of cases and 55% and 70% of controls nominated a doctor as someone who would influence them in having a mammogram. This compares with 5% to 7% who nominated husband, 3% to 8% nominating children, and 1% to 7% nominating friend. These variables did not predict non-attendance, because both cases and controls in both samples responded similarly, all nominating doctor as the most important influence, but with little evidence of the importance of significant others. Thus, the potential for doctors to play a major role in influencing attendance to mammography screening is apparent.

Rimer *et al.*, (1992) show that while the physician influence is important in prompting women to have a mammogram, the level of influence varies by age, with older women less likely to report physician advice to have a mammogram. This pattern is also clearly evident in this study. For the

Spontaneous sample, 47% of women aged 50-59 reported that a doctor had suggested a mammogram, compared with 19% of women aged 60+. The corresponding figures for the GP sample were 70% and 30%. Further, for the variable WOULD HAVE SX ON DOCTOR RECOM, 44% of the Spontaneous 50-59 year old group said they would definitely attend compared with 20% of the 60+ group. The corresponding figures for the GP sample are 69% and 31%. Hence, a distinct age effect is evident, both in doctors' advice to women, and women's acceptance of a doctor's advice.

Coll *et al.*, (1989) found that the likelihood of a doctor advising mammography was related to both age and education level of the patient, with significantly higher proportions of higher educated women recalling having been advised by their physician to have a mammogram. This education effect was not evident in the current study, perhaps due to the greater homogeneity within the two samples. In Chapter 3, section 3.3.2 it was shown that the Spontaneous population had a higher proportion of women with post-school qualifications across all three predictor groups in comparison to the GP population.

Bass *et al.*, (1994) asked attendees if they had heard of the particular screening service before receiving a letter of invitation, finding that over 75% had not. They suggest that this gives 'circumstantial' evidence of the importance of physicians' letters. However, this study shows that a similar proportion of both attenders and non-attenders had not heard of the SABXRS before receiving the letter (variable HEARD OF BXRS BEFORE LETTER, Table D1.6, Appendix D). This shows that information drawn from attendees only may lead to erroneous conclusions.

In emphasising the role of the doctor in increasing participation overall, we must not lose sight of the fact that not all women would be influenced by a doctor. Although the most significant influence mentioned by women in the study was a doctor, far exceeding other possible influential persons, it should not be overlooked that the second highest response to the open ended question about who would influence them in having a mammogram was NO-ONE WOULD INFLUENCE. As can be seen from Table D1.6 in Appendix D between 20% and 38% of women, both cases and controls, gave this response.

Further, despite the majority of women nominating a doctor as the main influence, it appears that the cases in this study did not actually take the advice when given (not in relation to SABXRS); 73% of Spontaneous-FTA cases stated that a doctor had suggested a mammogram in the past and 81% of Spontaneous-cancel cases. The corresponding figures for the GP sample were 67% and 83% (Appendix D, Table D1.6). Hence, while *not* having a doctor suggest a mammogram is clearly related to non-attendance, having a doctor's suggestion is not sufficient for most non-attenders.

Much of the literature focuses on the significant effect that doctors have on actual attendance from community surveys, suggesting that doctors' could strongly influence non-attenders by recommending mammography. This may be true for the general community who have not yet had a doctor suggest a mammogram, but may be misconstrued for the significant proportion of women who having had the advice of a doctor did not act upon it, nor those who do not support a doctor's role in this regard. The variable WOULD HAVE SX ON DR RECOM shows that a significant proportion of non-attenders stated that they would not take action on a doctor's recommendation (from 9% to 18% of cases, Appendix D, Table D1.6). This suggests that different strategies need to be employed for this group.

Another group that requires further evaluation are the controls (attenders) who also said they would not have another mammogram if a doctor suggested it. It was pointed out in section 4.7 above that these women (attenders who would not take doctor's advice) also stated they would not have another mammogram, implying dissatisfaction with the previous mammography experience. While the baseline study is primarily concerned about first attendance to the SABXRS, re-attendance is also critical to the success of the program. Part III presents the results of a survey of various groups of non-attenders to the SABXRS, including those invited to re-attend.

Further scrutiny of the data suggests that the barrier variables may provide clues as to how to reach women who are not likely to respond to the influence of a doctor. Table 4.8.4 clearly shows that women who said they would not be influenced by a doctor perceive more barriers. Only 12.8% of women who said they 'Definitely would' attend if a doctor recommended mammography had a low barrier score ($\leq$ 22, signifying more barriers), compared with 39.8% for women who said they 'Probably' would attend and 68.2% for those who said they would definitely not attend, or were unsure. This pattern persists for every single barrier variable that comprises the barrier score as well as other barriers, with quite marked differences. For example only 5.1% of women who said they would definitely take the doctor's advice agreed that they do not need a mammogram because they have no symptoms (NEED SYMPTOMS) compared with 56.1% of those who would not take the doctor's advice. The corresponding percents for RATHER NOT THINK ABOUT IT are 9.9% and 60.6%, for RADIATION CONCERN 15.2% and 53.0%, and for believing a mammogram would be PAINFUL 19.6% and 51.5%. All items in Table 4.8.4 were framed as negative aspects, except for the variable IMPORTANT FOR AGE where again marked differences are shown with 96.1% of women who said they would definitely take the doctor's advice agreeing that mammography was very important for women of their age compared with 57.4% for those who would not take the doctor's advice.

These data clearly indicate that addressing misinformation about mammography and fears that women have, for example about radiation and pain, are critical in breaking down the barriers. For the group of women who said they would not take the advice of a doctor with regard to mammography, it is not known whether this is because of the barriers they perceive or whether they do not respect the doctor's opinion. That is, it may be that if doctors addressed the barriers first, some women may then change their minds. For others, alternative strategies would need to be used to break down the barriers.

The discussion in 4.7.3 on the Influence construct pointed out that evidence suggests that in selecting appropriate communication channels, one needs to consider who are the significant others, as well as other characteristics of the target group, in particular educational level (Johnson and Meishcke, 1992; Baines *et al.*, 1989). The first reference found that doctors and certain organisations were influential. The current study only asked 'who' would influence women, and did not investigate the role of a respected organisation. Perhaps health insurance organisations or health departments may be appropriate channels with regard to mammography screening. The second reference suggests that health promotion programs wishing to reach women with a low education should focus on radio and television with messages geared to their level. In contrast, promotion in newspapers should be directed at readers with a higher education. In this study it was found that the higher educated women mentioned television as a source of information, but as pointed out in 4.7.3 above, this survey was conducted prior to the mass media campaign, when information on television would have been aired on current affairs and educational programs.

The results of the baseline survey provide insights about determinants of attendance and non-attendance during the initial phases of a new national mammography screening program. Overall the main variables found to be significant predictors in the analyses by individual constructs remained significant in the overall model, indicating that most confounders were related variables within the same construct. While some results agree with the literature, others were found to be contrary to the hypothesised direction of association. However, it was pointed out in the discussions by construct that the literature by and large relates to general community surveys. The results of this study fit most closely to other studies that relate to the provision of free mammographic services. For example, the BARRIER SCORE and individual items that were encompassed within it were borrowed from a study reporting attendance to a free screening program in the US (Rimer *et al.*, 1989b). Decisions regarding the inclusion of several other variables included in the study were informed by the results of case-control studies from the UK which also has a national screening program. (Hobbs *et al.*, 1980; French *et al.*, 1982; Maclean *et al.*, 1984) In general, the outcomes of variables compared with these studies were as hypothesised.

Although the reporting of the baseline data by both sample group and case type was cumbersome, the results clearly uphold the decision to carry out the four separate analyses. The intention to conduct separate analyses by sample group was made at the planning stages, as it was expected from the outset that these population would differ. The UK case-control study which found significant differences between self referred women and attenders and non-attenders following an invite was contributory in the decision to compare the two sample groups from the outset (Hobbs*et al.*, 1980). However, at the initial planning stages, while it was anticipated that case type may be a confounding factor, it was not anticipated that completely separate analyses would be required. Several of the outcomes suggest that the Cancel cases, particularly from the GP sample resemble the controls more than the FTA cases. A case-control study of attendance following the offer of low cost screening in the US (Rutledge *et al.*, 1988) compared 3 groups - attenders, non-attenders who have not had a mammogram outside the program, and non-attenders who had a mammogram outside the program within the previous three years. This study showed that the non-attenders who had a mammogram elsewhere resembled the attenders more than non-attenders who had not had a mammogram. It has been stressed throughout the analyses to this point that the dependent variable relates to mammographic screening to the SABXRS and not screening per se.

Chapter 5 reports on the follow-up of subjects interviewed at baseline to determine their attendance to the SABXRS after 4 years. It also reports analyses of the case-control study sample by mammography status both at baseline and after 4 years.

Part III of this thesis examines non-attenders to the SABXRS from invitations for rescreens and for initial screens using the electoral roll, and compares them with attenders. Part IV analyses mammography screening at the broad population level. Therefore, recommendations regarding the implications of the results of the case-control study on recruitment strategies will be reserved until Section V, after all data related to mammography both within and outside the SABXRS have been assessed.

Table 4.2.1 Socio-demographic construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups in bivariate analysis.

	SAMPLE GROUP *P*-value			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
MARITAL STATUS	0.109	0.812	**0.004**	0.427
LIFETIME OCCUPATION	0.243	0.549	**0.052**	**0.006**
PARTNER'S OCCUPATION	**0.014**	0.852	0.798	0.132
COUNTRY OF BIRTH	0.519	0.997	0.217	**0.094**
SPEAKS OTHER LANGUAGE	0.336	0.366	0.175	**0.040**
HOUSEHOLD COMPOSITION	0.233	0.618	**0.007**	**0.095**
PERSONS IN HOUSEHOLD	0.534	0.690	0.160	**0.074**
NUMBER OF CHILDREN	**<0.001**	0.567	**0.047**	0.477
INCOME	0.483	**0.042**	0.708	0.194

Table 4.2.2 Socio-demographic construct: Variables entered into logistic regression models.

	SAMPLE GROUP			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
AGE	✓	✗	✗	✗
MARITAL STATUS	✓‡	✗	✓‡	✗
AGE LEFT SCHOOL	✗	✗	✗	✓
QUALIFICATIONS POST-SCHOOL	✗	✗	✗	✓
LIFETIME OCCUPATION	✓	✗	✓	✓
PARTNER'S OCCUPATION	✓	✗	✗	✓
COUNTRY OF BIRTH	✗	✗	✓	✓
SPEAKS OTHER LANGUAGE	✗	✗	✓	✓
LANGUAGE SPOKEN	✗	✗	✗	✓‡
HOUSEHOLD COMPOSITION	✓	✗	✓	✓
PERSONS IN HOUSEHOLD	✗	✗	✓	✓
NUMBER OF CHILDREN	✓	✗	✓	✗
INCOME	✗	✓	✗	✓

‡ excluded from final model due to numerical problems (zero/very small number in a cell or colinearity with another variable)

Table 4.2.3 Socio-demographic construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups from logistic regression analysis

Variable	Spontaneous FTA[1] OR (95% CI)	Spontaneous Cancel[2] OR (95% CI)	GP FTA[3] OR (95% CI)	GP Cancel[4] OR (95% CI)
LIFETIME OCCUPATION (referent group = Managerial/professional)				
Clerk/Sales/Service	0.57 (0.23-1.42)	NE	0.47 (0.22-1.02)*	0.81 (0.37-1.77)
Trade/Manual	0.74 (0.21-2.66)		0.36 (0.17-0.78)***	0.34 (0.14-0.83)**
Home duties	0.33 (0.13-0.87)**		0.50 (0.25-0.99)**	0.58 (0.27-1.25)
PARTNER'S OCCUPATION (referent group = Managerial/professional)				
Tradesperson	0.72 (0.27-1.91)	NE	NE	1.11 (0.58-2.10)
Clerk/Sales/Service	0.56 (0.14-2.25)			1.74 (0.85-3.60)
Manual	2.45 (1.03-5.87)**			1.57 (0.85-2.90)
Not stated/No partner	0.62 (0.12-3.18)			1.90 (0.45-8.01)
HOUSEHOLD COMPOSITION (referent group = Lives with husband only)				
Husband & other	1.33 (0.58-3.07)	NE	0.75 (0.18-3.02)	0.20 (0.04-0.97)**
Son(s) only			4.11 (1.25-13.51)**	1.15 (0.23-5.72)
Daughter (s) only			1.80 (0.54-6.02)	0.91 (0.24-3.43)
(Children only) †	1.35 (0.33-5.55)			
Lives alone	2.06 (0.66-6.44)		1.92 (1.06-3.48)**	0.65 (0.34-1.26)
Other	3.05 (0.55-16.81)		1.79 (0.62-5.18)	0.73 (0.24-2.22)
NUMBER OF CHILDREN (referent group = None.)				
One or two	0.30 (0.09-0.93)**	NE	0.52 (0.19-1.47)	NE
Three or four	0.44 (0.13-1.45)		0.56 (0.20-1.54)	
Five or more	2.17 (0.49-9.58)		0.97 (0.33-2.88)	
INCOME (referent group = > $30,000 per annum)				
<= $20,000	NE	1.05 (0.62-1.78)	NE	1.01 (0.52-1.93)
$20.001 - $30,000		2.02 (1.09-3.75)**		1.78 (0.90-3.53)*
Not stated		0.53 (0.19-1.52)		0.78 (0.24-2.55)

* *P* < 0.10; ** *P* < 0.05; *** *P* < 0.01
OR, odds ratio; CI, confidence interval; NE, not entered in model
† For Spontaneous-FTA model 2 categories of Son(s) & Daughter(s) combined due to numerical problems
[1] Model $\chi^2 = 36.97$, $P = 0.002$. Percent Predicted Correct: Cases = 21.82; Controls = 97.21.
[2] Model $\chi^2 = 8.16$, $P = 0.043$. Percent Predicted Correct: Cases = 25.21; Controls = 86.05.
[3] Model $\chi^2 = 35.55$, $P = 0.008$. Percent Predicted Correct: Cases = 36.77; Controls = 85.43.
[4] Model $\chi^2 = 38.62$, $P = 0.040$. Percent Predicted Correct: Cases = 27.40; Controls = 83.07.

Table 4.2.4 Socio-demographic construct: Mean Age and Range by Sample Type and Case-Control Group

Group	Spontaneous – Age at appointment: Mean	Min	Max	*P*	GP – Age at invitation: Mean	Min	Max	*P*
FTA-case	53.91	40	80	*0.39*	56.97	50	70	*0.77*
Cancel-case	52.88	41	78	*0.79*	56.79	50	79	*0.93*
Control	52.89	40	75		56.80	50	80	

P Mann-Whitney U - Wilcoxon Rank Sum W Test, comparing mean of cases with mean of controls

Table 4.3.1 Health Motivation and Control Construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups in bivariate analysis.

	SAMPLE GROUP *P*-value			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
FREQUENCY OF BSE	0.749	0.592	**0.006**	0.747
DOCTOR CHECKED BREASTS	0.304	**0.013**	0.796	0.220
LAST BREAST EXAM	0.831	**<0.001**	**0.023**	0.103
EVER HAD PAP SMEAR	**0.011**	0.300	0.112	0.883
LAST PAP SMEAR	**0.064**	0.362	0.105	0.786
WHO INITIATED LAST PAP SMEAR	**0.031**	0.496	**0.052**	0.963
SMOKING	**0.077**	0.287	**0.017**	0.548
LIFESTYLE AFFECTS HEALTH	0.813	**0.045**	0.968	0.966
LAST TIME SAW DR	0.852	0.326	**<0.001**	0.123
DENTIST	**<0.001**	**0.042**	**0.028**	0.522

BSE, Breast Self Examination

Table 4.3.2 Health Motivation and Control Construct: Variables entered into logistic regression models.

	SAMPLE GROUP			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
DO BSE	✗	✗	✓†	✗
FREQUENCY OF BSE	✗	✗	✓	✗
DOCTOR CHECKED BREASTS	✗	✓	✓†	✓
LAST BREAST EXAM	✗	✓	✓	✓
EVER HAD PAP SMEAR	✓	✗	✓	✗
LAST PAP SMEAR	✓	✗	✓	✗
WHO INITIATED PAP SMEAR	✓	✗	✓	✗
SMOKING	✓	✗	✓	✗
DON'T SEE DOCTOR WHEN SHOULD	✓	✗	✗	✗
LIFESTYLE AFFECTS HEALTH	✗	✓	✗	✗
LAST TIME SAW DR	✗	✗	✓	✓
DENTIST	✓	✓	✓	✗
LONG TERM PROBLEM	✗	✗	✓	✗

BSE, Breast Self Examination
† not significant in itself, but entered in model as it was lead-in question to one that follows

Table 4.3.3 Health Motivation and Control Construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups from logistic regression analysis

Variable	SAMPLE TYPE			
	Spontaneous		GP	
	FTA[1]	Cancel[2]	FTA[3]	Cancel[4]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
DO BSE (referent group = Yes)				
No	NE	NE	0.48 (0.25-0.96)**	NE
FREQUENCY OF BSE (referent group = Monthly)				
1-2 times/year	NE	NE	0.91 (0.45-1.85)	NE
3-5 times/year			0.43 (0.21-0.88)**	
6-10 times/year			0.33 (0.16-0.70)***	
Not stated			0.66 (0.27-1.58)	
DOCTOR CHECKED BREASTS (referent group = Yes)				
No	NE	0.23 (0.08-0.64)***	0.51 (0.26-0.99)**	0.69 (0.37-1.26)
LAST BREAST EXAM (referent group = 1991)				
Before 1989	NE	0.26 (0.09-0.73)**	1.63 (0.73-3.64)	1.85 (0.89-3.84)
1989 or 1990		0.74 (0.42-1.32)	0.43 (0.24-0.77)***	0.72 (0.42-1.24)
Not stated		0.20 (0.06-0.70)**	0.52 (0.20-1.35)	0.72 (0.32-1.86)
EVER HAD PAP SMEAR (referent group = Yes)				
No	3.90 (1.13-13.45)**	NE	1.74 (0.73-4.15)	NE
SMOKING (referent group = Never smoked)				
Smoke now	2.05 (0.90-4.67)*	NE	1.87 (1.08-3.24)**	NE
Smoked in past	1.27 (0.57-2.81)		1.79 (0.99-3.22)*	
LAST TIME SAW DOCTOR (referent group = < 3 months ago)				
3 - < 6 months ago	NE	NE	1.17 (0.61-2.23)	1.12 (0.63-2.00)
6 - < 12 months ago			0.29 (0.10-0.82)**	0.56 (0.26-1.23)
>= 12 months ago			3.48 (1.27-9.72)**	2.44 (0.96-6.20)*
DENTIST(referent group = checkup)				
Problems	2.86 (1.47-5.58)***	1.80 (1.10-2.96)**	1.35 (0.82-2.24)	NE
Never visits	2.12 (0.52-8.65)	2.73 (0.92-8.12)*	1.78 (0.91-3.47)*	

BSE. Breast Self Examination
* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$
OR, odds ratio. CI, confidence interval; NE, not entered in model
[1] Model $\chi^2 = 24.08$, $P = 0.007$. Percent Predicted Correct: Cases = 5.36; Controls = 97.18.
[2] Model $\chi^2 = 32.17$, $P = <0.001$. Percent Predicted Correct: Cases = 15.25; Controls = 92.92.
[3] Model $\chi^2 = 64.43$, $P = <0.001$. Percent Predicted Correct: Cases = 46.10; Controls = 83.73.
[4] Model $\chi^2 = 14.05$, $P = 0.050$. Percent Predicted Correct: Cases = 21.23; Controls = 90.51.

Table 4.4.1 Knowledge Construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups in bivariate analysis.

	SAMPLE GROUP *P*-value			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
CANCER-MOST COMMON	0.578	0.140	**0.069**	0.495
KNOW SIGNS OF BC	0.343	0.294	0.976	**0.015**
SIGNS OF BREAST CANCER KNOWN:				
NIPPLE BLEEDING/DISCHARGE	0.118	0.190	**0.013**	0.600
PUCKERING/DIMPLING	**0.073**	0.239	0.635	**0.015**
NO. OF SYMPTOM/SIGNS KNOWN	0.166	0.738	0.306	**0.027**
AGE MOST AT RISK	0.712	0.425	**0.062**	0.431
INCIDENCE OF BC	**0.087**	0.635	0.310	0.132
CHECKS/TESTS FOR BREAST CANCER KNOWN:				
EXAMINE OWN BREASTS	**0.058**	0.123	**0.062**	0.778
DOCTOR EXAMINE BREASTS	0.175	0.103	**0.076**	0.327
MAMMOGRAPHY/X-RAY	0.240	0.878	0.283	**0.071**
NO. OF CHECKS KNOWN	**0.014**	**0.035**	0.412	0.173
KNOWS MAMMO FINDS BEFORE DR	**0.066**	0.322	**0.066**	0.992
HEARD OF SCREENING	0.836	**0.076**	**0.011**	0.169

BC, Breast Cancer

Table 4.4.2 Knowledge Construct: Variables entered into logistic regression models.

	SAMPLE GROUP			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
CANCER-MOST COMMON	✗	✓	✓	✗
CANCER- 2ND MOST COMMON	✗	✓	✗	✗
KNOW SIGNS OF BC	✓†	✗	✗	✓
SIGNS OF BREAST CANCER KNOWN:				
LUMP IN BREAST	✗	✗	✗	✓‡
NIPPLE BLEEDING/DISCHARGE	✓	✓	✓	✗
NIPPLE CHANGE/RETRACTION	✗	✓	✗	✓
CHANGE IN BREAST SHAPE	✓	✗	✓	✗
ARMPIT SWELLING	✓	✗	✗	✗
PUCKERING/DIMPLING	✓	✓	✗	✓
OTHER SYMPTOMS/SIGNS	✗	✗	✗	✓
NO. OF SIGNS KNOWN	✓	✗	✗	✓
LUMPS TO BC	✗	✗	✓	✗
AGE MOST AT RISK	✗	✗	✓	✗
INCIDENCE OF BC	✓	✗	✗	✓
CHECKS/TESTS FOR BREAST CANCER KNOWN:				
EXAMINE OWN BREASTS	✓	✓	✓	✗
DOCTOR EXAMINE BREASTS	✓	✓	✓	✗
MAMMOGRAPHY/X-RAY	✓	✗	✗	✓
NO. OF CHECKS KNOWN	✓	✓	✗	✓
KNOWS MAMMO FINDS BEFORE DR	✓	✗	✓	✗
HEARD OF SCREENING	✗	✓	✓	✓

† not significant in itself, but entered in model as it was lead-in question to one that follows

‡ excluded from final model due to numerical problems (zero/very small number in a cell or colinearity with another variable)

Table 4.4.3 Knowledge Construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups from logistic regression analysis

	SAMPLE TYPE			
	Spontaneous		GP	
Variable	FTA[1]	Cancel[2]	FTA[3]	Cancel[4]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
CANCER-MOST COMMON (referent group = Breast)				
Bowel	NE	2.08 (0.55-7.96)	1.00 (0.49-2.04)	NE
Lung		11.57 (1.75-76.46)**	3.45 (0.99-12.07)*	
Cervix		2.31 (0.65-8.28)	1.47 (0.85-2.54)	
Don't know		1.92 (0.17-21.32)	1.19 (0.46-3.09)	
CANCER-2ND MOST COMMON (referent group = Bowel)				
Breast	NE	0.96 (0.26-3.52)	NE	NE
Lung		1.48 (0.53-4.16)		
Cervix		2.13 (1.06-4.29)**		
Don't know		0.59 (0.10-3.60)		
NIPPLE BLEEDING/DISCHARGE (referent group = Known)				
Not known	1.55 (0.59-4.05)	0.62 (0.37-1.04)*	1.79 (0.98-3.26)*	NE
NIPPLE CHANGE/RETRACTION (referent group = Known)				
Not known	NE	0.66 (0.32-1.38)	NE	0.48 (0.21-1.09)*
PUCKERING/DIMPLING (referent group = Known)				
Not known	3.42 (0.68-17.19)	1.31 (0.56-3.05)	NE	0.36 (0.16-0.82)**
INCIDENCE OF BC (referent group = 1 in 15)				
1 in 5	1.94 (0.80-4.71)	NE	NE	0.74 (0.39-1.44)
1 in 35	1.21 (0.54-2.75)			1.02 (0.60-1.74)
1 in 60	0.58 (0.15-2.23)			0.32 (0.12-0.86)**
Don't know	1.81 (0.57-5.77)			1.03 (0.52-2.06)
DOCTOR EXAMINE BREASTS (referent group = Known)				
Not known	1.36 (0.43-4.35)	1.41 (0.76-2.62)	0.53 (0.33-0.85)***	NE
HEARD OF SCREENING (referent group = Yes)				
No	NE	1.45 (0.77-2.73)	1.51 (0.93-2.45)*	1.62 (1.02-2.58)**

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$

OR, odds ratio. CI, confidence interval NE, not entered in model

[1] Model $\chi^2 = 23.30$, $P = 0.140$ Percent Predicted Correct: Cases = 7.14; Controls = 98.58.

[2] Model $\chi^2 = 28.45$, $P = 0.028$ Percent Predicted Correct: Cases = 27.12; Controls = 93.46.

[3] Model $\chi^2 = 35.86$, $P = 0.011$. Percent Predicted Correct: Cases = 28.76; Controls = 85.38.

[4] Model $\chi^2 = 31.90$, $P = 0.004$. Percent Predicted Correct: Cases = 26.53; Controls = 90.12.

Table 4.5.1 Susceptibility Construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of four case-control bivariate analyses.

Variable	SAMPLE GROUP *P*-value			
	Spontaneous		GP Invitee	
	FTA	Cancel	FTA	Cancel
PERCEIVED SUSCEPTIBILITY	**0.050**	0.403	0.412	0.140
THINK ABOUT BC	0.318	**0.042**	0.858	**0.013**
HOW OFTEN THINK ABOUT BC	**0.064**	0.116	0.123	0.110
CONCERNED MAY HAVE BC	0.117	**0.015**	0.781	0.789
SPOKEN TO DR ON BC	0.288	**< 0.001**	0.679	0.287
EVER HAD LUMP	0.256	**0.002**	0.147	0.376
LUMP IN LAST 12 MONTHS	0.524	**< 0.001**	0.146	0.547
1ST DEGREE RELATIVE HAD BC	0.583	**0.091**	0.196	0.249
CLOSE FRIEND HAD BC	**0.024**	0.274	**0.061**	0.167
NUMBER KNOWN WITH BC	**0.063**	0.979	0.649	0.504

BC, Breast Cancer

Table 4.5.2 Susceptibility Construct: Variables entered into logistic regression models.

Variable	SAMPLE GROUP			
	Spontaneous		GP Invitee	
	FTA	Cancel	FTA	Cancel
PERCEIVED SUSCEPTIBILITY	✓	✗	✗	✓
THINK ABOUT BC	✓†	✓	✓†	✓
HOW OFTEN THINK ABOUT BC	✓	✓	✓	✓
CONCERNED MAY HAVE BC	✓	✓	✗	✗
SPOKEN TO DR ON BC	✗	✓	✗	✗
EVER HAD LUMP	✗	✓	✓	✗
LUMP IN LAST 12 MONTHS	✗	✓	✓	✗
KNOW SOMEONE WITH BC	✓†	✗	✓†	✗
1ST DEGREE RELATIVE HAD BC	✗	✓	✓	✓
CLOSE FRIEND HAD BC	✓	✗	✓	✓
OTHER RELATIVE HAD BC	✗	✗	✓	✗
NUMBER KNOWN WITH BC	✓	✗	✗	✗
CLOSENESS TO PERSONS WITH BC	✗	✗	✓	✗

† not significant in itself, but entered in model as it was lead-in question to one that follows

Table 4.5.3 Susceptibility Construct: Adjusted Odds Ratio and 95% Confidence Intervals for variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups from logistic regression analysis

	SAMPLE TYPE			
	Spontaneous		GP	
Variable	FTA[1]	Cancel[2]	FTA[3]	Cancel[4]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
HOW OFTEN THINK ABOUT BC (referent group = A lot of the time)				
Some of the time	0.19 (0.04-1.05)*	0.46 (0.13-1.67)	0.54 (0.16-1.82)	0.75 (0.25-2.25)
Occasionally	0.27 (0.06-1.17)*	0.74 (0.23-2.33)	0.47 (0.16-1.41)	0.76 (0.27-2.13)
Rarely	0.14 (0.02-0.88)**	0.53 (0.15-1.92)	1.36 (0.40-4.54)	1.19 (0.35-4.02)
CONCERNED MAY HAVE BC (referent group = Yes)				
No	0.67 (0.30-1.50)	0.49 (0.26-0.93)**	NE	NE
SPOKEN TO DR ON BC (referent group = Yes)				
No	NE	0.31 (0.13-0.76)**	NE	NE
EVER HAD LUMP (referent group = Yes)				
No	NE	0.25 (0.11-0.55)***	1.57 (0.66-3.75)	NE
LUMP IN LAST 12 MONTHS (referent group = Yes)				
No	NE	0.35 (0.14-0.84)**	2.42 (0.95-6.18)*	NE
KNOW SOMEONE WITH BC (referent group = Yes)				
No	3.82 (1.00-14.52)**	NE	0.30 (0.12-0.77)**	NE
1ST DEGREE RELATIVE HAD BC (referent group = Yes)				
No	NE	0.72 (0.33-1.55)	4.44 (1.64-12.02)***	0.65 (0.34-1.25)
OTHER RELATIVE HAD BC (referent group = Yes)				
No	NE	NE	2.64 (1.30-5.36)***	NE
NUMBER KNOWN WITH BC (referent group = Two or more)				
One	3.84 (1.20-12.31)**	NE	NE	NE
CLOSENESS TO PERSONS WITH BC (referent group = Extremely only)				
Quite close only	NE	NE	0.78 (0.37-1.66)	NE
Not very close only			0.33 (0.14-0.75)***	
Combination			1.23 (0.54-2.81)	

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$

OR, odds ratio. CI, confidence interval NE, not entered in model

[1] Model $\chi^2 = 24.42$, $P = 0.018$. Percent Predicted Correct: Cases = 9.09; Controls = 98.60.

[2] Model $\chi^2 = 34.27$, $P = <0.001$. Percent Predicted Correct: Cases = 27.97; Controls = 90.23.

[3] Model $\chi^2 = 30.27$, $P = 0.004$. Percent Predicted Correct: Cases = 28.95; Controls = 88.58.

[4] Model $\chi^2 = 17.09$, $P = 0.073$. Percent Predicted Correct: Cases = 16.33; Controls = 92.52.

Table 4.5.4 Susceptibility Construct: Chi-Square P value for test of significance between PERCEIVED SUSCEPTIBILITY and other selected variables

	SAMPLE TYPE					
	Spontaneous			GP		
	FTA	Cancel	Control	FTA	Cancel	Control
THINK ABOUT BC	0.104	0.082	0.075	0.047	0.086	0.036
CONCERNED MAY HAVE BC	<0.000	0.001	0.010	0.313	<0.001	<0.001
EVER HAD LUMP	0.075	0.365	0.878	0.067	0.552	0.081
KNOW ANYONE WITH BC	0.454	0.402	0.323	0.536	0.210	0.520
1ST DEGREE RELATIVE HAD BC	0.242	0.003	<0.001	0.027	0.044	0.006
CLOSE FRIEND HAD BC	0.377	0.908	0.180	0.360	0.427	0.296
NUMBER KNOWN WITH BC	0.610	0.035	0.199	0.672	0.064	0.486

Table 4.6.1 Barrier Construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of four case-control bivariate analyses.

	SAMPLE GROUP *P*-value			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
PERCEIVED BARRIERS				
ADVANTAGES OF FINDING BC	**0.048**	0.670	**0.065**	0.992
ADVANTAGES OF FINDING BREAST CANCER EARLY SPECIFIED:				
LIVE LONGER	0.625	0.996	**0.069**	0.298
CURE MORE LIKELY	0.649	0.264	**0.090**	0.799
LESS LIKELY TO LOSE BREAST	0.359	0.102	0.113	**0.084**
GET TREATMENT EARLIER	0.411	**0.037**	0.138	0.907
NO. OF PERCEIVED ADVANTAGES	0.373	0.567	**0.056**	0.607
BENEFITS OF MAMMO	**0.001**	**0.005**	**< 0.001**	**0.003**
BENEFITS OF MAMMOGRAPHY SPECIFIED:				
PEACE OF MIND	0.309	**0.047**	**< 0.001**	**0.002**
NO. OF PERCEIVED BENEFITS	**0.002**	**0.020**	**< 0.001**	**0.009**
BETTER NOT KNOWING-CANCER	0.184	**0.078**	**0.009**	0.102
PROBLEMS WITH MAMMO	0.893	0.745	**0.021**	**< 0.001**
NO. OF PERCEIVED PROBLEMS	0.925	**0.088**	**0.016**	**< 0.001**
PROBLEMS WOULD STOP	**0.001**	**0.013**	**0.001**	**< 0.001**
PROBLEMS WITH MAMMOGRAPHY SPECIFIED:				
PAIN	0.201	0.330	0.346	**0.008**
RADIATION	0.189	**0.026**	0.145	**0.003**
OTHER PROBLEMS	0.894	0.992	**0.035**	**0.084**
MAMMO FINDS ALL BC	0.934	0.899	0.192	**0.070**
CANCERS MISSED	**0.082**	0.744	**0.004**	0.218
REASONABLE TO MISS BC	**0.061**	0.684	**0.015**	0.288
EMBARRASSED BY FEMALE	**0.041**	0.211	0.139	0.891
EMBARRASSED BY MALE	**0.040**	0.603	0.273	0.816
AGREEMENT TO BARRIER STATEMENTS:				
NEED SYMPTOMS	**< 0.001**	**< 0.001**	**< 0.001**	**< 0.001**
EMBARRASSING	**0.035**	**0.021**	**0.004**	0.299
TOO MUCH TROUBLE	**< 0.001**	**< 0.001**	**< 0.001**	**0.002**
RATHER NOT THINK ABOUT IT	**0.001**	**0.006**	**< 0.001**	**0.001**
RADIATION CONCERN	**0.046**	**0.012**	**0.018**	0.105
INCONVENIENT	**0.041**	**0.082**	**< 0.001**	**< 0.001**
PAINFUL	**0.015**	**0.017**	**< 0.001**	**< 0.001**
ACCURACY CONCERN	0.900	0.511	**0.004**	**0.032**
MEANS MASTECTOMY	0.267	0.970	0.471	**0.025**
IMPORTANT FOR AGE	0.562	**0.043**	**< 0.001**	**< 0.001**
ASKING FOR TROUBLE	nc	nc	**0.002**	**0.002**
MORE TROUBLE THAN WORTH	0.392	**0.020**	**< 0.001**	**0.012**
ASKED BACK FOR TESTS	**< 0.001**	**0.002**	**< 0.001**	**0.011**
MORE TESTS MEAN BC	**< 0.001**	**0.004**	**< 0.001**	**0.041**
BARRIER SCORE	**< 0.001**	**< 0.001**	**< 0.001**	**< 0.001**
STRUCTURAL BARRIERS				
HOURS WORKED	0.216	0.705	**0.033**	0.392
COMMITMENT DIFFICULTY	**0.027**	0.895	0.263	0.336
ACCESS TO CAR	**0.001**	0.144	**0.002**	0.515
HOW OFTEN ACCESS CAR	**0.001**	0.326	**0.014**	0.437

BC, Breast Cancer; nc, not calculable

Table 4.6.2 Barrier Construct: Variables entered into logistic regression models.

	SAMPLE GROUP			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
PERCEIVED BARRIERS				
ADVANTAGES OF FINDING BC	✓‡	✗	✓	✗
ADVANTAGES OF FINDING BREAST CANCER EARLY SPECIFIED:				
EMOTIONAL FACTORS	✗	✗	✗	✓
LIVE LONGER	✗	✗	✓	✗
CURE MORE LIKELY	✗	✗	✓	✗
LESS LIKELY TO LOSE BREAST	✗	✓	✓	✓
GET TREATMENT EARLIER	✗	✓	✓	✗
NO. OF PERCEIVED ADVANTAGES	✗	✗	✓	✗
BENEFITS OF MAMMO	✓‡	✓‡	✓	✓
BENEFITS OF MAMMOGRAPHY SPECIFIED:				
INCREASE CHANCE OF CURE	✗	✓	✗	✗
PEACE OF MIND	✗	✓	✓	✓
NO. OF PERCEIVED BENEFITS	✓	✓	✓	✓
BETTER NOT KNOWING-CANCER	✓	✓	✓	✓
SHOULDN'T LOOK FOR ILLNESS	✗	✗	✓	✗
PROBLEMS WITH MAMMO	✓†	✓†	✓	✓
NO. OF PERCEIVED PROBLEMS	✗	✓	✓	✓
PROBLEMS WOULD STOP	✓	✓	✓	✓
BENEFITS OF MAMMOGRAPHY SPECIFIED:				
PAIN	✓	✗	✗	✓
RADIATION	✓	✓	✓	✓
UNCOMFORTABLE	✗	✗	✓	✗
OTHER PROBLEMS	✗	✗	✓	✓
MAMMO FIND ALL BC	✓†	✗	✓	✓
CANCERS MISSED	✓	✗	✓	✓
REASONABLE TO MISS BC	✓	✗	✓	✗
EMBARRASSED BY FEMALE	✓	✓	✓	✗
EMBARRASSED BY MALE	✓	✗	✗	✗
AGREEMENT WITH BARRIER STATEMENTS:				
NEED SYMPTOMS*	✓	✓	✓	✓
EMBARRASSING*	✓	✓	✓	✗
TOO MUCH TROUBLE*	✓	✓	✓	✓
RATHER NOT THINK ABOUT IT*	✓	✓	✓	✓
RADIATION CONCERN*	✓	✓	✓	✓
INCONVENIENT*	✓	✓	✓	✓
PAINFUL*	✓	✓	✓	✓
ACCURACY CONCERN*	✗	✗	✓	✓
MEANS MASTECTOMY	✗	✗	✗	✓
IMPORTANT FOR AGE	✗	✓	✓	✓
ASKING FOR TROUBLE	nc	nc	✓	✓
MORE TROUBLE THAN WORTH	✗	✓	✓	✓
ASKED BACK FOR TESTS	✓	✓	✓	✓
MORE TESTS MEAN BC	✓	✓	✓	✓
BARRIER SCORE	✓	✓	✓	✓
STRUCTURAL BARRIERS				
HOURS WORKED	✓	✗	✓	✗
DIFFICULTY WITH COMMITMENTS	✓	✗	✗	✗
ACCESS TO CAR	✓	✓	✓	✗
HOW OFTEN ACCESS CAR	✓	✗	✓	✗
PUBLIC TRANSPORT PROBLEMS	✗	✓	✗	✗
HOUSEHOLD MEMBER DISABLED	✗	✓	✓	✗

† not significant in itself, but entered in model as it was lead-in question to one that follows
‡ excluded from final model due to numerical problems (zero/very small number in a cell or colinearity with another variable
* replaced by BARRIER SCORE in final models

Table 4.6.3 Barrier Construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups from logistic regression analysis

	SAMPLE TYPE			
	Spontaneous		GP	
Variable	FTA[1]	Cancel[2]	FTA[3]	Cancel[4]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
LESS LIKELY TO LOSE BREAST (referent group = Stated				
Not stated	NE	1.63 (0.65-4.11)	3.19 (0.87-11.73)*	0.68 (0.33-1.39)
GET TREATMENT EARLIER (referent group = Stated)				
Not stated	NE	0.50 (0.29-0.87)**	1.68 (0.79-3.58)	NE
BENEFITS OF MAMMO (referent group = Yes)				
No	EX	EX	3.99 (0.91-17.54)*	0.94 (0.22-3.94)
PEACE OF MIND (referent group = Stated)				
Not stated	NE	1.93 (0.98-3.81)*	1.45 (0.79-2.64)	2.17 (1.25-3.75)***
NO. OF PERCEIVED BENEFITS (referent group = One)				
Two or more	0.76 (0.30-1.92)	0.53 (0.26-1.09)*	1.56 (0.67-3.62)	0.59 (0.31-1.12)
PROBLEMS WITH MAMMO (referent group = No)				
Yes	1.09 (0.38-3.15)	1.71 (0.92-3.18)*	0.84 (0.33-2.15)	1.53 (0.70-3.35)
NO. OF PERCEIVED PROBLEMS (referent group = One)				
Two or more	NE	0.20 (0.05-0.76)**	0.78 (0.11-5.28)	0.41 (0.05-3.14)
PROBLEM WOULD STOP (referent group = Definitely not)				
Yes/ maybe	11.74 (1.03-133.34)**	9.79 (1.39-68.88)**	0.82 (0.17-4.07)	2.51 (0.69-9.10)
Probably not	0.79 (0.15-4.13)	0.50 (0.13-1.89)	1.32 (0.31-5.64)	1.59 (0.44-5.74)
RADIATION (referent group = Not aware of problem)				
Aware of problem	0.26 (0.04-1.60)	0.22 (0.05-1.05)*	3.70 (0.49-27.94)	2.60 (0.54-12.43)
MEANS MASTECTOMY (referent group = Disagree)				
Agree	NE	NE	NE	0.40 (0.20-0.81)**
IMPORTANT FOR AGE (referent group = Agree)				
Disagree	NE	2.84 (0.66-12.22)	4.51 (1.31-15.54)**	3.97 (1.42-11.08)***
ASKED BACK FOR TESTS (referent group = Yes)				
No	4.63 (1.83-11.77)***	2.04 (1.02-4.09)**	3.54 (1.95-6.41)***	2.35 (1.36-4.06)***
BARRIER SCORE (referent group = 29-32)				
≤ 22	8.04 (1.63-39.70)**	4.16 (1.39-12.44)**	11.99 (4.13-34.79)***	1.56 (0.66-3.67)
23-24	3.24 (1.07-9.79)**	2.06 (0.98-4.36)*	4.88 (2.03-11.73)***	0.95 (0.52-1.74)
25-28	1.68 (0.49-5.75)	1.76 (0.82-3.78)	2.79 (1.07-7.28)**	0.70 (0.35-1.41)
HOURS WORKED (referent group = None)				
1-15	1.66 (0.34-8.23)	NE	3.85 (1.20-12.35)**	NE
16-39	0.43 (0.13-1.49)		0.76 (0.33-1.73)	
40+	1.48 (0.35-6.15)		3.82 (1.29-11.28)**	

Table 4.6.3 continued

Variable	Spontaneous FTA[1] OR (95% CI)	Spontaneous Cancel[2] OR (95% CI)	GP FTA[3] OR (95% CI)	GP Cancel[4] OR (95% CI)
COMMITMENT DIFFICULTIES (referent group = Not difficult)				
Very difficult	7.66 (1.76-33.34)***	NE	NE	NE
Quite difficult	2.73 (0.72-10.39)			
A little difficult	2.10 (0.76-5.79)			
ACCESS TO CAR (referent group = Yes)				
No	6.29 (2.19-18.13)***	1.29 (0.54-3.08)	1.90 (1.00-3.59)**	NE
PUBLIC TRANSPORT PROBLEMS (referent group = Not difficult at all)				
Very difficult	NE	1.53 (0.45-5.17)	NE	NE
Quite difficult		1.13 (0.38-3.37)		
A little difficult		1.95 (0.93-4.07)*		
Don't use		1.50 (0.75-3.00)		
HOUSEHOLD MEMBER DISABLED (referent group = No)				
Yes	NE	0.48 (0.24-0.96)**	0.75 (0.39-1.44)	NE

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$
OR, odds ratio; CI, confidence interval; NE, not entered in model
EX, excluded due to numerical problems
[1] Model $\chi^2 = 73.97$, $P = < 0.001$. Percent Predicted Correct: Cases = 41.51; Controls = 94.74.
[2] Model $\chi^2 = 72.06$, $P = < 0.001$. Percent Predicted Correct: Cases = 42.61; Controls = 91.43.
[3] Model $\chi^2 = 160.30$, $P = < 0.001$. Percent Predicted Correct: Cases = 62.84; Controls = 89.16.
[4] Model $\chi^2 = 81.78$, $P = < 0.001$. Percent Predicted Correct: Cases = 44.37; Controls = 89.47.

Table 4.6.4 Spontaneous cases: Selected Barrier Items by KNOW BENEFITS OF MAMMO

Barrier Items	KNOWS BENEFITS OF MAMMO % agreeing with Barrier Item: Yes	No	P-value*
NEED SYMPTOMS	8.6	37.5	0.034
TOO MUCH TROUBLE	9.2	25.0	0.182
RADIATION CONCERN	21.5	37.2	0.251
INCONVENIENT	10.4	25.0	0.218
PAINFUL	30.5	37.5	0.470
ACCURACY CONCERN	17.8	25.0	0.443
MEANS MASTECTOMY	12.9	50.0	0.017
IMPORTANT FOR AGE	4.3	50.0	0.003
MORE TROUBLE THAN WORTH	5.6	12.5	0.395
HEARD OF SCREENING	81.2	50.0	0.018

P-value, Pearson Chi-Square or Fisher's Exact test for variables with cells <5

Table 4.7.1 Influence Construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of four case-control bivariate analyses.

	SAMPLE GROUP *P*-value			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
EMOTIONAL SUPPORT PARTNER	**0.072**	0.828	**0.002**	0.636
CONFIDANT	0.680	0.215	**0.042**	0.328
SPECIFIC CLUBS VOLUNTEER WORK INVOLVED IN:				
TUTORS/SCHOOL HELP	0.104	**0.069**	0.785	0.238
MEMBER OF OTHER CLUB	0.101	0.694	0.741	**0.092**
SOURCES OF INFORMATION ABOUT MAMMOGRAPHY:				
FRIEND/FAMILY	**0.069**	0.420	**0.002**	**0.057**
GP SURGERY	0.991	0.166	0.538	**< 0.001**
OTHER SOURCE	0.144	0.634	**0.005**	0.800
NO. SOURCES ABOUT MAMMO	0.278	0.370	**0.016**	0.358
DR SUGGESTED MAMMO	**0.089**	**< 0.001**	**< 0.001**	**0.041**
WHO SUGGESTED MAMMO	0.190	**< 0.001**	**< 0.001**	0.161
WOULD HAVE SX ON DR RECOM	**< 0.001**	**< 0.001**	**< 0.001**	**< 0.001**
WHO WOULD INFLUENCE TO HAVE MAMMOGRAM:				
NO-ONE WOULD INFLUENCE	0.206	0.371	**< 0.001**	0.274
DOCTOR WOULD INFLUENCE	0.631	0.642	**< 0.001**	0.318
OTHER REL WOULD INFLUENCE	0.458	0.706	**0.069**	0.975
OTHER WOULD INFLUENCE	**0.028**	0.546	**0.021**	0.699
NO.OF INFLUENCES	0.402	0.664	**0.001**	0.368
SHOULD GP TELL ABOUT SABXRS	0.233	**0.094**	0.476	0.106
SHOULD ALL GET INVITE	0.756	**0.037**	**< 0.001**	**< 0.001**
USE ELECTORAL ROLL	0.255	0.333	**0.005**	**0.015**
<u>Additional variables relevant to GP sample only</u>				
GP LETTER	na	na	**< 0.001**	**< 0.001**
HOW MAMMO SUGGESTED	na	na	**< 0.001**	**< 0.001**
PATIENT OF PRACTICE	na	na	**0.005**	**0.059**
WOMAN'S ONLY PRACTICE	na	na	**0.019**	**0.013**
HEARD OF BXRS BEFORE LETTER	na	na	**< 0.001**	**0.068**
HAPPY ABOUT GP APPOINT	na	na	**< 0.001**	**< 0.001**

na, not applicable (question not relevant to sample group)

Table 4.7.2 Influence Construct: Variables entered into logistic regression models.

	SAMPLE GROUP			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
EMOTIONAL SUPPORT PARTNER	✓	✗	✓	✗
CONFIDANT	✗	✓	✓	✗
SPECIFIC CLUBS VOLUNTEER WORK INVOLVED IN:				
MEMBER OF SPORTS CLUB	✓	✗	✗	✗
TUTORS/SCHOOL HELP	✓	✓	✗	✓
MEMBER OF CHURCH GROUP	✗	✓	✗	✗
MEMBER OF SENIOR CITIZEN'S	✗	✗	✓	✗
MEMBER OF ETHNIC CLUB	✗	✓	✗	✗
MEMBER OF OTHER CLUB	✓	✗	✗	✓
SOURCES OF INFORMATION ABOUT MAMMOGRAPHY:				
FRIENDS/FAMILY	✓	✗	✓	✓
GP SURGERY	✗	✓	✗	✓
NEWSPAPER	✗	✗	✓	✗
RADIO	✓	✗	✗	✗
SABXRS PAMPHLET	✗	✓	✗	✗
MAGAZINE	✓	✓	✗	✗
OTHER SOURCE	✓	✗	✓	✗
NO. SOURCES ABOUT MAMMO	✗	✗	✓	✗
DR SUGGESTED MAMMO	✓	✓	✓	✓
WHO ELSE SUGGESTED MAMMO	✗	✗	✗	✓‡
WHO SUGGESTED MAMMO	✓	✓	✓	✓
DR ADVISED AGAINST MAMMO	nc	✗	✓	✗
WOULD HAVE SX ON DR RECOM	✓	✓	✓	✓
KNOW SOMEONE WHO HAD M	✗	✗	✓	✗
WHO WOULD INFLUENCE TO HAVE MAMMOGRAM:				
NO-ONE WOULD INFLUENCE	✓	✗	✓	✗
DOCTOR WOULD INFLUENCE	✗	✗	✓	✗
CHILDREN WOULD INFLUENCE	✗	✗	✗	✓
OTHER REL WOULD INFLUENCE	✗	✗	✓	✗
FRIEND WOULD INFLUENCE	✗	✗	✗	✓
OTHER WOULD INFLUENCE	✓	✗	✓	✗
NO.OF INFLUENCES	✗	✗	✓	✗
SHOULD GP TELL ABOUT SABXRS	✓	✓	✗	✓‡
SHOULD ALL GET INVITE	✗	✓	✓	✓
USE ELECTORAL ROLL	✗	✗	✓	✓
Additional variables relevant to GP sample only				
GP LETTER	na	na	✓	✓
HOW MAMMO SUGGESTED	na	na	✓	✓
PATIENT OF PRACTICE	na	na	✓	✓
WOMAN'S ONLY PRACTICE	na	na	✓	✓
WANTED MORE INFO	na	na	✓	✗
HEARD OF BXRS BEFORE LETTER	na	na	✓	✓
HAPPY ABOUT GP APPOINT	na	na	✓	✓

‡ excluded from final model due to numerical problems (zero/very small number in a cell or colinearity with another variable)
na, not applicable

Table 4.7.3 Influence Construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups from logistic regression analysis

Variable	SAMPLE TYPE			
	Spontaneous		GP	
	FTA[1]	Cancel[2]	FTA[3]	Cancel[4]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
EMOTIONAL SUPPORT PARTNER (referent group = Yes)				
No	0.38 (0.06-2.32)	NE	1.38 (0.57-3.31)	NE
No partner	1.73 (0.79-3.78)		1.66 (0.93-2.97)*	
TUTORS/SCHOOL HELP (referent group = Yes)				
No	0.33 (0.08-1.40)	0.31 (0.10-0.95)**	NE	0.70 (0.17-2.96)
MEMBER OF CHURCH GROUP (referent group = Yes)				
No	NE	3.13 (1.21-8.13)**	NE	NE
MEMBER OF ETHNIC CLUB(referent group = Yes)				
No	NE	6.44 (0.80-51.84)*	NE	NE
FRIENDS/FAMILY(referent group = Heard)				
Not heard	2.44 (1.02-5.83)**	NE	0.27 (0.14-0.53)***	0.48 (0.27-0.87)**
GP SURGERY (referent group = Heard)				
Not heard	NE	1.38 (0.74-2.59)	NE	0.32 (0.19-0.51)***
SABXRS PAMPHLET(referent group = Heard)				
Not heard	NE	0.42 (0.18-1.01)*	NE	NE
OTHER SOURCE (referent group = Heard)				
Not heard	0.67 (0.22-1.98)	NE	0.31 (0.10-0.95)**	NE
DR SUGGESTED MAMMO (referent group = Yes)				
No	0.37 (0.12-1.15)*	0.29 (0.12-0.70)***	3.35 (1.05-10.73**	1.27 (0.35-4.73)
WOULD HAVE SX ON DR RECOM(referent group = Definitely)				
Probably	13.06 (3.63-46.99)***	7.05 (2.47-20.11)***	3.07 (1.32-7.13)***	3.38 (1.42-8.06)***
No/uncertain	42.88 (4.15-442.62)***	33.66 (3.77-300.80)***	7.23 (1.82-28.70)***	18.85 (5.15-68.92)***
OTHER WOULD INFLUENCE (referent group = Yes)				
No	0.13 (0.01-1.21)*	NE	0.19 (0.02-2.13)	NE
SHOULD GP TELL ABOUT SABXRS (referent group = Yes)				
No	3.26 (0.52-20.54)	5.03 (1.23-20.61)**	NE	EX
SHOULD ALL GET INVITE (referent group = Yes)				
No	NE	1.14 (0.57-2.30)	3.83 (1.47-9.96)***	1.93 (0.64-5.82)
USE ELECTORAL ROLL(referent group = Yes)				
No	NE	NE	1.74 (0.99-3.06)*	1.14 (0.67-1.95)

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$; §, excluded from final model due to high OR/SE
OR, odds ratio; CI, confidence interval; NE, not entered in model
EX, excluded due to numerical problems
[1] Model $\chi^2 = 61.55$, $P = < 0.001$. Percent Predicted Correct: Cases = 30.91; Controls = 97.67.
[2] Model $\chi^2 = 74.47$, $P = < 0.001$. Percent Predicted Correct: Cases = 43.22; Controls = 90.65.
[3] Model $\chi^2 = 125.08$, $P = < 0.001$. Percent Predicted Correct: Cases = 58.94; Controls = 89.02.
[4] Model $\chi^2 = 79.92$, $P = < 0.001$. Percent Predicted Correct: Cases = 38.10; Controls = 90.16.

Table 4.7.4 Influence Construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in either one of models for the extended GP sample logistic regression analysis

Variable	FTA[5]	Cancel[6]
	OR (95% CI)	OR (95% CI)
EMOTIONAL SUPPORT PARTNER (referent group = Yes)		
No	1.37 (0.51-3.68)	NE
No partner	1.79 (0.91-3.51)*	
MEMBER OF OTHER CLUB(referent group = Yes)		
No	NE	0.26 (0.08-0.88)**
FRIENDS/FAMILY (referent group = Yes)		
No	0.31 (0.14-0.68)***	0.44 (0.22-0.86)**
DR SUGGESTED MAMMO (referent group = Yes)		
No	7.03 (1.83-26.99)***	2.92 (0.67-12.74)
WOULD HAVE SX ON DR RECOM (referent group = Definitely)		
Probably	4.71 (1.74-12.77)***	5.51 (2.08-14.64)***
No/uncertain	8.57 (1.81-40.58)***	24.08(6.03-96.20)***
SHOULD GP TELL ABOUT SABXRS (referent group = Yes)		
No	NE	EX
SHOULD ALL GET INVITE (referent group = Yes)		
No	2.92 (0.92-9.33)*	1.22 (0.35-4.27)
GP LETTER (referent group = Yes)		
No	2.16 (1.10-4.23)**	0.97 (0.52-1.80)
HOW MAMMO SUGGESTED (referent group = GP letter)		
Consultation	2.49 (1.19-5.22)**	8.07(4.07-16.00)***
WOMAN'S ONLY PRACTICE (referent group = Yes)		
No	1.40 (0.54-3.65)	2.17 (1.04-4.51)**
HAPPY ABOUT GP APPOINT (referent group = Yes)		
No	6.18 (2.52-15.17)***	3.12 (1.19-8.20)**

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$
OR, odds ratio; CI, confidence interval; NE, not entered in model
EX, excluded due to numerical problems
[5] Model $\chi^2 = 189.31$, $P = < 0.001$. Percent Predicted Correct: Cases = 69.59; Controls = 89.71.
[6] Model $\chi^2 = 140.51$, $P = < 0.001$. Percent Predicted Correct: Cases = 53.10; Controls = 86.45.

Table 4.7.5 Influence Construct: Time since last visit to the doctor by whether subjects believe all women should get an invite from doctor, by sample type, and by case/control status (column percent).

	SAMPLE TYPE					
	Spontaneous			GP		
	FTA	Cancel	Control	FTA	Cancel	Control
ALL WOMEN SHOULD GET INVITE - YES						
Time since last visit to doctor						
< 6 months	87.2	85.7	74.2	89.8	84.7	84.9
6 to 12 months	8.5	12.1	10.9	3.9	6.9	11.8
over 12 months	4.3	2.2	4.9	6.3	8.4	3.3
ALL WOMEN SHOULD GET INVITE - NO						
Time since last visit to doctor						
< 6 months	100.0	82.2	90.3	81.5	93.8	75.0
6 to 12 months	0.0	14.3	9.7	0.0	6.3	12.5
over 12 months	0.0	3.6	0.0	18.5	0.0	12.5

Table 4.7.6 Influence Construct: Significance of cross-tabulation of AGE, AGE LEFT SCHOOL (SCHOOL) and POST-SECONDARY QUALIFICATIONS (P-S QUAL) by Sample type.

	SAMPLE TYPE					
	Spontaneous			GP		
Source of information	AGE	SCHOOL	P-S QUAL	AGE	SCHOOL	P-S QUAL
FRIEND/FAMILY	✗	✗	✗	✗	✗	✗
GP SURGERY	✗	✗	✗	✓	✗	✗
GP LETTER	na	na	na	✗	✓	✗
OTHER HEALTH PROF	✗	✗	✗	✗	✗	✗
NEWSPAPER	✗	✗	✓	✗	✓	✗
TELEVISION	✗	✗	✓	✗	✓	✓
RADIO	✗	✗	✗	✗	✗	✗
SABXRS PAMPHLET	✗	✗	✓	✗	✗	✗
MAGAZINE	✗	✗	✗	✗	✗	✗

✓ $P < 0.05$ from chi-square test of significance
✗ $P \geq 0.05$ from chi-square test of significance
na, not applicable

Table 4.8.1 Variables entered into final overall logistic regression models.

	SAMPLE GROUP			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
Variables from Socio-demographic analyses				
LIFETIME OCCUPATION	✓♣	✗	✓♣♦	✓♣♦
PARTNER'S OCCUPATION	✓	✗	✗	✗
HOUSEHOLD COMPOSITION	✗	✗	✓♣♦	✓♣♦
NUMBER OF CHILDREN	✓♣	✗	✗	✗
INCOME	✗	✓♣	✗	✓
Variables from Health Motivation and Control analyses				
DO BSE	✗	✗	✓	✗
FREQUENCY OF BSE	✗	✗	✓	✗
DOCTOR CHECKED BREASTS	✗	✓	✓	✗
LAST BREAST EXAM	✗	✓♣	✓♣♦	✗
EVER HAD PAP SMEAR	✓	✗	✗	✗
SMOKING	✓♣	✗	✓♣♦	✗
LAST TIME SAW DOCTOR	✗	✗	✓	✓♣♦
DENTIST	✓♣	✓♣	✓♣♦	✗
Variables from Knowledge analyses				
CANCER-MOST COMMON	✗	✓♣	✓♣♦	✗
CANCER-2ND MOST COMMON	✗	✓♣	✗	✗
NIPPLE BLEEDING/DISCHARGE	✗	✓	✓	✗
NIPPLE CHANGE/RETRACTION	✗	✗	✗	✓
PUCKERING/DIMPLING	✗	✗	✗	✓
INCIDENCE OF BC	✗	✗	✗	✓♦
DOCTOR EXAMINE BREASTS	✗	✗	✓♣♦	✗
HEARD OF SCREENING	✗	✗	✓	✓♣
Variables from Susceptibility analyses				
THINK ABOUT BC	✓†♣	✗	✗	✗
HOW OFTEN THINK ABOUT BC	✓♣	✗	✗	✗
CONCERNED MAY HAVE BC	✗	✓♣	✗	✗
SPOKEN TO DR ON BC	✗	✓♣	✗	✗
EVER HAD LUMP	✗	✓♣	✓†	✗
LUMP IN LAST 12 MONTHS	✗	✓♣	✓♣	✗
KNOW SOMEONE WITH BC	✓	✗	✓♣♦	✗
1ST DEGREE RELATIVE HAD BC	✗	✗	✓♣♦	✗
OTHER RELATIVE HAD BC	✗	✗	✓♣	✗
NUMBER KNOWN WITH BC	✓♣	✗	✗	✗
CLOSENESS TO PERSONS WITH BC	✗	✗	✓♣♦	✗
Variables from Barrier analyses				
LESS LIKELY TO LOSE BREAST	✗	✗	✓	✗
GET TREATMENT EARLIER	✗	✓	✗	✗
BENEFITS OF MAMMO	✓‡‡	✓	✓♣♦	✗
PEACE OF MIND	✗	✓	✗	✓♣
NO. OF PERCEIVED BENEFITS	✗	✓	✗	✗
PROBLEMS WITH MAMMO	✓†	✓	✗	✗
NO. OF PERCEIVED PROBLEMS	✗	✓♣	✗	✗
PROBLEM WOULD STOP	✓♣	✓	✗	✗
RADIATION	✗	✓	✗	✗
BARRIER SCORE	✓	✓♣	✓♣♦	✗
MEANS MASTECTOMY	✗	✗	✗	✓♣♦
IMPORTANT FOR AGE	✗	✗	✓	✓♣♦
ASKED BACK FOR TESTS	✓♣	✓	✓♣♦	✓♣♦
HOURS WORKED	✗	✗	✓♣♦	✗
DIFFICULTY WITH COMMITMENTS	✓♣	✗	✗	✗
ACCESS TO CAR	✓♣	✗	✓♣♦	✗
PROBLEMS WITH PUB TRANS	✗	✓	✗	✗
HOUSEHOLD MEMBER DISABLED	✗	✓♣	✗	✗

Table 4.8.1 continued

	SAMPLE GROUP			
	Spontaneous		GP Invitee	
Variable	FTA	Cancel	FTA	Cancel
Variables from Influence analyses common to all groups				
EMOTIONAL SUPPORT PARTNER	✗	✗	✓‡	✗
TUTORS/SCHOOL HELP	✗	✓♣	✗	✗
MEMBER OF CHURCH GROUP	✗	✓♣	✗	✗
MEMBER OF ETHNIC CLUB	✗	✓	✗	✗
FRIENDS/FAMILY	✓	✗	✓♣	✓♣
GP SURGERY	✗	✗	✗	✓♣
SABXRS PAMPHLET	✗	✓♣	✗	✗
OTHER SOURCE	✗	✗	✓	✗
DR SUGGESTED MAMMO	✓	✓♣	✓♣	✗
WOULD HAVE SX ON DR RECOM	✓♣	✓♣	✓	✓♣
OTHER WOULD INFLUENCE	✓	✗	✗	✗
SHOULD GP TELL ABOUT SABXRS	✗	✓♣	✗	✓‡‡
SHOULD ALL GET INVITE	✗	✗	✓	✗
USE ELECTORAL ROLL	✗	✗	✓	✗
Variables from additional Influence analyses performed for GP sample				
EMOTIONAL SUPPORT PARTNER	NA	NA	✓‡	✗
MEMBER OF OTHER CLUB	NA	NA	✗	✓♦
FRIENDS/FAMILY	NA	NA	✓♦	✓♦
DR SUGGESTED MAMMO	NA	NA	✓♦	✓†♦
WOULD HAVE SX ON DR RECOM	NA	NA	✓♦	✓♦
SHOULD GP TELL ABOUT SABXRS	NA	NA	✗	✓‡‡
SHOULD ALL GET INVITE	NA	NA	✓	✗
GP LETTER	NA	NA	✓♦	✗
HOW MAMMO SUGGESTED	NA	NA	✓♦	✓♦
WOMAN'S ONLY PRACTICE	NA	NA	✗	✓♦
HAPPY ABOUT GP APPOINT	NA	NA	✓♦	✓♣

BC, Breast Cancer; NA, Not Applicable

† not significant in itself, but entered in model as it was lead-in question to one that follows

‡ excluded from final model due to numerical problems (zero/very small number in a cell or colinearity with another variable)

‡‡ excluded from respective construct model therefore not entered in overall model

♣ Statistically significant at P <0.10 in final overall model comparable across all four analyses

♦ Statistically significant at P <0.10 in final overall GP model with additional variables

Table 4.8.2 Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in at least one of sample groups from logistic regression analysis

	SAMPLE TYPE			
	Spontaneous		GP	
Variable	FTA[1]	Cancel[2]	FTA[3]	Cancel[4]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
LIFETIME OCCUPATION (referent group = Manag/Prof)				
Clerk/Sales/ Service	0.40 (0.11-1.46)	NE	0.28 (0.08-0.96)**	0.88 (0.35-2.20)
Trade/Manual	0.22 (0.02-2.24)		0.21 (0.06-0.73)**	0.23 (0.08-0.62)***
Home duties	0.08 (0.02-0.41)***		0.24 (0.08-0.75)**	0.48 (0.20-1.18)
HOUSEHOLD COMPOSITION (Referent group = Husband only)				
Husband and other	NE	NE	1.86 (0.81-4.24)	0.32 (0.16-0.63)***
Son/s only			5.51 (0.95-32.03)*	0.73 (0.14-3.79)
Daughter/s only			1.15 (0.15-8.88)	0.54 (0.12-2.45)
Lives alone			1.23 (0.49-3.11)	0.77 (0.35-1.67)
Other			2.10 (0.65-6.78)	0.94 (0.30-2.91)
NUMBER OF CHILDREN (referent group = None)				
One or two	0.21 (0.04-1.18)*	NE	NE	NE
Three or four	0.78 (0.13-4.63)			
Five or more	18.05 (1.74-187.52)**			
INCOME (Referent group = > $30,000)				
<= $20.000	NE	1.32 (0.55-3.16)	NE	0.78 (0.37-1.66)
$20,001-30,000		3.02 (1.19-7.66)**		1.85 (0.82-4.16)
Not stated		0.48 (0.12-1.90)		0.65 (0.14-2.98)
LAST BREAST EXAM (Referent group = 1991)				
Before 1989	NE	0.32 (0.08-1.22)*	2.04 (0.59-6.99)	NE
1989 or 1990		1.21 (0.53-2.75)	0.33 (0.14-0.79)**	
Unknown		0.17 (0.02-1.24)*	1.69 (0.47-6.14)	
SMOKING (referent group = Never smoked)				
Smoke now	8.67 (2.05-36.71)***	NE	1.88 (0.77-4.52)	NE
Have smoked	2.28 (0.51-10.14)		2.04 (0.89-4.69)*	
LAST TIME SAW DOCTOR (referent group = < 3 months ago)				
3 to < 6 months ago	NE	NE	1.56 (0.61-4.01)	1.06 (0.52-2.17)
6 to < 12 months ago			0.37 (0.09-1.53)	0.37 (0.14-0.99)**
12 months ago or more			1.38 (0.31-6.07)	2.35 (0.67-8.23)
DENTIST (referent group = Checkups)				
Problems	2.95 (0.97-8.94)*	2.57 (1.22-5.39)**	1.93 (0.91-4.11)*	NE
Never visits	0.41 (0.04-4.62)	2.06 (0.47-9.08)	1.75 (0.61-4.99)	
CANCER - MOST COMMON (Referent group = Breast)				
Bowel	NE	1.03 (0.18-5.90)	0.56 (0.17-1.88)	NE
Lung		9.96 (0.89-111.42)*	12.87 (1.93-85.94)***	
Cervix		0.96 (0.14-6.51)	0.86 (0.37-2.02)	
Don't know		1.18 (0.04-38.61)	0.53 (0.12-2.39)	
CANCER - 2ND MOST COMMON (Referent group = Bowel)				
Breast	NE	1.66 (0.24-11.56)	NE	NE
Lung		1.07 (0.26-4.29)		
Cervix		2.24 (0.87-5.76)*		
Don't know		0.47 (0.03-6.84)		
DOCTOR EXAMINE BREASTS (referent group = Known)				
Not known	NE	NE	0.48 (0.22-1.01)*	NE
HEARD OF SCREENING (referent group = Yes)				
No	NE	NE	1.68 (0.79-3.58)	1.64 (0.91-2.94)*

Table 4.8.2 continued

Variable	SAMPLE TYPE: Spontaneous FTA[1] OR (95% CI)	Spontaneous Cancel[2] OR (95% CI)	GP FTA[3] OR (95% CI)	GP Cancel[4] OR (95% CI)
THINK ABOUT BC (referent group = Yes)				
No	0.06 (0.01-0.40)***	NE	NE	NE
HOW OFTEN THINK ABOUT BC (referent group = A lot of the time)				
Some of the time	0.04 (0.00-0.44)***	NE	NE	NE
Occasionally	0.17 (0.02-1.19)*			
Rarely	0.03 (0.00-0.43)**			
CONCERNED MAY HAVE BC (referent group = Yes)				
No	NE	0.39 (0.17-0.88)**	NE	NE
SPOKEN TO DOCTOR ON BC (referent group = Yes)				
No	NE	0.33 (0.10-1.13)*	NE	NE
EVER HAD LUMP (referent group = Yes)				
No	NE	0.19 (0.06-0.56)***	1.32 (0.40-4.33)	NE
LUMP IN LAST 12 MONTHS (referent group = Yes)				
No	NE	0.23 (0.07-0.80)**	3.12 (0.81-12.02)*	NE
KNOW SOMEONE WITH BC (referent group = Yes)				
No	2.62 (0.39-17.50)	NE	0.09 (0.03-0.34)***	NE
1ST DEGREE RELATIVE HAD BC (referent group = Yes)				
No	NE	NE	5.72 (1.54-21.25)***	NE
OTHER RELATIVE HAD BC (referent group = Yes)				
No	NE	NE	2.99 (1.12-8.02)**	NE
NUMBER KNOWN WITH BC (referent group = Two or more)				
One	5.77 (1.05-31.79)**	NE	NE	NE
CLOSENESS TO PERSONS WITH BC (referent group = Extremely close only)				
Quite close only	NE	NE	0.40 (0.13-1.22)	NE
Not very close only			0.16 (0.05-0.53)***	
Combination			0.69 (0.20-2.37)	
BENEFITS OF MAMMO (referent group = Yes)				
No	EX	EX	8.41 (1.57-45.04)**	NE
PEACE OF MIND (referent group = Knew)				
Didn't know	NE	1.91 (0.86-4.26)	NE	1.86 (1.05-3.28)**
NO. OF PERCEIVED PROBLEMS (referent group = One)				
Two or more	NE	0.07 (0.01-0.40)***	NE	NE
PROBLEM WOULD STOP (referent group = Definitely not)				
Yes/maybe	22.00 (0.60-806.16)*	1.11 (0.09-14.50)	NE	NE
Probably not	0.25 (0.03-1.86)	0.47 (0.08-2.64)		
BARRIER SCORE (referent group = 29-32)				
<= 22	4.33 (0.69-27.34)	6.90 (1.92-24.75)***	9.28 (2.87-29.97)***	NE
23 -24	1.78 (0.43-7.33)	2.57 (1.00-6.55)*	2.82 (1.07-7.43)**	
25 -28	0.83 (0.15-4.44)	1.97 (0.75-5.16)	2.48 (0.81-7.53)	
MEANS MASTECTOMY (referent group = Disagree)				
Agree	NE	NE	NE	0.37 (0.17-0.79)**
IMPORTANT FOR AGE (referent group = Agree)				
Disagree	NE	NE	2.19 (0.55-8.78)	6.01 (1.94-18.61)***
ASKED BACK FOR TESTS (referent group = Yes				
No	9.71 (2.70-34.98)***	2.47 (1.04-5.88)**	3.78 (1.87-7.64)***	2.61 (1.41-4.86)***

Table 4.8.2 continued

Variable	SAMPLE TYPE: Spontaneous FTA[1] OR (95% CI)	Spontaneous Cancel[2] OR (95% CI)	GP FTA[3] OR (95% CI)	GP Cancel[4] OR (95% CI)
HOURS WORKED (referent group = None)				
0-15	NE	NE	4.26 (1.21-14.96)**	NE
16-39			1.01 (0.38-2.72)	
40+			1.88 (0.49-7.21)	
DIFFICULTY WITH COMMITMENTS (referent group = Not difficult)				
Very difficult	4.21 (0.85-20.83)*	NE	NE	NE
Quite difficult	1.77 (0.40-7.96)			
A little difficult	2.85 (0.73-11.06)			
ACCESS TO CAR (referent group = Yes)				
No	16.85 (3.41-83.31)***	NE	3.33 (1.50-7.39)***	NE
HOUSEHOLD MEMBER DISABLED (referent group = Yes)				
No	NE	0.48 (0.21-1.09)*	NE	NE
EMOTIONAL SUPPORT PARTNER (referent group = Yes)				
No	NE	NE	EX	NE
TUTORS/SCHOOL HELP (referent group = Yes)				
No	NE	0.30 (0.08-1.20)*	NE	NE
MEMBER OF CHURCH GROUP (referent group = Yes)				
No	NE	3.60 (1.12-11.62)**	NE	NE
FRIEND/FAMILY (referent group = Yes)				
No	1.28 (0.39-4.26)	NE	0.27 (0.12-0.63)***	0.36 (0.19-0.69)***
GP SURGERY (referent group = Yes)				
No	NE	NE	NE	0.22 (0.13-0.39)***
SABXRS PAMPHLET (referent group = Yes)				
No	NE	0.29 (0.09-0.99)**	NE	NE
DR SUGGESTED MAMMO (referent group = Yes)				
No	0.39 (0.11-1.33)	0.48 (0.22-1.05)*	2.95 (1.27-6.88)**	NE
WOULD HAVE SX ON DOCTOR RECOM (referent group = Definitely)				
Probably	22.36 (3.67-136.42)***	5.67 (1.50-21.35)**	2.28 (0.69-7.50)	4.84 (1.70-13.78)***
No/maybe	39.25 (1.48-1043.44)**	52.76 (3.09-900.58)***	2.40 (0.42-13.89)	10.27 (2.06-51.23)***
SHOULD GP TELL ABOUT SABXRS (referent group = Yes)				
No	NE	12.88 (2.15-77.12)***	NE	EX

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$

OR, odds ratio; CI, confidence interval; NE, not entered in model

EX, excluded due to numerical problems

[1] Model $\chi^2 = 133.38$, $P = < 0.001$. Percent Predicted Correct: Cases = 60.38; Controls = 94.31.

[2] Model $\chi^2 = 167.41$, $P = < 0.001$. Percent Predicted Correct: Cases = 68.97; Controls = 88.73.

[3] Model $\chi^2 = 242.51$, $P = < 0.001$. Percent Predicted Correct: Cases = 74.32; Controls = 90.44.

[4] Model $\chi^2 = 146.15$, $P = < 0.001$. Percent Predicted Correct: Cases = 59.03; Controls = 86.64.

Table 4.8.3 **Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in either one of models for the extended GP sample logistic regression analysis**

Variable	FTA[1] OR (95% CI)	Cancel[2] OR (95% CI)
LIFETIME OCCUPATION (referent group = Manag/Prof)		
Clerk/Sales/Service	0.34 (0.08-1.50)	0.60 (0.22-1.66)
Trade/Manual	0.20 (0.04-0.90)**	0.16 (0.05-0.50)***
Home duties	0.26 (0.06-1.07)*	0.43 (0.16-1.16)*
HOUSEHOLD COMPOSITION (Referent group = Husband only)		
Husband and other	2.39 (0.89-6.43)*	0.30 (0.14-0.65)***
Son/s only	8.97 (1.19-67.69)**	0.79 (0.13-4.95)
Daughter/s only	2.59 (0.16-42.86)	0.62 (0.11-3.46)
Lives alone	1.44 (0.47-4.46)	0.85 (0.35-2.04)
Other	1.28 (0.30-5.38)	0.49 (0.14-1.79)
LAST BREAST EXAM (Referent group = 1991)		
Before 1989	4.75 (1.03-21.88)**	NE
1989 or 1990	0.44 (0.16-1.19)	
Unknown	3.86 (0.82-18.08)*	
SMOKING (referent group = Never smoked)		
Smoke now	2.14 (0.72-6.30)	NE
Have smoked	2.60 (0.99-6.83)*	
LAST DOCTOR VISIT (referent group = < 3 months ago)		
3 to < 6 months ago	1.79 (0.56-5.76)	1.46 (0.64-3.36)
6 to < 12 months ago	0.41 (0.08-2.16)	0.32 (0.11-0.95)**
12 months ago or more	1.93 (0.32-11.45)	2.94 (0.69-12.52)
DENTIST (referent group = Checkups)		
Problems	2.82 (1.15-6.93)**	NE
Never visits	2.46 (0.75-8.14)	
CANCER - MOST COMMON (Referent group = Breast)		
Bowel	0.58 (0.15-2.28)	NE
Lung	11.42 (0.74-176.68)*	
Cervix	0.73 (0.26-2.06)	
Don't know	0.41 (0.08-2.19)	
INCIDENCE OF BC (Referent group = 1 in 15)		
1 in 5	NE	0.35 (0.14-0.87)**
1 in 35		0.48 (0.22-1.04)*
1 in 60		0.23 (0.06-0.89)**
Don't know		0.78 (0.29-2.09)
DOCTOR EXAMINE BREASTS (referent group = Known)		
Not known	0.34 (0.14-0.85)**	NE
KNOW SOMEONE WITH BC (referent group = Yes)		
No	0.07 (0.01-0.35)***	NE
1ST DEGREE RELATIVE HAD BC (referent group = Yes)		
No	19.71 (3.67-105.73)***	NE
HIGHEST CLOSENESS TO PERSONS WITH BC (referent group = Extremely close)		
Quite close	0.35 (0.09-1.35)	NE
Not very close	0.10 (0.02-0.42)***	
None known with BC	1.00 (0.24-4.22)	
BENEFITS OF MAMMO (referent group = Yes)		
No	13.11 (1.84-93.63)**	NE

Table 4.8.3 continued

Variable	FTA[1] OR (95% CI)	Cancel[2] OR (95% CI)
BARRIER SCORE (referent group = 29-32)		
$\leq$ 22	7.11 (1.86-27.14)***	NE
23 -24	2.84 (0.90-9.00)*	
25 -28	1.03 (0.27-3.91)	
MEANS MASTECTOMY (referent group = Disagree)		
Agree	NE	0.30 (0.13-0.70)***
IMPORTANT FOR AGE (referent group = Agree)		
Disagree	1.51 (0.22-10.36)	6.76 (1.79-25.52)***
ASKED BACK FOR TESTS (referent group = Yes		
No	4.44 (1.91-10.32)***	3.39 (1.63-7.05)***
HOURS WORKED (referent group = None)		
0-15	9.91 (2.16-45.50)***	NE
16-39	0.75 (0.24-2.40)	
40+	1.41 (0.23-8.76)	
ACCESS TO CAR (referent group = Yes)		
No	5.85 (2.15-15.93)***	NE
MEMBER OF OTHER CLUB (referent group = Yes)		
No	NE	0.17 (0.04-0.75)**
FRIENDS/FAMILY (referent group = Yes)		
No	0.28 (0.11-0.74)***	0.33 (0.15-0.70)***
DR SUGGESTED MAMMO (Referent group = Yes)		
No	4.32 (1.49-12.52)***	4.17 (1.61-10.82)***
WOULD HAVE SX ON DOCTOR RECOM (referent group = Definitely)		
Probably	7.23 (1.75-29.95)***	9.26 (2.92-29.38)***
No/uncertain	3.39 (0.43-26.81)	12.43 (1.86-82.92)***
GP LETTER (referent group = Yes)		
No	2.47 (0.96-6.34)*	NE
HOW MAMMO SUGGESTED (Referent group = GP letter)		
Other	3.55 (1.31-9.65)**	18.00 (8.40-38.57)***
WOMAN'S ONLY PRACTICE (referent group = Yes)		
No	NE	2.46 (1.02-5.91)**
HAPPY ABOUT GP APPOINT(referent group = Yes)		
No	16.68 (5.67-9.04)***	2.59 (0.91-7.36)*

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$
OR, odds ratio; CI, confidence interval; NE, not entered in model
EX, excluded due to numerical problems
[1] Model $\chi^2 = 301.97$, $P = < 0.001$. Percent Predicted Correct: Cases = 81.51; Controls = 91.13.
[2] Model $\chi^2 = 205.24$, $P = < 0.001$. Percent Predicted Correct: Cases = 74.65; Controls = 90.57.

Table 4.8.4 Cross-classification of variable WOULD HAVE SX ON DOCTOR RECOM with selected barrier variables

	WOULD HAVE SX ON DOCTOR RECOM			P-value*
	Definitely	Probably	No/Unsure	
BARRIER SCORE (% in lowest score = more perceived barriers)	12.8	39.8	68.2	< 0.001
Barrier Items: (% agreeing)				< 0.001
NEED SYMPTOMS	5.1	22.9	56.1	< 0.001
EMBARRASSING	5.3	13.3	15.2	< 0.001
TOO MUCH TROUBLE	3.2	14.5	24.2	< 0.001
RATHER NOT THINK ABOUT IT	9.9	37.3	60.6	< 0.001
RADIATION CONCERN	15.2	28.9	53.0	< 0.001
INCONVENIENT	5.7	20.5	27.3	< 0.001
PAINFUL	19.6	39.8	51.5	< 0.001
ACCURACY CONCERN	17.5	30.1	40.9	< 0.001
IMPORTANT FOR AGE	96.1	80.5	57.4	< 0.001
ASKING FOR TROUBLE	0.8	6.1	17.2	< 0.001
MORE TROUBLE THAN WORTH	2.4	14.8	23.4	< 0.001

* *P*-value, Pearson Chi-Square test

CHAPTER 5 FOLLOW-UP OF CASE-CONTROL SUBJECTS

5.1 INTRODUCTION

Chapter 4 presented the baseline results of the case-control study conducted in late 1991. Subjects included in the study were those recruited prior to the phase of rapid expansion for the SABXRS from late 1991, and before mass advertising by the National program. This chapter examines the attendance to the SABXRS of all these case-control subjects at the cut-off date of 31 December, 1995, four years after the base-line interview. Additional data items collected at base-line, but which related only to sub-sets of the study population are also presented. This includes details of mammography for cases screened outside the SABXRS prior to base-line and reasons for non-attendance at the SABXRS.

The conceptual framework for this thesis is the Health Belief Model supplemented by the Theory of Reasoned Action and the Transtheoretical Model of Readiness Stage as outlined in Chapter 1. That is, action with regard to mammography behaviour depends on stage of readiness for adoption of the behaviour, which in turn is dependent on personal and environmental factors. This chapter uses Rogers' (1983) theory of the *Diffusion of Innovations* to describe the stages of readiness in terms of five adopter categories; innovators, early adopters, early majorities, late majorities and laggards.

Chapter 4 focussed mainly on the underlying personal and environmental factors that differentiate attenders and non-attenders to the SABXRS as defined by the six broad study constructs. This chapter studies more explicitly the hypothesis stated in Chapter 2 that non-attenders comprise women at various stages of readiness for adoption of mammography behaviour, that is, some cases would need little prompting to attend the SABXRS, while others would be more difficult to recruit. It is postulated that at baseline the three main subgroups within each sample (FTA-cases, Cancel-cases and Controls) represented three broad groups of readiness to adopt, and within each are further sub-groups in terms of readiness. This is tested by taking actual attendance status by the end of 1995 as the dependent variable, and investigating whether data collected at baseline can predict later attendance. In other words, can the level of readiness to attend the SABXRS, or conversely the degree of resistance, be determined at an early stage in the development of the screening program?

For these analyses, cases are classified as either Late-adopters or Resistant-cases. Late-adopters had not adopted mammography at the SABXRS at baseline but had since attended, while the Resistant-cases had still not had a mammogram at the SABXRS by the end of 1995. By Rogers' classification the Late-adopters may either be the early or late majorities (since they would have attended at a time of rapid expansion in the Service), while the Resistant-cases would be categorised as the "laggards". Given that attendance status was measured at the same cut-off date for all cases (4 years after interview), the level of effort required by the SABXRS to influence cases to attend would have been variable. Some Late-adopters may have attended soon after the baseline interview without any further prompting, such as letters of invitation or other promotional methods, while others may have attended just prior to the cut-off date, following one or two further letters of invitation from the SABXRS and significant media promotion, both at the State and National levels.

The Controls are women who attended prior to the base-line interview requiring minimal effort by the Service. These women would be considered 'innovators' or 'early adopters' by Roger's classification. The Controls are viewed as having little or no resistance, given that they either made and kept an appointment themselves (Spontaneous Controls at baseline) or attended an appointment made on their behalf (without consulting them first) through a letter of invitation (GP Controls at baseline). It should be noted that some of the Controls had not re-attended since baseline, but they were not excluded from these analyses, as the criteria for selection was attendance status to SABXRS by December 1995 (attended versus never attended). Re-attendance by controls is examined separately in section 5.10.

Section 5.2 below describes the original sample of cases as used in the analyses in Chapter 4 (Spontaneous FTA, Spontaneous Cancel, GP FTA and GP Cancel) according to the current categorisation of cases - Resistant-case or Late-adopter.

Sections 5.3 to 5.9 present the results of the three sets of analyses comparing Resistant-cases, Late-adopters and Controls. The Cases-at-4-years analysis compares the two case groups to predict later attendance amongst initial non-attenders. Two further analyses are presented to determine if the baseline data can differentiate the stage of readiness to adopt between all three groups, as defined by attendance status at the SABXRS by 31 December 1995. The Resistant-case/Control analysis compares Resistant-cases with Controls, while the Late-adopter/Control analysis compares Late-adopters with the Controls. As in the baseline analyses, rather than conduct polychotomous regression analysis with a dependent variable comprising three categories, three separate sets of analyses were performed. The independent variables for all three analyses are those collected at the baseline survey.

As for the base-line analyses the same procedure of filtering the data is used; a model is presented for each construct (Socio-demographic; Health Motivation and Control; Knowledge; Susceptibility; Barriers; and, Influences) as well as an overall model which uses the results of the individual construct models. However, separate analyses are not performed by sample and case type. In these analyses, the sample type (Spontaneous, GP) and case type (FTA, Cancel) are entered as independent variables to determine if initial method of recruitment, and initial case type has an effect on attendance several years later. The initial recruitment method - variable SAMPLE TYPE - is entered as an independent variable in all three analyses. For the Cases-at-4-years analysis, three additional independent variables were entered which are only applicable for the comparison of cases; CASE TYPE, EVER HAD MAMMO and WILL USE SABXRS. The variable CASE TYPE refers to type of case at baseline (FTA, Cancel). EVER HAD MAMMO relates to mammography status at baseline, and since by definition cases were non-attenders to the SABXRS at base-line, this refers to having a mammogram outside the SABXRS; 45% of Resistant-cases and 62% of Late-adopters had had a mammogram outside the SABXRS at baseline, or conversely 55% of Resistant-cases and 38% of Late-adopters had never had a mammogram at baseline. WILL USE SABXRS relates to intention to use the SABXRS within the next 2 years of the base-line interview. By definition, all controls had had a mammogram at baseline and had used the SABXRS, hence it was not appropriate to included these two variables in the analyses which included controls. It should be noted, that although controls had already attended the SABXRS, they were also asked the question about intention to return, but it was not entered in the Resistant-case/Control an Late-adopter/Control analyses, as the dependent variable relates to whether there is, or is not, an attendance to SABXRS at all. The variable WILL USE SABXRS is examined in relation to re-attendance to SABXRS amongst control subjects in section 5.10 below.

The seven sections 5.3 to 5.8 summarise the bivariate and multivariate results for each of the study constructs and 5.9 presents the final overall multivariate model. Appendix D includes a table for each of the constructs, listing the variables included in these analyses and *P*-value (chi-square test) for each of the bivariate cross-classifications (Appendix D2, Tables D2.1 to D2.6).

Three common sets of tables are included within each of the six sections by construct, as for the baseline analyses. The first set of tables (5.3.1 to 5.8.1) list variables associated with attendance status at 31/12/95 at $P < 0.10$ level in at least one of the three bivariate analyses. The second set of tables (5.3.2 to 5.8.2) shows the variables which were entered in at least one of the models, a ✓ denoting variables that were entered. As for the baseline models, variables with a *P*-value of < 0.25 from the bivariate chi-square test were entered into the logistic regression models. The third set of tables (5.3.3 to 5.8.3) lists the independent variables from the logistic regression analysis that were found to be significant predictors (at $P < 0.10$) of attendance status at 31/12/95 in at least one of the models. The final multivariate logistic regression models for each construct and the overall models are included in Appendix E (E2.1 to E2.7, E3.1 to E3.7, and E4.1 to E4.7).

The category used as the reference group in the logistic regression analyses is shown in the third set of tables next to the variable name, and all other categories are listed below the variable name. The same reference categories were used as for the baseline analyses. The odds ratio reflects the estimated odds of persistent non attendance (Cases-at-4-years and Resistant-case/Control models) or delayed attendance (Late-adopter/Control model) to the SABXRS, after adjusting for the confounding effects of other variables included in the models. Odds ratios of less than 1.00 indicate a lower likelihood of being a persistent non-attender/delayed attender; odds ratios greater than 1.00 indicate a greater likelihood of being a persistent non-attender/delayed attender.

It would be expected that any associations found would show similar results in terms of the direction of association for all analyses, but that the strength of the associations would differ. Resistant-cases would be expected to exhibit more characteristics associated with non-attendance compared with both Late-adopters and Controls, but the differences would be expected to be more pronounced in the comparison with the latter group. Thus it is hypothesised that most differences would occur in the Resistant-case/Control analysis, and for variables found to be common predictors across analyses, the strength of association would be greatest in the Resistant-case/Control model, followed by the Cases-at-4-years model, and weakest for the Late-adopter/Control model.

5.2 DESCRIPTION OF CASES BY ATTENDANCE STATUS AT 31 DECEMBER, 1995

Table 5.2.1 shows that of the 478 cases (non-attenders) at baseline, 269 (56%) had attended the SABXRS for at least one mammogram at the cut-off date (Late-adopters), while the other 209 (44%) remained non-attenders (Resistant-cases). Overall 83% of Late-adopters had attended within 2 years of the baseline interview and 92% within 3 years.

Overall, significantly more cases were Late-adopters amongst the Spontaneous cases (63.4%) than the GP cases (56.3%) ($P = 0.02$). The highest proportion of Late-adopters occurred amongst the Spontaneous Cancel-cases and the lowest amongst the GP FTA-cases, both results supporting the findings from the previous Chapter which suggest that the GP FTA-cases most closely resemble non-attenders from the literature and that the Cancel-cases resembled the Controls more than the FTA-cases in many regards. Table 5.2.2 provides a detailed breakdown of cases by period to attendance by SAMPLE and CASE TYPE. The group that attended within the shortest period were the Spontaneous FTA-cases, with 47% of Late-adopters in this group attending within 3 months of the interview. Some of these may be the cases who simply forgot to attend and the interview may have prompted them to attend.

Further breakdown of the data by appointment clinic (not shown) found that within the Spontaneous sample, attendance was not related to the screening clinic where they were booked nor date of their first appointment (the appointment which they failed to attend or cancelled); those with earlier appointments were just as likely as those with later appointments to be Late-adopters. For the GP sample there was also no difference by GP practice, that is, the GP who sent the invitation letter. It should be noted that GP practice is also related to screening clinic; all three clinics operating at that time were represented in the GP sample, with women from specific practices being invited to a specific clinic. However, for the GP cases there was a difference in late attendance amongst the Cancel-cases but not the FTA-cases when categorised by invitation date. As outlined in Chapter 3, the initial GP sample was drawn from women with an invitation date between March 1990 and March 1991. Cancel-cases whose appointment was before October 1990 were more likely to remain non-attenders (or Resistant-cases) than those whose appointment was in or after October 1990 (57.4% versus 32.9%, $P = 0.002$). The earlier cases were less likely to have ever had a mammogram at the time of interview; 50% of GP Cancel-cases invited prior to October 1990 had ever had a mammogram compared with 73% of those invited in October or later ($P = 0.003$). This may be related to a doctor's suggestion regarding mammography; of the Cancel-cases invited prior to October 1990, 67% said a doctor had suggested a mammogram prior to the baseline interview compared with 81% amongst those with the later invitation date ($P = 0.005$).

5.3 RESULTS - SOCIO-DEMOGRAPHIC CONSTRUCT

5.3.1 Bivariate Results

No bivariate association (at $P < 0.10$) was evident in any analysis for the following variables; AGE LEFT SCHOOL, QUALIFICATIONS POST-SCHOOL, PARTNER'S OCCUPATION, COUNTRY OF BIRTH, SPEAK OTHER LANGUAGE, LANGUAGE SPOKEN, PERSONS IN HOUSEHOLD, and RELIGION. (Appendix D, Table D2.1)

Significant bivariate associations with a $P < 0.10$ are listed in Table 5.3.1 below. AGE was the only variable significant in all three analyses here, but was not found to have a significant bivariate association in any of the base-line models. The Resistant-case/Control analysis showed the most bivariate associations, which complies with the hypothesis that most differences would be expected in this analysis.

5.3.2 Multivariate Results

Variables which entered the models based on a *P*-value of < 0.25 are listed in Table 5.3.2 below.

The final models are included in Appendix E, Tables E2.1, E3.1 and E4.1. It should be noted that the variable MARITAL STATUS was excluded from the final Resistant-case/Control model due to high coliniarity with HOUSEHOLD COMPOSITION.

Table 5.3.3 below lists the independent variables from the logistic regression analysis that were significant predictors of persistent non-attendance or delayed attendance to screening at the SABXRS in any of the models at $P < 0.10$.

AGE was an independent predictor in the Cases-at-4-years model and Late-adopter/Control model, but the direction of association differed. Resistant-cases were more likely to be older (60+) than Late-adopters, but Late-adopters were younger than Controls. HIGHEST QUALIFICATION remained an independent predictor in the two models where it was entered showing that Resistant-cases were more likely to have a bachelor degree or higher than both Late-adopters and Controls (against the predicted result from the literature). Further, Late-adopters were more likely to work in managerial/professional positions than Controls (LIFETIME OCCUPATION). Both Resistant-cases and Late-adopters were more likely to have 5 or more children than Controls. INCOME was significant in the Late-adopter/Control model showing that Late-adopters were more likely to be in the middle income group. This variable was also significant overall (P=0.08) in the Resistant-case/Control model, but not for the individual comparisons. SOURCE OF INCOME was significant in the Cases-at-4-years model showing that Resistant-cases were more likely to receive a government pension as the main source of income compared with Late-adopters. This seems at odds with the finding that Resistant-cases were more qualified. However, while the proportion of Resistant-cases with a bachelor degree is 3 times that of Late-adopters, the proportion is still relatively small. On the other hand, the proportions on pensions is high for both groups, but higher for Resistant-cases. It appears that Resistant-cases may comprise women at both extremes, as none of the Resistant-cases with a higher degree were on a government pension, whereas 14% of Late-adopters with a higher degree were on a government pension. SOCIO-ECONOMIC STATUS showed a significant result overall ($P = 0.05$) in the Cases-at-4-years model, but none of the individual categorical comparisons reached significance.

5.3.3 Discussion

It was suggested in the discussion of the socio-demographic base-line results (4.3.3) that non-attenders at base-line appeared to differ from those identified in the literature. It was postulated that the reason may be that the literature by and large refers to attendance to mammography per se (usually to paid services) and not to a free government funded service. The results four years later continue to show that the higher income, higher educated women do not attend the SABXRS, but neither do those in the lower income, lower socio-economic categories. A possible explanation may be that the Resistant-cases represent two groups, those who resist mammography screening absolutely and those who choose to be screened in the private sector. Section 5.11 below examines the mammographic history of cases outside the SABXRS at baseline and how this is related to later attendance or continued non-attendance. Part IV presents information on where women in the community are having their screening mammograms, to provide an overall prevalence of this phenomenon.

A notable difference from the base-line results is that older age now shows a highly significant independent association in the model that differentiates Resistant-cases and Controls.

Overall, the socio-demographic variables were reasonable predictors for the Cases-at-4-years model, correctly predicting 50% of Resistant-cases and 78% of Late-adopters, with a P-value of < 0.001 for the final model. For the Resistant-case/Control model and Late-adopter/Control model, these variables were poor predictors of Resistant-cases and Late-adopters (15% and 20% respectively) but good predictors of Controls (95% and 91%), with an overall significance of P = 0.002 for both models.

5.4 RESULTS - HEALTH MOTIVATION AND CONTROL CONSTRUCT

5.4.1 Bivariate Results

No bivariate association (at $P < 0.10$) was evident in any analysis for the following variables; EXERCISE, EXERCISE FREQUENCY, DON'T SEE DOCTOR WHEN SHOULD, LIFESTYLE AFFECTS HEALTH, HEALTH STATUS, LONG TERM PROBLEM, DISABILITY INTERFERES, SELF ESTEEM, and MULTIDIMENTIONAL LOCUS OF CONTROL (both overall and sub-scales). (Appendix D, Table D2.2)

Significant bivariate associations with a $P < 0.10$ are listed in Table 5.4.1 below. FREQUENCY OF BSE, the three variables relating to Pap Smear and SAMPLE TYPE were significant for the two analyses that included Resistant-cases, differentiating them from both Late-adopters and Controls. The variables SMOKING and DENTIST were significant in the two models with Controls, indicating that preventive behaviours differentiate between women who took up the offer of screening at the SABXRS immediately (controls) and both the resistant and delayed attenders.

The three variables applicable only to the Cases-at-4-years analysis, CASE TYPE, EVER HAD MAMMO, and WILL USE SABXRS were all significant, indicating that those who remained non-attenders were more likely to be FTA-cases at baseline (than Cancel-cases), were more likely to have never had a mammogram at base-line, and less likely to say they intended to have a mammogram at the SABXRS within the next two years (following the base-line interview).

5.4.2 Multivariate Results

Variables which entered the models based on a P-value of < 0.25 are listed in Table 5.4.2 below. It can be seen that fewer variables entered the Late-adopter/Control model.

The final models are included in Appendix E, Tables E2.2, E3.2 and E4.2. Table 5.4.3 below lists the independent variables from the logistic regression analysis that were significant predictors of persistent or delayed non-attendance to screening at the SABXRS in any model at $P < 0.10$.

FREQUENCY OF BSE remained an independent predictor in the two models with Resistant-cases, showing that they do BSE *more* frequently than either Late-adopters or Controls. Where this variable was a significant result at base-line (GP FTA model), it also showed that non-attenders do BSE *more* frequently, in contrast to the expected result. Also in contrast to the literature, but in agreement with the base-line analysis, is the result that non-attenders are *more* likely to have had a breast exam by a doctor in the year preceding the base-line interviews.

SMOKING was an independent predictor only in the Late-adopter/Control model, showing that delayed attenders were more likely to have smoked in the past than Controls. In the base-line models smoking was significant in the two FTA models, comparing cases that failed to attend initially with controls.

The variable EVER HAD PAP SMEAR was an independent predictor for the Cases-at-4-years model, showing that Resistant-cases were less likely to have ever had a pap smear test at base-line compared with Late-adopters; of course, they may have had one since.

The variable DENTIST which was found to be a predictor in three of the four baseline models, was also significant in Resistant-case/Control and Late-adopter/Control models showing Resistant-cases and Late-adopters were both more likely to visit the dentist only for problems or not visit at all.

The three variables applicable only to the Cases-at-4-years (CASE TYPE, EVER HAD MAMMO, and WILL USE SABXRS) remained independent predictors. Resistant-cases were more likely to be an FTA-case and to have never had a mammogram at baseline compared with Late-adopters.

A dose-response effect was evident for the variable WILL USE SABXRS. The odds ratios of comparing the categories 'Probably would' attend, 'Probably not' and 'Definitely not' with the reference category 'Definitely would' attend were 2.3, 3.9 and 13.2 respectively. That is, those who said they definitely had no intention of attending were 13 times more likely to be a Resistant-case (CI 6.4 - 27.3). This shows a strong relationship between intention and action.

5.4.3 Discussion

The variable SAMPLE TYPE was entered in all three models, and it was predicted that GP cases would be more likely to be Resistant-cases, and to a lesser extent Late-adopters, given that they received an unsolicited invitation at base-line, whereas the Spontaneous sample booked themselves. This variable was significant only in the Resistant-case/Control model, and the effect was not strong. This indicates that while clear differences were shown between the GP and Spontaneous samples at the time of recruitment, the initial method of recruitment was no longer important after 4 years; it had a weak effect on persistent non-attendance, but no effect on delayed attendance.

As hypothesised also, FTA-cases at baseline were more likely to be Resistant-cases four years on compared with Cancel-case, but the effect was not as strong as might have been expected from the base-line results, where FTA and Cancel cases were analysed separately on the basis of the differences that were evident when the data were initially examined. From the point of view of increasing participation to mammography screening, it shows that both types of cases could be influenced to attend after initially either failing to attend without notice or cancelling the initial appointment, but nevertheless more of the Cancel-cases later attended.

The findings relating to BSE and breast exam by a doctor seem at odds with the literature both in the baseline and current analyses. Cases were found to do BSE more frequently than controls, and were also more likely to have had a recent breast exam by a doctor. In these analyses, Resistant-cases were *more* likely to do BSE (at base-line) than both Late-adopters and Controls. A possible explanation may be that they were more worried due to breast problems. A possible proxy for breast problems is the variable LUMP IN LAST 12 MONTHS. However, a cross-tabulation of this variable with FREQUENCY OF BSE found no statistical association for any of the 3 groups (Resistant-cases, Late-adopters or Controls). A statistically significant association was found between FREQUENCY OF BSE and LAST BREAST EXAM for all 3 groups, but the difference was due to those who never practice BSE also being less likely to have a recent breast exam by a doctor. For those who do practice BSE, there is no relationship to having a recent breast exam.

The finding that both Resistant-cases and Late-adopters were more likely than Controls to have had a breast exam by a doctor in the year prior to interview also contrasts with the predicted result, and again suggests breast problems as a possible explanation. A cross-tabulation of recent breast exam by LUMP IN LAST 12 MONTHS appears to support this; 10% of Controls had had a lump, compared with 24% for Resistant-cases and 19% for Late-adopters. Further, most of the Resistant-cases and Late-adopters with a lump also had a mammogram outside the SABXRS ($P < 0.001$). It may be that the Late-adopters with a prior breast lump were cleared by their doctor, and therefore had their next mammogram with the SABXRS, while the Resistant-cases who were cleared either continued to have private mammograms or stopped having them. However, the actual numbers with a breast lump were small, therefore this would only account for a small part of the difference, both in these analyses and in the baseline analyses.

With the preventive behaviours of EVER HAD PAP SMEAR and DENTIST, the direction of association was as hypothesised, and the strength of effect varied with level of resistance to attendance at the SABXRS. Resistant-cases were less likely to have had a pap smear compared with both Late-adopters and Controls, whereas there was no difference between Late-adopters and Controls, suggesting that pap smear behaviour predicts persistent non-attendance, but not delayed attendance. Thus, there is potential for promoting both pap smear screening and mammography screening together, since the main target population for both is older women. DENTIST differentiated between both case groups and Controls, but not between the case groups. The odds ratio for attending a dentist only for problems (reference, attending for check-up) was 2.4 in the model comparing Resistant-cases and Controls, but 1.5 in the model comparing Late-adopters and Controls, showing that while both case groups were less likely to visit a dentist for check-up, the effect was more pronounced for the Resistant-cases.

The variable WILL USE SABXRS clearly showed that the Resistant-cases were far more likely to state four years previously that they would not use the SABXRS, and to have abided by that intention. Further, the variable EVER HAD MAMMO which relates to mammography behaviour in the past was also able to predict behaviour four years later; Resistant cases were less likely to have ever had a mammogram at baseline, and four years on still not had a mammogram with the SABXRS, after further letters of invitation and intensive media campaigns. Of course it is possible that they may have had a mammogram elsewhere in the ensuing four years. However, other information collected at baseline suggests that it is probable that a high proportion of Resistant-cases would not have had a screen elsewhere at the cut-off date. Given that intention to use the SABXRS was a strong predictor of later attendance to the SABXRS, it is also likely that this applies to intention with regard to screening elsewhere. At baseline subjects were also asked whether they intended having a mammogram elsewhere in the next two years. Only 19% of the Resistant-cases said (at baseline) that they intended to have a screen elsewhere, suggesting that up to 80% of these women have never been screened despite direct contact with the SABXRS and/or further attempts to induce them to attend.

Further, some cases who had had a mammogram outside the SABXRS at baseline stated that they did not intend to have another one, either at the SABXRS or anywhere else. Table 5.4.4 below cross-classifies EVER HAD MAMMO with intention to have a mammogram in the next two years. Intention in this table is derived by combining WILL USE SABXRS with the question about intention to have a mammogram outside the SABXRS. As can be seen, 69% of the Resistant-cases who had never had a mammogram at baseline maintained that they had no intention of having one within the next 2 years, either at the SABXRS or elsewhere. This compares with 17% for the Late-adopters. Further, 44% of Resistant-cases who had had a mammogram outside the service at baseline did not intend to have another one. The corresponding figure for the Late-adopters is 5%. Although WILL USE SABXRS was not included in the Resistant-case/Control analysis for reasons explained in the introduction above, the question was also asked of controls, and the frequencies included in Table D2.2 of Appendix D. It can be seen that 5% of Controls said they would 'Probably not' or 'Definitely not' re-attend the SABXRS within the next two years, and a further 9% said they 'Probably will'. Section 5.10 will explore the actual re-attendance behaviour of Controls.

The association of intention to have a mammogram with actual mammographic behaviour is also supported in the literature (Appendix B, Table B2.7). An intervention study (Rothman *et al.*, 1993) found intention to attend independently predicted attendance at 12 months following the intervention. The current analysis shows that intention can predict attendance even four years later.

Overall, the Health Motivation and Control variables were good predictors for the Cases-at-4-years model, correctly predicting 59% of Resistant-cases and 80% of Late-adopters, with an overall significance of $P < 0.001$. However, for the Resistant-case/Control and Late-adopter/Control models only 24% of Resistant-cases and 10% of Late-adopters were correctly predicted, unlike the Controls in which correct predictions were made for 93% and 95% respectively.

A model was run excluding the variable WILL USE SABXRS from the Cases-at-4-years model to determine the contribution of this variable to the overall model. This reduced the correct prediction of cases from 59% to 44%, showing that while this variable was important, other Health Motivation and control variables were also important. On the other hand, when the variable WILL USE SABXRS was included in the Resistant-case/Control model, the correct prediction of cases rose from 24% to 70%. However, as explained above it was not intended to use this as a predictor in the models which compared cases with controls, since controls had already attended the SABXRS at baseline (a criterion for selection as control), therefore the variable would not be measuring the same domain between cases and controls at the four year follow-up. Further, it was almost a perfect predictor, and would have resulted in an unstable model. The cross-tabulation of WILL USE

SABXRS ('Definitely would', 'Probably would', 'Probably not', and 'Definitely not') by Resistant-case/Control shows a strong bivariate association. Using the category 'Definitely would' as the reference group, the odds ratios for 'Probably would', 'Probably not', and 'Definitely not' were 10.4 (CI 6.3-17.1), 24.7 (CI 12.9-47.5), and 51.1 (CI 23.8-109.4) respectively, all with a significance of $P < 0.001$. That is, women who said they definitely would not attend the SABXRS were 51 times more likely to be Resistant-cases and not Controls.

5.5 RESULTS - KNOWLEDGE CONSTRUCT

5.5.1 Bivariate Results

No bivariate association (at P < 0.10) was evident in any analysis for the following variables; CANCER-2ND MOST COMMON, KNOWS SIGNS OF BC, LUMP IN BREAST, NIPPLE CHANGE/RETRACTION, CHANGE IN BREAST SHAPE, PUCKERING DIMPLING, PAIN/SORE BREAST, OTHER SYMPTOMS/SIGNS, (the previous 6 relating to specific symptoms/signs of breast cancer known), NUMBER OF SYMPTOMS/SIGNS KNOWN, LUMPS TO BREAST CANCER, AGE MOST AT RISK, KNOW CHECKS FOR BC, DOCTOR EXAMINE BREASTS, MAMMOGRAPHY/X-RAY, and OTHER CHECKS KNOWN (the previous 3 relating to specific checks or test that can detect breast cancer. (Appendix D, Table D2.3).

Significant bivariate associations with a $P < 0.10$ are listed in Table 5.5.1 below. From the list above, it can be seen that most knowledge variables showed no bivariate association, and from Table 5.5.1 it can be seen that no variable was common across all three analyses. For the two models where the dependent variable included the Resistant-cases, common bivariate associations were; NIPPLE BLEEDING/DISCHARGE as a sign of breast cancer, EXAMINE OWN BREASTS as a check for breast cancer, NO. OF CHECKS KNOWN, and KNOWS MAMMO BEFORE DOCTOR (that is, knows that mammography can find breast cancer before a doctor can feel lump). Only two variables distinguished between Late-adopters and Controls, INCIDENCE OF BC and HEARD OF SCREENING.

5.5.2 Multivariate Results

Variables which entered the models based on P-value of < 0.25 are listed in Table 5.5.2 below. Even at this level of significance it can be seen that few entered the Late-adopter/Control model. Table 5.5.3 below lists the independent variables from the logistic regression analysis that were significant predictors in any model at $P < 0.10$. The final models are included in Appendix E, Tables E2.3, E3.3 and E4.3. Four variables remained independent predictors for the Cases-at-4-years and Resistant-case/Control models (that is, the two with Resistant-cases), while all five entered in the Late-adopter/Control model remained independent predictors.

Knowledge of various signs of breast cancer were found to be predictors in the various analyses, but none stood out as of any meaningful significance; some showed cases to be knowledgeable about the specific sign, while others showed the reverse. For the Resistant-cases models, two variables were common predictors, EXAMINE OWN BREAST and KNOWS MAMMO FINDS BEFORE DR. Compared to both Late-adopters and Controls, Resistant-cases were less likely to specify breast self examination as a method of finding cancer, and less likely to know that mammography can find cancers even before a doctor can feel a lump.

Both Resistant-cases and Late-adopters were more likely to specify lung cancer as the most common cancer for women in their age group compared with Controls (variable CANCER-MOST COMMON). Late-adopters were more likely to specify a higher incidence of breast cancer at baseline than Controls; from the variable INCIDENCE OF BREAST CANCER, Late-adopters were 2 times *less* likely to answer 1 in 60 as the incidence against the reference group 1 in 15 (the correct incidence at the time of the baseline survey). Late-adopters were also significantly more likely to say they had not heard of mammography screening at baseline.

5.5.3 Discussion

The analysis of the knowledge variables at baseline found that few predicted initial attendance, and that all women (cases and controls) tended to have uniformly high, or uniformly low knowledge of specific variables about knowledge of mammography and breast cancer.

At the baseline analyses it was found that subjects who specified lung cancer rather than breast cancer as the most common cancer for women in their age group were more likely to be cases (Chapter 4, Table 4.4.3). In this analysis the same difference was found between Resistant-cases and Controls, but not between Resistant-cases and Late-adopters. Knowledge at baseline, that breast cancer was the most common was 68% for Controls , 67% for Late-adopters, and 58% for Resistant-cases. Further, the difference between the two case groups is linked to actual mammography experience; 62% of Late-adopters had ever had a mammogram at baseline (outside the SABXRS) compared with 45% of Resistant-cases. A further breakdown of the data shows that both Resistant-cases ($P = 0.01$) and Late-adopters ($P = 0.03$) who had a mammogram at baseline also correctly identified breast as the most common cancer site for women.

The information presented in the previous paragraph suggests that knowledge about breast cancer is linked to mammography experience. However, awareness or knowledge alone does not change behaviour. The finding in both the baseline and current analyses of an association between nominating lung cancer as the most common and being a Resistant-case, perhaps indicates that the anti-smoking campaigns linking smoking with lung cancer have raised awareness or fear about lung cancer, but not necessarily behaviour. A cross-tabulation of the cancer specified as the most common by smoking status (for all subjects) shows that those who nominated lung cancer were also significantly more likely to be smokers ($P = 0.001$). Thus, awareness alone is not sufficient as shown by the fact that a high proportion of Resistant-cases did know that breast cancer is the most common, just as smokers are aware of the risk of lung cancer.

A related variable is actual INCIDENCE OF BREAST CANCER, where it was found that Late-adopters were 2 times *less* likely to answer 1 in 60 as the incidence against the reference group 1 in 15, or conversely, more likely to specify the correct higher incidence than Controls. Late-adopters were also significantly more likely to say they had not heard of mammography screening at baseline, suggesting a proportion of them presented for screening after finding out about it at the interview. Anecdotal evidence from the interviewers supports this premise. At the debriefing, interviewers commented that quite a number of women were interested in more information about the SABXRS and indicated they would have a mammogram with the Service. The previous construct did in fact, show a strong association between intention and action.

Overall, all three knowledge analyses show that the variables left in the final models were reasonable predictors of distinguishing between Resistant-cases and Late-adopters, but not between the two case groups and controls. The Cases-at-4-years model, correctly predicted 47% of Resistant-cases and 75% of Late-adopters, while only 14% and 12% of Resistant-cases and Late-adopters were predicted in the other two models. All models had a high statistical significance.

5.6 RESULTS - SUSCEPTIBILITY CONSTRUCT

5.6.1 Bivariate Results

Appendix D, Table D2.4 lists the variables included in this construct.

For all three analyses, few of the 18 variables showed a significant bivariate association. This includes the variable EVER HAD BC which refers to women having had breast cancer themselves. However, this variable was not considered for inclusion in the multivariate analysis, as it is SABXRS policy not to screen women with prior breast cancer, unless they had had breast cancer more than 10 years ago, or if less than 10 years they are not under the regular care of a doctor. Hence, it is likely that the Cases with breast cancer were rejected by the Service. Even without this possible bias, the small numbers would without doubt have caused numerical problems in logistic regression; only one Late-adopter had previous breast cancer compared with 10 Resistant-cases.

Significant bivariate associations with a $P < 0.10$ are listed in Table 5.6.1 below.

5.6.2 Multivariate Results

Variables which entered the models based on a *P*-value of < 0.25 are listed in Table 5.6.2 below. The final models are included in Appendix E, Tables E2.4, E3.4 and E4.4.

Table 5.6.3 below lists the independent variables from the logistic regression analysis that were significant predictors in at least one of the models at $P < 0.10$.

Two variables remained independent predictors in the Resistant-cases models. The final Cases-at-4-years model found that OUTCOME OF EXPERIENCE WITH BC and CLOSENESS TO PERSONS WITH BC predicted persistent non-attendance. This latter variable was also significant in the Resistant-case/Control model together with EVER HAD LUMP. OUTCOME OF EXPERIENCE WITH BC shows that Resistant-cases were more likely to be in the 'Other' category (compared to those in 'Died of BC only'), but it is not known what experiences were included in this category, as it was anticipated that the majority of responses would be covered by the categories listed. The CLOSENESS TO PERSONS WITH BC variable shows that Resistant-cases were *more* likely to have been extremely close to person/s known with breast cancer than attenders (both Late-adopters and Controls), against the hypothesised direction of association. The same result was found in the base-line model where this variable was significant (Chapter 4, Table 4.5.3). Also Resistant-cases were more likely to have had a breast lump at base-line compared with Controls, again opposite to the predicted association.

The Late-adopter/Control model found that compared with Controls (who came initially), Late-adopters were *more* likely to be concerned that they may have breast cancer and to have spoken to a doctor about this concern. The odds ratios indicate that this is against the predicted direction, a result also found in the baseline analyses (Chapter 4, Table 4.5.3). Late-adopters were also more likely to have known an acquaintance with breast cancer in comparison to controls, again against the predicted direction of association.

5.6.3 Discussion

Resistant-cases were more likely to have had a breast lump themselves and to have known someone extremely close to them with breast cancer, yet they did not attend the SABXRS despite having had an appointment and in most cases at least two letters of invitation. That is, from these variables the Resistant-cases should have perceived themselves as more susceptible. A possible explanation would be that these women are being screened outside the SABXRS.

Table 5.6.4 below classifies cases with a breast lump and those who knew someone extremely close with breast cancer by whether they had a screen outside the SABXRS at baseline. It can be seen that 74% of both Resistant-cases with a breast lump and Late-adopters with a breast lump had had a mammogram outside the SABXRS. This shows that the Late-adopters switched to the SABXRS, while the Resistant-cases may have continued to have mammograms outside the Service or stopped having them. For those who did not have a lump, only 29% of Resistant-cases had had an outside mammogram, while 56% of Late-adopters had, showing not only that the Late-adopters switched to the SABXRS, but also that they were already more likely to be aware of the benefits of mammography at baseline. For cases who knew someone with breast cancer, the table shows that both Resistant-cases and Late-adopters were more likely to have had a mammogram outside if they did *not* know someone to whom they were extremely close. Hence, it appears that for this sample, knowing someone with breast cancer to whom one is extremely close does not directly affect one's own feeling of susceptibility.

The finding that Late-adopters were *more* likely to be concerned that they may have breast cancer and spoken to a doctor about this concern is at odds with the predicted direction of association. This result was also found in the baseline analyses (Chapter 4, Table 4.5.3). A plausible explanation may be that the Late-adopters had a breast problem at baseline, which was a reason for not attending at that time.

As for the knowledge construct, these analyses had few variables that remained in the final models, and those that remained differentiated between Resistant-cases and Late-adopters (Cases-at-4-years model), but not between the comparison of either case group and the Controls.

5.7 RESULTS - BARRIER CONSTRUCT

5.7.1 Bivariate Results

Variables investigated in the barrier construct and bivariate *P*-values are listed in Appendix D Table D2.5.

For the baseline bivariate analyses, variables showing no association were mainly those relating to advantages of finding breast cancer at an early stage and benefits of mammography, or questions focussing on the positive aspects of mammography. However, those focusing on negative aspects were found to have been associated invariably with non-attendance at baseline and remain associated with persistent non-attendance four years later.

Significant bivariate associations with a $P < 0.10$ in any of the three analyses are listed in Table 5.7.1 below. It can be seen that as for the base-line analyses (Chapter 4, Table 4.6.1) a large number of the barrier variables show highly significant bivariate associations. As expected, fewer barriers distinguish the Late-adopters from the Controls, compared with the barriers that differentiate Resistant-cases from both Late-adopters and Controls.

5.7.2 Multivariate Results

Variables which entered the models based on a *P*-value of < 0.25 are listed in Table 5.7.2 below. It can be seen that as for the base-line models, most barrier variables were entered in the two Resistant-case models.

The final models are included in Appendix E. The variable NO. OF PERCEIVED ADVANTAGES was excluded from the final Resistant-case/Control model due to numerical problems. As for the base-line analyses, two barrier models were run, one with the BARRIER SCORE (E2.5a, E3.5a and E4.5a), and the other with the individual barrier items that comprise the score (E2.5b, E3.5b and E4.5b).

Table 5.7.3 below lists the independent variables from the logistic regression analysis that were significant predictors in any of the three final models at $P < 0.10$. The table relates to the models with the BARRIER SCORE.

More variables remained predictors for the Resistant-case/Control model than for either of the other two. The only variable common to all three analyses was HOURS WORKED. Compared with women who did not work, those who worked 16-39 hours were significantly *less* likely to be Resistant-cases than Late-adopters or Controls.

In the Cases-at-4-years model which compares Resistant-cases and Late-adopters, other significant predictors showed that those who did not state CURE MORE LIKELY as an advantage, who were 'Quite/extremely' embarrassed by a female radiographer, who only sometimes had access to a car, and who stated that known problems with mammography would stop them from attending (PROBLEM WOULD STOP), were more likely to be persistent non-attenders (all as hypothesised).

The Resistant-cases model which compares Resistant-cases and Controls found similar results, but with stronger associations, and more barriers as was hypothesised, since this analysis compares initial attenders with those who have remained non-attenders after four years. For example, PROBLEM WOULD STOP was also a significant predictor showing that Resistant-cases were 6 times more likely to state that problems they perceived with mammography would stop them from having one (OR = 6.3) - the corresponding OR for the Cases-at-4-years analysis was 3.8. The OR in relation to embarrassment by a female radiographer was also almost doubled. The BARRIER SCORE strongly differentiated between Resistant-cases and Controls; those with the lowest score and hence most barriers were 7 times more likely to be Resistant-cases. Additional perceived barriers showed that compared with Controls, Resistant-cases were 4 times more likely not to perceive that mammography was IMPORTANT FOR AGE, 4.5 times more likely to agree that mammography was MORE TROUBLE THAN WORTH, nearly 4 times more likely not to know that some women are ASKED BACK FOR TESTS. The structural barriers showed Resistant-cases to have DIFFICULTY WITH COMMITMENTS and twice as likely to have no ACCESS TO CAR. However, against the hypothesised result Resistant-cases were *less* embarrassed by a male radiographer.

The BARRIER SCORE, IMPORTANT FOR AGE, and ASKED BACK FOR TESTS variables showed the same effect for the Late-adopters model but with lower odds ratios as hypothesised.

5.7.3 Discussion

As was the finding in base-line models, the variables in this construct show that perceived and structural barriers are indeed strong predictors of non-attendance immediately following recruitment and are sustained after further attempts at recruiting the same potential clients. Further, the predicted direction is mostly supported. One variable where the association was in the opposite direction was EMBARRASSED BY MALE which showed that the Resistant-cases were less embarrassed than Controls. However, a plausible explanation for this may be that the Controls chose to have their mammograms at the SABXRS knowing that only female radiographers were employed by the Service, whereas with a service outside the program they may well have encountered a male radiographer. Further, it is known that some of the cases did in fact have mammograms outside the SABXRS.

For the variable HOURS WORKED, the referent group was 'none' assuming that non-attendance would be associated with working. This was not the result found for either model with the Resistant-cases; that is the Late-adopters and Controls were more likely to work. However, in the base models where this variable was significant it was found that non-attenders were more likely to work, which implies that the cases at base-line who are now Late-adopters were also the ones who worked. This is in fact the case; at base-line 40% of Late-adopters worked, but only 27% of Resistant-cases.

In this construct the perceived and structural barriers at baseline were found to strongly differentiate between Resistant-cases and Controls, and to a much lesser extent between Resistant-cases and Late-adopters, and between Late-adopters and Controls. This indicates that the barriers at baseline may have been overcome by Late-adopters (they were in a state of readiness to change their perceptions), while for the Resistant-cases the barriers persist. The BARRIER SCORE result supports this view; it did not differentiate between Resistant-cases and Late-adopters, but strongly differentiated between Resistant-cases and Controls. The model that included the individual barrier items (Appendix E, Model E3.5b) rather than the BARRIER SCORE found the following items to be significant at $P < 0.10$; NEED SYMPTOMS (OR = 7.8, $P < 0.001$), TOO MUCH TROUBLE (OR = 9.2, $P = 0.006$), RATHER NOT THINK ABOUT IT (OR = 2.0, $P = 0.09$), and, PAINFUL (OR = 2.08, $P = 0.05$). For the Cases-at-4-years that included the individual barrier items the only significant item was NEED SYMPTOMS (OR = 2.0, $P = 0.05$).

Overall, the Cases-at-4-years model, correctly predicted 52% of Resistant-cases and 79% of Late-adopters, the Resistant-case/Control model predicted 55% of Resistant-cases and 93% of Controls, and the Late-adopter/Control model 39% of Late-adopters and 89% of Controls, all with an overall P-value of < 0.001 for the final model.

5.8 RESULTS - INFLUENCE CONSTRUCT

5.8.1 Bivariate Results

Appendix D, Table D2.6 lists the variables and bivariate P-values included in this analysis.

Significant bivariate associations with a $P < 0.10$ are listed in Table 5.8.1 below. As for the barrier construct several strong associations are evident for the models which include the Resistant-cases, but not the Late-adopter/Control model. The only variable significant across all analyses is WOULD HAVE SX ON DR RECOM, with a P-value of < 0.001 in all three. This was also the only variable with a bivariate association (again at < 0.001) in all four models in the baseline analysis (Chapter 4, Table 4.7.1).

5.8.2 Multivariate Results

Variables which entered the models based on a P-value of < 0.25 are listed in Table 5.8.2 below. It can be seen that more variables were entered in the Resistant-case/Control model than the other models, again showing greater variation between persistent non-attenders (Resistant-cases) and initial attenders (Controls), than the other comparisons.

The final models are included in Appendix E, Tables E2.6, E3.6 and E4.6. Table 5.8.3 below lists the independent variables from the logistic regression analysis that were significant in any model at $P < 0.10$.

WOULD HAVE SX ON DR RECOM remained the strongest independent predictor in all models. This question asked subjects how likely it would be that they would take a doctor's recommendation to have a screening mammogram (Definitely would, Probably would, Probably would not, Definitely would not). A dose-response effect is seen in all analyses. For the Resistant-case/Control analysis where the greatest effect is seen (as expected), those who said they 'Probably would' attend were 7 times more likely to be Resistant-cases against the reference group 'Definitely would', while those who were unsure or said 'Definitely not' were 37 times more likely to be Resistant-cases. Even though the latter figure has a wide confidence interval for the odds ratio, the lower limit is still high at 12.3. The variable DOCTOR WOULD INFLUENCE relates to an unprompted question regarding who would influence them in having a mammogram; Resistant-cases were two times more*unlikely* to mention a doctor than both Late-adopters and Controls. They were also more likely to specify fewer influences overall (NO. OF INFLUENCES), and to disapprove of the use of the electoral roll for recruitment purposes. Resistant-cases were also more likely not to have a partner (EMOTIONAL SUPPORT FROM PARTNER) compared with Controls who had emotional support from a partner, and to be involved in tutoring/school help and belong to a senior citizens club. The variable CONFIDANT is shown in the table because it achieved overall significance (P = 0.06) for the Resistant-case/Control model, but none of the individual comparisons were significant. However, on the basis of overall significance this variable was entered in the final overall model.

A variable that was significant in the Late-adopter/Control model, but not the others was SHOULD ALL GET GP INVITE. Late-adopters were twice as likely to disapprove of using general practitioner letters of invitation. Given that some of the Late-adopters were GP invitees who originally (at base-line) did not attend on the basis of the letter, and all GP Controls attended without delay, this result is understandable.

5.8.3 Discussion

As for the baseline models (Chapter 4, Table 4.7.3), the strongest Influence predictor was WOULD HAVE SX ON DR RECOM. Other significant outcomes in these analyses suggest that the Resistant-cases have made a conscious decision not to attend the SABXRS and are not likely to be influenced by others. This suggests there may be little the SABXRS can do to attract them. The finding that they were more likely to voluntarily provide tutoring or school help and be members of a senior citizens club suggests other pursuits in their life may be more important, and that either mammography is not a priority or the perceived barriers are so entrenched that no persuasion will change their minds.

Overall, the Cases-at-4-years model, correctly predicting 51% of Resistant-cases and 83% of Late-adopters, the Resistant-case/Control model predicted 45% of Resistant-cases and 94% of Controls, and the Late-adopter/Control model 25% of Late-adopters and 92% of Controls, with an overall model P-value of < 0.001 for all three final models.

5.9 RESULTS - OVERALL MODELS

5.9.1 Results

This section presents the results of the final overall models drawing on the results of the previous models by study construct (Socio-demographic, Health Motivation and Control, Knowledge, Susceptibility, Barriers, and Influences). As for the final overall base-line models, the variables entered in these models are those found to be significant at $P < 0.10$ from the final logistic regression models for each of the constructs.

Variables which entered the models are listed in Table 5.9.1 below. More variables entered the Resistant-case/Control model as was the case particularly for the Barrier and Influence constructs. Fewer differences would be expected between the two case groups (Resistant-cases and Late-adopters), both being initial non-attenders, as well as between the two groups of attenders, initial attenders (Controls) and delayed attenders (Late-adopters).

The final models are included in Appendix E, Tables E2.7, E3.7 and E4.7. Table 5.9.2 below lists the independent variables from the logistic regression analysis that were significant predictors in any of the models at $P < 0.10$.

AGE remained an independent predictor in the Cases-at-4-years model, showing that the individuals in the oldest age group (60+) were twice as likely to be Resistant-cases, and that the Late-adopters were more likely to be aged 50-59. The odds ratio for the 40-49 year group (not statistically significant) suggests that Resistant-cases are also more likely to be in the youngest age group, and the frequencies (Appendix D, Table D1) show that this is indeed the case. There is a rational explanation for this; women in the 40-49 year age group would not have been sent a re-invitation to the Service, as the target population is women aged 50-69.

HIGHEST QUALIFICATION also remained an independent predictor in the Cases-at-4-years model, but not the other three socio-demographic variables entered. This variable was also significant in the Resistant-case/Control model, showing that Resistant-cases were more likely to have a bachelor degree or higher than both Late-adopters and Controls.

All other socio-demographic variables entered in the Resistant-case/Control model remained significant, while for the Late-adopter/Control model three of the four entered remained significant (AGE was not an independent predictor). The variable NUMBER OF CHILDREN shows a similar effect in both models; women with 5 or more children (reference group 'none') were more likely to be cases, but the difference is greater between Resistant-cases and Controls than between Late-adopters and Controls. A similar result was obtained in the overall baseline models where this variable remained significant (Chapter 4, Table 4.8.2). Another significant variable common to both models that included Controls was INCOME. In the overall baseline models, where income was significant, it was found that non-attenders were more likely to be in the middle income range. This same effect is seen between the Late-adopters and Controls, but the Resistant-cases compared to Controls are more likely to be in the highest income group.

For the variables entered from the Health Motivation and Control construct, FREQUENCY OF BSE remained a predictor in the two Resistant-cases models, with similar odds ratios; Resistant-cases did BSE *more* frequently than both Late-adopters and Controls, but no difference was found between Late-adopters and Controls, that is, the two groups of attenders (both initial and delayed). This indicates that the effect seen at baseline for FREQUENCY OF BSE was mainly attributed to those cases who remained persistent non-attenders. However, for the variable DR CHECKED BREASTS the similarity is between the two groups of initial non-attenders; both Resistant-cases and Late-adopters were more likely to have had a breast exam by a doctor at baseline.

SMOKING and LAST TIME SAW DR remained predictors in the Late-adopter/Control model, and DENTIST remained significant in the two models in which it was entered. SAMPLE TYPE which was entered into the Resistant-case/Control model did not remain an independent predictor in the overall model, thus the finding from the Health Motivation and Control construct that Resistant-cases were more likely to be from the GP sample was found to be a confounder for variables from other constructs.

Two of the three variables (CASE TYPE, EVER HAD MAMMO and WILL USE SABXRS) from the Health Motivation and Control construct that applied only to the Cases-at-4-years model remained predictors. EVER HAD MAMMO which relates to having a mammogram outside the SABXRS at baseline did not independently discriminate between Resistant-cases and Late-adopters. However, the effect found in the construct model that FTA-cases were more likely to be Resistant-cases persisted. Further, WILL USE SABXRS regarding future intentions (collected at baseline) remained a strong predictor; those who said they would 'Definitely not' use the SABXRS were 6 times more likely to be Resistant-cases compared with 'Definitely would'.

None of the knowledge variables remained independent predictors in the two Resistant-cases models, and only two knowledge variables remained significant in the Late-adopter/Control model, CANCER MOST COMMON and HEARD OF SCREENING. Women who nominated lung cancer as the most common were more likely to be Late-adopters, as were those who had not heard of screening mammography at baseline.

From the Susceptibility construct, CLOSENESS TO PERSONS WITH BC remained the only independent predictor in the Cases-at-4-years model. An additional predictor for the Resistant-case/Control model was EVER HAD LUMP. For the Late-adopter/Control model CONCERN MAY HAVE BREAST CANCER and SPOKEN TO DR ABOUT CONCERN continued to show that Late-adopters were more concerned than Controls at baseline.

Only two of the barrier variables entered in the Cases-at-4-years model remained independent predictors; CURE MORE LIKELY and SHOULDN'T LOOK FOR ILLNESS, while most entered in the Resistant-case/Control and Late-adopter/Control models remained independent predictors. The BARRIER SCORE still strongly differentiated Resistant-cases from Controls and to a lesser extent Late-adopters from Controls. In both models in which the individual BARRIER SCORE items were entered (E3.7b and E4.7b), the items NEED SYMPTOMS and TOO MUCH TROUBLE remained significant, with high odds ratios.

From the Influence construct the variable WOULD HAVE SX ON DOCTOR RECOM remained a strong predictor in all three models. After adjusting for the confounding effect of a large number of variables, those who said they would not take a doctor's recommendation to have a screening mammogram, or were unsure about it, were significantly more likely to be Resistant-cases (OR = 3.1 in Cases-at-4-years model and 23.7 in Resistant-case/Control model). Although the strength of this association was lessened in the Late-adopter/Control model compared with the Influence construct model (Table 5.8.3), Late-adopters were still 4 times more likely to say they 'Probably' would attend rather than 'Definitely', in comparison to Controls.

Overall these final models are good predictors of persistent non-attendance and delayed attendance. In the Cases-at-4-years model, the variables correctly predicted 69% of Resistant-cases and 84% of Late-adopters, while in Resistant-case/Control model 74% of Resistant-cases and 95% of Controls were correctly predicted. For the Late-adopter/Control model 56% of Late-adopters and 88% of Controls were correctly predicted. All models were significant at $P < 0.001$.

Comparing the final overall models presented here, which relate to attendance status of study subjects four years later, with the final overall base-line models (Chapter 4, Table 4.8.2), it is evident that many of the variables that predicted non-attendance at base-line also predict persistent non-attendance. Only some key aspects of this comparison will be drawn out here.

In the base-line analyses LIFETIME OCCUPATION was significant in 3 of the 4 models, showing that women with managerial or professional occupations were more likely to be non-attenders. This effect was also found between Late-adopters and Controls. The variable HIGHEST QUALIFICATION was significant in the Cases-at-4-years and Resistant-case/Control models here and showed that women with a bachelor degree or higher were more likely to be Resistant-cases than both Late-adopters and Controls. Given the high correlation between having a higher degree and working as a professional or manager (see Table 5.9.3 below), these two variables point to a similar conclusion which is further supported from the finding in both the base-line analyses and the follow-up analyses that Resistant-cases are more likely to be on higher incomes.

NUMBER OF CHILDREN was significant in the baseline Spontaneous FTA model, and in the follow-up Resistant-case/Control and Late-adopter/Control models, all showing that women with more children were more likely to be non-attenders at baseline, and Resistant-cases or Late-adopters at follow-up. It should be noted that the CASE TYPE variable in the current analysis found that FTA-cases were more likely to be persistent non-attenders, which partly explains why the NUMBER OF CHILDREN variable was significant only for the FTA model at base-line.

The SMOKING variable which was significant only in the final overall Late-adopter/Control model here, was a predictor in both the FTA models at baseline. The health behaviour relating to DENTIST was predictive in three of the models at base-line and the Resistant-case/Control and Late-adopter/Control models at the follow-up. As indicated above the CANCER MOST COMMON variable which identified cases as those believing lung cancer was the most common, in these analyses showed the same effect in the Late-adopter/Control model.

The two variables relating to embarrassment, asked separately with regard to a female and male radiographer, were both independent predictors in the Resistant-case/Control model, but not any of the overall baseline models, showing that this variable is an important determinant of persistent non-attendance.

The BARRIER SCORE predicted non-attendance in two of the base-line models and the Resistant-case/Control and Late-adopter/Control models here, thus separating cases from controls but not Resistant-cases from Late-adopters. The barrier of ACCESS TO CAR was significant in both baseline FTA models, and the same two models here, again separating cases from controls but not Resistant-cases from Late-adopters.

Another major conclusion that can be drawn from a comparison of the base-line and follow-up models is the influence that a doctor has on encouraging actual attendance from the variable WOULD HAVE SX ON DOCTOR RECOM. Women who said they would not follow a doctor's advice with regard to mammography were more likely to be the non-attenders at baseline (cases) and the persistent non-attenders at follow-up (Resistant-cases).

5.9.2 Discussion

The socio-demographic variables which remained in the overall models provide an insight into some groups that need to be specifically targeted. These include older women (60+) and the higher educated. The latter in particular, may be utilising the private sector for mammographic screening. This information is available from the Omnibus Surveys which will be investigated in PART IV. Unless women pay for the full cost of a bilateral mammogram, in theory they may not obtain a mammogram under Medicare without symptoms or a family history. Although women with a family history can claim a Medicare rebate, by definition they are having a screening mammogram if they have no symptoms, and thus it could be argued that they should be encouraged to join the official screening program.

From the Health Motivation and Control construct, the SMOKING variable remained an independent predictor in the Late-adopter/Control model showing that women who had smoked in the past, but were not smoking at the time the interviews were conducted, were twice as likely to be Late-adopters.

The health behaviour variable DENTIST has remained a strong independent predictor, in the two models with Controls, thus differentiating between both case groups and Controls, but not between the two case groups. Both Resistant-cases and Late-adopters were more likely (at baseline) to visit a dentist only when problems occurred, but Controls went for regular check-ups. It may be that Late-adopters also changed their dental behaviour in the intervening 4 years. On the other hand, to change dental behaviour usually involves additional expenditure, whereas a mammogram at the SABXRS is provided free.

The variable SAMPLE TYPE which refers to the initial method of recruitment (Spontaneous or GP) did not predict persistent non-attendance. This suggests that method of recruitment is important for initial attendance but not continued non-attendance at the SABXRS after 4 years.

EVER HAD MAMMO which relates to having a mammogram outside the SABXRS at baseline was found to be an independent predictor in the construct model which examined only Health Motivation and Control variables (section 5.4.2 above), but it did not independently discriminate between Resistant-cases and Late-adopters in the final overall model. Thus, although a high proportion of cases had a history of prior mammography outside the SABXRS at baseline, this did not determine which cases would later switch to the SABXRS. However, the other two variables applicable only to the Cases-at-4-years model (CASE TYPE and WILL USE SABXRS) remained independent predictors in the overall model. CASE TYPE (FTA, Cancel), showed that Resistant-cases were more likely to have failed to attend without notice rather than cancel the initial appointment. For the Spontaneous FTA group, it appears that these women changed their mind about having a mammogram with the SABXRS at baseline (since they made the appointment themselves), and have not been not convinced to attend since. For the GP FTA group it is more likely that they never intended attending, and disregarded the GP letter and letters of invitation from the SABXRS a year later. The variable relating to intention, WILL USE SABXRS about intention to use the SABXRS remained the most important predictor that distinguished between Resistant-cases and Late-adopters, a finding supported by the literature.

The finding that the BARRIER SCORE continued to separate both Resistant-cases and Late-adopters from Controls, suggests that the barriers continue to prevent the Resistant-cases from having a mammogram with the SABXRS, but are no longer a problem for the Late-adopters. The latter may have changed their perceptions in the intervening four years, or may now perceive that the benefits outweigh the costs (or problems).

A finding that should be addressed is that Resistant-cases were more likely to be subjects who at the baseline interview said they would be embarrassed by a female radiographer compared with Controls. The finding that Resistant-cases were less embarrassed by a male radiographer than Controls may at first appear contradictory. However, further breakdown of the data provides a rational explanation. It is true that Controls were more likely to be embarrassed by a male radiographer, and it was suggested in the barrier construct discussion above, that this may be a factor in choosing the SABXRS, because to date it has only employed female radiographers. However, every subject who said they would be embarrassed by a female radiographer (cases and controls) *also* said they would be embarrassed by a male radiographer, with the level of embarrassment being the same or greater for the male. Hence, the issue that needs to be addressed relates to women who find it generally embarrassing to undress from the waist up.

Table 5.9.4 below compares the level of embarrassment by attendance status to the SABXRS by country of birth, language and religion. It can be seen that a high proportion of both Controls and Late-adopters stated at the baseline interview that they would be embarrassed only by a male radiographer, the proportion being higher for non-English speaking women. A higher proportion of Late-adopters stated they would be embarrassed by both male and female compared with the Controls. Hence, this may have been a factor in initial non-attendance. However, the highest proportions for embarrassment by both a male and female radiographer occur amongst the Resistant-cases. Women from a non-English speaking background (NESB) were more embarrassed, particularly the southern European and other NESB women except for the northern European. Greek women in the sample in particular appear to have a problem in this regard, as indicated by both language (40% of Greek Resistant-cases embarrassed by both) and religion (highest amongst Orthodox which is the most likely religion of Greek women). The sample of non-English speaking women was too small in this study to evaluate this issue more conclusively, but the available data suggest further research in this regard may be useful in developing recruitment strategies.

The key outcomes from the comparison of these results at follow-up with those at base-line is that several variables separated cases from controls at both baseline and follow-up, but that differences were also evident between Resistant-cases and Late-adopters. This suggests that level of readiness can be predicted early and supports the conceptual framework proposed for this thesis, which incorporates the expanded Theory of Reasoned Action and the Transtheoretical Model of Readiness Stage into the Health Belief Model as outlined in Chapter 1, using Rogers' categorise of stage of readiness. That is, action with regard to mammography behaviour depends on stage of readiness for adoption of the behaviour. The cases at base-line were at varying stages of readiness as proven by their later behaviour. Intention predicted later attendance, and a clear dose-response effect was evident, where the odds of being a Resistant-cases increased along the scale of intention from definitely would attend, probably would, probably not, and definitely not. The finding that none of the knowledge variables predicted mammography behaviour further supports the theory that knowledge alone is not sufficient for action.

Another major conclusion that can be drawn from a comparison of the base-line and follow-up models is the influence that a doctor has on encouraging actual attendance. The variable WOULD HAVE SX ON DOCTOR RECOM which shows that women who said they would follow a doctor's advice with regard to mammography were more likely to be attenders at baseline (Controls) and the new attenders at follow-up (Late-adopters). Conversely those who were non-attenders at baseline and persistent non-attenders at follow-up were women who said they would not follow a doctor's advice. Thus, although recruitment through doctor support should be encouraged, ways of targeting women who would not be influenced by a doctor need to be addressed.

In conclusion, it is clear that information collected at baseline can predict later attendance, and that attenders and non-attenders cannot be studied as homogeneous groups if the results are to be used to inform recruitment strategies aimed at achieving high participation rates.

5.10 RE-ATTENDANCE BY CONTROLS AND NUMBER OF ATTENDANCES AFTER INTERVIEW FOR ALL SUBJECTS

Attendance after interview for control subjects refers to re-attendance to the SABXRS, since the criteria for selection of controls was an attendance at SABXRS. Overall, 89.1% of the Controls had re-attended by 31/12/95. The proportion was slightly higher for the GP sample (90.2%) than the Spontaneous sample (87.9%). Of those who attended, most had done so within two years of the interview: 92.1% for the Spontaneous sample and 94.8% for GP sample. This is certainly within the National program's objective of over 75%.

It is suggested that a high proportion of the 10% who did not re-attended represent Rogers' *disenchantment discontinuance* group who reject an idea as a result of dissatisfaction with its performance (Rogers, 1983, p 187). As with the cases, there is a clear relationship between intention to attend the SABXRS (WILL USE SABXRS in two years) and actual attendance as can be seen in Table 5.10.1. This table presents overall figures, since the numbers not re-attending is small. Of those who said they 'Definitely would' re-attend most (93%) did, and visa versa (those who said 'Definitely not', mostly did not re-attend).

In the final overall models presented in Table 5.9.2, it was found that FTA cases were more likely to be Resistant-cases. Amongst cases who attended, it is also apparent that the FTA-cases took longer to adopt the behaviour than the Cancel-cases, as indicated by number of attendances in Table 5.10.2. As expected, Controls had the highest number of attendances after interview followed by the Cancel-cases, then the FTA-cases. All subjects had the same opportunity to attend after interview, hence these data further confirm the suggestion that the three case groups (FTA, Cancel and Control) represented varying states of readiness at baseline. Fewer attendances indicates a longer time lapse between interview and attendance after interview, although some women may have attended early then discontinued. Those screened 3 or 4 times within the 4 year period would be women screened annually, on the basis of having a very strong family history or previous breast cancer.

It was postulated in the introduction to this chapter that late adopters were more likely to discontinue than early adopters. However, the follow-up period is not long enough to test this premise for these subjects.

5.11 MAMMOGRAPHIC HISTORY (OUTSIDE SABXRS) OF CASES

5.11.1 Introduction

During the examination of the baseline data it became evident that a high proportion of cases had been screened outside the SABXRS at the time of the baseline interviews. This was an unexpected finding, as ostensibly screening mammography is not (and was not at the time) claimable under Medicare, except for women with a personal or family history of breast cancer and those with breast symptoms. Overall, 54.2% of cases had had a mammogram outside the SABXRS at baseline. Given the high rates of external mammography for cases, it was determined that a separate section was warranted to explore this phenomenon.

The variable EVER HAD MAMMO defines whether the subjects in the study had ever had a mammogram prior to the baseline interview. By definition all controls at baseline had had a mammogram at the SABXRS. Hence, the variable EVER HAD MAMMO could not be entered into the models reported in Chapter 4 which compared cases (defined as non-attenders to the SABXRS) with controls (attended SABXRS).

In sections 5.3 to 5.9 above which investigated attendance status at the SABXRS four years after the baseline interviews, EVER HAD MAMMO was entered into the Cases-at-4-years model which compared Resistant-cases (still no attendance at the SABXRS) with Late-adopters (no attendance at baseline, but attended by 31/12/95). While this variable was statistically significant in the bivariate analysis, it was not found to be an independent predictor in the final overall model, after adjusting for the effect of other variables included in the model (section 5.9). Thus, although a high proportion of cases had history of prior mammography outside the SABXRS at baseline, this did not determine which cases would later switch to the SABXRS.

In the above analyses all cases were combined. The next section provides details of mammography prior to the baseline interview by the four case groups, defined in the baseline analyses in Chapter 4; Spontaneous FTA, Spontaneous Cancel, GP FTA, GP Cancel. However, due to small numbers and zero cells, this analysis is largely descriptive. The purpose is to gain an insight into mammography occurring outside the official screening program during the early phases of its establishment.

5.11.2 Cases with Mammographic History at Baseline by Selected Variables

Overall 59.4% of the Spontaneous cases and 51.2% of the GP cases had had a history of mammography at baseline. The proportions for women aged 50-69 (the target age group) were 45.0% for the Spontaneous cases and 51.2% for the GP cases. From the outset it was acknowledged that the study population was not representative of the general population. In particular, the Spontaneous sample was expected to differ from the general population in terms of factors that characterise a self motivated group who make an appointment with the SABXRS on their own volition. However, based on the extent of mammography by the GP cases, it appears that the GP sample may also differ significantly from the overall population of women listed as GP clients. The doctors in the practices from which the GP sample was drawn were generally supportive of the SABXRS, and may have encouraged mammography in the private sector prior to participating in the trial of recruitment by GP invitation to the SABXRS.

Figure 5.11.1 shows that within the study sample of cases, the proportions with a history of mammography were higher for Cancel-cases than FTA-cases in both samples. For the Spontaneous sample 46.4% of FTA-cases and 65.5% of Cancel-cases had had a mammogram outside the SABXRS at baseline ($P = 0.02$); the corresponding figures for the GP sample were 40.0% and 62.8% ($P < 0.001$).

In the analysis of the Knowledge construct in Chapter 4 it was found that Cancel-cases from both samples were more likely to know the correct incidence of breast cancer than Controls. Since Cancel-cases were more likely to have had a history of mammography at baseline this suggests that those who have mammograms outside the program may be more motivated to find out more about it. Further, they would have needed a referral from a doctor, and therefore were more likely to have had a one-to-one discussion about breast cancer, whereas Controls did not require a doctor consultation before attending.

Figure 5.11.1 also shows that a prior history of mammography was related to later attendance at the SABXRS (by December 1995), except for the Spontaneous Cancel-cases where the proportion who were Late-adopters was equal for cases with and without a prior history.

Table 5.11.1 shows the proportion of cases with a history of mammography prior to interview by age. It can be seen that at baseline, the highest proportions were in the 40-49 year group for both groups of Spontaneous cases (50.0% for FTA and 69.6% for Cancel). The GP sample did not include women under 50. The lowest proportion was in the older age group for the GP FTA-cases (26.9%). For the Late-adopters, all Spontaneous age groups show high proportions with a prior history of mammography, the highest being for the young (40-49) Spontaneous FTA at 77.8%. The GP Late-adopters show lower proportions, particularly amongst the FTA 60+ group. The Resistant-cases show lower proportions with a prior history, particularly amongst the FTA cases. However, for Spontaneous Cancel-cases the proportions are high and comparable to the Late-adopters. This suggests they either had a mammogram outside the Service, then continued to do so, or they discontinued mammography behaviour after the experience of it - akin to the *disenchantment discontinuance* effect described by Rogers (1983).

Table 5.11.2 provides further information about the mammogram outside the SABXRS prior to baseline. The first column "All cases" relates to all cases with a mammographic history, and the second column "Late-adpoters" are a sub-set of all cases (those who later attended the SABXRS). For the first variable WHO SUGGESTED MAMMOGRAM it would be expected that a higher proportion of the Spontaneous sample would state that their last mammogram was self-initiated compared with the GP sample. However, the proportion of Spontaneous FTA who said they initiated the last mammogram was as low as for the two GP groups, all three being less than 20%. In contrast, 42% of the Spontaneous Cancel-cases initiated the mammogram themselves. The proportions were similar amongst the Later-adopters, indicating that later attendance at the SABXRS was not related to how the mammogram outside the Service prior to baseline was initiated.

WHO SUGGESTED MAMMOGRAM was also asked of controls (in relation to their mammogram with the SABXRS), with marked differences between the two samples; 52% of Spontaneous Controls stated that they initiated their last mammogram themselves, compared with < 1% (0.8) of GP Controls (data not shown in tables). Hence, while the Spontaneous Controls were similar to the Spontaneous Cancel-cases, the GP Controls differed widely from both GP case groups. Moreover, over 90% of GP Controls specified the GP letter, whereas few of the GP cases mentioned the letter. At the point in the interview at which this information was collected, no mention had been made by the interviewer regarding an invitation letter from a doctor. Hence, the small numbers in the category 'doctor letter' for cases does not mean a letter was not received, but merely that the subject did not specifically mention it without prompting. Given that the letter specifically related to an appointment with the SABXRS (which the GP cases did not attend) it implies that for those few who did mention the letter, it may have been a prompt for them to have a mammogram, but not with the SABXRS.

Although 42% of Spontaneous Cancel-cases initiated the last mammogram themselves, that still leaves the majority who stated that it was doctor initiated, either by letter or other means (usually during a visit to the surgery). Further, over 80% of the Spontaneous FTA-cases stated that their doctor initiated their last mammogram. Hence, even for the Spontaneous sample, the influence of the doctor appears significant in the decision to make an appointment. Perhaps some of these subjects felt pressured to make an appointment before they were ready to have a mammogram, and therefore consciously decided not to keep it by either disregarding it (FTA) or cancelling. Anecdotal evidence from booking staff advise that doctors' sometimes ring and make appointments for their patients while the woman is in the doctor's room. Such bookings are recorded as Spontaneous.

The next variable in Table 5.11.2 REASON FOR LAST MAMMOGRAM shows that a high proportion of all groups stated that their last mammogram was for screening purposes, with proportion for late adopters being higher still amongst all groups. Given that screening mammograms are not covered by Medicare, this suggests a high level of 'pseudo' screening, in which symptoms are presumed to be present. Cases who initiated the mammogram themselves were more likely to state that their last mammogram was for screening; of the Spontaneous cases who initiated the mammogram themselves, 76% said it was for screening, compared with 55% for those who said a doctor initiated it (data not shown in table).

As with the previous variable, the Spontaneous Cancel-cases stand out as different from the other three for REASON FOR LAST MAMMOGRAM; 41% of All Spontaneous Cancel-cases had a mammogram for diagnostic purposes, compared with 25% to 32% for the other three groups. This may partly explain the result found in the Susceptibility construct in Chapter 4 that Spontaneous Cancel-cases were significantly more concerned that they may have breast cancer (Table 4.5.3). They also had the highest level of screening because of a family history at 10.3% (which is covered by Medicare), followed by the GP Cancel-cases (6.5%). Although women with a personal history of breast cancer are discouraged from attending the SABXRS, those with a family history are encouraged to attend, and receive an annual mammogram if they are less than 50 years old and have a strong family history (defined as having a first degree relative who developed breast cancer before age 50, or a first degree relative with bilateral breast cancer, or more than one first degree relative with breast cancer.)

The variable LAST MAMMOGRAM BEFORE OR AFTER SABXRS APPOINTMENT DATE in Table 5.11.2 relates to whether the mammogram outside the SABXRS was before or after the appointment date (or invitation date for the GP sample) with the SABXRS, that is, the appointment they failed to attend or cancelled. About 50% of the cases had the last mammogram *before* (both for All cases and Late-adopters), except for the Spontaneous FTA-cases, where most had had it after the appointment. It should be noted that in addition to those shown in the 'Before' category, a proportion of those in the category 'Same month' may have been before, but from the data it could not be determined if it was before or after the appointment date.

Screening with the SABXRS does not require a doctor's referral whereas a mammogram outside the Service does. Table 5.11.3 examines whether cases who had a prior mammogram made a special trip to the doctor just for that purpose. As expected, this was the case for over 60% of those who had a diagnostic mammogram. For the screening cases, the proportions varied from 17% for Spontaneous FTA-cases to 44% for Spontaneous Cancel-cases.

Table 5.9.2 showed that the strongest predictor of persistent non-attendance in the final Cases-at-4-years model was the subject's stated intention about attending the SABXRS within two years of interview (WILL USE SABXRS). From Table 5.10.4 below it can be seen that regardless of mammographic history and sample type, intention shows a strong relationship with actual behaviour; there is a marked downward trend through the categories of WILL USE SABXRS. However, it is far from a perfect relationship, which indicates that consideration should be given to re-inviting initial non-attenders even when they express attitudes to the contrary, since some of those who said the would definitely not attend, eventually did attend. It can be difficult to gauge where one draws the line between harassment and the chance to increase participation by making another approach with the prospect that they may have changed their perceptions, and now be in a state of readiness to attend.

5.12 ADDITIONAL DATA NOT USED IN ANALYSES

5.12.1 Introduction

This section summarises additional data collected at baseline, but not used in the analyses either in Chapter 4 or the preceding sections of this Chapter, due to small numbers or because the question related to different sub-groups from those analysed.

5.12.2 Main Source of Information about SABXRS

Table 5.12.1 shows the main source of information about the SABXRS by the study sub-groups used in Chapter 4. It was not used in previous analyses because it was only relevant to cases who had heard of the Service. Amongst the Spontaneous sample the sources are similar for both types of cases and controls, with doctor being nominated most frequently. Hence, despite cases having heard about the SABXRS from a doctor to the same extent as controls, the influence was not sufficient for them to attend, as shown in the models both in this and the previous chapter. For the GP sample a significantly higher proportion nominated the GP letter of invitation amongst the GP Cancel-cases and the Controls than the FTA-cases. The breakdown by attendance status at 31/12/95 (Table 5.12.2) shows that for the GP sample, nominating the GP letter as the main source at baseline does not appear to be associated with later adoption amongst the FTA-cases. However, amongst the GP Cancel-cases, a higher proportion of Resistant-cases than Late-adopters nominated the letter. This suggests the Resistant-cases may have objected to the letter. Further breakdown of the data (not shown) confirms this; 18% of Cancel Late-adopters were unhappy about the GP making an appointment for them compared with 37% for Resistant-cases ($P = 0.01$). For the GP FTA-cases 33% of Late-adopters were unhappy compared with 58% of Resistant-cases ($P = 0.003$).

5.12.3 Reasons for not Keeping Appointment/Invitation and for not Using SABXRS

The next set of tables relate to cases only. Tables 5.12.3 shows the reasons given for not keeping the appointment/invitation with the SABXRS. It can be seen that although a high proportion had had a mammogram outside the service, and a significant proportion occurred after the SABXRS appointment (Table 5.11.2), this was not specified as the main reason for not attending at interview. It is likely that women who specified *Breast problem* would have had a mammogram; this was the second highest reason for both Cancel groups. For all groups the highest proportion was in the category *Apathy/no need*. This included specific reasons like 'forgot appointment', 'too busy', 'haven't got around to it', 'don't need a mammogram', 'mammogram is not necessary', 'no suitable time'. This latter category (no suitable time) was highest amongst the Spontaneous Cancel-cases, representing nearly half the responses in this category (or 30% overall), which indicates that they may have cancelled due to the long waiting period. If this were the case, it may have been more appropriate to code this reason as a structural barrier, but no information was available as to why they could not find a suitable time. Only a small proportion of the other three groups gave this reason. *Structural barriers* included specific reasons like 'too difficult to get to' and 'too far', while *Perceived barriers* related to concern or fear about mammography. It is probable that the underlying reason for a proportion of cases categorised as 'Apathy/no need' was in fact concern or fear, or other perceived barriers. From 3.9% (Spontaneous Cancel) to 9.6% (GP Cancel) said they prefer to have their mammograms privately. Very few women mentioned that they did not attend because their doctor did not recommend it, in contrast to a US study where 45% of non-attenders gave this as a reason (Roetzheim *et at.*, 1993). In that study the most common reason given was 'Too expensive' which is not an issue for women in Australia. After these two reasons, barriers also featured highly.

Table 5.12.4 shows the main reason for not using the SABXRS service in 1995 by attendance status at 31/12/95 to examine whether reason at base-line is related to later attendance. Given the small numbers no definitive conclusions should be drawn, but it can be seen that some cases later attended from each category, even those who said they prefer private.

The variable WILL USE SABXRS was found to be the strongest predictor of later attendance amongst cases in the final overall model in the analyses presented above (Table 5.9.2). Cases who stated they 'Probably won't' or 'Definitely won't' attend the SABXRS in two years time were asked for their reason for not wanting to use the Service. The main reason for each respondent is summarised in Table 5.12.5. The small numbers for the Spontaneous FTA-cases preclude comment, but for the other three groups it can be seen that more definitive reasons are given. Fewer women gave 'Don't need/too busy/too much trouble' as a reason, and a new category of 'Don't like tests/xrays' appears, which was probably the underlying reason for not keeping the appointment. However, as can be seen from Table 5.12.6 which splits these women by attendance status at 31/12/95, some of these women did later attend. The 'Other' category includes mainly access problems, and a few who wanted an annual mammogram or stated that the 'SABXRS was not good' (only 4 in total for both these reasons). The availability of screening times (on weekdays during office hours) does not appear to have been a major barrier to access. When asked for preference regarding screening times the following proportions preferred an out of hours service in the Spontaneous sample; 8.9% for FTA, 7.9% for Cancel and 7.9% for Control. The corresponding proportions for the GP sample were 12.9%, 6.8% and 3.9%.

All women, except those who said they 'Definitely would attend' the SABXRS in two years were asked what would most likely prompt them to attend. Table 5.12.7 shows that the two categories 'If referred by doctor' and 'Symptoms/problems' represent 55-65% of the responses across the four groups, with similar distributions by attendance status at 31/12/95 (Table 5.12.8), except for the GP Cancel cases where the Resistant-cases show a higher proportion in the 'If referred by doctor' category. This latter table shows that some women who said 'Nothing' would prompt them, did in fact attend. Eighteen women specifically said their prompt would be a 'free service', presumably implying they would not attend otherwise. However, it is clear from another question which specifically asked how much they would be prepared to pay for a mammogram, that other women also expect a free service, as indicated in the next section.

5.12.4 Willingness to Pay for Mammogram

Table 5.12.9 shows the responses for the whole study population to the question "How much, if anything, would you be prepared to pay out of your own pocket to have a screening mammogram?" This question relates to mammography generally, hence the category 'Won't have mammogram' refers to women who did not want to specify an amount as they had no intention of having a mammogram at the SABXRS or elsewhere. From 20% to 37% stated they were not willing to pay anything, the highest proportion being for the GP Controls, indicating that it may have been a factor in their decision to have a mammogram with the SABXRS. However, a high proportion of women *were* willing to pay, regardless of attendance status. In addition to those who specified an amount, it would be reasonable to assume that a significant proportion of the 20-30% who could not nominate an amount ('Don't know') would be willing to pay. This suggests that a high proportion of women who attend the free SABXRS may be willing to contribute and thus reduce the cost to the general public. The National Program objectives include "..... the provision of services at minimal or no charge, and free to eligible women who would not attend if there was a charge." (National Program for the Early Detection of Breast Cancer, 1994a) To the investigator's knowledge, no service in the program has to date asked for a contribution from women. Further, from Table 5.12.10, willingness to pay does not appear to have determined later attendance at the SABXRS; excluding the category 'Won't have mammogram' the *P*-value for the Chi square test ranged from 0.24 to 0.85.

5.12.5 Suggestions for Service Improvement/Change

The final data from the case-control study not presented elsewhere relates to open ended questions asked of all subjects at the end of the interview to assist the Service in planning. In interpreting these data, it is important to recall that these data were collected at the end of 1991 just prior to the major expansion of the Service. One question asked subjects whether they could offer any suggestions about how more women could be encouraged to attended the SABXRS. Significantly more Spontaneous women (75.5%) offered suggestions than GP women (55.4%). Within the sample groups the proportions by caseness were not significantly different. Within the four case groups, only the GP Cancel-cases showed a significant difference by later attendance; 59.7% of the Late-adopters offered suggestions compared with 35% of Resistant-cases. Suggestions offered in order of frequency were; television/radio/interviews (18.4% of total study population), doctors to encourage/positively promote mammography (15.5%), advertising in newspapers/magazines (10.7%), general advertising to increase awareness (10.1%), talks at club/group meetings (9.2%), promotional posters/pamphlets (6.7%), more advertising in doctors clinics (4.9%), send invitations/follow-ups (4.8%), women encourage others/tell friends/family (3.2%), direct mail (3.9%), by improving the Service (3.1%), introduce SABXRS in school curriculum (1.4%).

Subjects were also told that the SABXRS planned to open new clinics, then asked if they could suggest where they should be located. Clearly the responses need to be interpreted within the context of available service, at the time subjects were selected; the Service was offered at three hospitals - one in the western suburbs of Adelaide, one in the south and one in the city centre. During the interview phase a clinic was opened in the north of Adelaide, but the mobile service to country areas did not commence until several months after interviews ceased. The most frequently reported suggestion was for a clinic was in the southern suburbs of Adelaide (31.7% of total sample). Although a clinic was available south of Adelaide, it should be noted that Adelaide stretches a long way north and south, and the newer southern suburbs are still a long distance from the service available. The next most prevalent location suggested was northern suburbs (18.3%), followed by western suburbs (16.4%), outside Adelaide (14.4%) and central Adelaide (3.1%). When asked what type of venue the new services should be offered from the following responses were given; hospital (24.3%), health centre (17.8%), a shopping centre (17.2%), near transport (5.5%), mobile unit (3.4%), local councils (3.1%), community centre (1.9%).

5.13 SUMMARY

A great deal of information has been presented in this chapter, both analytical and descriptive. The first part of this chapter re-analysed the base-line data by the six study constructs, but with attendance to the SABXRS by 31/12/95 as the dependent variable. Section 5.9.2 discussed the findings of the overall models which drew on these analyses. It was found that the Knowledge and Susceptibility constructs barely featured, both in these and the base-line analyses. In general, knowledge was either universally high or low. At baseline, knowledge of the age most at risk (older women) was poor amongst all subjects, and age itself was not found to predict actual non-attendance. However, four years on, age was found to independently predict persistent non-attendance, with older women being twice as likely to be Resistant-cases than Late-adopters. This suggests that either the message about age as a risk factor is not getting to these women, or other factors have a stronger influence. Barriers, the influence of a doctor and intention to attend were the strongest predictors both at base-line and in determining later attendance. Particular barrier perceptions that need to be addressed include the belief that non-symptomatic women do not need a mammogram and apathy (too much trouble). Embarrassment, among particular ethnic groups may also be an issue, but the numbers were too small in this study to be more definitive.

The Resistant-cases represent the *Laggards* of Rogers' (1983) classification in many respects. However, a proportion of these women had had a mammogram outside the SABXRS prior to base-line. Although it is not known if they have continued to have mammograms outside, it is still an issue for the National Program that needs to be addressed. The population surveys in Part IV will provide further insight as to the extent of the problem. Overall, these analyses showed that the base-line data could predict attendance at that time as well as later attendance. This is despite loss of power due to further segregation of the samples than initially planned, and numerical problems in the logistic regression, further compounded by incomplete data (only cases with a valid response to every data item are included).

The key premise of this thesis that non-attenders represent a number of sub-groups which will require a range of recruitment strategies was clearly supported from the base-line and follow-up analyses. Thus the framework used for this study provides a good basis for developing recruitment strategies for women at various states of readiness. General strategies can be recommended from the results of this thesis, but over time, further characterisation will be required. For example, even though these analyses provide a portrayal of the Resistant cases, within this sub-group there appeared two extremes in relation to socio-economic status - high educated/high income women and low educated/low income women. It has been suggested that the higher educated may be having mammograms elsewhere and perhaps the lower educated not having them at all. But this cannot be presumed, yet it is important to know if recruitment strategies are to be successful, given that the effect of recruitment strategies varies according to educational level and state of readiness.

Although these types of analyses provide insights into patterns which predict mammographic behaviour, and thus participation, divergence at the individual level should not be ignored if numerically the numbers are large. For example, although in general a prior history of mammography, intention to attend and reason for cancellation predicted later attendance, there were cases where women stated they definitely would not attend the SABXRS yet did so, and conversely some who stated they definitely would attend the SABXRS but did not. Within the framework of this thesis, it would be suggested that the former represent women who initially were not in a state of readiness, but over the intervening period something changed (new information to change appropriate barrier), while the latter group may have regressed to an earlier stage of adoption (unless they attended elsewhere).

The National Program is already at a stage where re-attendance is a critical issue. From this sample of controls, re-attendance was found to be high, and thus the level of *disenchantment discontinuance* described by Rogers (1983) low. However, the controls in this sample represent the innovators or early adoptors. It was suggested in Chapter 2, in discussing the framework, that the late adopters are more likely to discontinue than early adopters. The data from the case-control study cannot inform in this regard, but data presented in Part V on overall participation to the SABXRS should provide some insight.

The additional information presented in Section 12, suggest that factors that influence readiness to adopt can change over time, although no direct evidence of this was available; that is, the samples was not re-interviewed. Self reported reasons for not keeping the base-line appointment (Table 5.12.4) indicate that none of the barriers were rigid. For example, women who at base-line stated structural barriers as preventing attendance were later able to attend. Similarly for perceived and other barriers. Table 5.12.8 shows that among women who said nothing would prompt them to attend were some who did attend, though to a lower extent than for other categories. The point is that for this sample, a proportion did change in their stage of readiness to adopt mammography screening at the SABXRS over the four year period as measured by actual behaviour.

The open ended questions asking women for suggestions to improve the Service also provide some interesting information. Although women are clearly not averse to mammography being offered in hospitals, the SABXRS along with others in Australia set about removing services from hospitals and establishing stand-alone centres. Yet, even outside hospitals other suggestions were for clinics within existing services such as health centres. One needs to question whether the expense for establishing stand alone services could have been better utilised elsewhere, either within mammography screening or other health services. Regarding location of clinics, despite there being a need for a service in the lower southern suburbs of Adelaide, expressed both by this sample, and general demographic statistics for the region, this has not yet been established.

Table 5.2.1 Cases: Attendance status by 31/12/95 by SAMPLE and CASE Type

	SAMPLE TYPE		
	Spontaneous cases No. (%)	GP cases No. (%)	All cases No. (%)
FTA			
Late-adopter *	30 (53.6)	75 (48.4)	105 (49.8)
Resistant-case **	26 (46.4)	80 (51.6)	106 (50.2)
Total	*56 (100.0)*	*155 (100.0)*	*211 (100.0)*
Cancel			
Late-adopter *	81 (68.1)	83 (56.1)	164 (61.4)
Resistant-case **	38 (31.9)	65 (43.9)	103 (38.6)
Total	*119 (100.0)*	*148 (100.0)*	*267 (100.0)*
All Cases			
Late-adopter *	111 (63.4)	158 (56.3)	269 (56.2)
Resistant-case **	64 (36.6)	145 (43.7)	209 (43.7)
Total	*175 (100.0)*	*303 (100.0)*	*478 (100.0)*

* Non attender at base-line but attended by 31/12/95

** Non attender at base-line and still no attendance by 31/12/95

Table 5.2.2 Cases: Time to attendance at SABXRS following interview by SAMPLE and CASE TYPE

	SAMPLE TYPE				TOTAL
Period from interview to	Spontaneous		GP		
attendance at SABXRS	FTA-case	Cancel-case	FTA-case	Cancel-case	
LATE ADOPTERS					
(Number and Percent in brackets of Late-adopters)					
≤ 3 months	14 (46.6)	9 (11.1)	8 (10.7)	11 (13.3)	42 (15.6)
> 3 but ≤ 6 months	1 (3.3)	8 (9.9)	8 (10.7)	7 (8.4)	24 (8.9)
> 6 but ≤ 12 months	2 (6.7)	7 (8.6)	7 (9.3)	14 (16.9)	30 (11.2)
> 12 but ≤ 18 months	8 (26.7)	38 (46.9)	29 (38.7)	24 (28.9)	99 (36.8)
> 18 months	5 (16.7)	19 (23.5)	23 (30.7)	27 (32.5)	74 (27.5)
Total Late Adopters	*30 (100.0)*	*81 (100.0)*	*75 (100.0)*	*83 (100.0)*	*269 (100.0)*
LATE ADOPTERS					
(Number and Percent in brackets of All cases)					
≤ 3 months	14 (25.0)	9 (7.6)	8 (5.2)	11 (7.4)	42 (8.8)
> 3 but ≤ 6 months	1 (1.8)	8 (6.7)	8 (5.2)	7 (4.7)	24 (5.0)
> 6 but ≤ 12 months	2 (3.6)	7 (5.9)	7 (4.5)	14 (9.5)	30 (6.3)
> 12 but ≤ 18 months	8 (14.3)	38 (31.9)	29 (18.7)	24 (16.2)	99 (20.7)
> 18 months	5 (8.9)	19 (16.0)	23 (14.8)	27 (18.2)	74 (15.5)
Total Late Adopters	*30 (53.6)*	*81 (68.1)*	*75 (48.4)*	*83 (56.1)*	*269* (56.2)
RESISTANT CASES					
(Number and Percent in brackets of All cases)					
Total Resistant Cases	*26 (46.4)*	*38 (31.9)*	*80 (51.6)*	*65 (43.9)*	*209 (43.7)*
TOTAL CASES	56 (100.0)	119 (100.0)	155 (100.0)	148 (100.0)	478 (100.0)

Table 5.3.1 Socio-demographic construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in bivariate analysis in any of three analyses

Variable	ANALYSIS Cases-at-4-years	 Resistant-case /Control	 Late-adopter /Control
AGE	**<0.001**	**0.009**	**0.081**
MARITAL STATUS	0.786	**0.049**	0.241
HIGHEST QUALIFICATION	**0.070**	0.198	0.469
EMPLOYMENT STATUS	**0.003**	**0.045**	0.385
LIFETIME OCCUPATION	0.580	0.296	**0.022**
HOUSEHOLD COMPOSITION	**0.011**	**0.003**	0.286
NUMBER OF CHILDREN	0.634	**0.006**	**0.063**
SOURCE OF INCOME	**0.003**	0.101	0.197
INCOME	0.542	**0.084**	**0.048**
SOCIO-ECONOMIC STATUS	0.109	**0.099**	0.422

Table 5.3.2 Socio-demographic construct: Variables entered into logistic regression models

Variable	ANALYSIS Cases-at-4-years	 Resistant-case /Control	 Late-adopter /Control
AGE	✓	✓	✓
MARITAL STATUS	✗	✓‡	✓
HIGHEST QUALIFICATION	✓	✓	✗
EMPLOYMENT STATUS	✓	✓	✗
LIFETIME OCCUPATION	✗	✗	✓
PARTNER'S OCCUPATION	✗	✓	✗
HOUSEHOLD COMPOSITION	✓	✓	✗
NUMBER OF CHILDREN	✗	✓	✓
SOURCE OF INCOME	✓	✓	✓
INCOME	✗	✓	✓
SOCIO-ECONOMIC STATUS	✓	✓	✗

‡ excluded from final model due to numerical problems (zero/very small number in a cell or colinearity with another variable)

Table 5.3.3 Socio-demographic construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in any of final logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years[1] OR (95% CI)	Resistant-case /Control[2] OR (95% CI)	Late-adopter /Control[3] OR (95% CI)
AGE (referent group = 50-59)			
40-49	0.74 (0.38-1.46)	0.72 (0.38-1.37)	0.82 (0.52-1.31)
60+	1.99 (1.25-3.19)***	1.29 (0.85-1.97)	0.66 (0.44-1.00)*
HIGHEST QUALIFICATION (referent group = Bachelor degree or higher)			
Trade/apprenticeship	0.35 (0.08-1.49)	0.28 (0.08-0.94)**	NE
Certificate or diploma	0.25 (0.09-0.72)**	0.42 (0.18-1.00)*	
No post-secondary qual	0.25 (0.09-0.70)***	0.41 (0.18-0.98)**	
LIFETIME OCCUPATION (referent group = Managerial/professional)			
Clerk/Sales/Service	NE	NE	0.74 (0.46-1.21)
Trade/Manual			0.44 (0.24-0.78)***
No post-secondary qual			0.60 (0.37-0.96)**
Home duties			
HOUSEHOLD COMPOSITION (referent group = Lives with husband only)			
Husband & other	0.91 (0.55-1.50)	0.75 (0.47-1.19)	NE
Son(s) only	0.54 (0.17-1.69)	1.14 (0.37-3.54)	
Daughter (s) only	2.49 (0.73-8.50)	2.18 (0.83-5.73)	
Lives alone	0.63 (0.36-1.11)	0.99 (0.58-1.69)	
Other	1.81 (0.85-3.84)	2.11 (1.03-4.35)**	
NUMBER OF CHILDREN (referent group = None.)			
One or two	NE	1.30 (0.59-2.83)	1.73 (0.86-3.46)
Three or four		0.97 (0.65-1.44)	0.97 (0.68-1.40)
Five or more		1.91 (1.12-3.25)**	1.76 (1.05-2.94)**
SOURCE OF INCOME (referent group = Wages/Salary)			
Private	1.17 (0.67-2.05)	0.90 (0.52-1.54)	0.81 (0.52-1.25)
Govt pension	1.63 (0.92-2.89)*	1.35 (0.72-2.55)	0.67 (0.40-1.14)
INCOME (referent group = > $30,000)			
<= $20,000	NE	0.76 (0.38-1.50)	1.51 (0.88-2.61)
$20,001-30,000		1.57 (0.89-2.78)	1.93 (1.20-3.08)***
Not stated		0.80 (0.33-1.92)	0.98 (0.46-2.07)
SOCIO-ECONOMIC STATUS (referent group = High)			
low	0.69 (0.39-1.21)	1.04 (0.63-1.73)	NE
medium	1.21 (0.73-2.01)	1.38 (0.89-2.15)	

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$

OR, odds ratio; CI, confidence interval; NE, not entered in model

[1] Model $\chi^2 = 50.58$, $P = <0\ 001$. Percent Predicted Correct: Resistant-cases = 50.24; Late-adopters = 77.61

[2] Model $\chi 2 = 51.46$, P = 0.002. Percent Predicted Correct: Resistant-cases = 14.98; Controls = 94.88.

[3] Model $\chi 2 = 36.97$, P = 0.002. Percent Predicted Correct: Late-adopters 19.78; Controls = 91.04.

Table 5.4.1 Health Motivation and Control construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in bivariate analysis in any of three analyses

Variable	ANALYSIS Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
DO BSE	**0.030**	0.188	0.236
FREQUENCY OF BSE*	**0.016**	**<0.001**	0.592
DOCTOR CHECKED BREASTS	**0.019**	0.519	**0.040**
LAST BREAST EXAM	0.117	0.146	**0.085**
EVER HAD PAP SMEAR	**<0.001**	**<0.001**	0.389
LAST PAP SMEAR	**0.001**	**0.001**	0.906
WHO INITIATED PAP SMEAR	**<0.001**	**0.002**	0.690
SMOKING	0.235	**0.030**	**0.034**
LAST TIME SAW DOCTOR	0.301	**0.077**	0.140
DENTIST	0.168	**<0.001**	**0.023**
SAMPLE TYPE	**0.017**	**<0.001**	0.228
CASE TYPE	**0.011**	NA	NA
EVER HAD MAMMO	**<0.001**	NA	NA
WILL USE SABXRS	**<0.001**	NA	NA

BSE, Breast Self Examination; NA, Not Applicable

Table 5.4.2 Health Motivation and Control construct: Variables entered into logistic regression models

Variable	ANALYSIS Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
DO BSE	✓	✓	✓
FREQUENCY OF BSE*	✓	✓	✗
DOCTOR CHECKED BREASTS	✓	✓†	✓
LAST BREAST EXAM	✓	✓	✓
EVER HAD PAP SMEAR	✓	✓	✗
LAST PAP SMEAR	✓	✓	✗
WHO INITIATED PAP SMEAR	✓	✓	✗
SMOKING	✓	✓	✓
LAST TIME SAW DOCTOR	✗	✓	✓
DENTIST	✓	✓	✓
SAMPLE TYPE	✓	✓	✓
CASE TYPE	✓	NA	NA
EVER HAD MAMMO	✓	NA	NA
WILL USE SABXRS	✓	NA	NA

NA, Not Applicable
† not significant in itself, but entered in model as it was lead-in question to one that follows

Table 5.4.3 Health Motivation and Control construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in any of final logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years[1] OR (95% CI)	Resistant-case /Control[2] OR (95% CI)	Late-adopter /Control[3] OR (95% CI)
FREQUENCY OF BSE* (referent group = Monthly)			
1-2 times/year	0.44 (0.21-0.90)**	0.57 (0.31-1.05)*	NE
3-5 times/year	0.82 (0.43-1.57)	0.58 (0.34-1.00)*	
6-10 times/year	0.61 (0.32-1.18)	0.35 (0.20-0.61)***	
Not stated	0.50 (0.19-1.30)	0.51 (0.24-1.11)*	
DOCTOR CHECKED BREASTS (referent group = Yes)			
No	1.02 (0.51-2.05)	0.63 (0.37-1.07)*	0.49 (0.30-0.80)***
LAST BREAST EXAM (referent group = 1991)			
Before 1989	1.06 (0.52-2.16)	1.16 (0.63-2.14)	1.03 (0.60-1.78)
1989 or 1990	1.18 (0.68-2.02)	0.59 (0.37-0.95)**	0.67 (0.45-0.99)**
Not stated	0.61 (0.23-1.58)	0.42 (0.19-0.93)**	0.60 (0.32-1.13)
EVER HAD PAP SMEAR (referent group = Yes)			
No	2.31 (0.94-5.67)*	2.46 (1.22-4.94)**	NE
SMOKING (referent group = Never smoked)			
Smoke now	1.24 90.72-2.11)	1.35 (0.86-2.12)	1.26 (0.83-1.93)
Have smoked	0.85 (0.50-1.45)	1.26 (0.80-2.00)	1.53 (1.05-2.26)**
LAST TIME SAW DOCTOR (referent group = < 3 months ago)			
3 - < 6 months ago	NE	1.12 (0.69-1.82)	0.91 (0.59-1.39)
6 - < 12 months ago		0.88 (0.47-1.63)	0.56 (0.31-1.01)*
>= 12 months ago		2.55 (1.19-5.46)**	1.25 (0.57-2.70)
DENTIST (referent group = checkup)			
Problems	1.41 (0.89-2.25)	1.70 (1.15-2.52)***	1.47 (1.05-2.06)**
Never visits	0.95 (0.48-1.90)	1.74 (0.97-3.12)*	1.58 (0.92-2.71)*
SAMPLE TYPE (referent group = Spontaneous)			
GP invitee	0.86 (0.53-1.40)	1.62 (1.09-2.40)**	1.23 (0.89-1.73)
CASE TYPE (referent group = Cancel)			
FTA	1.72 (1.10-2.70)**	NA	NA
EVER HAD MAMMO (referent group = Yes)			
No	1.57 (0.99-2.47)*	NA	NA
WILL USE SABXRS (referent group = Definitely would)			
Probably would	2.25 (1.34-3.77)***	NA	NA
Probably not	3.86 (2.15-6.90)***		
Definitely not	13.23 (6.43-27.23)***		

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$

OR, odds ratio; CI, confidence interval; NE, not entered in model

[1] Model $\chi^2 = 106.44$, $P = <0.001$. Percent Predicted Correct: Resistant-cases = 58.54; Late-adopters = 80.00.

[2] Model $\chi^2 = 73.02$, $P = <0.001$. Percent Predicted Correct: Resistant-cases = 23.79; Controls = 92.70.

[3] Model $\chi^2 = 30.98$, $P = 0.003$. Percent Predicted Correct: Late-adopters = 9.81; Controls = 94.65.

Table 5.4.4 Health Motivation and Control construct: EVER HAD MAMMO (at base-line) by Intention to have mammogram in next two years (as stated at base-line)

EVER HAD MAMMO	Intention to have mammogram in next 2 years			
	Yes[1] No. (%)	No[2] No. (%)	Don't know[3] No. (%)	Total No. (%)
Yes				
Late-adopters	157 (*95*)	8 (*5*)	1 (*1*)	166 (*100*)
Resistant-cases	74 (*53*)	62 (*44*)	4 (*3*)	140 (*100*)
No				
Late-adopters	82 (*80*)	17 (*17*)	3 (*3*)	102 (*100*)
Resistant-cases	14 (*21*)	46 (*69*)	7 (*10*)	67 (*100*)

[1] Answered 'Definitely would' or 'Probably would' to question about intention to have a mammogram with the SABXRS or 'Yes' to intention to have a mammogram outside the SABXRS
[2] Answered 'Definitely not' or 'Probably not' to question about intention to have a mammogram with the SABXRS or 'No' to intention to have a mammogram outside the SABXRS
[3] Answered 'Don't know' to intention to have a mammogram outside the SABXRS

Table 5.5.1 Knowledge construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in bivariate analysis in any of three analyses

Variable	ANALYSIS		
	Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
CANCER-MOST COMMON	0.277	**0.033**	0.242
NIPPLE BLEEDING/DISCHARGE	**0.007**	**0.018**	0.512
ARMPIT SWELLING	**0.020**	0.126	0.218
INCIDENCE OF BC	0.991	0.188	**0.088**
EXAMINE OWN BREASTS	**<0.001**	**<0.001**	0.994
NO. OF CHECKS KNOWN	**0.003**	**0.002**	0.898
KNOWS MAMMO FINDS BEFORE DR	**0.006**	**<0.001**	0.700
HEARD OF SCREENING	0.501	**0.031**	**0.002**

BC, Breast Cancer

Table 5.5.2 Knowledge construct: Variables entered into logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
CANCER-MOST COMMON	✗	✓	✓
CANCER- 2ND MOST COMMON	✓	✗	✗
NIPPLE BLEEDING/DISCHARGE	✓	✓	✗
NIPPLE CHANGE/RETRACTION	✓	✗	✓
ARMPIT SWELLING	✓	✓	✓
PUCKERING/DIMPLING	✓	✗	✗
LUMPS TO BC	✓	✓	✗
INCIDENCE OF BC	✗	✓	✓
EXAMINE OWN BREASTS	✓	✓	✗
MAMMOGRAPHY/X-RAY	✓	✓	✗
OTHER CHECKS FOR BC	✓	✗	✗
NO. OF CHECKS KNOWN	✓	✓	✗
KNOWS MAMMO FINDS BEFORE DR	✓	✓	✗
HEARD OF SCREENING	✗	✓	✓

BC, Breast Cancer

Table 5.5.3 Knowledge construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in any of final logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years[1]	Resistant-case /Control[2]	Late-adopter /Control[3]
	OR (95% CI)	OR (95% CI)	OR (95% CI)
CANCER-MOST COMMON (referent group = Breast)			
Bowel	NE	0.89 (0.47-1.69)	0.74 (0.41-1.34)
Lung		3.34 (1.09-10.24)**	2.95 (1.03-8.43)**
Cervix		1.41 (0.92-2.16)	0.97 (0.65-1.46)
Don't know		1.42 (0.62-3.25)	0.78 (0.33-1.87)
NIPPLE BLEEDING/DISCHARGE (referent group = Known)			
Not known	1.60 (0.96-2.67)*	1.36 (0.87-2.13)	NE
NIPPLE CHANGE/RETRACTION (referent group = Known)			
Not known	1.11 (0.55-2.67)	NE	0.62 (0.37-1.05)*
ARMPIT SWELLING (referent group = Known)			
Not known	2.51 (0.79-7.97)	1.81 (0.59-5.55)	0.55 (0.28-1.09)*
PUCKERING/DIMPLING (referent group = Known)			
Not known	0.41 (0.20-0.86)**	NE	NE
LUMPS TO BREAST CANCER (referent group = 1 in 10)			
2 in 10	1.01 (0.51-2.03)	0.95 (0.51-1.79)	NE
3 in 10	0.50 (0.20-1.20)	0.47 (0.21-1.08)*	
4 in 10	1.56 (0.55-4.38)	1.14 (0.48-2.71)	
5 in 10	1.35 (0.68-2.67)	0.98 (0.54-1.79)	
6-10 in 10	0.86 (0.41-1.80)	0.71 (0.36-1.41)	
Don't know	0.94 (0.51-1.76)	0.90 (0.50-1.61)	
INCIDENCE OF BC (referent group = 1 in 15)			
1 in 5	NE	0.96 (0.58-1.66)	1.10 (0.69-1.74)
1 in 35		0.88 (0.56-1.37)	0.94 (0.64-1.40)
1 in 60		0.59 (0.31-1.13)	0.53 (0.30-0.95)**
Don't know		0.99 (0.54-1.82)	1.31 (0.77-2.21)
EXAMINE OWN BREASTS (referent group = Known)			
Not known	2.25 (1.23-4.09)***	1.67 (1.01-2.75)**	NE
KNOWS MAMMO FINDS BEFORE DR (referent group = Yes)			
No	1.52 (0.99-2.33)*	1.59 (1.09-2.32)**	NE
HEARD OF SCREENING (referent group = Yes)			
No	NE	1.05 (0.69-1.59)	1.79 (1.27-2.53)***

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$

OR, odds ratio; CI, confidence interval; NE, not entered in model

[1] Model $\chi^2 = 47.33$, $P = 0.001$. Percent Predicted Correct: Resistant-cases = 47.09; Late-adopters = 74.53.

[2] Model $\chi^2 = 45.36$, $P = 0.002$. Percent Predicted Correct: Resistant-cases = 14.09; Controls = 95.27.

[3] Model $\chi^2 = 29.10$, $P = 0.002$. Percent Predicted Correct: Late-adopters = 12.31; Controls = 95.07.

Table 5.6.1 Susceptibility construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in bivariate analysis in any of three analyses

Variable	ANALYSIS Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
EVER HAD LUMP	0.925	**0.027**	**0.012**
LUMP IN LAST 12 MONTHS	0.926	**0.036**	**0.027**
EVER HAD BC	0.041	**0.036**	**0.081**
KNOW ANYONE WITH BC	**0.041**	0.333	0.162
ACQUAINTANCE HAD BC	**<0.001**	**0.056**	**0.030**
NUMBER KNOWN WITH BC	**0.042**	0.333	0.396
OUTCOME OF EXPERIENCE WITH BC	**0.057**	0.723	0.180
CLOSENESS TO PERSONS WITH BC	**0.015**	**0.017**	0.419

BC, Breast Cancer

Table 5.6.2 Susceptibility construct: Variables entered into logistic regression models

Variable	ANALYSIS Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
LIKELIHOOD OF GETTING BC	✗	✓	✗
THINK ABOUT BC	✗	✗	✓
HOW OFTEN THINK ABOUT BC	✗	✗	✓
CONCERNED MAY HAVE BC	✗	✗	✓
SPOKEN TO DR ABOUT CONCERN	✗	✓	✓
EVER HAD LUMP	✗	✓	✓
LUMP IN LAST 12 MONTHS	✗	✓	✓
KNOW ANYONE WITH BC	✓	✓†	✓
ACQUAINTANCE HAD BC	✓	✓	✓
NUMBER KNOWN WITH BC	✓	✗	✗
OUTCOME OF EXPERIENCE WITH BC	✓	✗	✗
CLOSENESS TO PERSONS WITH BC	✓	✓	✗

† not significant in itself, but entered in model as it was lead-in question to one that follows

Table 5.6.3 Susceptibility construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in any of final logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years[1]	Resistant-case /Control[2]	Late-adopter /Control[3]
	OR (95% CI)	OR (95% CI)	OR (95% CI)
CONCERNED MAY HAVE BC (referent group = Yes)			
No	NE	NE	0.65 (0.41-1.03)*
SPOKEN TO DR ABOUT CONCERN (referent group = Yes)			
No	NE	0.60 (0.31-1.16)	0.55 (0.31-1.00)*
EVER HAD LUMP (referent group = Yes)			
No	NE	0.52 (0.29-0.96)**	0.67 (0.38-1.17)
ACQUAINTANCE HAD BC (referent group = Yes)			
No	1.51 (0.89-2.58)	1.10 (0.67-1.79)	0.72 (0.51-1.03)*
OUTCOME OF EXPERIENCE WITH BC (referent group = Died of BC only)			
Recurred/still treated only	1.20 (0.51-2.83)	NE	0.70 (0.36-1.40)
Cured/remission only	1.21 (0.69-2.11)		0.84 (0.53-1.33)
Other only	2.16 (0.90-5.20)*		0.71 (0.33-1.53)
Combination	0.65 (0.31-1.38)		1.00 (0.60-1.68)
CLOSENESS TO PERSONS WITH BC (referent group = Extremely only)			
Quite close only	0.82 (0.45-1.51)	1.02 (0.59-1.76)	NE
Not very close only	0.54 (0.27-1.08)*	0.51 (0.28-0.96)**	
Combination	0.86 (0.38-1.95)	0.74 (0.38-1.43)	

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$

OR, odds ratio. CI, confidence interval NE, not entered in model

[1] Model $\chi^2 = 22.43$, $P = 0.13$. Percent Predicted Correct: Resistant-cases = 60.10; Late-adopters = 57.20.

[2] Model $\chi^2 = 27.63$, $P = 0.010$. Percent Predicted Correct: Resistant-cases = 5.34; Controls = 98.93.

[3] Model $\chi^2 = 23.64$, $P = 0.051$. Percent Predicted Correct: Late-adopters = 11.65; Controls = 93.60.

Table 5.6.4 Susceptibility construct: Percent of cases who had mammogram outside SABXRS at base-line by EVER HAD LUMP and CLOSENESS TO PERSONS WITH BC at base-line

Variable	% of CASES WHO HAD MAMMOGRAM AT BASELINE OUTSIDE SABXRS	
	Attendance status at 4 years	
	Resistant-case	Late-adopter
EVER HAD LUMP		
Yes	74	74
No	29	56
CLOSENESS TO PERSONS WITH BC		
Extremely	36	54
Other	46	63

Table 5.7.1 Barrier construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in bivariate analysis in any of three analyses

Variable	ANALYSIS Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
PERCEIVED BARRIERS			
ADVANTAGES OF FINDING BC	0.760	**0.087**	0.151
CURE MORE LIKELY	**0.006**	**0.050**	0.242
BENEFITS OF MAMMO	**<0.001**	**<0.001**	**<0.001**
FIND BC EARLY	**0.008**	**0.020**	0.501
PEACE OF MIND	0.641	**<0.001**	**0.001**
NO. OF PERCEIVED BENEFITS	**0.003**	**<0.001**	**0.001**
BETTER NOT KNOWING-CANCER	**0.067**	**<0.001**	**0.072**
SHOULDN'T LOOK FOR ILLNESS	0.236	**0.015**	0.624
PROBLEMS WITH MAMMO	0.546	**0.007**	**0.029**
NO. OF PERCEIVED PROBLEMS	0.110	**0.027**	**0.008**
PROBLEM WOULD STOP	**0.002**	**<0.001**	**0.003**
PAIN	**0.008**	**<0.001**	0.532
UNCOMFORTABLE	**0.002**	**0.067**	**0.079**
OTHER PROBLEMS	**0.007**	**0.005**	0.752
MAMMO FINDS ALL BC	**0.001**	**0.002**	0.470
CANCERS MISSED	**0.001**	**<0.001**	0.446
REASONABLE TO MISS BC	**0.002**	**<0.001**	0.445
EMBARRASSED BY FEMALE	**0.010**	**<0.001**	0.619
EMBARRASSED BY MALE	0.816	**<0.001**	0.285
NEED SYMPTOMS	**< 0.001**	**< 0.001**	**< 0.001**
EMBARRASSING	**0.043**	**<0.001**	**0.050**
TOO MUCH TROUBLE	**0.030**	**< 0.001**	**< 0.001**
RATHER NOT THINK ABOUT IT	**<0.001**	**<0.001**	**0.001**
RADIATION CONCERN	**0.046**	**<0.001**	**0.035**
INCONVENIENT	**0.014**	**<0.001**	**<0.001**
PAINFUL	**0.002**	**<0.001**	**0.003**
ACCURACY CONCERN	0.419	**0.005**	**0.040**
BARRIER SCORE	**< 0.001**	**< 0.001**	**<0.001**
FINDING EARLY SAVES LIVES	**0.048**	0.179	0.316
IMPORTANT FOR AGE	**<0.001**	**<0.001**	**0.003**
ASKING FOR TROUBLE	**0.013**	**<0.001**	**0.021**
MORE TROUBLE THAN WORTH	**<0.001**	**<0.001**	**0.024**
ASKED BACK FOR TESTS	**0.059**	**<0.001**	**<0.001**
MORE TESTS MEAN BC	0.128	**<0.001**	**<0.001**
STRUCTURAL BARRIERS			
HOURS WORKED	**0.005**	**<0.001**	0.175
ACCESS TO CAR	**0.054**	**<0.001**	**0.026**
HOW OFTEN ACCESS CAR	**0.058**	**<0.001**	**0.020**
HOUSEHOLD MEMBER DISABLED	0.261	**0.055**	0.441

BC, Breast Cancer; nc, not calculable

Table 5.7.2 Barrier construct: Variables entered into logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
PERCEIVED BARRIERS			
ADVANTAGES OF FINDING BC	✗	✓	✓
CURE MORE LIKELY	✓	✓	✓
CANCER LESS LIKELY TO SPREAD	✓	✗	✗
LESS LIKELY TO LOSE BREAST	✓	✓	✗
LESS LIKELY TO NEED TREATMENT	✗	✓	✗
NO. OF PERCEIVED ADVANTAGES	✓	✓‡	✗
BENEFITS OF MAMMO	✓	✓	✓
FIND BC EARLY	✓	✓	✗
PEACE OF MIND	✗	✓	✓
NO. OF PERCEIVED BENEFITS	✓	✓	✓
BETTER NOT KNOWING-CANCER	✓	✓	✓
SHOULN'T LOOK FOR ILLNESS	✓	✓	✗
PROBLEMS WITH MAMMO	✓†	✓	✓
NO. OF PERCEIVED PROBLEMS	✓	✓	✓
PROBLEMS WOULD STOP	✓	✓	✓
PAIN	✓	✓	✗
UNCOMFORTABLE	✓	✓	✓
OTHER PROBLEMS	✓	✓	✗
MAMMO FINDS ALL BC	✓	✓	✗
CANCERS MISSED	✓	✓	✗
REASONABLE TO MISS BC	✓	✓	✗
EMBARRASSED BY FEMALE	✓	✓	✗
EMBARRASSED BY MALE	✗	✓	✗
NEED SYMPTOMS	✓	✓	✓
EMBARRASSING	✓	✓	✓
TOO MUCH TROUBLE	✓	✓	✓
RATHER NOT THINK ABOUT IT	✓	✓	✓
RADIATION CONCERN	✓	✓	✓
INCONVENIENT	✓	✓	✓
PAINFUL	✓	✓	✓
ACCURACY CONCERN	✗	✓	✓
BARRIER SCORE	✓	✓	✓
MEANS MASTECTOMY	✓	✗	✗
FINDING EARLY SAVES LIVES	✗	✓	✗
IMPORTANT FOR AGE	✓	✓	✓
ASKING FOR TROUBLE	✓	✓	✓
MORE TROUBLE THAN WORTH	✓	✓	✓
ASKED BACK FOR TESTS	✓	✓	✓
MORE TESTS MEAN BC	✓	✓	✓
STRUCTURAL BARRIERS			
HOURS WORKED	✓	✓	✓
DIFFICULTY WITH COMMITMENTS	✗	✓	✗
ACCESS TO CAR	✓	✓	✓
HOW OFTEN ACCESS CAR	✓	✓	✓
HOUSEHOLD MEMBER DISABLED	✗	✓	✗

† not significant in itself, but entered in model as it was lead-in question to one that follows
‡ excluded from final model due to numerical problems (zero/very small number in a cell or colinearity with another variable

Table 5.7.3 Barrier construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in any of final logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years[1] OR (95% CI)	Resistant-case /Control[2] OR (95% CI)	Late-adopter /Control[3] OR (95% CI)
CURE MORE LIKELY (referent group = Stated			
Not stated	1.62 (0.97-2.72)*	1.32 (0.84-2.09)	0.71 (0.50-0.99)**
LESS LIKELY TO NEED TREATMENT (referent group = Stated			
Not stated	NE	10.18 (1.12-92.66)**	NE
FIND BC EARLY (referent group = Stated)			
Not stated	1.14 (0.67-1.92)	2.19 (1.11-4.32)**	NE
PEACE OF MIND (referent group = Stated)			
Not stated	NE	2.71 (1.40-5.27)***	1.81 (1.23-2.65)***
NO. OF PERCEIVED BENEFITS (referent group = One)			
Two or more	0.79 (0.45-1.40)	0.28 (0.14-0.55)***	0.77 (0.51-1.19)
SHOULDN'T LOOK FOR ILLNESS (referent group = Strongly disagree)			
Strongly agree	0.37 (0.14-0.98)**	1.59 (0.48-5.25)	NE
Agree	0.54 (0.20-1.45)	0.26 (0.11-0.61)***	
Disagree	0.65 (0.21-2.04)	0.37 (0.16-0.86)**	
NO. OF PERCEIVED PROBLEMS (referent group = One)			
Two or more	1.47 (0.32-6.81)	0.51 (0.11-2.45)	0.30 (0.12-0.74)***
PROBLEM WOULD STOP (referent group = Definitely not)			
Yes/maybe	3.85 (1.52-9.76)***	6.28 (1.90-20.72)***	1.63 (0.54-4.95)
Probably not	0.86 (0.33-2.27)	1.03 (0.33-3.16)	1.13 (0.50-2.53)
UNCOMFORTABLE (referent group = Aware of problem)			
Not aware of problem	0.62 (0.19-1.20)	0.70 (0.18-2.64)	1.62 (0.93-2.80)*
EMBARRASSING-FEMALE (referent group = Not embarrassed)			
Little embarrassed	0.85 (0.91-1.80)	1.82 (0.71-4.67)	NE
Quite/extremely embarrassed	2.87 (0.91-9.07)*	4.61 (0.95-22.45)*	
EMBARRASSING-MALE (referent group = Not embarrassed)			
Little embarrassed	NE	0.64 (0.36-1.15)	NE
Quite embarrassed		0.17 (0.06-0.47)***	
Extremely embarrassed		0.33 (0.11-0.98)**	
BARRIER SCORE (referent group = 29-32)			
≤ 22	1.55 (0.68-3.52)	7.01 (2.95-16.65)***	3.17 (1.72-5.84)***
23-24	1.28 (0.62-2.63)	2.96 (1.49-5.89)***	1.61 (1.03-2.51)**
25-28	1.29 (0.59-2.80)	2.28 (1.11-4.67)**	1.18 (0.73-1.92)
IMPORTANT FOR AGE (referent group = Agree)			
Disagree	1.34 (0.65-2.77)	4.27 (1.58-11.58)***	2.33 (1.02-5.31)**
MORE TROUBLE THAN WORTH (referent group = Disagree)			
Agree	1.75 (0.64-4.81)	4.49 (1.07-18.80)**	0.91 (0.32-2.61)
ASKED BACK FOR TESTS (referent group = Yes)			
No	1.34 (0.85-2.12)	3.75 (2.27-6.20)***	2.29 (1.56-3.36)***
HOURS WORKED (referent group = None)			
1-15	0.78 (0.34-1.80)	1.21 (0.49-2.99)	1.77 (0.90-3.47)*
16-39	0.38 (0.19-0.75)***	0.32 (0.15-0.67)***	0.99 (0.65-1.51)
40+	1.03 (0.51-2.07)	0.88 (0.36-2.12)	1.63 (0.88-3.00)

Table 5.7.3 continued

Variable	Cases-at-4-years[1] OR (95% CI)	Resistant-case /Control[2] OR (95% CI)	Late-adopter /Control[3] OR (95% CI)
	ANALYSIS		
DIFFICULTY WITH COMMITMENTS (referent group = Not difficult)			
Very difficult	NE	2.58 (1.07-6.25)**	NE
Quite difficult		1.70 (0.83-3.48)	
A little difficult		1.20 (0.68-2.10)	
ACCESS TO CAR (referent group = Yes)			
No	1.54 (0.91-2.59)	2.09 (1.20-3.64)***	1.21 (0.79-1.86)
HOW OFTEN HAVE ACCESS TO CAR (referent group = All the time)			
When required/sometimes	1.98 (0.89-4.36)*	1.40 (0.70-2.81)	0.58 (0.28-0.96)**
Someone else drives	1.10 (0.44-2.76)	1.17 (0.42-3.24)	1.27 (0.63-2.56)

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$
OR, odds ratio; CI, confidence interval; NE, not entered in model
EX, excluded due to numerical problems
[1] Model $\chi^2 = 92.67$, $P = <0\ 001$. Percent Predicted Correct: Resistant-cases = 51.56; Late-adopters = 79.31.
[2] Model $\chi^2 = 255.64$, $P = <0\ 001$. Percent Predicted Correct: Resistant-cases = 54.74; Controls = 93.39.
[3] Model $\chi^2 = 100.46$, $P = <0\ 001$. Percent Predicted Correct: Late-adopters = 38.93; Controls = 88.96.

Table 5.8.1 Influence construct: Variables associated with non-attendance to SABXRS at P < 0.10 level in bivariate analysis in any of three analyses

Variable	Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
	ANALYSIS		
EMOTIONAL SUPPORT PARTNER	0.317	**0.011**	0.144
CONFIDANT	0.323	**0.075**	0.392
TUTORS/SCHOOL HELP	0.402	**0.038**	0.249
MEMBER OF SENIOR CITIZEN'S	**0.050**	**0.093**	0.524
MEMBER OF ETHNIC CLUB	**0.090**	0.800	0.103
GP SURGERY	0.405	0.282	**0.030**
OTHER HEALTH PROF.	**0.096**	0.144	0.654
NO. SOURCES ABOUT MAMMO	0.137	**0.068**	0.825
DR SUGGESTED MAMMO	**< 0.001**	**0.015**	**0.060**
WHO SUGGESTED MAMMO	**< 0.001**	**0.002**	0.158
WOULD HAVE SX ON DR RECOM	**< 0.001**	**< 0.001**	**< 0.001**
KNOW SOMEONE WHO HAD MAMMO	**0.068**	0.105	0.649
NO-ONE WOULD INFLUENCE	**0.032**	**0.038**	0.733
DOCTOR WOULD INFLUENCE	**< 0.001**	**< 0.001**	0.902
FRIEND WOULD INFLUENCE	**0.041**	**0.076**	0.616
OTHER WOULD INFLUENCE	0.266	0.307	**0.012**
NO.OF INFLUENCES	**0.007**	**0.032**	0.537
SHOULD GP TELL ABOUT SABXRS	**0.045**	**0.058**	0.655
SHOULD ALL GET INVITE	0.525	**< 0.001**	**0.001**
USE ELECTORAL ROLL	**< 0.001**	**< 0.001**	0.315

Table 5.8.2 Influence construct: Variables entered into logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
EMOTIONAL SUPPORT PARTNER	✗	✓	✓
CONFIDANT	✗	✓	✗
DOES VOLUNTEER WORK	✗	✗	✓
TUTORS/SCHOOL HELP	✗	✓	✓
MEMBER OF CHURCH GROUP	✗	✓	✗
MEMBER OF SENIOR CITIZEN'S	✓	✓	✗
MEMBER OF ETHNIC CLUB	✓	✗	✓
MEMBER OF OTHER CLUB	✓	✗	✗
FRIEND/FAMILY	✗	✗	✓
GP SURGERY	✗	✗	✓
OTHER HEALTH PROF.	✓	✓	✗
NEWSPAPER	✗	✗	✓
RADIO	✗	✗	✓
OTHER SOURCE	✗	✓	✗
NO. SOURCES ABOUT MAMMO	✓	✓	✗
DR SUGGESTED MAMMO	✓	✓	✓
WHO SUGGESTED MAMMO	✓	✓	✓
DR ADVISED AGAINST MAMMO	✗	✓	✗
WOULD HAVE SX ON DR RECOM	✓	✓	✓
KNOW SOMEONE WHO HAD MAMMO	✓	✓	✗
NO-ONE WOULD INFLUENCE	✓	✓	✗
DOCTOR WOULD INFLUENCE	✓	✓	✗
CHILDREN WOULD INFLUENCE	✗	✗	✓
OTHER REL WOULD INFLUENCE	✗	✓	✗
FRIEND WOULD INFLUENCE	✓	✓	✗
OTHER WOULD INFLUENCE	✗	✗	✓
NO.OF INFLUENCES	✓	✓	✗
SHOULD GP TELL ABOUT SABXRS	✓	✓	✗
SHOULD ALL GET INVITE	✗	✓	✓
USE ELECTORAL ROLL	✓	✓	✗

Table 5.8.3 Influence construct: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in any of final logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years[1]	Resistant-case /Control[2]	Late-adopter /Control[3]
	OR (95% CI)	OR (95% CI)	OR (95% CI)
EMOTIONAL SUPPORT PARTNER (referent group = Yes)			
No	NE	1.26 (0.62-2.56)	1.03 (0.57-1.84)
No partner		1.58 (0.97-2.58)*	1.37 (0.95-1.96)*
CONFIDANT (referent group = Husband only)			
Sibling only	NE	0.51 (0.22-1.17)	NE
Child only		0.61 (0.31-1.17)	
Other relative only		1.19 (0.50-2.87)	
Friend/other only		0.94 (0.50-1.77)	
Other		1.74 (0.76-4.00)	
TUTORS/SCHOOL HELP (referent group = Yes)			
No	NE	0.32 (0.12-0.85)**	0.56 (0.22-1.43)
MEMBER OF SENIOR CITIZEN'S CLUB (referent group = Yes)			
No	0.31 (0.07-1.36)	0.23 (0.07-0.74)**	NE
FRIEND/FAMILY (referent group = Heard)			
Not heard	NE	NE	0.73 (0.51-1.04)*
GP SURGERY (referent group = Heard)			
Not heard	NE	NE	0.71 (0.51-0.99)**
NO. SOURCES ABOUT MAMMOGRAPHY (referent group = Three or more)			
None/one	0.79 (0.47-1.31)	0.93 (0.56-1.56)	NE
Two	0.58 (0.33-1.02)*	0.66 (0.38-1.16)	
WHO SUGGESTED MAMMO (referent group = Doctor and other)			
No-one	2.24 (0.94-5.33)*	1.74 (0.76-3.95)	0.73 (0.34-1.56)
Doctor only	0.77 (0.45-1.32)	0.64 (0.37-1.12)	0.81 (0.53-1.23)
WOULD HAVE SX ON DR RECOM(referent group = Definitely)			
Probably	1.44 (0.80-2.59)	6.72 (3.32-13.60)***	3.87 (2.09-7.15)***
No/uncertain	5.27 (2.55-10.92)***	37.25 (12.32-112.62)***	6.10 (1.89-19.66)***
DOCTOR WOULD INFLUENCE (referent group = Yes)			
No	2.24 (1.14-4.40)**	2.37 (1.10-5.09)**	NE
OTHER WOULD INFLUENCE (referent group = Yes)			
No	NE	NE	0.23 (0.06-0.94)**
NO. OF INFLUENCES (referent group = Two or more)			
One	1.90 (0.84-4.33)	2.33 (0.92-5.87)*	NE
SHOULD ALL GET GP INVITE (referent group = Yes)			
No	NE	0.95 (0.48-1.89)	1.87 (1.13-3.09)**
USE ELECTORAL ROLL(referent group = Yes)			
No	1.49 (0.95-2.34)*	1.74 (1.09-2.76)**	NE

* $P < 0.10$' ** $P < 0.05$; *** $P < 0.01$

OR, odds ratio; CI, confidence interval; NE, not entered in model ($P \geq 0.25$)

EX, excluded due to numerical problems

[1] Model $\chi^2 = 87.66$, $P = <0\ 001$. Percent Predicted Correct: Resistant-cases = 50.99; Late-adopters = 82.77.

[2] Model $\chi^2 = 189.21$, $P = <0\ 001$. Percent Predicted Correct: Resistant-cases = 43.94; Controls = 93.65.

[3] Model $\chi^2 = 69.37$, $P = <0\ 001$. Percent Predicted Correct: Late-adopters = 25.00; Controls = 91.65.

Table 5.9.1 Overall models: Variables entered into logistic regression models

Variable	ANALYSIS		
	Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
Variables from Socio-economic analyses			
AGE	✓	✗	✓
HIGHEST QUALIFICATION	✓	✓	✗
LIFETIME OCCUPATION	✗	✗	✓
HOUSEHOLD COMPOSITION	✓	✓	✗
NUMBER OF CHILDREN	✗	✓	✓
SOURCE OF INCOME	✓	✗	✗
INCOME	✗	✓	✓
SOCIO-ECONOMIC STATUS	✓	✗	✗
Variables from Health behaviours analyses			
DO BSE	✓†	✓†	✗
FREQUENCY OF BSE	✓	✓	✗
DOCTOR CHECKED BREASTS	✗	✓	✓
LAST BREAST EXAM	✗	✓	✓
EVER HAD PAP SMEAR	✓	✓	✗
SMOKING	✗	✗	✓
LAST TIME SAW DOCTOR	✗	✓	✓
DENTIST	✗	✓	✓
SAMPLE TYPE	✗	✓	✗
CASE TYPE	✓	NA	NA
EVER HAD MAMMO	✓	NA	NA
WILL USE SABXRS	✓	NA	NA
Variables from Knowledge analyses			
CANCER-MOST COMMON	✗	✓	✓
NIPPLE BLEEDING/DISCHARGE	✓	✗	✗
NIPPLE CHANGE/RETRACTION	✗	✗	✓
ARMPIT SWELLING	✗	✗	✓
PUCKERING/DIMPLING	✓	✗	✗
LUMPS TO BREAST CANCER	✗	✓	✗
INCIDENCE OF BC	✗	✗	✓
EXAMINE OWN BREASTS	✓	✓	✗
KNOWS MAMMO BEFORE DR	✓	✓	✗
HEARD OF SCREENING	✗	✗	✓
Variables from Susceptibility analyses			
CONCERNED MAY HAVE BC	✗	✗	✓
SPOKEN TO DR ABOUT CONCERN	✗	✗	✓
EVER HAD LUMP	✗	✓	✗
KNOW ANYONE WITH BC	✓†	✓†	✗
ACQUAINTANCE HAD BC	✗	✗	✓
OUTCOME OF EXPERIENCE WITH BC	✓	✗	✗
CLOSENESS TO PERSONS WITH BC	✓	✓	✗

Table 5.9.1 continued

Variable	ANALYSIS Cases-at-4-years	Resistant-case /Control	Late-adopter /Control
Variables from Barrier analyses			
CURE MORE LIKELY	✓	✗	✓
LESS LIKELY TO NEED TREATMENT	✗	✓‡	✗
BENEFITS OF MAMMO	✗	✓†	✗
FIND BC EARLY	✗	✓	✗
PEACE OF MIND	✗	✓	✓
NO. OF PERCEIVED BENEFITS	✗	✓	✗
SHOULDN'T LOOK FOR ILLNESS	✓	✓	✗
PROBLEMS WITH MAMMO	✓†	✓†	✓†
NO. OF PERCEIVED PROBLEMS	✗	✗	✓
PROBLEM WOULD STOP	✓	✓	✗
UNCOMFORTABLE	✗	✗	✓
EMBARRASSED BY FEMALE	✓	✓	✗
EMBARRASSED BY MALE	✗	✓	✗
BARRIER SCORE	✗	✓	✓
IMPORTANT FOR AGE	✗	✓	✓
MORE TROUBLE THAN WORTH	✗	✓	✗
ASKED BACK FOR TESTS	✗	✓	✓
HOURS WORKED	✓	✓	✓
COMMITMENT DIFFICULTIES	✗	✓	✗
ACCESS TO CAR	✓†	✓	✓†
HOW OFTEN ACCESS TO CAR	✓	✓	✓
Variables from Influence analyses common to all groups			
EMOTIONAL SUPPORT PARTNER	✗	✓‡	✓
CONFIDANT	✗	✓	✗
TUTORS/SCHOOL HELP	✗	✓	✗
MEMBER OF SENIOR CITIZEN'S	✗	✓	✗
FRIEND/FAMILY	✗	✗	✓
GP SURGERY	✗	✗	✓
NO. SOURCES ABOUT MAMMO	✓	✗	✗
DR SUGGESTED MAMMO	✓†	✗	✗
WHO SUGGESTED MAMMO	✓	✗	✗
WOULD HAVE SX ON DR RECOM	✓	✓	✓
NO-ONE WOULD INFLUENCE	✗	✓†	✗
DOCTOR WOULD INFLUENCE	✓	✓	✗
OTHER WOULD INFLUENCE	✗	✗	✓
NO. OF INFLUENCES	✗	✓	✗
SHOULD ALL GET GP INVITE	✗	✗	✓
USE ELECTORAL ROLL	✓	✓	✗

BC, Breast Cancer; NA, Not Applicable

† not significant in itself, but entered in model as it was lead-in question to one that follows

‡ excluded from final model due to numerical problems (zero/very small number in a cell or colinearity with another variable

Table 5.9.2 Overall models: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with non-attendance to SABXRS at P < 0.10 level in any of final overall logistic regression models

Variable	ANALYSIS Cases-at-4-years[1] OR (95% CI)	Resistant-case /Control[2] OR (95% CI)	Late-adopter /Control[3] OR (95% CI)
AGE (referent group = 50-59)			
40-49	1.38 (0.57-3.34)	NE	0.78 (0.43-1.41)
60+	1.96 (1.05-3.64)**		0.70 (0.43-1.15)
HIGHEST QUALIFICATION (referent group = Bachelor degree or higher)			
Trade qual/apprenticeship	0.25 (0.04-1.40)	0.09 (0.01-0.62)**	NE
Certificate or diploma	0.25 (0.07-0.87)**	0.24 (0.07-0.89)**	
No post-secondary qual	0.23 (0.07-0.79)**	0.21 (0.06-0.77)**	
LIFETIME OCCUPATION (referent group = Managerial/professional)			
Clerk/Sales/Service	NE	NE	0.63 (0.34-1.59)
Trade/Manual			0.26 (0.13-0.54)***
No post-secondary qual			0.46 (0.25-0.84)**
Home duties			
HOUSEHOLD COMPOSITION (Referent group = Husband only)			
Husband and other	0.77 (0.40-1.48)	0.48 (0.23-1.00)*	NE
Son/s only	0.53 (0.13-2.17)	0.64 (0.11-3.90)	
Daughter/s only	2.17 (0.49-9.67)	2.92 (0.66-12.94)	
Lives alone	0.61 (0.29-1.28)	1.39 (0.55-3.49)	
Other	1.60 (0.60-4.29)	1.97 (0.65-5.96)	
NUMBER OF CHILDREN (referent group = None)			
One or two	NE	0.88 (0.25-3.12)	1.25 (0.55-2.83)
Three or four		1.79 (0.90-3.59)*	0.88 (0.57-1.36)
Five or more		3.25 (1.29-8.18)**	1.72 (0.92-3.22)*
INCOME (Referent group = > $30,000)			
<= $20.000	NE	0.29 (0.10-0.83)**	1.07 (0.58-1.98)
$20,001-30,000		0.69 (0.25-1.87)	1.99 (1.11-3.57)**
Not stated		0.41 (0.09-1.85)	0.58 (0.23-1.42)
FREQUENCY OF BSE (Referent group = Monthly)			
1-2 times year	0.33 (0.14-0.80)**	0.33 (0.12-0.95)**	NE
3-5 times/year	0.46 (0.21-1.00)*	0.30 (0.12-0.76)**	
6-10 times/year	0.45 (0.21-0.99)**	0.23 (0.09-0.56)***	
unknown	0.43 (0.15-1.26)	0.35 (0.09-1.28)	
DR CHECKED BREASTS (Referent group = Yes)			
No	NE	0.42 (0.16-1.12)*	0.47 (0.25-0.88)**
SMOKING (referent group = Never smoked)			
Smoke now	NE	NE	1.17 (0.70-1.97)
Have smoked			2.02 (1.27-3.21)***
LAST TIME SAW DOCTOR (referent group = < 3 months ago)			
3 - < 6 months ago	NE	1.83 (0.79-4.21)	0.88 (0.51-1.50)
6 - < 12 months ago		0.67 (0.25-1.84)	0.41 (0.19-0.88)**
>= 12 months ago		1.80 (0.47-6.97)	1.50 (0.58-3.87)
DENTIST (referent group = Checkups)			
Problems	NE	2.43 (1.30-4.57)***	1.79 (1.18-2.70)***
Never visits		1.76 (0.61-5.07)	1.35 (0.67-2.71)
CASE TYPE (referent group = Cancel)			
FTA	1.76 (1.01-3.05)**	NA	NA

Table 5.9.2 continued

Variable	Cases-at-4-years[1] OR (95% CI)	Resistant-case /Control[2] OR (95% CI)	Late-adopter /Control[3] OR (95% CI)
	ANALYSIS		
WILL USE SABXRS (Referent group = Definitely would)			
Probably would	1.67 (0.88-3.15)	NA	NA
Probably not	3.10 (1.51-6.36)***		
Definitely not	6.29 (2.65-14.96)***		
CANCER-MOST COMMON (referent group = Breast)			
Bowel	NE	0.62 (0.20-1.95)	0.75 (0.36-1.56)
Lung		2.34 (0.33-16.49)	3.20 (0.92-11.07)*
Cervix		1.03 (0.48-2.21)	0.82 (0.49-1.38)
Don't know		0.45 (0.08-2.57)	0.75 (0.26-2.17)
HEARD OF SCREENING (referent group = Yes)			
No	NE	NE	2.34 (1.50-3.65)***
CONCERNED MAY HAVE BC (referent group = Yes)			
No	NE	NE	0.46 (0.27-0.79)***
SPOKEN TO DOCTOR ABOUT CONCERN (referent group = Yes)			
No	NE	NE	0.44 (0.22-0.91)**
EVER HAD LUMP (referent group = Yes)			
No	NE	0.39 (0.20-0.74)***	NE
CLOSENESS TO PERSONS WITH BC (referent group = Extremely close only)			
Quite close only	0.82 (0.37-1.83)	0.79 (0.31-1.99)	NE
Not very close only	0.31 (0.14-0.73)***	0.25 (0.09-0.68)***	
Combination	0.76 (0.28-2.01)	0.81 (0.29-2.25)	
CURE MORE LIKELY (referent group = Stated)			
Not stated	1.64 (0.99-2.71)*	NE	0.69 (0.46-1.02)*
PEACE OF MIND (referent group = Knew)			
Didn't know	NE	2.80 (1.16-6.75)**	1.98 (1.31-2.98)***
NO. OF PERCEIVED BENEFITS (referent group = Two or more)			
One	NE	0.44 (0.18-1.10)*	NE
SHOULDN'T LOOK FOR ILLNESS (referent group = Strongly agree)			
Agree	0.29 (0.09-0.91)**	2.54 (0.48-13.40)	NE
Disagree	0.42 (0.13-1.35)	0.40 (0.15-1.10)*	
Strongly disagree	0.40 (0.11-1.52)	0.48 (0.17-1.30)	
NO. OF PERCEIVED PROBLEMS (referent group = One)			
Two or more	NE	NE	0.20 (0.07-0.61)***
PROBLEM WOULD STOP (referent group = Definitely not)			
Yes/maybe	2.29 (0.81-6.49)	5.44 (1.10-26.89)**	NE
Probably not	0.79 (0.25-2.47)	0.26 (0.06-1.21)*	
UNCOMFORTABLE (referent group = Aware of problem)			
Not aware of problem	NE	NE	1.78 (0.95-3.34)*
EMBARRASSED BY FEMALE (referent group = Not embarrassed)			
Little embarrassed	0.99 (0.43-2.28)	2.69 (0.78-9.22)	NE
Quite/extremely embarrassed	2.57 (0.73-9.01)	19.20 (2.93-125.92)***	
EMBARRASSED BY MALE (referent group = Not embarrassed)			
Little embarrassed	NE	0.73 (0.34-1.58)	NE
Quite embarrassed		0.16 (0.04-0.61)***	
Extremely embarrassed		0.14 (0.03-0.56)***	

Table 5.9.2 continued

Variable	Cases-at-4-years[1] OR (95% CI)	Resistant-case /Control[2] OR (95% CI)	Late-adopter /Control[3] OR (95% CI)
	ANALYSIS		
BARRIER SCORE (referent group = 29-32)			
<= 22	NE	4.44 (1.44-13.70)***	2.84 (1.42-5.68)***
23 -24		2.23 (0.91-5.46)*	1.50 (0.89-2.52)
25 -28		2.26 (0.91-5.65)*	1.18 (0.67-2.06)
IMPORTANT FOR AGE (referent group = Agree)			
Disagree	NE	3.75 (0.95-14.80)*	2.88 (1.12-7.38)**
ASKED BACK FOR TESTS (referent group = Yes			
No	NE	4.60 (2.37-8.94)***	2.09 (1.36-3.22)***
HOURS WORKED (referent group = None)			
0-15	0.97 (0.33-2.90)	1.33 (0.41-4.25)	2.06 (0.96-4.44)*
16-39	0.52 (0.22-1.24)	0.22 (0.08-0.62)***	0.87 (0.50-1.52)
40+	1.03 (0.39-2.70)	0.81 (0.25-2.69)	1.63 (0.73-3.62)
ACCESS TO CAR (referent group = Yes)			
No	1.34 (0.71-2.54)	2.61 (1.30-5.26)***	2.25 (1.33-3.78)***
CONFIDANT (referent group = Husband only)			
Sibling only	NE	0.48 (0.14-1.64)	NE
Child only		0.64 (0.25-1.63)	
Other relative only		1.39 (0.42-4.65)	
Friend/other only		1.45 (0.58-3.61)	
Other		3.77 (1.05-13.59)**	
TUTORS/SCHOOL HELP (referent group = Yes)			
No	NE	0.15 (0.04-0.65)**	NE
FRIEND/FAMILY (referent group = Yes)			
No	NE	NE	0.59 (0.38-0.91)**
GP SURGERY (referent group = Yes)			
No	NE	NE	0.68 (0.46-1.00)*
NO. SOURCES ABOUT MAMMOGRAPHY (referent group = Three or more)			
None/one	0.63 (0.32-1.21)	NE	NE
Two	0.49 (0.24-0.99)**		
WOULD HAVE SX ON DOCTOR RECOM (referent group = Definitely)			
Probably	1.05 (0.46-2.39)	6.72 (2.28-19.87)***	4.15 (1.91-9.02)***
No/maybe	3.10 (1.13-8.52)**	23.69 (5.05-111.10)***	1.80 (0.42-7.73)
DOCTOR WOULD INFLUENCE (referent group = Yes)			
No	1.60 (0.95-2.71)*	2.04 (0.76-5.46)	NE
SHOULD ALL GET GP INVITE (referent group = Yes)			
No	NE	NE	2.29 (1.27-4.11)***

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$;
OR, odds ratio; CI, confidence interval; NE, not entered in model
EX, excluded due to numerical problems; nc, not calculable
[1] Model $\chi^2 = 196.23$, $P = <0\ 001$. Percent Predicted Correct: Resistant-cases = 68.81; Late-adopters = 84.35.
[2] Model $\chi^2 = 373.90$, $P = <0\ 001$. Percent Predicted Correct: Late-adopters = 74.05; Controls = 94.80.
[3] Model $\chi^2 = 225.15$, $P = <0\ 001$. Percent Predicted Correct: Late-adopters = 55.56; Controls = 87.64.

Table 5.9.3 LIFETIME OCCUPATION by HIGHEST QUALIFICATION[1] (row percents)

Highest Qualification	LIFETIME OCCUPATION Managerial /Professional	Trades-person	Clerk/sales /service	Manual	Home duties	Total
Bachelor degree or higher	86	0	3	0	11	100
Trade qual or apprenticeship	3	42	10	1	34	100
Certificate or diploma	31	2	34	4	29	100
No post-secondary qual	7	3	26	17	47	100

[1] Chi-square test of significance P < 0.001

Table 5.9.4 ATTENDANCE STATUS WITH SABXRS AT 31/12/1995 by Embarrassment by selected characteristics (row percents)

ATTENDANCE STATUS WITH SABXRS AT 31/12/1995

	Control			Late-adopter			Resistant -case		
	Embarrassed to undress			Embarrassed to undress			Embarrassed to undress		
	No	Male only	Both	No	Male only	Both	No	Male only	Both
Country of Birth									
Australia	59.3	31.3	9.4	58.7	31.4	9.9	56.0	24.8	19.1
Other English speaking	63.6	23.9	12.5	63.3	20.4	16.3	64.5	25.8	9.7
Southern Europe	51.4	40.0	8.6	42.9	28.6	28.6	61.5	15.4	23.1
Northern Europe	62.5	31.3	6.3	72.7	27.3	--	54.5	36.4	9.1
Other	47.1	41.2	11.8	50.0	42.9	7.1	44.4	11.1	44.4
Speaks non-English at home									
Yes	53.9	36.8	9.2	51.2	32.6	16.3	57.1	17.9	25.0
No	60.3	29.8	9.9	59.8	29.0	11.2	57.1	25.4	17.5
Language spoken									
Italian	52.4	38.1	9.5	46.2	30.8	23.1	85.7	0.0	14.3
Greek	54.5	45.5	--	50.0	25.0	25.0	40.0	20.0	40.0
Other NESB	52.4	35.7	11.9	54.5	36.4	9.1	50.0	25.0	25.0
Religion									
Anglican/CoE	62.8	28.1	9.1	64.5	26.3	9.2	58.2	25.5	16.4
Catholic	57.1	34.5	8.4	52.3	32.3	15.4	58.7	21.7	19.6
Orthodox	60.0	33.3	6.7	60.0	22.0	20.0	57.1	14.3	28.6
Uniting	60.6	27.7	11.7	60.0	28.0	12.0	51.2	30.2	18.6
Other Christian	52.1	40.8	7.0	51.6	34.3	5.7	56.8	21.6	21.6

Table 5.10.1 Controls: Re-attendance at SABXRS by 31/12/95 by Intention at Baseline (row percents)

	RE-ATTENDED Yes N= 418	No N=51
WILL USE SABXRS		
Definitely would	92.8	7.2
Probably would	83.3	16.7
Probably not	53.3	46.7
Definitely not	11.1	88.9

Table 5.10.2 Cases/Controls who attended after interview: Number of Attendances by Sample by Case-Control status (column percents)

	SAMPLE					
	Spontaneous			GP		
Number of Attendances	FTA N=30	Cancel N=81	Control N=189	FTA N=75	Cancel N=83	Control N=229
One	53.3	35.8	25.4	50.7	39.8	14.8
Two	33.3	61.7	71.4	49.3	60.2	84.7
Three	13.3	2.5	2.1	0.0	0.0	0.4
Four	0.0	0.0	1.1	0.0	0.0	0.0

Figure 5.11.1 Cases: Mammographic History at Baseline and attendance status at 31/12/95 by Sample Type and Case Type (column percents)

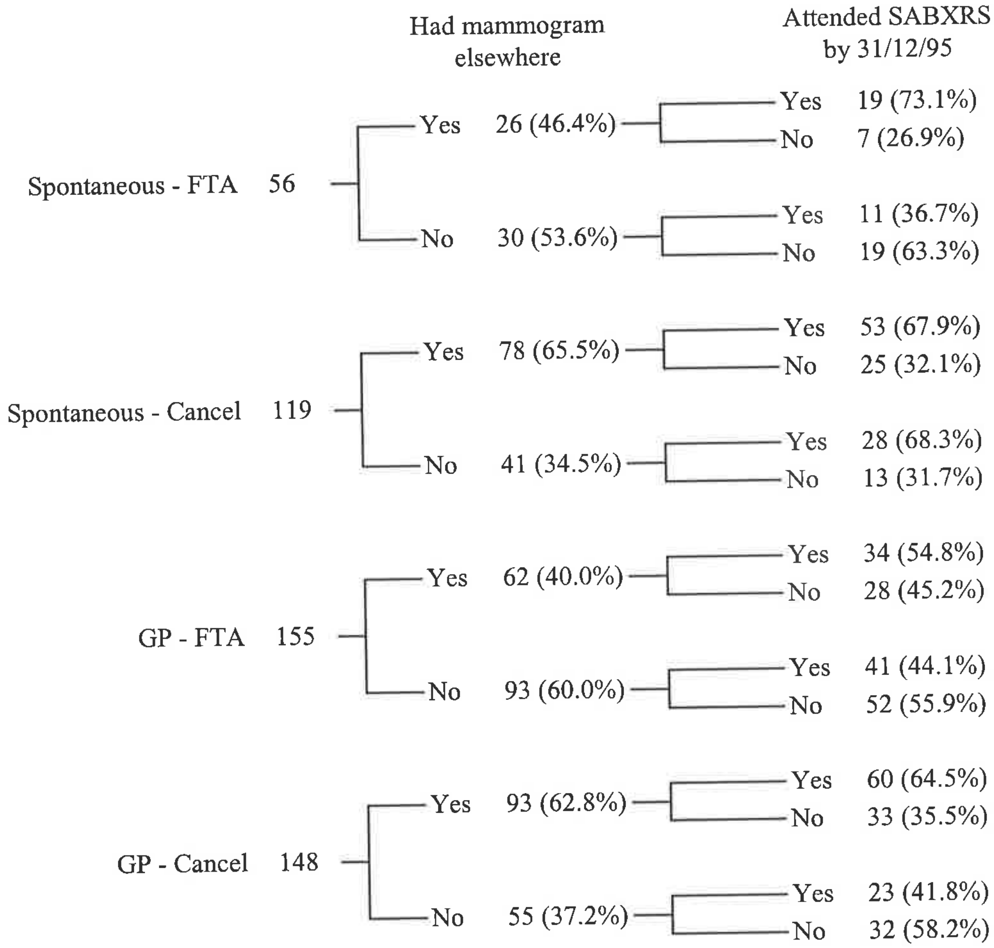


Table 5.11.1 Cases by Mammographic History at Baseline by Sample Type and Case Type and age

	Spontaneous				GP			
	FTA-case		Cancel-case		FTA-case		Cancel-case	
AGE	N	% Had[1]	N	% Had[1]	N	% Had[1]	N	% Had[1]
ALL CASES								
40-49	16	50.0	46	69.6	na		na	
50-59	31	45.2	48	66.7	103	46.6	101	69.3
60+	9	44.4	25	56.0	52	26.9	47	48.9
LATE ADOPTERS								
40-49	9	77.8	33	66.7	na		na	
50-59	17	52.9	34	67.6	55	49.1	65	78.5
60+	4	75.0	14	57.1	20	35.0	18	50.0
RESISTANT CASES								
40-49	7	14.3	13	76.9	na		na	
50-59	14	35.7	14	64.3	48	43.8	36	52.8
60+	5	20.0	11	54.5	32	21.9	29	48.3

[1] Percent of N with a mammographic history at base-line

Table 5.11.2 Cases with Mammographic History at Baseline by Sample Type and Case Type by selected variables associated with that mammogram

	SAMPLE TYPE							
	SPONTANEOUS				GP			
	FTA-case		Cancel-case		FTA-case		Cancel-case	
	All cases N=26	Late-adopters N=19	All cases N=78	Late-adopters N=53	All cases N=62	Late-adopters N=34	All cases N=93	Late-adopters N=60
WHO SUGGESTED LAST MAMMOGRAM								
Self-initiated	19.2	21.1	42.3	45.3	11.5	12.1	18.7	15.3
Doctor letter	na		na		4.9	9.1	7.7	10.2
Doctor other	80.8	79.0	57.7	54.7	83.6	78.8	73.6	74.6
REASON FOR LAST MAMMOGRAM								
Diagnostic	26.9	15.8	41.0	35.8	32.3	29.4	25.0	18.3
Screening	73.1	84.2	59.0	64.2	67.7	70.6	75.0	81.7
LAST MAMMOGRAM BEFORE OR AFTER SABXRS APPOINTMENT DATE								
Same month	12.5	11.8	12.0	11.8	3.4	6.1	6.6	8.6
Before	29.2	17.6	54.7	52.9	52.5	48.5	56.0	56.9
After	58.3	70.6	33.3	35.3	44.1	45.5	37.4	34.5

Table 5.11.3 Cases with Mammographic History by whether Special trip made for referral by Sample Type and Case Type by Reason for mammogram

	SAMPLE TYPE			
	Spontaneous		GP	
	FTA-case No. (%)	Cancel-case No. (%)	FTA-case No. (%)	Cancel-case No. (%)
WAS A SPECIAL TRIP MADE TO DOCTOR TO OBTAIN REFERRAL FOR MAMMOGRAM				
Diagnostic				
Yes	4 (66.7)	20 (64.5)	12 (60.0)	14 (60.9)
No	2 (33.3)	11 (35.5)	8 (40.0)	9 (39.1)
Total Diagnostic	*6 (100.0)*	*31 (100.0)*	*20 (100.0)*	*23 (100.0)*
Screening				
Yes	3 (16.7)	20 (44.4)	10 (25.0)	19 (27.5)
No	15 (83.3)	25 (55.6)	30 (75.0)	50 (72.5)
Total Screening	*18 (100.0)*	*45 (100.0)*	*40 (100.0)*	*69 (100.0)*

Table 5.11.4 Cases: Attendance at SABXRS by 31/12/95 by Mammographic History at Baseline by Sample Type by Intention at Baseline (row percents)

	EVER HAD MAMMO							
	YES				NO			
	Spontaneous		GP		Spontaneous		GP	
WILL USE SABXRS	Late-adopters N=72	Resistant-cases N=32	Late-adopters N=94	Resistant-cases N=60	Late-adopters N=39	Resistant-cases N=32	Late-adopters N=64	Resistant-cases N=83
Definitely would	79.6	20.4	75.4	24.6	63.2	36.8	76.7	23.3
Probably would	78.1	21.9	67.7	32.3	38.9	61.1	38.1	61.9
Probably not	43.8	56.3	53.3	46.7	63.6	36.4	32.1	67.9
Definitely not	14.3	85.7	28.6	71.4	25.0	75.0	17.6	82.4

Table 5.12.1 Main source of information about SABXRS (column percents)

	SAMPLE					
	Spontaneous			GP		
Main source of information about SABXRS	FTA N= 49[1]	Cancel N=106[1]	Control N=179[1]	FTA N=105[1]	Cancel N=112[1]	Control N=195[1]
Print media	18.4	15.1	12.8	11.4	8.9	6.7
Radio/TV	8.2	7.5	12.3	4.8	7.1	6.2
GP letter	na	na	na	49.5	66.1	70.8
GP other	38.8	34.9	40.2	7.6	4.5	6.7
Friend/relative	6.1	17.9	15.6	12.4	7.1	2.6
SABXRS pamphlet	14.3	13.2	8.4	5.7	2.7	4.6
Other[2]	14.3	11.3	10.6	8.6	3.6	2.6

[1] Excludes women who had not heard of SABXRS and where heard but source is missing
[2] Includes talks, workplace, organisations
na, not applicable

Table 5.12.2 Cases: Main source of information about SABXRS by Attendance at 31/12/95 (column percents)

	SAMPLE							
	Spontaneous				GP			
	FTA		Cancel		FTA		Cancel	
Main source of information about SABXRS	Late-adopters N=26	Resistant-cases N=23	Late-adopters N=73	Resistant-cases N=33	Late-adopters N=53	Resistant-cases N=52	Late-adopters N=62	Resistant-cases N=50
Print media	19.2	17.4	11.0	24.2	9.4	13.5	8.1	10.0
Radio/TV	3.8	13.0	6.8	9.1	3.8	5.8	8.1	6.0
GP letter	na	na	na	na	49.1	50.0	61.3	72.0
GP other	46.2	30.4	37.0	30.3	11.3	3.8	4.8	4.0
Friend/relative	7.7	4.3	20.5	12.1	13.2	11.5	6.5	8.0
SABXRS pamphlet	15.4	13.0	15.1	9.1	5.7	5.8	4.8	0.0
Other[2]	7.7	21.7	9.6	15.2	7.5	9.6	6.5	0.0

[1] Excludes women who had not heard of SABXRS and where heard but source is missing
[2] Includes talks, workplace, organisations
na, not applicable

Table 5.12.3 Cases: Main reason for not using SABXRS by Case Type (column percents)

	SAMPLE			
	Spontaneous		GP	
Main reason for not keeping SABXRS appointment	FTA N= 39[1]	Cancel N=102[1]	FTA N=109[1]	Cancel N=115[1]
Prefers Private mammogram	5.1	3.9	4.6	9.6
Barriers				
Structural barriers	5.1	5.9	0.9	5.2
Perceived barriers	10.3	7.8	6.4	4.3
Apathy/no need	76.9	64.7	73.4	52.2
External factors				
Breast problem	2.6	13.7	7.4	21.7
Other clinical problem	0.0	2.0	3.7	3.5
Other	0.0	2.0	3.7	3.5

[1] Excludes women who had not heard of SABXRS or heard but reason is missing

Table 5.12.4 Cases: Main reason for not using SABXRS by Case Type by Attendance Status at 31/12/95 (column percents)

	SAMPLE							
	Spontaneous				GP			
	FTA		Cancel		FTA		Cancel	
Main reason for not keeping SABXRS appointment	Late-adopters N=17[1]	Resistant-cases N=22[1]	Late-adopters N=67[1]	Resistant-cases N=35[1]	Late-adopters N=54[1]	Resistant -cases N=55[1]	Late-adopters N=59[1]	Resistant-cases N=56[1]
Prefers Private	11.8	0.0	1.5	8.6	3.7	5.5	8.5	10.7
Barriers								
Structural barriers	5.9	4.5	4.5	8.6	0.0	1.8	8.5	1.8
Perceived barriers	5.9	13.6	7.5	8.6	0.0	12.7	3.3	5.4
Apathy/no need	70.6	81.8	67.2	60.0	85.2	61.8	50.8	53.6
External factors								
Breast problem	5.9	0.0	13.4	14.3	3.7	10.9	20.3	23.2
Other clinical problem	0.0	0.0	3.0	0.0	3.7	3.6	3.4	3.6
Other	0.0	0.0	3.0	0.0	3.7	3.6	5.1	1.8

[1] N, number of responses (ie, not unique women, includes multiple responses) . Asked of cases who said they 'Probably won't' or 'Definitely won't' use SABXRS in next 2 years.

Table 5.12.5 Cases: Main reason for not wanting mammogram with SABXRS in next 2 years by Case Type (column percents)

	SAMPLE			
	Spontaneous		GP	
Reason for not wanting to use SABXRS	FTA N= 4[1]	Cancel N=37[1]	FTA N=53[1]	Cancel N=62[1]
Don't like tests/xrays	0.0	10.8	18.9	21.0
Don't need/too busy/too much trouble	25.0	10.8	39.6	21.0
Perceived barriers	50.0	32.4	13.2	14.5
Medical	0.0	10.8	15.1	25.8
Other	25.0	35.1	13.2	17.7

[1] N, number of responses (ie, not unique women, includes multiple responses) . Asked of cases who said they 'Probably won't' or 'Definitely won't' use SABXRS in next 2 years.

Table 5.12.6 Cases: Main reason for not wanting mammogram with SABXRS in next 2 years by Case Type by Attendance Status at 31/12/95 (column percents)

	SAMPLE							
	Spontaneous				GP			
	FTA		Cancel		FTA		Cancel	
Reason for not wanting to use SABXRS	Late-adopters N=1[1]	Resistant-cases N=3[1]	Late-adopters N=16[1]	Resistant-cases N=23[1]	Late-adopters N=22[1]	Resistant-cases N=39[1]	Late-adopters N=22[1]	Resistant-cases N=49[1]
Don't like tests/xrays	0.0	0.0	12.5	8.7	9.1	20.5	18.2	18.4
Don't need/too busy/too much trouble	0.0	33.3	12.5	17.4	31.8	41.0	13.6	26.5
Perceived barriers	0.0	66.7	43.8	21.7	27.3	17.9	22.7	20.4
Medical	0.0	0.0	6.3	13.0	18.2	10.3	22.7	22.4
Other	100.0	0.0	25.0	39.1	13.6	10.3	22.7	12.2

[1] N, number of responses (ie, not unique women, includes multiple responses) . Asked of cases who said they 'Probably won't' or 'Definitely won't' use SABXRS in next 2 years.

Table 5.12.7 Cases: What would Prompt to have mammogram with SABXRS by Case Type (column percents)

	SAMPLE			
	Spontaneous		GP	
What would prompt to use SABXRS	FTA N= 21[1]	Cancel N=81[1]	FTA N=106[1]	Cancel N=103[1]
Preventive action	14.3	8.6	5.7	4.9
If referred by doctor	23.8	25.9	28.3	35.9
Symptoms/problems	38.1	29.6	28.3	29.1
Other	19.0	29.6	17.9	13.6
Nothing	4.8	6.2	19.8	16.5

[1] N, number of responses (ie, not unique women, includes multiple responses) . Asked of cases who said they 'Probably will', 'Probably won't' or 'Definitely won't' use SABXRS in next 2 years.

Table 5.12.8 Cases: What would Prompt to have mammogram with SABXRS by Case Type by Attendance Status at 31/12/95 (column percents)

	SAMPLE							
	Spontaneous				GP			
	FTA		Cancel		FTA		Cancel	
What would prompt to use SABXRS	Late-adopters N=11[1]	Resistant-cases N=10[1]	Late-adopters N=44[1]	Resistant-cases N=37[1]	Late-adopters N=39[1]	Resistant-cases N=67[1]	Late-adopters N=43[1]	Resistant-cases N=60[1]
Preventive action	18.2	10.0	15.9	0.0	7.7	4.5	9.3	1.7
If referred by doctor	27.3	20.0	22.7	29.7	25.6	29.9	27.9	41.7
Symptoms/problems	36.4	40.0	29.5	29.7	33.3	25.4	30.2	28.3
Other	18.2	20.0	27.3	32.4	25.6	13.4	20.9	8.3
Nothing	0.0	10.0	4.5	8.1	7.7	26.9	11.6	20.0

[1] N, number of responses (ie, not unique women, includes multiple responses) . Asked of cases who said they 'Probably will', 'Probably won't' or 'Definitely won't' use SABXRS in next 2 years.

Table 5.12.9 Willingness to pay for mammogram (generally) by Sample Type by Case Type (column percents)

	SAMPLE					
	Spontaneous			GP		
Amount willing to pay for mammogram	FTA N=56	Cancel N=119	Control N=215	FTA N=155	Cancel N=148	Control N=254
Nothing	32.1	24.4	20.5	29.0	25.0	36.6
$1-20	10.7	22.7	20.0	8.4	14.2	20.9
$21-40	7.1	14.3	9.3	5.8	8.8	6.3
$> $40	21.4	15.1	27.9	15.5	16.9	16.1
Don't know	25.0	20.2	20.5	29.0	22.3	19.7
Won't have mammogram	3.6	3.4	1.9	12.3	12.8	0.4

Table 5.12.10 Cases: Willingness to pay for mammogram (generally) by Sample Type by Case Type by Attendance status at 31/12/95 (column percents)

	SAMPLE							
	Spontaneous				GP			
	FTA		Cancel		FTA		Cancel	
Amount willing to pay for mammogram	Late-adopters N=30	Resistant-cases N=26	Late-adopters N=81	Resistant-cases N=38	Late-adopters N=75	Resistant-cases N=80	Late-adopters N=83	Resistant-cases N=65
Nothing	26.7	38.5	24.7	23.7	37.3	21.3	27.7	21.5
$1-20	13.3	7.7	25.9	15.8	9.3	7.5	19.3	7.7
$21-40	6.7	7.7	14.8	13.2	6.7	5.0	8.4	9.2
$> $40	30.0	11.5	11.1	23.7	12.0	18.8	18.1	15.4
Don't know	23.3	26.9	22.2	15.8	30.7	27.5	22.9	21.5
Won't have mammogram	0.0	7.7	1.2	7.9	4.0	20.0	3.6	24.6

PART III

INVITEE STUDY: ATTENDERS AND NON-ATTENDERS TO SOUTH AUSTRALIAN BREAST X-RAY SERVICE FOLLOWING INVITATION FOR INITIAL AND RESCREEN

CHAPTER 6 INVITEE STUDY

6.1 INTRODUCTION

Part II of this thesis focused on the two recruitment strategies in use at the SABXRS during the early phase of the program, namely the use of general practitioner (GP) lists and self-referral. As the Service expanded, and it could no longer rely on spontaneous bookings to fill the appointment slots available, the electoral roll became the main method to target women. While the GP lists yielded a higher response rate, there was considerable work involved in the organisational aspects. During the early phases of issuing electoral roll (ER) invitations the response rate was not far behind that of GP invitations, hence it was more cost-effective.

However, as Figure 2.1.2 in Chapter 2 shows, the response rate to ER invitations in Adelaide declined markedly in 1994, particularly in some areas, and there was concern regarding the continued ability of the Service to fill appointments. The investigator was granted approval to conduct a survey of non-attenders to ER invitations (focusing on reasons for non-attendance); the initial ethics approval for the case-control study was extended to cover women whose names were obtained from the electoral roll. Approval was also granted to survey non-attenders to re-screen invitations simultaneously. Given that the Service was moving into the phase where both its success and sustainability depended on the ability to maintain women as regular clients once they were recruited this was considered an important and timely aspect to study as well. The surveys were carried out under the auspices of the University of Adelaide as for the case-control study.

Three separate samples were drawn to represent the three invitation types issued; Electoral Roll invitation for a first screen, Re-Invitation for first screen and Invitation for Re-screen. Explanatory details and selection method are presented in the next section (6.2). The results of the interviews conducted with non-attenders are presented in section 6.3, with summarised tables at the end of this chapter. The detailed frequencies for the variables studied by clinic and invitation type are listed in Appendix D3, with variables grouped into five separate tables (D3.1 to D3.5) representing: 1) socio-demographic characteristics, 2) knowledge and perceptions about mammography and the SABXRS, 3) exposure to, and history of, mammography and breast cancer, 4) response to invitation and reasons for not attending, and 5) intentions about mammography in the future. Where appropriate comparisons are made between the non-attenders interviewed and attenders matched by invitation type and invitation date. For these comparisons, chi square tests of significance were performed to test the hypothesis that non-attenders are likely to differ from attenders on a range of variables. However, this part of the analysis is limited since attenders were not interviewed; the comparative data for attenders are based on data collected routinely when women present for screening.

6.2 METHOD

6.2.1 Study Population and Sample Selection

Women issued an invitation in the first quarter of 1995 were the first stage of selection for the study. Arndale was chosen for inclusion to represent metropolitan Adelaide as over 70% of the ER invitations during this period were issued for that clinic. For a comparison with a country clinic, the mobile unit located in Port Augusta was chosen as it was the most distant of the two mobiles and had a higher number of invitations. Port Augusta is a town with a population of 14,000 persons in June 1995 (Australian Bureau of Statistics, 1996c), located about 305 kilometres from Adelaide. The town itself comprised about 1,180 women aged 50 to 69, the target age group for the SABXRS. This location services a wide geographical area which included just over 2 000 female residents in the target age group at that time. The catchment area serviced by the Arndale comprised nearly 22,000 women aged 50 to 69 at the time. Figure 6.2.1 shows the location of the clinics and the geographical catchment area for each. Geographical areas are allocated to clinics on the basis of Statistical Local Areas (SLA) as defined by the Australian Bureau of Statistics.

Figure 6.2.2 shows the number and outcome of invitations sent to these two areas during this period. Three types of invitations were issued:

1. First invitation for an initial screen with the SABXRS to target women who had not had any contact with the SABXRS, using the electoral roll list of women aged 50 to 69 (ER Invitee). The first screen is referred to as 'Round 1' (R1).
2. A second invitation for a Round 1 screen with the SABXRS to women who had not responded to a previous ER invitation, or who made a Spontaneous appointment which they did not keep (R1 Re-invitee). R1 Re-invite letters are sent 12 months following the initial electoral roll invitation or spontaneous appointment missed for women in Adelaide, and at 2 years (when the van revisits) for mobile clinic clients.
3. An invitation for a second screen with the SABXRS, two years following the first screen (Re-screen Invitee), issued only to women aged less than 70.

All invitations include a suggested date but no time. In order to secure an appointment the woman was required to telephone the service. This contrasts with the earlier GP invitations (Chapter 3) which included a date and time, and where no action was required by the woman to confirm the appointment.

In Port Augusta, the sample included invitations to women from three SLAs in the catchment area (Port Augusta town and the two proximate SLAs) while the van was in Port Augusta for its second visit early in 1995. In Arndale, invitations were included in relation to appointments over a similar time period, but January was excluded as few invitations were issued.

All 3 invitation types were included for Port Augusta, but for Arndale Round 1 re-invitations were excluded as very few were issued. The number of invitations issued in the selection period by clinic and invitation type, and the outcome of those invitations is shown in Figures 6.2.3 to 6.2.7.

It can be seen that in Arndale only 20% of women issued an ER invitation (ER Invitees) actually attended in response to the invitation (defined as an attendance within 90 days of the invitation date), and 20% of women who made an appointment failed to keep it. Further, only 56% of women issued a re-screen invitation (Re-screen Invitees) attended, and the proportions were even lower for the two largest SLAs which were closest to the clinic, Hindmarsh-Woodville (40%) and Port Adelaide (34%). These SLAs have a higher proportion of non-English speaking women than the average for Adelaide (data presented in section 6.3.1 below).

For Port Augusta 75% of Re-screen invitees attended. However, attendance was recorded for only 35% of ER invitees and 25% of R1 Re-invitees. Further, as would be expected, attendance was related to distance. For the ER invitees, 12% of women from the Roxby Downs SLA and 7% of those from the Unincorporated Far North attended, areas that are significant distances from Port Augusta (see Figure 6.2.1). However there was no difference for the SLAs in and around the town of Port Augusta (52% attended from both Port Augusta and Kanyaka-Quorn and 47% from Mt Remarkable). For the Re-screens, although attendance was lower for the distant SLAs, 64% of the women from the Unincorporated Flinders and 50% from the Unincorporated Far North attended, showing a high level of commitment to screening amongst these women after they join the program, despite the distance they need to travel.

The *No Response* outcome category, which comprised women who were invited but did not respond in any way to the invitation, was chosen as the next stage of selection. The catchment area for Port Augusta is vast (see Figure 6.2.1), thus the distant SLAs were excluded. However, the number of target women residing in these are quite low; 23 in Carrieton, 37 in Hawker, 50 in Roxby Downs, 76 in Unincorporated Flinders Ranges, and, 205 in Unincorporated Far North, the latter being spread over half the State (Australian Bureau of Statistics, 1996c). For the remaining three SLAs in Port Augusta, a significant proportion of the potential sample was excluded on the basis of having only a postal address. After these unavoidable exclusions, all remaining cases were included for Port Augusta. For Arndale half of the ER and all the Re-screen non-responders were included.

6.2.2 Survey Method and Response Rates

The main aim of this study was to focus on reasons for non-attendance following the issue of an invitation to attend for the first time or to re-attend. Only non-attenders were interviewed. The investigator planned the study and designed the questionnaire using the same wording and categorisations as for the case-control study questionnaire (Chapter 3) where appropriate.

The survey entailed personal interview in the home. Although the cost of surveying these women was relatively high, particularly in the country area, it was considered warranted to ensure a high response rate, particularly given that the selected women had made no contact at all with the Service (*No Response* outcome category). The survey aimed to probe in detail the reasons for not taking up the offer of a mammogram with the SABXRS. It also repeated a number of the questions included the case-control study, hence in order to make valid comparisons the method of collection was preferably the same (otherwise complex testing and adjustment for survey method would be required) and the wording identical. A section of questioning was also included to allow comparison with women who had attended matched by invitation type and date. This comprised questions that the Service collects from attenders on presentation to the Service for a mammogram about current and past breast problems and personal and family history of breast cancer. For these questions, the non-attenders surveyed were asked to refer to the time they received the invitation so that the responses related to the same period for both attenders and non-attenders; that is breast problems which developed since the invitation date were excluded. The questionnaires are included in Appendix G.

Interviewers were provided with lists of selected cases grouped geographically, and for Port Augusta given a map with selections marked on it. Figures 6.2.3 to 6.2.7 also provide details of the final response to the survey. It can be seen that from 9% (Arndale ER) to 27% (Arndale R1 Re-invite) of the sample was found to be out of the scope, either on the basis of ineligibility for this study or for screening with the SABXRS per se. Overall, 20% of those classified as 'Out of scope' were deceased, and 80% of the deceased were amongst the ER sample, which reinforces the problems in using the electoral roll identified in Chapter 1. Of the overall 'Out of scope' cases, 38% were due to incorrect or insufficient addresses, some being vacant houses, and 37% due to selection error. These latter were cases where the interviewer discovered that the woman had recently had a mammogram at the SABXRS. However, it was found that most of these women had a mammogram in the period between selection and interview. Two of the 'Out of Scope' cases were males; this also is an error from the electoral roll since the list supposedly includes only females aged 50 to 69.

The other major source of sample loss resulted from women no longer being resident at the address on the electoral roll for ER and R1 Re-invite cases and on the SABXRS database for the Re-screen cases. Women who moved to a known address within the area were traced and interviewed, therefore the total proportion who actually moved was higher than indicated in these figures. These data also indicate that only a small proportion of undelivered letters are returned to the SABXRS, given the relatively low *Return to Sender* numbers in Figures 6.2.3 to 6.2.7.

The sample that was potentially contactable after excluding the 'Out of Scope' and 'Moved' (to an unknown or distant address) is labelled 'POTENTIAL CONTACTS' in Figures 6.2.3 to 6.2.7. It can be seen that a proportion of these were lost due to no contact after several attempts by the interviewer. Of those who were contacted, from 85% (Arndale ER) to 92% (Arndale R1 Re-invite) were interviewed. The refusal rate ranged from 5.6% (both Arndale and Port Augusta Re-screen) to 12.3% (Arndale ER). The small proportion classified as 'Unable to interview' were for the following reasons; bereavement (13%), illness of the subject (47%), illness of a family member (7%) and language difficulty (33%). All the language cases (5 in number) were from Arndale.

It was considered important to include as many women as possible from the outlying areas in the survey, to determine whether the problem of access due to distance was an important barrier to attending. However, the cost of the interviewer returning to the outlying areas meant that the number of calls was necessarily limited; for the non-contacts in the town of Port Augusta, between 2 and 7 calls were made (average = 4) in an attempt to contact a resident, whereas for the two outlying SLAs only 1 or 2 calls were made (average = 1.6). In contrast, for the Hindmarsh-Woodville SLA in the city between 1 and 10 calls were made with an average of 6.5.

6.2.3 Statistical Analysis

The results presented in this chapter are largely descriptive, since the focus was on non-attenders and no hypotheses were drawn regarding non-attenders from the two regions. Rather, the regions were selected to represent an Adelaide and a country clinic, with the intention of using the information gained to inform recruitment strategies. For this reason, the next two sections assess the representativeness of the samples to determine the generalisability of the findings.

Results from the interviews with non-attenders are presented in tables by variable groupings showing frequencies and proportions. All five non-attender groups are presented in the tables and these are examined for general patterns rather than statistical significance. A 10% difference is considered indicative of variation between the groups. Bivariate analysis was performed to determine whether certain variables were related to intentions regarding future mammography, using the odds ratio as the measure of association (Table 6.3.8).

Where comparisons are made between attenders and non-attenders the chi-square test of independence is used, except for tables with cells of < 5, in which case Fisher's Exact Test is used. The hypothesised direction of association follows that predicted from the literature and that of the case-control study.

6.2.4 Assessment of Bias Between Selected and Not Selected Non-attenders

The representativeness of the sample from which conclusions are drawn is a critical consideration in any study. This section compares non-attenders selected for inclusion in the survey ('Selected for Survey' in Figures 6.2.3 to 6.2.7) with all other non-attenders from the invitations issued in the study period. The latter includes the balance of non-attenders from the *No Response* outcome category, as well as those from the *Cancelled, Return to Sender* and *Made Appointment* outcome categories (= Invitations Sent - (Attended + Selected for Survey)). From the previous section it was shown that a proportion of those selected for survey were in fact out of scope, either in terms of eligibility for the study or for a mammogram at the SABXRS. However, this would also apply to an unknown extent to non-attenders not selected for survey. Hence, for this comparison no exclusions were made for either group. Differences in the frequencies of $\geq$ 10% is used as an indicator of possible bias.

The only details provided by the Electoral Office are age and address, hence no other information is available on which to compare the ER and R1 Re-invite cases. As indicated above SLA (address) was a criteria for selection, particularly for Pt Augusta due to distance. For Arndale, ER invitations were issued only for the SLA of Hindmarsh-Woodville during the selection period, and while the Re-screen sample was spread over Adelaide (and some outside), about half the non-attenders overall were from the two closest SLAs (Port Adelaide and Hindmarsh-Woodville). As expected, the more distant SLAs had a higher proportion of Not Selected cases, being excluded outright if outside Adelaide or being more difficult to contact. These more distant SLAs also had higher proportions of non-attenders in the *Cancelled, Return to Sender* and *Made Appointment* (but did not keep it) outcome categories, or conversely the proximate SLAs had a higher proportion in the *No Response* category.

Comparing the Selected and Not Selected cases on age, it can be seen from Table 6.2.1 that the age groupings of Selected and Not Selected cases within each clinic are very similar for the ER and R1 Re-invite cases. However, the Selected Arndale Re-screens are younger than the Not Selected cases, while the reverse is true for Port Augusta. These age differences for Re-screens reflect underlying SLA differences for both clinics. The two main SLAs (Port Adelaide and Hindmarsh-Woodville) from which the sample was drawn in Arndale has a younger population than Adelaide as a whole (see Table 6.3.1), while the town of Port Augusta is older than the distant SLAs which were excluded and represent a vast area of northern South Australia, including Roxby Downs (an expanding mining town, hence a young population), and the remote areas (including mining, farming areas).

For the Re-screen sample additional demographic variables (collected at the first screen) are available for comparison. Port Augusta has a high proportion of aboriginals while the Arndale area has a high proportion of migrants (both compared with regional and state averages, see Table 6.3.1). Comparing Selected and Not Selected cases on these variables (not shown), in Port Augusta the proportion of aboriginals was higher in both the Selected (9%) and Not Selected (6%) non-attenders than the overall proportion for the region (5%). For Arndale Selected non-attenders had a higher proportion who speak a language other than English at home (37%) than Not Selected cases (16%). However, this represents underlying SLA selection differences in that the two close SLAs for Arndale are high migrant areas. This also explains the higher proportion of non-attenders overall in the *No Response* outcome category for the SLAs close to Arndale; it would be expected that women who speak a language other than English at home would be more likely to simply ignore or not respond to the invitation rather than telephone to cancel or make an appointment (this was also found in the case-control study).

In summary, differences in SLA distributions basically reflect the selection process and age differences represent underlying population variations in age by SLA, which in turn reflect distance from the clinic. Overall for Arndale, it can be concluded that the Selected non-attenders represent all non-attenders for the SLAs of Port Adelaide and Hindmarsh-Woodville, but the populations in these SLAs are younger and more likely to speak a language other than English when compared with the whole of Adelaide. For Port Augusta the Selected non-attenders represent the populations within the three main SLAs from which the cases were selected, but were older than the other SLAs comprising the catchment area for this clinic.

6.2.5 Assessment of Bias Between Interviewed and not Interviewed Non-attenders

Within the 'Selected for Survey' cases, those Interviewed were compared with those Not Interviewed in the same way as the above analysis. Cases found to be out of the scope by the interviewers were excluded. As would be expected the distant SLAs had a higher proportion of Not Interviewed cases, primarily due to the cost of call-backs as indicated in 6.2.2 above.

For both Arndale and Port Augusta the age distributions were similar for the ER and R1 Re-invitations (see Table 6.2.2). An unexpected finding was the proportion of women aged 70 to 73 amongst the Arndale ER sample (19.7% of Interviewed cases and 16.7% of Not Interviewed cases) given that the ER lists provided to the Service only include women 50-69. Inquiry with the Service found that this resulted from the use of an outdated ER file for Arndale. This raised questions as to whether the use of an old file may have contributed to the low response to the ER invitations in Arndale. However, the investigator was provided with data that showed that response did not improve for later invitations when an updated file was obtained; that is, the low response to ER invitations was still very much an issue in Arndale in late 1995.

For the Re-screens, the Interviewed cases were younger than the Not Interviewed for Arndale, but for Port Augusta the Interviewed cases were older. Both represent underlying SLA differences resulting from fewer interviews in the more distant SLAs that are difficult to contact. As indicated above the more distant SLAs for Arndale were older, and the reverse was the case for Port Augusta.

Amongst the Re-screen cases the additional variables of language spoken at home and aboriginality were also examined. For Port Augusta both the Interviewed and Not Interviewed samples had the same proportion of aboriginals (8%), but for Arndale there were more women who spoke a language other than English at home amongst the Interviewed cases (42%) than the Not Interviewed (32%) cases. This reflects underlying high rates of non-English speaking (NES) women in the proximate SLAs, but also shows that language was not a barrier to interview, and the advantage of the personal interview method. Despite speaking a language other than English with their families, some women spoke English well enough to be interviewed in English, while for others an interpreter was used.

Other variables available for Re-screens from the first screen relating to past use of mammography and history of breast disease were also examined for Re-screens. The only notable difference was in the proportion who had had a mammogram prior to their first screen at the SABXRS amongst the Port Augusta Re-screens; 8% of the Interviewed cases had a prior mammogram compared with 19% of the Not Interviewed cases.

In summary, the Interviewed sample differs from the Not Interviewed sample in terms of residential area alone for the Round 1 samples in both Arndale and Port Augusta, but differs in terms of both residential area and age for both Re-screen samples. The higher proportion of Not Interviewed Re-screen cases with a history of mammography in Port Augusta, may suggest that they have returned to the private sector or stopped having mammograms, and while this proportion is based on a small number of cases, it should be considered as a possible bias.

6.3 RESULTS

6.3.1 Demographic Characteristics: Comparison of Sample of Non-attenders with Attenders, Regional and State Populations

This section compares the demographics of the Non-attenders interviewed in this study with data available for Attenders matched by invitation type and invitation date for women aged 50-69. It also compares these groups with the overall population of women aged 50-69, both from the region and the state, using the Estimated Resident Population (ERP), June 1995 (Australian Bureau of Statistics, 1996c), the closest estimates available to the selection period. Data other than age are based on Australian Bureau of Statistics 1996 census data (customised tables). The purpose of these comparisons is to be aware of differences in the study population when drawing conclusions. The ABS data relate to all women living in the region, and hence will include women not listed on the electoral roll.

The data for age, aboriginality and NES status are presented in Table 6.3.1. For age differences, the split between 50-59 versus 60-69 was examined. For the Arndale ER sample (drawn from the SLA of Hindmarsh-Woodville), both Non-attenders and Attenders had a lower proportion of women in the younger age group (39% and 44% respectively) compared with the overall SLA population (49%). This suggests that the younger migrant women may be missing from the electoral roll. Based on the ERP in June 1995 for this SLA, 12.3% of women aged 50-69 were missing from the roll.

For the Port Augusta ER sample, both Non-attenders and Attenders had markedly higher proportions in the younger age group (81% and 90%) than the region (57%). This may suggest that the ER excludes older women. However, this was the second time the van visited Port Augusta, and 79% of those on the Roll had already attended the SABXRS (hence, ER invitations were issued only to the remaining 21%). When comparing the overall number of women aged 50-69 on the ER list obtained from the Electoral Office (in September 1994), with the June 1994 EPR (Australian Bureau of Statistics, 1995), 4.7% were missing from the three SLAs combined from which the sample was drawn.

Considering the age breakdown (50-59 versus 60-69) for the Re-screen samples, the proportion of younger women for Arndale Non-Attenders and Attenders was similar (55% and 53% respectively), both a little higher that the regional figure (49%). However, for Port Augusta, the Non-attenders were significantly older (only 39% 50-59) than both Attenders (56%) and the region (57%). This suggests that older women are less likely to re-attend.

Regarding aboriginality, overall only a small proportion (0.05%) of the Arndale region is aboriginal, while the proportion for the Port Augusta region is 4.7% compared with 0.6% for the state. The proportion of aboriginal women is significantly higher in Non-attenders (14.8%) than Attenders (3.5%) for the ER invitees in Port Augusta, but this is based on a small number of interviewed ER Non-attenders (aboriginality is not known for the Not Interviewed non-attenders). The proportions for the R1 Re-invitees in Port Augusta indicate that a high proportion of aboriginal women who did not respond to a first ER invitation did so on the second invitation; 11.9% of in the Re-invite Attenders were aboriginal. For the Re-screens in Port Augusta (based on reasonably large numbers) the proportion of aboriginals in the Attenders was only 2.5% compared with 8% for Non-attenders indicating a problem in maintaining attendance amongst aboriginal women.

While aboriginal women are over-represented in Port Augusta, Arndale is over-represented in the proportion of women who speak a language other than English at home (referred to as NES or Non English Speaking). Overall, 37% of the Arndale population of women aged 50-69 are NES, compared with 20% for Adelaide and 16% for South Australia. However, the proportion of NES women for both ER Non-attenders (25%) and Attenders (24%) is lower than the region, indicating both a lower level of recruitment, but also the fact that migrants are under-represented on the Electoral Roll. The breakdown of migrants by country of birth shows that those from southern Europe in particular are under-represented in both Non-attenders and Attenders for Arndale. For Re-screens the proportion of NES women is lower (24%) among Attenders compared with Non-attenders (40%) and the two SLAs from which most of the sample was drawn (32%), indicating a lower likelihood of returning for a second screen.

Other demographic data collected at interview are in Appendix D3, Table D3.1, which lists the specific language and country of birth of interviewees. Overall Port Augusta is a low socio-economic area, and both clinics have low proportions of women with post-school qualifications. A high proportion of the Port Augusta ER sample were employed (35%) compared to all other groups (15.5% to 17.5%), suggesting that they are perhaps less financially secure and need to work, given the low status of the area generally.

In summary, the electoral roll for Arndale is deficient, missing 12% of women aged 50-69, and those missing are more likely to be younger women (50-59 than 60-69) and non-English speaking

(NES). However, not only are NES women less likely to be invited to Arndale (by not being on the roll), but also are less likely to re-attend after having an initial screen with the SABXRS. The use of the electoral roll is less problematic for Port Augusta, but the failure of aboriginal and older women to return for a re-screen may be an issue.

6.3.2 Knowledge and Perceptions about Mammography and SABXRS

Table 6.3.2 below summarises Table D3.2 in Appendix D3. Overall 95% of the Round 1 (ER and R1 Re-invite) sample had heard of mammography and over 80% had heard of screening. However, about 10% of both Re-screen samples said they had *not* heard of mammography performed for screening purposes, despite the fact that they had had one with the SABXRS.

The Port Augusta ER sample had the lowest proportion who knew of one or more benefits of mammography at 54% compared with 76% for the Arndale ER sample. However, amongst women who knew of benefits, a higher proportion of the Port Augusta ER sample specified more than one benefit (64%) compared with only 17% of the Arndale sample. Over 65% of the R1 Re-invite sample also knew of benefits. For the re-screens, only 88% of the Arndale sample and 95% of the Port Augusta sample knew any benefits, even though they had been screened at the SABXRS, and most only mentioned one benefit for both samples. For the Round 1 samples combined, the most commonly mentioned benefit (without prompting from the interviewers) was FIND BREAST CANCER EARLY, reported by 82% of Arndale and 93% of Port Augusta women who knew of benefits. Other benefits mentioned were FINDS LUMP CANT FEEL, INCREASED CHANCE OF CURE, DECREASED CHANCE OF LOSING BREAST and, PEACE OF MIND (see Appendix D3, Table D3.2 for details for each sample).

A higher proportion of the Port Augusta R1 Re-invite sample knew of problems with mammography (37%) than both the ER samples (29% for Arndale and 19% for Port Augusta). The respective proportions for Re-screens were 33% for Arndale and 43% for Port Augusta. Amongst those who knew of problems, the Port Augusta samples were more likely to mention more than one. Overall, the most common problem mentioned (unprompted) by the Round 1 samples was PAIN, mentioned by 45% of Non-attenders who knew of problems, but only 38% of these women had had ever a mammogram. The next most common problem was UNCOMFORTABLE, mentioned by 35%, and of these only 26% had ever had a mammogram. Thus, these perceived problems were mostly not based on actual experience for women never screened by the SABXRS. Overall, the most common problem mentioned by the Re-screen samples combined was UNCOMFORTABLE, mentioned (unprompted) by 39% of non-attenders who knew of problems. The next most common response was PAIN mentioned by 31%, followed by PUSHING AND SHOVING mentioned by 17%. Other problems mentioned were EMBARRASSMENT (6%), DOESN'T FIND ALL CANCERS/INACCURATE (3%), RADIATION (3%), and CAUSES CANCER (2%). Appendix D3, Table D3.2 provides a detailed list.

The two regions differed in the proportion of Round 1 invitees who had heard of the SABXRS before receiving the letter of invitation; 81% of the Port Augusta Round 1 samples combined and 58% of the Arndale sample. For the Round 1 samples, the main source of information about the SABXRS for those who had heard of the SABXRS was Television mentioned (unprompted) by 52% of the Port Augusta women and 45% of the Arndale women. The next two most frequently reported main sources were Friend/relative (19% for Port Augusta and 28% for Arndale) and for

Newspaper (8% and 6%). The proportions for other sources were quite small, but a full list of responses is shown in Appendix D3, Table D3.2. These include magazines, seminars, work associates and SABXRS pamphlet. Very few women mentioned a doctor.

The Re-screen samples were also asked an open ended question about sources of information about the SABXRS. As with the Round 1 samples, the most commonly mentioned source amongst women who had heard of the SABXRS was Television, referred to by 55% of Arndale women and 34% of Port Augusta women. For Arndale the next two most common sources were Doctor (12%) and Relative/friend (9%), while for Port Augusta they were Newspaper (24%) and SABXRS pamphlet (11%). For Port Augusta 'Newspaper' was more likely to relate to a local paper as with the R1 samples. Television also remained the predominant *main* source, mentioned by 59% of Arndale women and 44% of Port Augusta women. The full list of responses is shown in Appendix D3, Table D3.2.

When asked specifically if they knew that the van was located in Port Augusta from January to March of 1995, most Port Augusta women said they had seen the van (95% for the Round 1 samples and 98% for Re-screens). However, for Arndale only 26% of the ER sample and 46% of the Re-screen sample knew the location of any of the SABXRS clinics in metropolitan Adelaide (variable KNOW CLINIC LOCATION). This is despite the fact that the Arndale clinic is located in the major shopping centre for the region, facing the car park, although this may still not be as prominent as the mobile van in Port Augusta. For the Re-screens it is understandable that such a high proportion of the Arndale sample did not know the location since the clinic at which they had their last mammogram no longer existed. However, it shows that they did not notice the detail in the letter which specified the new location, suggesting they made a conscious decision not to re-attend.

For the AGE MOST AT RISK variable, a low proportion (8% overall) of the three Round 1 samples combined nominated the correct category 'In her 60s', with only 9% of the women actually aged 60-69 and 3% of women aged 50-59 nominated this; the most common response was 'Don't know' (44%). For the Re-screens the proportion nominating the older 'In her 60s' category was even lower with only one woman from each clinic nominated this. The most common response was also 'Don't know'.

For the variable INCIDENCE OF BREAST CANCER, the highest response was also in the 'Don't know' category for all samples, with less than a quarter of the sample nominating the correct category (1 in 15). As for the previous variable, Re-screens were no more knowledgeable than Round 1 women.

The finding that such a high proportion of non-attenders perceived benefits in having a mammogram begs the question as to why they did not respond to the invitation. Table 6.3.3 shows the results of cross-tabulating KNOW BENEFITS OF MAMMOGRAPHY with mammography behaviour, past and intended. For the Re-screens and the Port Augusta Round 1 samples no association was found, that is, there was no relationship between knowledge of benefits and past mammography or intentions about having future mammograms. However, for the Arndale ER sample knowledge of the benefits of mammography was significantly related to the other variables; those who knew benefits were more likely to have had mammography outside the SABXRS (40%) compared with those who did not know of any benefits (7%), more likely to say they would have a mammogram in the next 2 years (74% versus 26%), and for this to be with the SABXRS.

6.3.3 Exposure and History of Mammography and Breast Cancer

These data are summarised in Table 6.3.4. Overall, amongst the Round 1 samples only 31% of non-attenders from both regions had had a doctor suggest a mammogram to them, the proportion being much lower for the R1 Re-invitees (10%) than the ER samples (37% for Arndale and 46% for Port Augusta). For the Re-screens it was quite high in the city (74%), but only 17% in Port Augusta. This would be due to the method of recruitment for their Round 1 screen with the SABXRS. Most of the Arndale women were self referred (a high proportion probably on a doctor's recommendation) whereas the Port Augusta Re-screens would have been sent an invitation from the electoral roll when the van first visited. A small proportion of the Round 1 samples were specifically told by a doctor that they did not need a mammogram, but none of the Re-screens.

EVER HAD MAMMOGRAM refers to mammography outside the SABXRS; for the Re-screens this relates to having a mammogram prior to their mammogram with the SABXRS. For Arndale it can be seen that about a third of both the ER sample and the Re-screen sample had had a mammogram outside the Service prior to their first invitation/appointment with the Service. On the other hand, for Port Augusta, about a third of the ER women had been screened elsewhere, but less than 10% of both the R1 Re-invitees and Re-screens. Both these latter two groups would have been sent an ER invitation two years previously, at a time when mammography was less prevalent overall in Port Augusta than Adelaide. About half the Port Augusta ER sample had their mammogram in Whyalla, the closest town with a mammography machine some 100 kilometres away, while the rest mostly travelled to Adelaide.

The Re-screen non-attenders were asked if they remembered their last mammogram with the SABXRS and their reason for having that mammogram (not presented in Table 6.3.4; details in Appendix D3, Table D3.3). All remembered their last mammogram with the SABXRS. However, the reason they gave for having that particular mammogram varied significantly. For Arndale, about 90% said either in response to a letter from the SABXRS or because a doctor suggested it (about equal proportions for each), whereas for Port Augusta, the main response was a letter (69%) followed by the fact that they saw the van in town (9%), with only 5% at the suggestion of a doctor. These data correlate with the low proportion in Port Augusta who responded in the affirmative to the specific question asking if a doctor had suggested a mammogram (DR SUGGESTED MAMMOGRAM).

The Re-screen sample was also asked if they had had a mammogram outside the Service since their last mammogram with the SABXRS (variable MAMMOGRAM ELSEWHERE SINCE BXRS) - a small proportion had, mostly for diagnostic purposes. For the Round 1 samples, about half had had their last mammogram for diagnostic purposes and a significant proportion had it over two years ago, indicating that they would have been due for a mammogram when the invitation was issued on the basis of the SABXRS recommendations. It should be noted that for new clients, the SABXRS accepts women who have had a mammogram over 12 months ago. A lesser time gap is acceptable for country clients to allow them to enter the two year visit cycle of the mobile in a particular location. Hence, most of those who had had a mammogram would have been accepted at the time of the invitation.

Over 70% of the total Round 1 sample and 80% of the Re-screens knew someone who had had a mammogram. Over 60% of the total Round 1 samples and Re-screen samples knew someone with breast cancer. Over 15% of the Round 1 samples combined had a family history of breast cancer, although only 4% had a first degree relative (mother, sister or daughter) with breast cancer; even fewer had a 'Very strong family history' as defined by the SABXRS (see note 6, Table 6.3.4). A higher proportion of the Re-screens had a first degree relative with breast cancer (9%).

Other variables relating to personal history of breast cancer and breast problems indicate that a small proportion of the Re-screen non-attenders (4%) had a breast lump at the time of the invitation. None of the R1 Re-invitees did so, but a higher proportion of ER non-attenders from Port Augusta stated that they had a lump they could feel at the time the invitation was issued (15%) than Arndale (3%). Although numerically only 10 ER women had a lump, all these women had had a previous mammogram, and seven said they 'Definitely will' have another mammogram within 2 years, but only one woman intended to have her next mammogram with the SABXRS. Although, the Service discourages women with symptoms from attending, most women with lumps who telephone the service are accepted after speaking to a nurse or medical officer, as the 'lump' is not considered indicative of breast cancer (for example 'lumpy breasts'). Even after this screening by nurses or medical officers, a high proportion of women report lumps on the form completed on presentation for a mammogram. For example, of the Attenders who answered 'Yes' to having a current lump in their breast which they could feel, 46% were considered not significant by the nurses/medical officers who sight the forms of women who report symptoms, and these cases were ultimately recoded as asymptomatic.

A number of the variables included in this section were also collected for women who attend the SABXRS, and these were asked in exactly the same manner in the survey to enable a comparison with attenders from the same invitation list. These are listed in Table 6.3.5, the same definitions applying as for Table 6.3.4. The variable EVER HAD MAMMOGRAM for Attenders refers to mammograms prior to their mammogram at the SABXRS. For the Round 1 group, there was a statistically significant difference between Non-attenders and Attenders for the R1 Re-invite group (10% of Non-attenders and 24% of Attenders had mammogram), but not for either of the ER groups. The only other significant difference for the Round 1 groups (where a test could be performed) was for HAD BREAST CANCER for the Arndale ER group; Non-attenders were more likely to have had breast cancer, not an unexpected result given the policy of the SABXRS. It should be noted that about 15% of all three Round 1 Non-attender samples reported a family history of breast cancer but none of the Attenders. Of those with a family history, 44% of the Arndale Non-attenders had ever had a mammogram, 60% of the Port Augusta ER Non-attenders, but only 9% of the R1 Re-invite Non-attenders. For the Re-screens a similar pattern is shown with regard to family history; about 20% of Non-attenders had a history but virtually none of the Attenders. This group of Non-attenders had however had a mammogram with the SABXRS. One could postulate as to whether these women were encouraged by their doctor to go privately or whether they felt re-assured by a negative screen during the previous round. Non-attenders were asked at interview about their intention to have a future mammogram; 81% of the Re-screen non-attenders with a close family history stated that they 'Definitely will' have a future mammogram and a further 15% suggested they may have one (not necessarily with the SABXRS). Hence, it appears that the high risk group are not being missed, but may have decided to move to the private sector, which is quite acceptable given that a Medicare rebate is available for them.

6.3.4 Response to Invitation and Reasons for Not Attending

Table 6.3.6 summarises Table D3.4 in Appendix D3. It can be seen that a high proportion of women remembered receiving the invitation, except for the Port Augusta Re-screens (only 64% remembered). Of those who did remember, the overwhelming majority were happy about receiving an invitation. Further, there was no difference by age or NES status in this regard. This indicates that women accept these methods of recruitment, both as a first approach with a letter that informs them that their name was obtained from the electoral roll and as a second approach to those who failed to respond to the first. The few who were not happy gave the following reasons; own responsibility, privacy, fear of mammogram, don't want a mammogram and poor health.

The other two variables in Table 6.3.6 collate the reasons given for not making an appointment with the SABXRS in response to the invitation. The first lists all reasons (30% gave more than one reason) while the second lists the main reason for each woman. For the main reason, it can be seen that the Arndale ER sample was more likely to mention barriers than the Port Augusta ER sample. In particular, a high proportion of women from Arndale (42%) saw no need to have a mammogram ('Apathy/no need') while a further 15% mentioned *Perceived barriers*. The R1 Re-invite Port Augusta group was similar to the Arndale ER group in this regard, with 43% in the 'Apathy/no need' category and 13% in 'Perceived barriers'.

For the Re-screens about half of both groups specified *External factors* as the main reason ('Other clinical problem' or 'Other', the latter mostly being away on holiday or family commitment), but the Port Augusta sample more likely to specify 'Perceived barriers' (22% versus 7% for Arndale). This suggests that the Port Augusta women may have been more disenchanted by the previous experience than the Arndale women.

Reason for not making an appointment was also examined by SLA (not shown). As would be expected it was found that a higher proportion of the small number of women interviewed from the distant SLAs stated 'Too far' as their reason for not making an appointment.

6.3.5 Intentions

The variable WOULD HAVE ANOTHER MAMMOGRAM in Table 6.3.7 (which summarises Table D3.5 in Appendix D3) shows that over 80% of the ER invitees who had had a mammogram would have another one, as would the Re-screen non-attenders. This was not the case for the R1 Re-invite sample where only 38% of those who had had a mammogram said they would have another one (bearing in mind the small number who had had one in the first instance). The main reasons given for not having another mammogram were 'Too much radiation' and 'Not needed' (see Appendix D3, Table D3.5 for details). Of the Round 1 women who said they would have another mammogram only 49% nominated the SABXRS, with a further 11% being unsure as to where they would have their next mammogram.

WHO WOULD INFLUENCE refers to the question "Who, if anyone, would influence you in deciding whether or not you would have a mammogram?", and was asked of the whole sample. It can be seen that a considerable proportion stated that 'No-one' would influence them, which can be interpreted as they would make the decision themselves. The highest proportion in the 'No one' category were the R1 Re-invitees with 86% stating that no one would influence them, but for all groups the proportion in this category was higher for Port Augusta than Arndale. About 40% of both ER groups said they would be influenced by a doctor or other health professional (only 2 in the latter group), a contrast with the 5% for the R1 Re-invite group. For the Re-screens 48% of Arndale women stated a doctor would influence them, but only 14% of the Port Augusta women. This may suggest greater independence in country women, but also reflects past experience; a high proportion of the Port Augusta Re-screens had previously accepted the ER invitation issued when the van first visited, and hence did not require a doctor's prompt.

WILL HAVE MAMMOGRAM WITHIN TWO YEARS was asked of all women regarding intention to have a mammogram (anywhere) in the next two years. For the Round 1 women, 44% of the Arndale ER sample, 46% of the Port Augusta ER sample, and only 12% of the R1 Re-invite sample were very confident ('Definitely will') about having a mammogram within the next two years. A further 20% of the Arndale ER sample, 23% of the Port Augusta ER sample and 36% of the R1 Re-invitees suggested they 'Probably will'. However, from the variable WILL HAVE MAMMOGRAM WITH SABXRS, it can be seen that less than half of all three Round 1 groups would commit themselves to using the SABXRS within the next two years. The relationship between main reason for not making an appointment and intention to use the SABXRS is varied. For all three Round 1 groups combined, the proportion who intended to use the SABXRS according to main reason for not making an appointment (data not shown) were; 38% for 'Private mammogram', 100% for 'Structural barriers', 25% for 'Perceived barriers', 60% for 'Apathy/no need', 6% for 'Breast problem', 53% for 'Other clinical problem' and 70% for 'Other'. Most women who had had a mammogram intended to continue with the private sector.

For the Re-screens WILL HAVE MAMMOGRAM WITHIN TWO YEARS shows that 79% of the Arndale women and 63% of the Port Augusta women would commit to 'Definitely will' with a further 12% and 25% respectively saying they 'Probably will'. Only 9% of the Arndale and 11% of the Port Augusta Re-screen sample stated they 'Definitely won't' or 'Probably won't' have a mammogram within the next 2 years. This contrasts with 30% for the Arndale Round 1 sample and 45% for the Port Augusta Round 1 samples. A high proportion of the Re-screen women intended to have another mammogram with the SABXRS in the next two years (89% for Arndale and 84% for Port Augusta), and this corresponds with the findings from the previous section that they mostly gave practical reasons for not making an appointment. All women who were away on holidays or had a family commitment as their reason, and all but one of those who were ill at the time of the invitation, answered 'Yes' to WILL HAVE MAMMOGRAM WITH SABXRS. The lowest proportion (at 54%) intending to use the SABXRS was amongst those with 'Perceived barriers'.

Women who stated they 'Definitely won't', 'Probably won't', or were unsure about having a mammogram in the next two years (anywhere) were asked their reason for this (variable REASONS FOR NOT HAVING A MAMMOGRAM). For the two ER samples the answers vary. The Arndale sample was more likely to be apathetic (53%) in contrast to the Port Augusta sample where perceived barriers were the most common deterrent (55% nominating pain, fear, embarrassment, x-rays). This variable includes multiple responses, and 24% of women gave more than one reason. The *main* reason is listed in Appendix D (variable MAIN REASON FOR NOT HAVING MAMMOGRAM), and while the proportions vary a little, the order or magnitude does not change. Amongst the 52 Round 1 women overall who indicated they 'Definitely won't' have another mammogram, the most common reason was 'Don't need mammogram' (44%), 12% said they had other medical problems, 10%

stated that they were too busy or it was too much trouble, and the remaining 34% stated reasons defined as perceived barriers. Apart from those with medical problems which may imply less priority to mammography, a proportion of the others should also be amenable to change, since their perceptions are by and large not related to experience; only 8 (7%) of the 116 Round 1 women in the first 3 categories 'Don't like tests' to 'Perceived barriers' in Table 6.3.7 under REASONS FOR NOT HAVING A MAMMOGRAM had ever had a mammogram. For the small proportion of Re-screens who did not intend to have a mammogram, the answers for all the Arndale women and all but one of the Port Augusta women, indicate they were disillusioned with the experience (all in first 3 categories of REASON FOR NOT HAVING MAMMOGRAM).

WHAT WOULD PROMPT TO HAVE A MAMMOGRAM was asked of all respondents, regardless of their stated intention about having a mammogram, and sought to determine cues for action. A higher proportion of the Re-screens mentioned 'Preventive action' than the Round 1 samples; 39% for Arndale and 54% for Port Augusta. Over half the Arndale Re-screens and a quarter of the Port Augusta Re-screens stated that they would be prompted 'If referred by a doctor' or by breast 'Symptoms/problems'. For the Round 1 women 'Symptoms/problems' was the most frequent response for the Arndale ER and Port Augusta R1 Re-invite samples, whereas for Port Augusta ER it was 'Preventive action'. Only a very small minority of the two Re-screen samples and the Port Augusta ER sample stated that 'Nothing' would prompt them, but 5% of the Arndale ER and 15% of the R1 Re-invite women did so. Amongst the 32 Round 1 women overall who said 'Nothing' would prompt them, the most common single reason for not having a mammogram (variable MAIN REASON FOR NOT HAVING MAMMOGRAM) was 'Don't need mammogram' (28%), but 'Perceived barriers' accounted for 31%. There was a high correlation between the response 'Nothing' would prompt and the response to the variable WILL HAVE MAMMOGRAM WITHIN TWO YEARS; Definitely will (3% said 'Nothing' would prompt), Probably will (6%), Probably won't (19%), Definitely won't (69%) and Don't Know (3%). About 90% of those who said 'Nothing' would prompt, also stated they would not (probably/definitely won't have) have a mammogram in future. This consistency in responses suggests confidence in the results and any recommendations based on them. Whether they maintain this level of resistance after two years will be explored in Chapter 7.

Table 6.3.8 examines the relationship between WILL HAVE MAMMOGRAM WITHIN TWO YEARS, categorised according to the degree of conviction (Definitely will, Maybe, Definitely will not) by various selected variables. All Round 1 cases and Re-screen cases were combined for this table, and the odds ratios use the category 'Definitely will' as the reference. For the Round 1 cases, a statistically significant association was shown for several variables, and moreover, the relationship was generally stronger with degree of resistance to mammography. Intention was related to age with older women being more resistant. Compared with women aged less than 60, older women (60+) were 1.9 times more likely to be in the 'Maybe' category of intention to have a mammogram in two years, but 4.9 times more likely to be in the 'Definitely will not' category. Women who were *not* employed were more likely to resist mammography (OR = 3.3 for Maybe and 4.2 for Definitely will not), as were those with lower education (OR = 2.2 for Maybe and 2.6 for Definitely will not). Similarly a higher degree of resistance was associated with: not knowing any benefits of mammography or not having heard of mammography (OR = 3.6 for Maybe and 6.5 for Definitely will not); never had a mammogram (OR = 5.9 and 16.9); doctor not suggesting a mammogram (OR = 8.7 and 6.9); not heard of *screening* mammography (OR = 8.5 for Definitely will not). There was no relationship with language spoken at home, knowing problems with mammography, remembering the letter of invitation or having a close family history of breast cancer (first degree relative had breast cancer). This latter result is of some concern given that these high risk women never screened at SABXRS were stating they would not have a mammogram at all, neither with the SABXRS nor elsewhere.

For the Re-screens only one variable in Table 6.3.8 was associated with strength of conviction towards a mammogram within 2 years, KNOW BENEFITS OF MAMMOGRAPHY, with those not knowing benefits being 4 times more likely to 'Maybe' intend having a mammogram and seven times more likely to be in the category 'Definitely will not' compared with women who 'Definitely will'.

6.4 DISCUSSION

This study was conducted due to concern about the falling response to invitations, particularly in some areas of Adelaide. In the study period only 20% of ER invitations for Arndale resulted in an attendance. In addition, in Arndale only 56% of women issued a re-screen invitation attended, and the proportion was even lower from Statistical Local Areas (SLAs) with a higher proportion of non-English speaking women. This is worrying given that the Service accreditation requirement for women aged 50-69 is a re-screen rate of $\geq$ 75% of women screened in the previous round (National Program for the Early Detection of Breast Cancer, 1994a). While the re-screen attendance for Port Augusta was good (75%), only 35% of ER invitees attended and 25% of R1 Re-invitees, with attendance clearly related to distance.

These results do not represent the remote populations, covering the vast expanse north of Port Augusta, which could not be included in the study for logistic reasons. A telephone interview was not possible for the Round 1 clients, as a telephone number is not available unless they make an appointment. Perhaps the Service should consider telephoning women who do make an appointment but fail to keep it. This could also be an option for the re-screen clients. Overall, the numbers of women involved are small, and would have little impact on overall participation rates, however the issue is one of equity of access.

Overall, the Arndale population was younger and had more non English speaking (NES) women than both the Port Augusta and regional and state populations, while Port Augusta had a higher proportion of aboriginal women. A high proportion of women in the target age group (50-69) in the Arndale area were excluded from the Electoral roll (12.3%) in comparison with 4.7% for Port Augusta. The sample selected was found to be representative of the main SLAs included in the study, but these SLAs differed from others in the region. For Arndale the two largest and closest SLAs from which most recruits were drawn have a younger population which is also more likely to speak a language other than English when compared with the whole of Adelaide. For Port Augusta the women from three SLAs from which cases were selected were older than the women from other SLAs comprising the catchment area for this clinic.

Within the SABXRS populations for these clinics, Arndale non-attenders were older and had fewer NES women (particularly southern Europeans) than attenders, for both the ER and Re-screen populations. On the other hand both attenders and non-Attenders from the ER population in Port Augusta were younger than the R1-Reinvite and regional and state populations. Port Augusta seems to have been quite successful in recruiting aboriginal women for an initial screen, particularly after issuing a Re-invitation, but not at maintaining them for a rescreen. Also, as for Arndale, older and NES women in Port Augusta were less likely to re-attend.

It was also found that a higher proportion of non-attenders had a family history of breast cancer than attenders for all five groups. It is reasonable to expect that women with a family history are being screened outside the SABXRS, regardless of the appropriateness of doing so, given that a rebate is available to them. However, this does not explain why the Re-screen non-attenders attended in the first place. Most (81%) of Re-screen non-attenders with a close family history stated they 'Definitely will' have a future mammogram, hence this high risk group are not being missed, but some have chosen to move to the private sector. For R1 women with a close family history (mother or sister had breast cancer), 55% of the ER group (Arndale and Port Augusta combined) stated that they 'Definitely will' have a mammogram (anywhere) within the next 2 years, but none of the R1 Re-invite group. A further 10% of the ER group and 33% of the R1-Re-invite group stated they 'Definitely won't' have a mammogram within the next 2 years. The finding that none of the high risk R1-Re-invite group was certain about future mammography is of some concern, even though it was based on small numbers. Further, investigation of this issue is required and efforts made to educate these women about the need for screening.

Comparing the interviewed non-attenders with those not interviewed, no differences were found for the Round 1 samples. For the Re-screens, the interviewed sample in Arndale was younger than those not interviewed while the reverse association with age was noted in Port Augusta This suggests that a possible bias in the results presented in this chapter would be to overestimate the proportion of Re-screens who may re-attend in Arndale, since older women would be less likely to re-attend. For Port Augusta there may be also be a bias in overestimating the proportion of re-screen invitees who will re-attend, since a higher proportion of those not interviewed had a history of mammography prior to their first interview with the SABXRS, and may have decided to return to the private sector.

Hence, NES women are being missed, not only because they are more difficult to recruit in the first instance, but also because fewer return for re-screen. The problem is further exacerbated by the fact that a significant proportion of migrant women are not on the electoral roll, the main source of new recruits. The maintenance of aboriginal women is also a problem, represented in this study by an area with a high aboriginal population. The initial Accreditation Standards for the National Program required that the proportion of aboriginal and non-English speaking women recruited into the program reflect the respective proportions in the population. This has been revised in the current standards (National Program for the Early Detection of Breast Cancer, 1994a) to at least 50% of the population rate in urban areas (including Port Augusta), and in compliance with a specific plan in rural and remote areas. The change in the standard recognises the difficulty, as these data show, in recruiting some segments of the population, and the effort and cost that would be required to meet the original standard.

Data from the interviews with non-attenders indicate that amongst women who had never been screened at the SABXRS, the Port Augusta ER sample would be less difficult to recruit than either the Arndale ER sample or the Port Augusta R1 Re-invite sample. Over half (54%) the Port Augusta ER women gave external factors as their main reason for not responding to the invitation, compared with 27% for the Arndale ER and 33% for Port Augusta R1-invite. For the latter groups 'Apathy/no need' was the main reason (over 40%). The high proportion of women who do not rate the need to have a mammogram highly has implications for strategic policy planning, and shows that the large media campaigns, wide distribution of brochures, and other methods aimed at educating women about the need to participate, have not produced the desired effect. It is possible that those who state 'Apathy/no need' may have underlying fears about mammography which could be further investigated through focus groups.

Over 40% of all three Round 1 groups stated that they would have a mammogram with the SABXRS in the next two years. Whether these women follow through their intention will be tested in the next chapter. Although it is reassuring that a significant proportion of women who had never been screened with the SABXRS intend to use the Service, it is important to focus on the greater proportion who did not intend to use the SABXRS (over 50% for each of the three Round 1 groups). For the two ER samples an additional 20% of women said they would 'Definitely' or 'Probably' have a mammogram within the next two years, but not with the SABXRS. This statement however applies to less than 5% of the R1 Re-invite group. Only 15% of those who stated that their last mammogram was for screening purposes nominated the SABXRS as the location of their next mammogram. There is obviously a need to educate women that the SABXRS was specifically established to provide screening mammography and is the most appropriate service for women without symptoms.

For the Re-screen sample it would appear that a high proportion could be re-recruited into the SABXRS. The majority (89% for Arndale and 84% for Port Augusta) stated that they would have a mammogram again with the SABXRS, hence it appears that few have been turned away by the experience of a mammogram at the SABXRS. Over 50% of both the Arndale and Port Augusta sample gave external factors as the reason for not making an appointment.

Knowledge of the benefits of mammography ranged from the lowest level at 54% for the Port Augusta ER group to 95% for the Port Augusta Re-screen group, and knowledge of the benefits were related to knowledge of problems with mammography. The most common problem mentioned by the Round 1 non-attenders who knew of problems was 'Pain' (45%) and 'Uncomfortable' (35%), but this was mostly not based on actual experience with mammography. These two problems were also the two most common for the Re-screen sample but in reverse, with 31% mentioning 'Pain' and 39% 'Uncomfortable'.

Knowledge about the age at risk and incidence of breast cancer was low for all groups of non-attenders. Knowledge about the correct (older) age at which women are most at risk was actually lower for the Re-screen samples than the Round 1 samples. This is despite an information sheet which they were required to read before consenting to their mammogram with the SABXRS which points out that age is the most significant risk factor. Similarly, the proportions mentioning the correct incidence (1 in 15) was no higher for the Re-screen women (around 20% correct for all groups), again despite supposedly greater exposure to the information. Hence, greater exposure to the information is not sufficient on its own, nor is awareness about the SABXRS.

A substantial proportion of women who become R1 Re-invitees were less attuned to the concept of mammography screening; about 30% of both ER groups had had a mammogram outside the Service, but less than 10% of the R1 Re-invite group. The original ER invitation for these women two years previously filtered out the more willing. Availability of mammography at Port Augusta outside the biennial visits of the mobile van requires travel to Whyalla 100 kilometres away or to

Adelaide. Nevertheless the rate of mammography for the Port Augusta ER sample matched that of the Arndale ER sample where the clinic was in close proximity and available throughout the year. Arndale residents also have easy access to other non-SABXRS mammography services.

The influence of a doctor may also contribute to the reluctance of R1 Re-invitees to have a mammogram, both within and outside the SABXRS with less than 10% having had a doctor suggest a mammogram in the past compared with 46% for the Port Augusta ER. Further, only 5% of the R1 Re-invite sample suggested a doctor as the person who would influence them in having a mammogram compared with over 40% for the two ER samples. The Re-screen samples also show interesting results in relation to this variable; nearly 50% of the Arndale sample nominated a doctor but only 14% of the Port Augusta sample. The Port Augusta Re-screen group also had a lower proportion with a doctor suggesting a mammogram in the past (17% compared with 74% for Arndale Re-screens). This difference is likely to be due to their initial method of recruitment, that is, the method that led to them having their previous mammogram with the SABXRS. For Port Augusta, 88% of these Re-screen women were recruited initially by an electoral roll invitation compared with only 20% of Arndale women. All women aged 50-69 on the electoral roll at the time of the first visit of the mobile van to Port Augusta in 1993 were sent an invitation. On the other hand few electoral roll invitations were issued to women in the catchment area for Arndale two years previously, as only a half-time clinic was operating in the area.

The difference in the proportion who nominated a doctor as an influence amongst the three Port Augusta groups suggests three levels of readiness to accept mammography (14% for Re-screens, 40% for ER and 5% for R1-Reinvite). The Re-screen group represents the group recruited with little effort when the van first visited two years previously, being self-motivated and not requiring a doctor's influence. On the other hand, the R1 re-invite group represent women who are not self motivated, but also not influenced by a doctor, nor anyone else; 86% stated that 'No-one' would influence them. For these women this response can be interpreted as deciding themselves *not* to have a mammogram, in contrast to the Re-screen group. The R1-Reinvite women did not respond to an invitation from the SABXRS on two occasions, two years apart, and mostly have not accessed mammography elsewhere. Moreover, for the few R1 Re-invitees who had a mammogram they were more likely to have had it more recently and for it to be for diagnostic purposes. The ER group appear to fall in between in terms of readiness to adopt mammography.

The high proportion of non-attenders who intend to have or continue to have mammograms is encouraging, particularly amongst the Re-screen group. Most Re-screen women indicated they would return, but one group that did differ in this regard were the women who specified 'Perceived Barriers' as the reason for not making an appointment - only 54% intending to use the SABXRS again. The most common barrier was pain, hence it suggests these women found the experience painful enough to outweigh any benefits they perceived; these women would represent Rogers (1983) *disenchanted* group. Amongst the Round 1 samples (combined), those who specified 'Perceived barriers' were also the least likely to intend using the SABXRS, with only 25% saying they would do so. Most of the Round 1 women who had a mammogram intended to continue with the private sector, and in contrast to the Re-screen group only about half of those with 'Other clinical problems' intended using the Service. It is possible that the severity of problems in the Round 1 samples was greater, since the severe cases amongst the Re-screen group would have been excluded two years previously.

Strength of intention about having a mammogram within the next two years (Definitely will, Maybe, Definitely will not) was associated with intention for only one variable (know benefits of mammography) for the Re-screen group (Table 6.3.8), but as discussed in the previous paragraph, most of the Re-screen sample did intend returning, and for those who did not, perceived barriers appears to offer the best explanation. However, for the Round 1 sample, a statistically significant relationship was found for several variables, all in the direction predicted by the literature; women less likely to intend having a mammogram were older, less educated, not employed, did not know the benefits of mammography, had never had a mammogram, and had not had a doctor suggest a mammogram.

Information about which source of information reaches women most effectively is important for the development of appropriate media strategies. Overwhelmingly, the most common response for both clinics and all samples was 'Television', indicating the success of the National televised campaign in drawing women's attention to mammography. For Port Augusta the next most common source was 'Newspapers', and it is important to note that most women cited their local newspaper. 'Friends and relatives' were important sources for all groups with 'Doctor' infrequently mentioned except by the Arndale Re-screen sample. However, these data inform on sources *noticed* by women, and alone they cannot advise on recruitment strategies, since all these women failed to attend following an invitation. Information about sources that did not rate highly is just as important. For example, the large effort put into distributing SABXRS pamphlets in a range of languages may need to be questioned.

These data provide valuable insights about women not responding to all invitation types used by the SABXRS, both for initial and re-screens. A major issue is that women do not understand the difference between screening and diagnostic mammography, as evidenced by the high proportion of those screened outside the Service indicating they would continue to do so. Clearly this is an issue that involves doctors as well, since to have a mammogram outside the Service entails a visit to the doctor for a referral. The community surveys presented in the next part of this thesis examine the level of 'screening' occurring outside the National screening program.

The next chapter follows up the subjects of this study twenty seven months later, which is the period used by the SABXRS to determine 'active participants', that is, women who comply with the recommended screening interval of two years (allowing a three month window). This will determine whether women follow through with their intentions, and link actual behaviour with the variables collected at interview.

In conclusion, results presented in this chapter indicate that there is definitely potential to recruit a significant proportion of women who do not respond to invitations. Whether this proportion is large enough to meet the target of 70% of women 50-69 requires further analysis. This analysis will be left to the last chapter drawing on data presented in Chapters 4 and 5 about the intended and actual behaviour of the case-control subjects, this chapter on invitees and the next chapter as the two year follow-up of invitees, as well as Chapter 8 on the level of external screening.

Table 6.2.1 Non-attenders by Selection status by Clinic by Age

Variable	Arndale Clinic		Port Augusta Clinic	
	Selected No (%)	Not Selected No (%)	Selected No (%)	Not Selected No (%)
ELECTORAL ROLL	***N = 363***	***N = 548***	***N = 61***	***N = 155***
AGE				
50-59	114 (31.4)	171 (31.2)	51 (83.6)	125 (80.7)
60-69	180 (49.6)	274 (50.0)	10 (16.4)	29 (18.7)
70+	69 (19.0)	103 (18.8)	0 (0.0)	1 (0.7)
R1 RE-INVITE	***N = 0***	***N = 0***	***N = 178***	***N = 171***
AGE				
40-49			1 (0.6)	4 (2.3)
50-59			71 (39.9)	73 (42.7)
60-69			105 (59.0)	93 (54.4)
70+			1 (0.6)	1 (0.6)
RE-SCREEN	***N = 128***	***N = 211***	***N = 100***	***N = 182***
AGE				
40-49	3 (2.3)	2 (1.0)	1 (1.0)	5 (2.8)
50-59	72 (56.3)	100 (47.4)	41 (41.0)	101 (55.5)
60-69	53 (41.1)	107 (50.7)	56 (56.0)	75 (41.2)
70+	0 (0.0)	2 (1.0)	2 (2.0)	1 (0.6)

Table 6.2.2 Selected for Survey (excluding out of scope): Interview Status by Clinic by Age

Variable	Arndale Clinic		Port Augusta Clinic	
	Interviewed No (%)	Not Interviewed No (%)	Interviewed No (%)	Not Interviewed No (%)
ELECTORAL ROLL	*N = 223*	*N = 108*	*N = 26*	*N = 24*
AGE				
50-59	70 (31.4)	36 (33.3)	21 (80.8)	20 (83.3)
60-69	109 (48.9)	54 (50.0)	5 (19.2)	4 (16.7)
70+	44 (19.7)	18 (16.7)	0 (0.0)	0 (0.0)
R1 RE-INVITE	***N = 0***	***N = 0***	*N = 84*	*N = 70*
AGE				
40-49			1 (1.2)	0 (0.0)
50-59			34 (40.5)	28 (40.0)
60-69			48 (57.1)	42 (60.0)
70+			1 (1.2)	0 (0.0)
RE-SCREEN	*N = 66*	*N = 28*	*N = 64*	*N = 26*
AGE				
40-49	2 (3.0)	1 (3.6)	1 (1.6)	0 (0.0)
50-59	34 (51.5)	18 (64.3)	24 (37.5)	14 (53.9)
60-69	30 (45.5)	9 (32.1)	38 (59.4)	11 (42.3)
70+	0 (0.0)	0 (0.0)	1 (1.6)	1 (3.9)

Table 6.3.1 Demographic Characteristics of Non-Attenders and Attenders by Clinic by Invitation Type compared with regional population from which samples drawn and overall Adelaide Statistical Division (ASD), Non-ASD and State populations (column percents)

	Arndale			Port Augusta					South Australia		
Variable	Non-attender	Attender	Region	Non-attender	Attender	Non-attender	Attender	Region	ASD	Non-ASD	State
ROUND 1[1]	Electoral Roll			Electoral Roll		R 1 Re-invite					
AGE											
50-59	38.9	43.8	49.2	80.8	89.5	41.5	50.4	56.9	53.6	53.3	53.5
60-69	61.1	56.2	50.8	19.2	10.5	58.5	49.6	43.1	46.4	46.7	46.5
ABORIGINALITY											
Yes	0.0	0.0	0.5	15.4	3.5	4.8	11.9	4.7	0.4	1.3	0.6
SPEAK OTHER LANGUAGE											
Yes	24.7	24.4	36.7	11.5	2.6	10.7	13.5	5.8	20.1	6.0	16.3
RE-SCREENS[2]											
AGE											
50-59	54.6	52.7	49.0			38.7	56.0	56.7	53.6	53.3	53.5
60-69	45.5	46.4	47.3			61.3	44.0	43.3	46.4	46.7	46.5
ABORIGINALITY											
Yes	0.0	0.0	0.6			7.8	2.5	4.7	0.4	1.3	0.6
SPEAK OTHER LANGUAGE											
Yes	40.0	24.4	31.9			10.9	4.8	5.8	20.1	6.0	16.3

[1] Arndale ER relates to Hindmarsh-Woodville SLA only; Pt Augusta ER and R1 Re-invite relate to SLAs of Pt Augusta, Kanyaka-Quorn and Mt Remarkable.
[2] Arndale Re-screens relate to SLAs of Hindmarsh-Woodville and Pt Adelaide; Pt Augusta to SLAs of Pt Augusta, Kanyaka-Quorn and Mt Remarkable.

Table 6.3.2 Non-attenders by Clinic by Round: Knowledge and Perceptions About Mammography and SABXRS

Variable	Arndale No. (%) Electoral Roll	Arndale No. (%) Re-screen	Port Augusta No. (%) Electoral Roll	Port Augusta No. (%) R1 Re-invite	Port Augusta No. (%) Re-screen
HEARD OF MAMMOGRAPHY					
Yes	212 (95.1)	na	25 (96.2)	81 (96.4)	na
No	11 (4.9)		1 (3.8)	3 (3.6)	
HEARD OF SCREENING					
Yes	182 (81.6)	59 (89.4)	21 (80.8)	71 (84.5)	59 (92.2)
No/not sure	41(18.4)	7 (10.6)	5 (19.2)	13 (15.5)	5 (7.8)
KNOW BENEFITS OF MAMMOGRAPHY					
Yes	169 (75.8)	58 (87.9)	14 (53.9)	55 (65.5)	61 (95.3)
No/never heard of mammogram	54 (24.2)	8 (12.1)	12 (46.1)	29 (34.5)	3 (4.7)
NO. OF BENEFITS KNOWN					
One	140 (82.8)	47 (81.0)	5 (35.7)	34 (61.8)	44 (72.1)
Two or more	29 (17.2)	11 (19.0)	9 (64.3)	21 (38.2)	17 (27.9)
KNOW PROBLEMS WITH MAMMOGRAPHY					
Yes	64 (28.7)	22 (33.3)	5 (19.2)	31 (36.9)	28 (43.8)
No/never heard of mammogram	159 (71.3)	44 (66.7)	21 (80.8)	53 (63.1)	36 (56.3)
NO. OF PROBLEMS KNOWN					
One	56 (87.5)	19 (86.4)	4 (80.0)	19 (61.3)	16 (57.1)
Two or more	8 (12.5)	3 (13.6)	1 (20.0)	12 (38.7)	12 (42.9)
HEARD OF SABXRS BEFORE LETTER					
Yes	130 (58.3)	na	23 (88.5)	66 (78.6)	na
No	59 (26.5)		1 (3.9)	15 (17.9)	
Don't remember letter	34 (15.2)		2 (7.7)	3 (3.6)	
KNOW CLINIC LOCATION					
Yes	57 (25.6)	30 (45.5)	23 (88.5)	82 (97.6)	63 (98.4)
No	166 (74.4)	36 (54.6)	3 (11.5)	2 (2.4)	1 (1.6)
AGE MOST AT RISK					
In her 40s	41 (18.5)	16 (24.2)	3 (11.5)	8 (9.5)	6 (9.5)
In her 50s	68 (30.6)	17 (25.8)	10 (38.5)	31 (36.9)	24 (38.1)
In her 60s	22 (9.9)	1 (1.5)	1 (3.9)	2 (2.4)	1 (1.6)
Don't know	91 (41.0)	32 (48.5)	12 (46.2)	43 (51.2)	32 (50.8)
INCIDENCE OF BREAST CANCER					
1 in 5	30 (13.5)	4 (6.1)	7 (26.9)	7 (8.3)	12 (19.1)
1 in 15	56 (25.2)	14 (21.2)	6 (23.1)	18 (21.4)	12 (19.1)
1 in 35	22 (9.9)	7 (10.6)	2 (7.7)	11 (13.1)	9 (14.3)
1 in 60	4 (1.8)	5 (7.6)	1 (3.9)	3 (3.6)	2 (3.2)
Don't know	110 (49.5)	36 (54.6.)	10 (38.5)	45 (53.6)	28 (44.4)

na, not applicable

Table 6.3.3 Non-attenders by Clinic by Round: KNOW BENEFITS OF MAMMOGRAPHY by selected variables (column percents)

	KNOW BENEFITS OF MAMMOGRAPHY								
	ARNDALE			PORT AUGUSTA					
Variable	Yes	No[1]	*P-value*	Yes	No[1]	*P-value*	Yes	No[1]	*P-value*
ROUND 1	***Electoral Roll*** N = 169	N = 43		***Electoral Roll*** N = 14	N = 11		***R1 Re-invite*** N = 55	N = 26	
EVER HAD MAMMOGRAM									
Yes	40.2	7.0	*< 0.001*	35.7	36.4	*0.97*	12.7	3.8	*0.20*
No	59.8	93.0		64.3	63.6		87.3	96.2	
WILL HAVE MAMMOGRAM IN NEXT 2 YEARS									
Yes[2]	74.0	25.6	*< 0.001*	78.6	63.6	*0.66*	52.7	38.5	*0.23*
No[3]	26.0	74.4		21.4	36.4		47.3	61.5	
WILL HAVE MAMMOGRAM IN NEXT 2 YEARS WITH SABXRS									
Yes[2]	56.2	23.3	*< 0.001*	50.0	36.4	*0.69*	49.1	38.5	*0.37*
No[3]	43.8	76.7		50.0	63.6		50.9	61.5	
RE-SCREENS	N = 58	N = 8		N = 61	N = 3				
WILL HAVE MAMMOGRAM IN NEXT 2 YEARS									
Yes[2]	93.1	75.0	*0.15*	88.5	66.7	*0.33*			
No[3]	6.9	25.0		11.5	33.3				
WILL HAVE MAMMOGRAM IN NEXT 2 YEARS WITH SABXRS									
Yes[2]	91.4	75.0	*0.20*	85.2	66.7	*0.40*			
No[3]	8.6	25.0		14.8	33.3				

[1] Excludes those who have not heard of mammography
[2] Definitely will or Probably will
[3] Definitely won't, Probably won't, Unsure

Table 6.3.4 Non-attenders by Clinic by Round: Exposure to and history of mammography and breast cancer

Variable	Arndale No. (%)		Port Augusta No. (%)		
	Electoral Roll	Re-screen	Electoral Roll	R1 Re-invite	Re-screen
DR SUGGESTED MAMMOGRAM					
Yes	83 (37.2)	49 (74.2)	12 (46.2)	8 (9.5)	11 (17.2)
No	140(62.8)	17 (25.8)	14 (53.9)	76 (90.5)	53 (82.8)
DR SUGGESTED DON'T NEED MAMMO					
Yes	4 (1.8)	0 (0.0)	1 (3.9)	2 (2.4)	0 (0.0)
No	219(98.2)	66 (100.0)	25 (96.23)	82 (97.6)	64 (100.0)
EVER HAD MAMMOGRAM[1]					
Yes	71 (31.8)	20 (30.3)	9 (34.6)	8 (9.5)	5 (7.8)
No	152 (68.2)	46 (69.7)	17 (65.4)	76 (90.5)	59 (92.2)
MAMMOGRAM ELSEWHERE SINCE BXRS					
Yes	na	5 (7.6)	na	na	3 (4.7)
No		61 (92.4)			61 (95.3)
PURPOSE OF LAST MAMMOGRAM					
Diagnostic[2]	33 (46.5)	5 (100.0)	7 (77.8)	1 (12.5)	2 (66.7)
Screening[3]	38 (53.5)	0 (0.0)	2 (22.2)	7 (87.5)	1 (33.3)
WHEN LAST MAMMOGRAM					
Up to 2 years	39 (54.9)	3 (60.0)	7 (77.8)	1 (12.5)	2 (66.7)
> 2 years	32 (45.1)	2 (40.0)	2 (22.2)	7 (87.5)	1 (33.3)
KNOW SOMEONE WHO HAD MAMMO					
Yes	155 (69.5)	49 (74.2)	16 (61.5)	66 (78.6)	55 (85.9)
No	68 (30.5)	17 (25.8)	10 (38.5)	18 (21.4)	9 (14.1)
KNOW SOMEONE WITH BREAST CANCER					
Yes	148 (66.7)	44 (66.7)	14 (53.9)	48 (57.1)	42 (65.6)
No	74 (33.3)	22 (33.3)	12 (46.2)	36 (42.9)	22 (34.4)
ANY FAMILY HISTORY					
Yes	34 (15.3)	13 (19.7)	5 (19.2)	11 (13.1)	12 (18.8)
No	189 (84.7)	53 (80.3)	21 (88.8)	73 (86.9)	52 (81.3)
CLOSE FAMILY HISTORY[4]					
Yes	26 (11.7)	13 (19.7)	5 (19.2)	9 (10.7)	8 (12.5)
No	197 (88.3)	53 (80.3)	21 (88.8)	75 (89.3)	56 (87.5)
FAMILY HISTORY - 1ST DEGREE[5]					
Yes	10 (4.5)	6 (9.1)	1 (3.9)	4 (7.8)	6 (9.4)
No	213 (95.5)	60 (90.9)	25 (96.2)	80 (95.2)	58 (90.6)
VERY STRONG FAMILY HISTORY[6]					
Yes	4 (1.8)	4 (6.1)	0 (0.0)	2 (2.4)	4 (6.3)
No	219 (98.2)	62 (93.9)	26 (100.0)	82 (97.6)	60 (93.8)
BREAST LUMP AT INVITE					
Yes	6 (2.7)	3 (4.6)	4 (15.4)	0 (0.0)	2 (3.1)
No	216 (97.3)	63 (95.5)	22 (84.6)	84 (100.0)	62 (96.9)
BREAST PROBLEM AT INVITE					
Yes	7 (3.2)	2 (3.0)	1 (3.9)	1 (1.2)	1 (1.6)
No	215 (96.8)	64 (97.0)	25 (96.2)	83 (98.8)	63 (98.4)
PAST BREAST PROBLEM					
Yes	45 (20.2)	19 (28.8)	7 (26.9)	7 (8.3)	16 (25.0)
No	178 (79.8)	47 (71.2)	19 (73.1)	77 (91.7)	48 (75.0)

Table 6.3.4 continued

Variable	Arndale No. (%) Electoral Roll	Arndale No. (%) Re-screen	Port Augusta No. (%) Electoral Roll	Port Augusta No. (%) R1 Re-invite	Port Augusta No. (%) Re-screen
HAD BREAST CANCER					
Yes	7 (3.2)	0 (0.0)	2 (7.7)	0 (0.0)	2 (3.1)
No	216 (96.8)	66 (100.0)	24 (92.3)	84 (100.0)	62 (96.9)

na, not applicable
[1] For Re-screens refers to whether had mammogram prior to first screen with SABXRS in 1993
[2] Diagnostic; has signs or symptoms of breast cancer,
[3] Screening; non-symptomatic, including past history of breast cancer, either personal or family, .
[4] Mother, sister, daughter, aunt or grandmother
[5] Mother, sister or daughter
[6] 1st degree relative had breast cancer before age 50 *or* 1st degree relative had bilateral breast cancer (any age) *or* more than one 1st degree relative had breast cancer (any age).

Table 6.3.5 **Attenders and Non-attenders by Clinic and Round: Exposure to and history of mammography and breast cancer by attendance status (column percents)**

Variable	ARNDALE Non-attenders	ARNDALE Attender	ARNDALE *P-value*	PORT AUGUSTA Non-attenders	PORT AUGUSTA Attender	PORT AUGUSTA *P-value*	PORT AUGUSTA Non-attenders	PORT AUGUSTA Attender	PORT AUGUSTA *P-value*
ROUND 1	***Electoral Roll*** N = 223	N = 225		***Electoral Roll*** N = 26	N = 114		***R1 Re-invite*** N = 84	N = 119	
EVER HAD MAMMOGRAM									
Yes	31.8	34.7	*0.53*	34.6	26.3	*0.39*	9.5	24.4	*0.01*
No	68.2	65.3		65.4	73.7		90.5	75.6	
BREAST LUMP AT INVITE									
Yes	2.7	1.3	*0.34*	15.4	5.3	*0.09*	0.0	4.2	*nc*
No	97.3	98.7		84.6	94.7		100.0	95.8	
BREAST PROBLEM AT INVITE									
Yes	3.2	4.4	*0.48*	3.9	1.4	*0.47*	1.2	5.9	*0.14*
No	96.8	95.6		96.2	88.6		98.8	94.1	
PAST BREAST PROBLEM									
Yes	20.2	17.3	*0.44*	26.9	17.5	*0.27*	8.3	19.3	*0.03*
No	79.8	82.7		73.1	82.5		91.7	80.7	
HAD BREAST CANCER									
Yes	3.2	0.4	*0.04*	7.7	0	*nc*	0.0	1.7	*nc*
No	96.8	99.6		92.3	114		100.0	98.3	
ANY FAMILY HISTORY									
Yes	15.3	0	*nc*	19.2	0	*nc*	13.1	0.0	*nc*
No	84.7	225		80.8	114		86.9	100.0	
VERY STRONG FAMILY HISTORY									
Yes	1.8	0.0	*nc*	0.0	0.0	*nc*	2.4	0.0	*nc*
No	98.2	100.0		100.0	100.0		97.6	100.0	
RE-SCREENS	**N = 66**	**N = 434**		**N = 64**	**N = 827**				
HAD MAMMOGRAM BEFORE SABXRS R1 SCREEN									
Yes	30.3	33.2	*0.64*	7.8	15.0	*0.12*			
No	69.7	66.8		92.2	85.0				
BREAST LUMP AT INVITE									
Yes	4.6	2.1	*0.20*	3.1	2.5	*0.68*			
No	95.5	97.9		96.9	97.6				
BREAST PROBLEM AT INVITE									
Yes	3.0	9.5	*0.13*	1.6	6.9	*0.11*			
No	97.0	90.6		98.4	93.1				
PAST BREAST PROBLEM									
Yes	28.8	19.6	*0.12*	25.0	19.6	*0.30*			
No	71.2	80.4		75.0	80.4				
HAD BREAST CANCER									
Yes	0.0	0.7	*nc*	3.1	0.2	*0.03*			
No	100.0	99.3		96.9	99.8				
ANY FAMILY HISTORY									
Yes	19.7	0.5	*< 0.001*	18.8	0.4	*< 0.001*			
No	80.3	99.5		81.3	99.6				
VERY STRONG FAMILY HISTORY									
Yes	6.1	0.2	*< 0.001*	6.3	0.0	*nc*			
No	93.9	99.8		93.8	100.0				

Table 6.3.6 Non-attenders by Clinic by Round: Response to invitation and Reasons for not attending

Variable	Arndale No. (%) Electoral Roll No (%)	Arndale No. (%) Re-screen No (%)	Port Augusta No. (%) Electoral Roll No (%)	Port Augusta No. (%) R1 Re-invite No (%)	Port Augusta No. (%) Re-screen No (%)
REMEMBER RECEIVING LETTER					
Yes	189 (84.8)	60 (90.9)	24 (92.3)	81 (96.4)	41 (64.1)
No	34(15.2)	6 (9.1)	2 (7.7)	3 (3.6)	23 (35.9)
HAPPY ABOUT LETTER					
Yes	184 (97.3)	60 (100.0)	23 (95.8)	77 (95.1)	41 (100.0)
No	5 (2.7)	0 (0.0)	1 (4.2)	4 (4.9)	0 (0.0)
REASON FOR NOT MAKING APPOINTMENT (all reasons)					
Private mammogram[1]	30 (11.8)	10 (11.1)	9 (22.0)	1 (1.0)	3 (5.4)
Barriers					
Structural barriers[2]	11 (4.3)	3 (3.3)	1 (2.4)	6 (5.9)	2 (3.6)
Perceived barriers[3]	33 (12.9)	9 (10.0)	4 (9.8)	17 (16.7)	9 (16.6)
Apathy/no need[4]	101 (39.6)	30 (33.3)	8 (19.5)	44 (43.1)	16 (28.6)
External factors					
Breast problem[5]	14 (5.5)	2 (2.2)	9 (22.0)	0 (0.0)	1 (1.8)
Other clinical problem[6]	39 (15.3)	17 (18.9)	9 (22.0)	11 (10.8)	12 (21.4)
Other[7]	27 (10.6)	19 (21.1)	1 (2.4)	23 (22.6)	13 (23.2)
MAIN REASON FOR NOT MAKING APPOINTMENT					
Private mammogram[1]	23 (12.2)	6 (10.0)	1 (4.2)	1 (1.2)	2 (4.9)
Barriers					
Structural barriers[2]	6 (3.2)	3 (5.0)	1 (4.2)	3 (3.7)	2 (4.9)
Perceived barriers[3]	29 (15.4)	4 (6.7)	3 (12.5)	15 (18.5)	9 (22.0)
Apathy/no need[4]	79 (42.0)	15 (25.0)	6 (25.0)	35 (43.2)	7 (17.1)
External factors					
Breast problem[5]	10 (5.3)	0 (0.0)	7 (29.2)	0 (0.0)	0 (0.0)
Other clinical problem[6]	24 (12.8)	14 (23.3)	6 (25.0)	7 (8.6)	11 (26.8)
Other[7]	17 (9.0)	18 (30.0)	0 (0.0)	20 (24.7)	10 (24.4)

[1] Private mammogram; did not make an appointment because had a private mammogram elsewhere or they prefer to use a private service or to receive an annual mammogram
[2] Structural barriers; includes No suitable time and Too far
[3] Perceived barriers; includes Concern/fear, Pain, Rather not know, and Fear of x-rays
[4] Apathy/no need; includes Too busy, No need, and Didn't get around to it
[5] Breast problem; to past breast cancer or being under the care of a specialist for current breast problem
[6] Other clinical problem; Illness at the time of the invitation or Treatment for problems not related to the breast
[7] Other; includes On holidays, Family commitment, Language problem, Lost letter

Table 6.3.7 Non-attenders by Clinic by Round: Intentions regarding mammography

Variable	Arndale No. (%) Electoral Roll No (%)	Arndale Re-screen No (%)	Port Augusta No. (%) Electoral Roll No (%)	Port Augusta R1 Re-invite No (%)	Port Augusta Re-screen No (%)
WOULD HAVE ANOTHER MAMMOGRAM[1]					
Yes	60 (84.5)	53 (80.3)	8 (88.9)	3 (37.5)	53 (82.8)
No/depends[2]	11 (15.5)	13 (19.7)	1 (11.1)	5 (62.5)	11 (17.2)
WHO WOULD INFLUENCE					
No-one	92 (38.7)	28 (39.4)	13 (52.0)	70 (86.4)	45 (63.4)
Doctor/health professional[3]	99 (41.6)	34 (47.9)	10 (40.0)	4 (4.9)	10 (14.1)
Relative	32 (13.4)	6 (8.5)	1 (4.0)	6 (7.4)	16 (22.5)
Friend/other	15 (6.3)	3 (4.2)	1 (4.0)	1 (1.2)	0 (0.0)
WILL HAVE MAMMOGRAM WITHIN 2 YEARS					
Definitely will	98 (43.9)	52 (78.8)	12 (46.2)	10 (11.9)	40 (62.5)
Probably will	44 (19.7)	8 (12.1)	6 (23.1)	30 (35.7)	16 (25.0)
Probably won't	32 (14.4)	1 (1.5)	7 (26.9)	26 (31.0)	4 (6.3)
Definitely won't	35 (15.7)	5 (7.6)	1 (3.9)	16 (19.1)	3 (4.7)
Don't know	14 (6.3)	0 (0.0)	0(0.0)	2 (2.4)	1 (1.6)
WILL HAVE MAMMOGRAM WITH SABXRS					
Yes	109 (48.9)	59 (89.4)	11 (42.3)	38 (45.2)	54 (84.4)
No/not sure[4]	114 (51.1)	7 (10.6)	15 (57.7)	46 (54.8)	10 (15.6)
REASONS FOR NOT HAVING MAMMOGRAM[5]					
Don't like tests/xrays	15 (15.8)	3 (37.5)	0 (0.0)	4 (12.5)	0 (0.0)
Don't need/too busy/too much trouble	50 (52.6)	2 (37.5)	3 (27.3)	0 (0.0)	1 (12.5)
Perceived barriers	18 (18.9)	2 (25.0)	6 (54.6)	20 (62.5)	6 (75.0)
Medical	9 (9.5)	0 (0.0)	1 (9.1)	5 (15.6)	1 (12.5)
Other[6]	3 (3.2)	0 (0.0)	1 (9.1)	3 (9.4)	0 (0.0)
WHAT WOULD PROMPT TO HAVE MAMMOGRAM					
Preventive action	40 (13.4)	37 (38.5)	11 (32.4)	27 (26.0)	43 (54.4)
If referred by doctor	98 (32.8)	25 (26.0)	8 (23.5)	18 (17.3)	9 (11.4)
Symptoms/problems	115 (38.5)	25 (26.0)	10 (29.4)	32 (30.8)	9 (11.4)
Other	31 (10.4)	8 (8.3)	4 (11.8)	11 (10.6)	17 (21.5)
Nothing	15 (5.0)	1 (1.0)	1 (2.9)	16 (15.4)	1 (1.3)

1 For Round 1 relates only to 71 Arndale cases and 10 Port Augusta cases who have had a prior mammogram

2 No/depends; includes a definite 'No' answer as well as a conditional or qualified response, such as 'Only if a doctor suggested it' or 'If developed symptoms'

3 Only 2 cases with health professional other than doctor (both Round 1)

4 No/not sure; includes women who will not have a mammogram at all, those who would have one privately and those who are not sure where they would have one

5 Asked of those women in the last three categories of WILL HAVE MAMMOGRAM WITHIN TWO YEARS; Probably won't, Definitely won't and Don't know

6 Other; includes access problems, breast implants, too old, and bruise easily

Table 6.3.8 Non-attenders: Relationship of selected variables with Intention to have Mammogram within 2 years

	INTENTION TO HAVE MAMMOGRAM WITHIN 2 YEARS[1] Odds ratio (95% confidence interval)			
	Round 1		Re-screen	
Predictor variables	Maybe[2]	Definitely will not	Maybe[2]	Definitely will not
AGE AT INVITE (Referent group = 60)				
60+	1.9 (1.2, 3.2)**	4.9 (2.1, 12.0)**	2.0 (0.8, 5.2)	0.6 (0.1, 3.1)
SPEAK OTHER LANGUAGE (Referent group = No)				
Yes	1.7 (0.9, 3.3)	1.1 (0.4, 2.9)	0.8 (0.3, 2.3)	1.6 (0.3, 8.6)
HIGHEST SCHOOLING (Referent group = Secondary)				
None/primary	2.2 (1.3, 3.8)**	2.6 (1.3, 5.5)**	2.2 (0.9, 5.6)	2.6 (0.5, 14. 8)
EMPLOYED (Referent group = Yes)				
No	3.3 (1.7, 6.5)***	4.2 (1.4, 13.1)**	2.3 (0.6, 10.5)	nc
HEARD OF SCREENING (Referent group = Yes)				
No/not sure	1.0 (0.5, 2.1)	8.5 (2.3, 33.0)***	1.9 (0.4, 7.9)	nc
KNOW BENEFITS OF MAMMOGRAPHY (Referent group = Yes)				
No/never heard of mammogram	3.6 (1.9, 7.2)***	6.5 (2.8, 15.1)***	4.4 (0.9, 21.5)*	7.3 (0.8, 65.3)*
KNOW PROBLEMS WITH MAMMOGRAPHY (Referent group = Yes)				
No/never heard of mammogram	1.3 (0.8, 2.3)	1.1 (0.5, 2.4)	0.6 (0.3, 1.6)	0.9 (0.2, 5.3)
EVER HAD MAMMOGRAM (Referent group = Yes)				
No	5.9 (3.3, 10.8)***	16.9 (4.7, 72.0)***	na	na
DR SUGGESTED MAMMOGRAM (Referent group = Yes)				
No	8.7 (4.7, 16.1)***	6.9 (2.9, 16.9)***	1.4 (0.6, 3.6)	1.6 (0.3, 9.0)
REMEMBER RECEIVING LETTER (Referent group = Yes)				
No	0.8 (0.4, 1.7)	0.9 (0.3, 2.5)	1.2 (0.4, 3.5)	nc
CLOSE FAMILY HISTORY (Referent group = Yes)				
No	1.4 (0.6, 3.0)	1.3 (0.4, 3.9)	2.0 (0.5, 9.5)	1.6 (0.1, 36.6)

na, not applicablenc, not calculable
* $P < 0.05$ * $P < 0.01$ * $P < 0.001$
[1] Comparison category = 'Definitely will'.
[2] Includes Probably will, Probably won't, Don't know.

Figure 6.2.1 Statistical Local Areas (SLAs) serviced by Arndale and Port Augusta and SLAs sampled

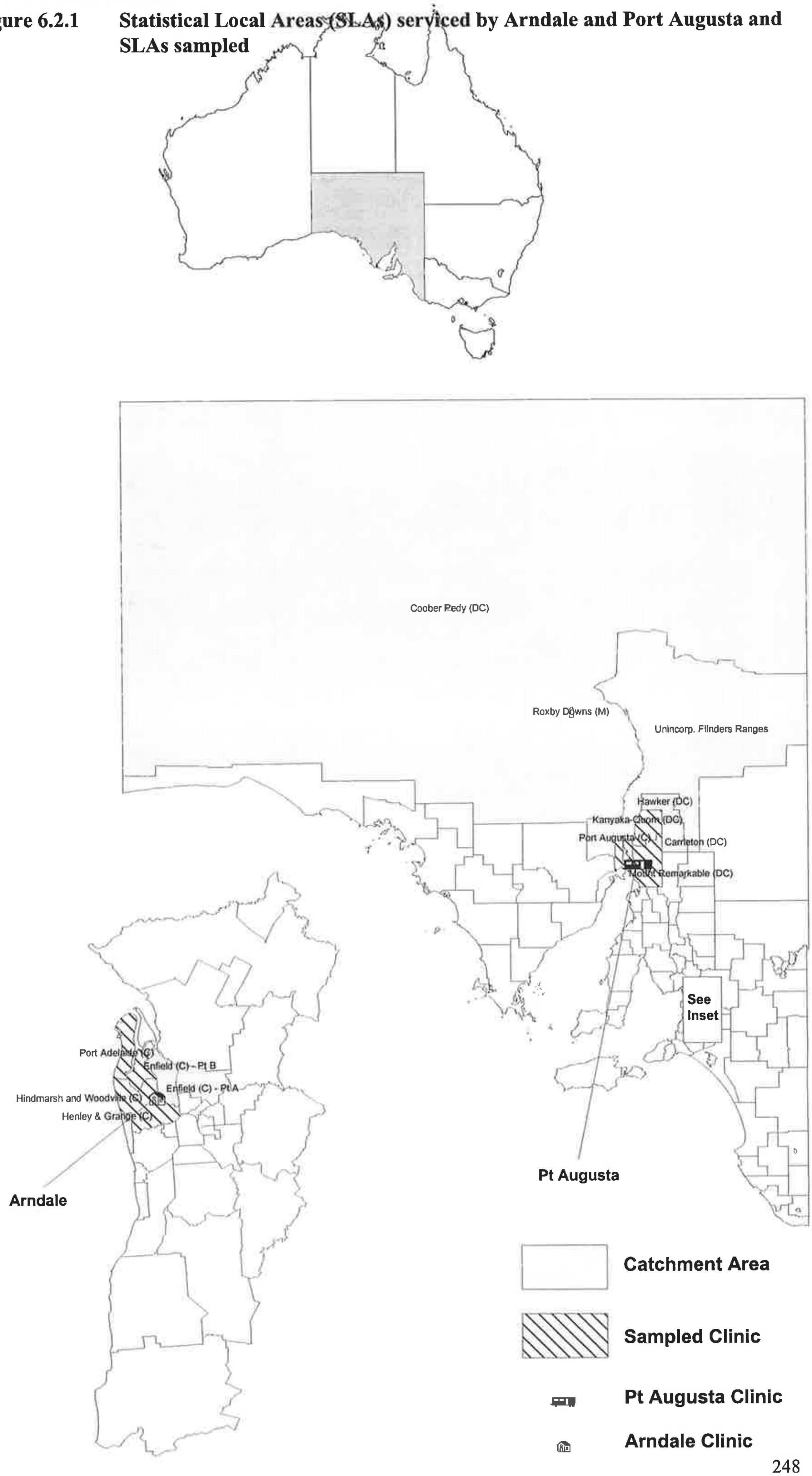


Figure 6.2.2 SABXRS: Invitations sent 1/1/95 to 31/3/95

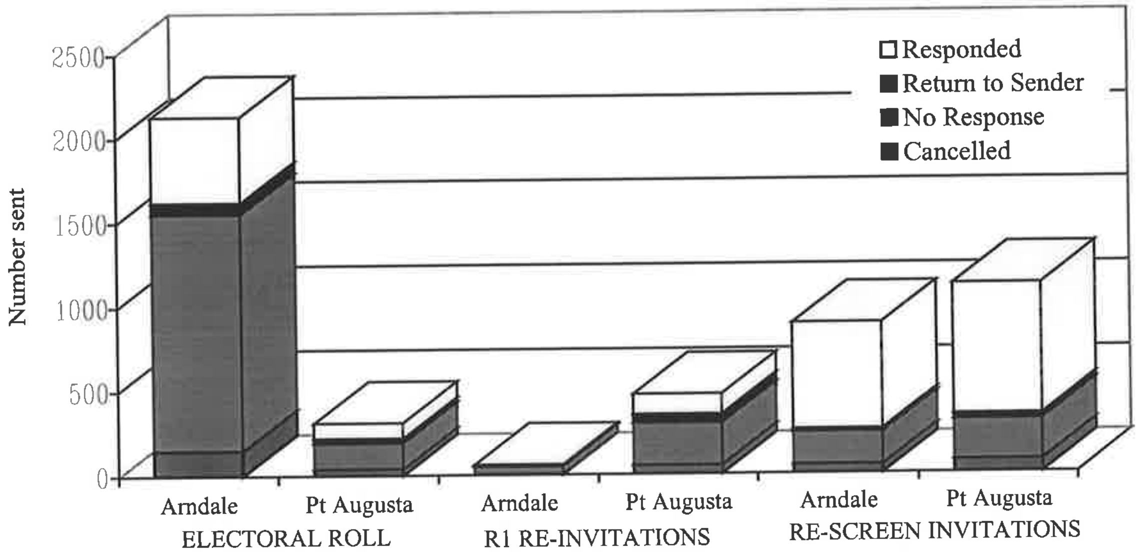
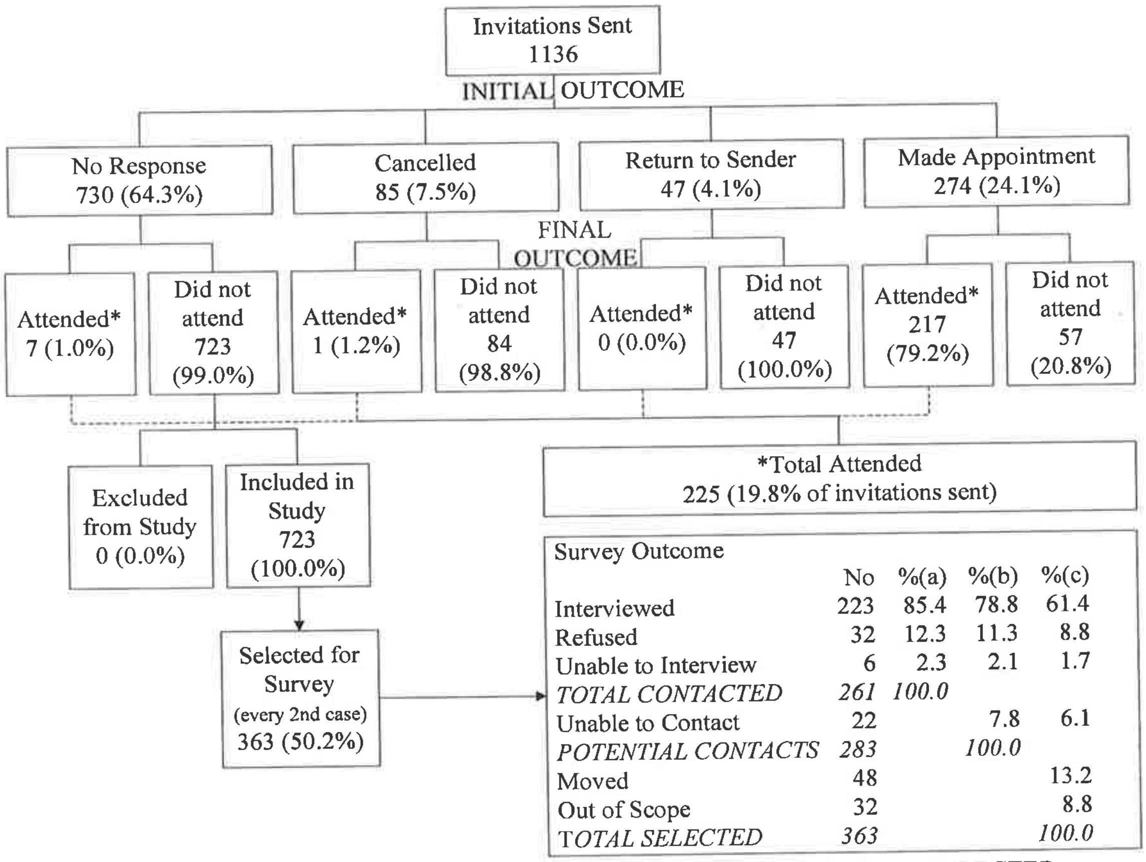


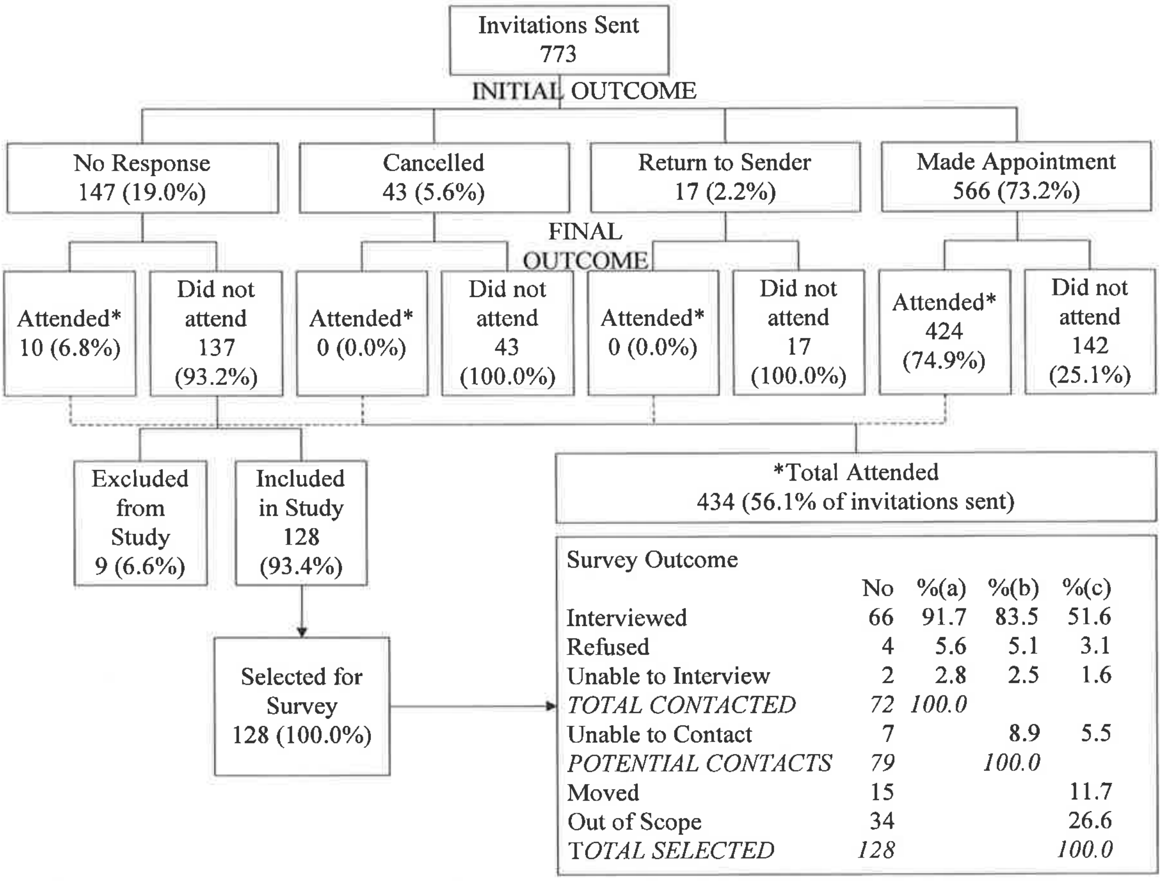
Figure 6.2.3 Arndale - Electoral Roll Invitations (ER Invite)



Survey Outcome	No	%(a)	%(b)	%(c)
Interviewed	223	85.4	78.8	61.4
Refused	32	12.3	11.3	8.8
Unable to Interview	6	2.3	2.1	1.7
TOTAL CONTACTED	*261*	*100.0*		
Unable to Contact	22		7.8	6.1
POTENTIAL CONTACTS	*283*		*100.0*	
Moved	48			13.2
Out of Scope	32			8.8
TOTAL SELECTED	*363*			*100.0*

(a) % of *TOTAL CONTACTED*; (b) % of *POTENTIAL CONTACTS* (c) % of *TOTAL SELECTED*

Figure 6.2.4 Arndale - Re-screen Invitations (Re-screen Invite)

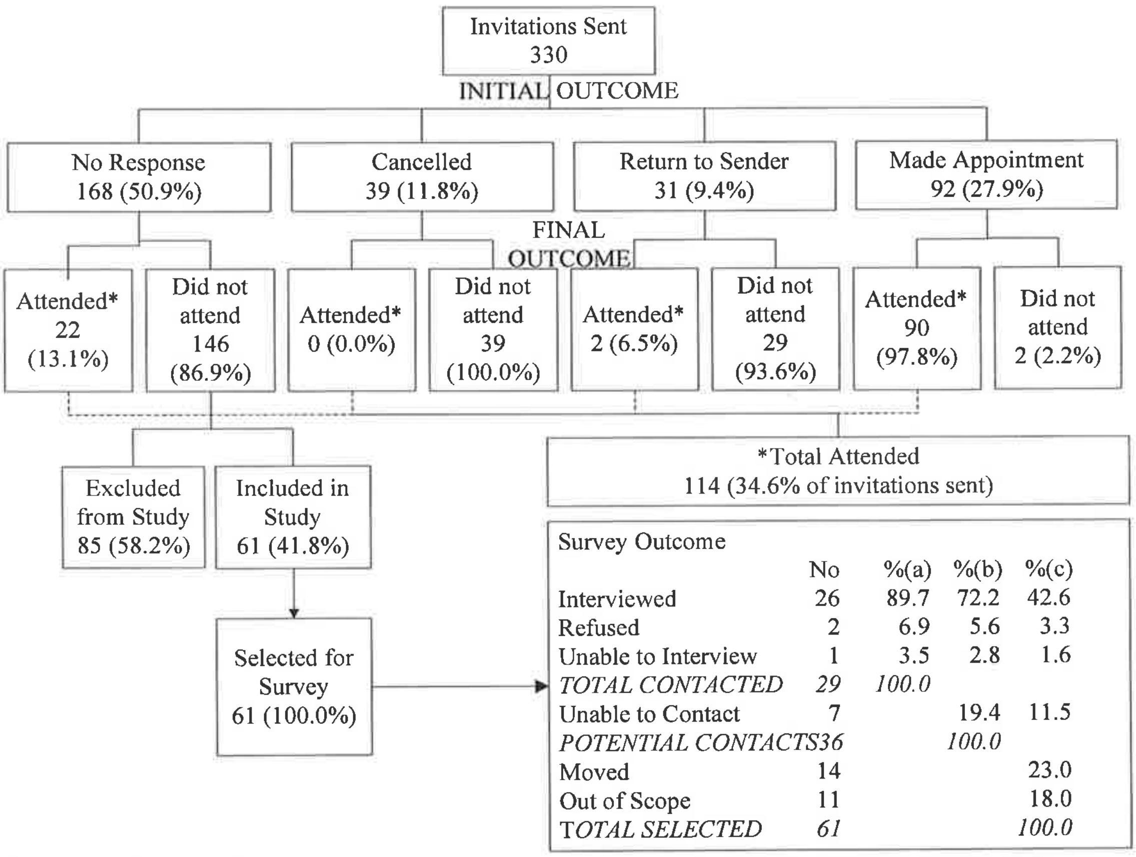


Survey Outcome

	No	%(a)	%(b)	%(c)
Interviewed	66	91.7	83.5	51.6
Refused	4	5.6	5.1	3.1
Unable to Interview	2	2.8	2.5	1.6
TOTAL CONTACTED	*72*	*100.0*		
Unable to Contact	7		8.9	5.5
POTENTIAL CONTACTS	*79*		*100.0*	
Moved	15			11.7
Out of Scope	34			26.6
TOTAL SELECTED	*128*			*100.0*

(a) % of *TOTAL CONTACTED*; (b) % of *POTENTIAL CONTACTS* (c) % of *TOTAL SELECTED*

Figure 6.2.5 Port Augusta - Electoral Roll Invitations (ER Invite)

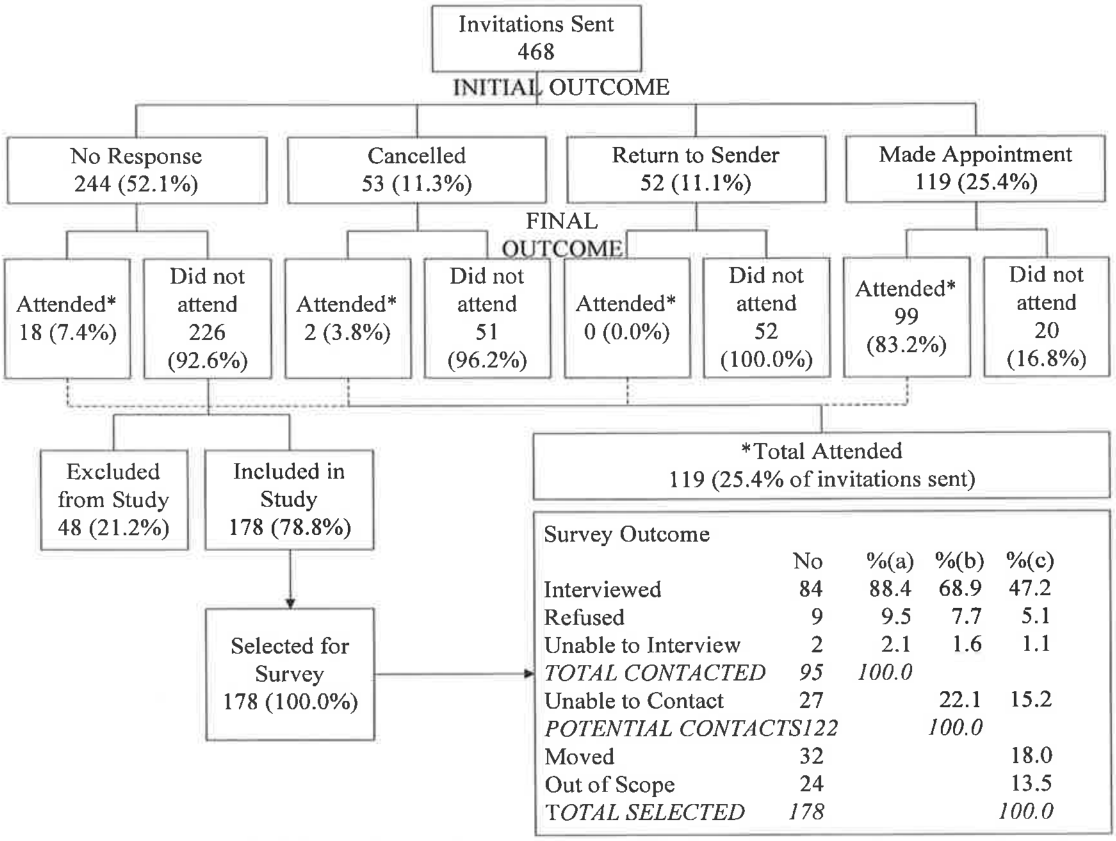


Survey Outcome

	No	%(a)	%(b)	%(c)
Interviewed	26	89.7	72.2	42.6
Refused	2	6.9	5.6	3.3
Unable to Interview	1	3.5	2.8	1.6
TOTAL CONTACTED	*29*	*100.0*		
Unable to Contact	7		19.4	11.5
POTENTIAL CONTACTS	*36*		*100.0*	
Moved	14			23.0
Out of Scope	11			18.0
TOTAL SELECTED	*61*			*100.0*

(a) % of *TOTAL CONTACTED*; (b) % of *POTENTIAL CONTACTS* (c) % of *TOTAL SELECTED*

Figure 6.2.6 Port Augusta - Round 1 Re- Invitations (R1 Re-invite)

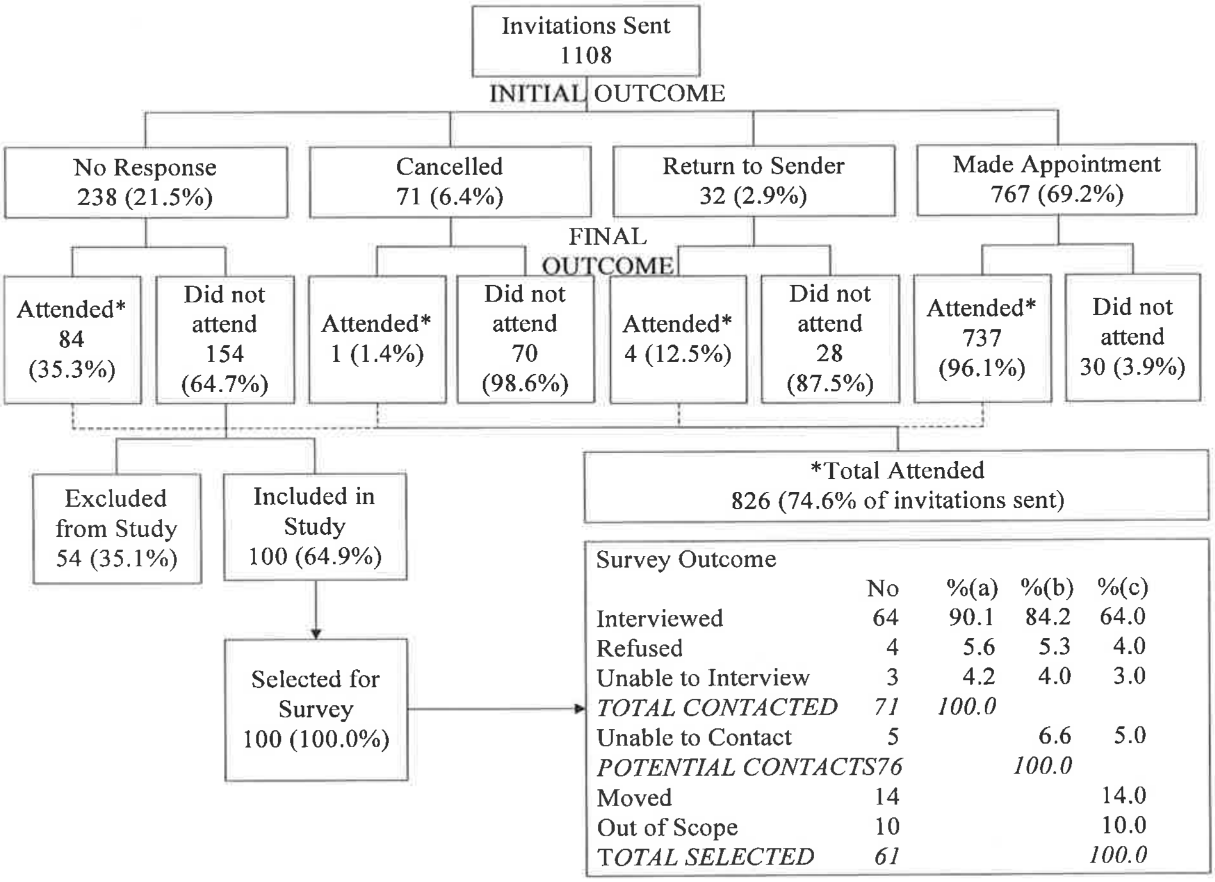


Survey Outcome

	No	%(a)	%(b)	%(c)
Interviewed	84	88.4	68.9	47.2
Refused	9	9.5	7.7	5.1
Unable to Interview	2	2.1	1.6	1.1
TOTAL CONTACTED	*95*	*100.0*		
Unable to Contact	27		22.1	15.2
POTENTIAL CONTACTS	*122*		*100.0*	
Moved	32			18.0
Out of Scope	24			13.5
TOTAL SELECTED	*178*			*100.0*

(a) % of *TOTAL CONTACTED*; (b) % of *POTENTIAL CONTACTS* (c) % of *TOTAL SELECTED*

Figure 6.2.7 Port Augusta - Re-screen Invitations (Re-screen Invite)



Survey Outcome

	No	%(a)	%(b)	%(c)
Interviewed	64	90.1	84.2	64.0
Refused	4	5.6	5.3	4.0
Unable to Interview	3	4.2	4.0	3.0
TOTAL CONTACTED	*71*	*100.0*		
Unable to Contact	5		6.6	5.0
POTENTIAL CONTACTS	*76*		*100.0*	
Moved	14			14.0
Out of Scope	10			10.0
TOTAL SELECTED	*61*			*100.0*

(a) % of *TOTAL CONTACTED*; (b) % of *POTENTIAL CONTACTS* (c) % of *TOTAL SELECTED*

CHAPTER 7 FOLLOW-UP OF INVITEE SUBJECTS

7.1 INTRODUCTION

This chapter follows the non-attenders and attenders invited to either Pt Augusta while the van was located there between January and March, 1995, or to Arndale between February and March, 1995. This follow-up refers to an attendance to the SABXRS for a mammogram between the period from the invitation in early 1995 to 30 June 1997. This allows at least 27 months follow-up, which is the window period used to determine re-attendance for a 2 year re-screen (National Program for the Early Detection of Breast Cancer, 1994a).

While most of the re-screen attendees would have attended in early 1997 following a re-screen invitation, for the Round 1 (R1) cases this may have occurred at any time during the period. The original Arndale electoral roll (ER) non-attenders would have received a R1 Re-invitation a year after the initial invitation, unless they attended within the year, while the Pt Augusta ER non-attenders would have received a R1 Re-invitation when the van next visited between December 1996 and April 1997 (unless they attended another SABXRS service within the two years). The initial R1 Re-invite non-attenders from 1995 mostly would not have received another invitation[1].

Section 7.2 examines all non-attenders following the invitation and compares attendance status at follow-up by non-attender group. Section 7.3 focuses only on those non-attenders interviewed to determine whether data collected at interview is associated with attendance by June 1997. Section 7.4 examines re-attendance amongst those who did attend in response to an invitation to Pt Augusta or Arndale during the study period in 1995.

7.2 FOLLOW-UP OF THE VARIOUS NON-ATTENDERS GROUPS

7.2.1 Comparison of Non-attenders by Invitation Outcome Category

This section examines attendance at follow-up for the various non-attender groups from the study period. For the Round 1 cases, a non-attendance by June 1997 represents cases who had never been screened by the SABXRS, and for the Re-screen cases, those not screened for over 4 years, since the re-screen invitation issued in 1995 was sent two years following their previous mammogram with the SABXRS.

Table 7.2.1 below shows that the proportion of attenders for Round 1 cases was low for both clinics. Only 11% of the Arndale ER non-attenders and 20% of the Pt Augusta ER non-attenders had had a mammogram with the SABXRS by 30 June, 1997. For the R1 Re-invite sample in Pt Augusta, an even lower proportion (8%) had attended. For the Re-screen cases about 50% of cases from both clinics had attended. Hence, it appears that about half the women who do not attend for

[1] R1 Re-invitations are issued to women who had not responded to a previous electoral roll invitation, or who made a Spontaneous appointment which they did not keep. Following this second invitation (or first for those who made an appointment spontaneously), no further invitation is issued, except for those who telephoned to cancel and indicated they wished to use the Service.

their re-screen when due after 2 years, eventually return to the Service. Within each invitation type, attendance varies by the initial outcome of the 1995 invitation. Those women who made an appointment in response to the invitation, but failed to keep it, were more likely to attend by 30 June, 1997.

Attendance was examined by Statistical Local Area (SLA) and age (data not shown). For the ER cases, only one SLA was represented for Arndale, but for Pt Augusta where several were represented no differences were evident. For the R1 Re-invite group, overall attendance was low at 8% as indicated above, but for women in the town of Pt Augusta it was significantly lower (5%) than the more distant SLAs. It may be easier to address distance barriers than perceived psychological barriers. For the Re-screen groups there was no difference by SLA for Pt Augusta, but for Arndale, the SLA of Hindmarsh-Woodville, with the highest proportion of migrants, had a significantly lower attendance.

Regarding age, for all invitation types and for both clinics, older women were less likely to have attended by June 1997. These differences are statistically significant at $P < 0.05$ except for the Arndale Re-screens. Additional data are available for Re-screen cases from their initial screen with the SABXRS, which are presented in Table 7.2.2. The only statistically significant difference is for the variable SPEAK OTHER LANGUAGE for Arndale; women who speak a language other than English at home were less likely to attend at follow-up.

7.2.2 Comparison of Interviewed Non-attenders with Other Non-attenders

Table 7.2.3 compares the Interviewed non-attend cases, (selected from the invitation outcome category of *No response* - see Chapter 6), with all non-attenders from the *No response* category, as well as with all non-attenders from all outcome categories. These data show that the interview does not seem to have had an effect as a cue to attend. For the Arndale Re-screens the proportion attending at follow-up from both the interviewed and non-interviewed *No response* cases was lower than All Non-attenders. This would be related to a higher attendance amongst the *Made Appointment* outcome category (women who, in 1995, made an appointment but did not keep it) as shown in Table 7.2.1.

It was hypothesised in Chapter 6 that for Round 1 (R1) women, the Pt Augusta ER cases would be less difficult to recruit than both the Arndale ER and the Pt Augusta R1-Re-invite cases. This was based on the data presented in that chapter which showed that over half the Pt Augusta ER cases gave practical or external reasons for not attending (for example; illness, holidays, access, private mammography), whereas the majority of other two R1 groups gave apathy or perceived barriers as reasons. In addition, 70% of the Port Augusta ER cases intended having a mammogram within the next two years ('Definitely will' or 'Probably will') compared with 64% for Arndale ER and 48% for Pt Augusta R1-Re-invite cases. It can be seen from Table 7.2.3 that the hypothesis is supported by attendance at follow-up, that is, a higher proportion of Pt Augusta ER cases attended than other R1 cases. However, the proportions attending was well below stated intention for all groups. At interview 42% of the Port Augusta ER cases stated an intention to use the SABXRS within two years, but less than half did so. Also, two years earlier 49% of the Arndale ER interviewed cases and 45% of the Port Augusta R1 Re-invite cases stated an intention to use the SABXRS within two years, but only 7% and 1% did so. Similarly, 89% of the Arndale Re-screens and 84% of the Pt

Augusta Re-screens, at interview, stated an intention to use the Service, but only 38% of the former did so, and 45% of the latter.

7.3 FOLLOW-UP OF INTERVIEWED NON-ATTENDERS

7.3.1 Introduction

Tables 7.3.1 to 7.3.5 examine attendance at follow-up for the interviewed non-attenders by the variables collected at interview to determine associations with later attendance. The data are presented as for Chapter 6 by the five sub-groups: socio-demographic characteristics; knowledge and perceptions about mammography and the SABXRS; exposure to and history of, mammography or breast cancer; response to invitation and reasons for not attending; and, intentions about mammography in the future. As only one of the 84 Interviewed R1 Re-invite cases attended by June 1997, the analyses below exclude this group.

It should be noted that the numbers are low for the Pt Augusta ER group in particular, with several zero cells. Given that each of the four samples represent different populations, it was not considered feasible to sum across samples. In particular, the ER and Re-screen samples could not be combined since the ER group represents women who have never been screened by the SABXRS, while the Re-screen have been screened at least once. The other split by geographical location represents women offered a different type of service; Arndale provides a continuous service from a fixed city location, while the Pt Augusta service is only available biennially from a mobile van.

The *P*-values shown in the tables relate to the test of independence between attenders and non-attenders at follow-up. However, several were not calculable due to zero cells and for cells less than 5 (involving several of the cross-tabulations), Fisher's exact test was used instead of the chi square test of independence. Given the loss of statistical power due to small numbers and zero cells consideration was given to excluding the *P*-values from the tables, but they were left in as indicative since some of the cross-tabulations which had reasonable numbers. However, the reporting of results below will generally examine patterns rather than statistical significance.

7.3.2 Results

Table 7.3.1 summarises the demographic variables. Across all four groups, those who had attended by June 1997 were younger than non-attenders. Except for the Port Augusta ER group (where the number attending was only 5), attenders were also more likely to be born in Australia. It appears that all attenders were less likely to have post-school qualifications and also that Arndale attenders were more likely to be employed.

Several zero cells occur in Table 7.3.2 which shows the knowledge variables. However, 2 X 2 tables with zero cells may indicate a perfect association where the proportions in the comparison group diverge significantly from the 0%/100% split of the other group. For example, despite the small number of Pt Augusta ER attenders (5), they all had heard of screening, knew the location of the clinic, and none mentioned any problems with mammography, whereas for the non-attenders only 76% had heard of screening, 86% knew the location, and 24% mentioned problems. Attenders from all samples were more likely to know benefits of mammography, and for the two

Arndale samples, they also knew more problems. For Arndale, attenders in 1997 were more likely to nominate the younger age group as most at risk and a higher incidence of breast cancer than non-attenders.

The next set of variables relating to exposure to, and history of, mammography and breast cancer are presented in Table 7.3.3. There are also several tables amongst this group with zero cells, but none which appear to be of any significance, since the proportion in the cell corresponding to the zero cell in the comparison group is also low. A higher proportion of attenders from the Arndale ER group had had a doctor suggest a mammogram, but there appears no association for the other groups. The Arndale ER attenders were more likely to have had a previous mammogram (prior to interview outside the SABXRS), and for that mammogram to have been performed for screening purposes. Similarly for the Arndale Re-screen sample, women who had had a mammogram outside the Service between screens were more likely to re-attend.

Response to the initial invitation and reasons for not attending in 1995 do not appear to be associated with later attendance or re-attendance in 1997, as can be seen from Table 7.3.4. There appear to be no marked differences in proportions for the variables shown for both attenders and non-attenders across all four samples.

Although stated intention in 1995 shows some association with attendance in 1997, this was not uniform and the strength of association varied as shown in Table 7.3.5. Stating at interview that others would influence them (doctor, relative, friend or other) was related to both attendance and re-attendance, and the association appears stronger for both Arndale samples. Conversely, non-attenders were more likely to state that 'No-one' would influence them. Although an association between attendance and stated intention to have a mammogram within 2 years (and to have it with the SABXRS) was evident for all groups, it was greater for the Arndale ER and Pt Augusta Re-screen samples. However, it can be seen that a high proportion of women did not follow through with their intentions. For the last variable in the table, WHAT WOULD PROMPT TO HAVE MAMMOGRAM, no definitive pattern emerges, although it appears that the Arndale ER attenders were more likely to have stated in 1995 that they would be prompted to have a mammogram purely for screening purposes.

Chapter 6 reported that television was the most common source of information about the SABXRS, followed by newspapers. Attendance in 1997 was cross-tabulated with stated source at interview (not shown). Television rated highest for both attenders and non-attenders (in 1997) in the Arndale ER sample, followed by friend/relative. None of the women who specified newspapers, radio or doctor (other common sources) attended in 1997. Television and friend/relative rated first and second also for the Arndale Re-screen sample, both for attenders and non-attenders in 1997. Too few of the Pt Augusta ER sample attended to make judgements about source, but amongst the Pt Augusta Re-screen sample, television again rated first for both 1997 attenders and non-attenders. However, for this group 'local newspaper' rated second which would reflect the media releases prior and during the van's visit to the town. However, this shows that exposure does not lead to action, since the sources are similar for both attenders and non-attenders.

It was planned to follow this bivariate analysis with a multivariate model, but given the small numbers and that so little was found to be predictive, such modelling would be unwarranted. After this analysis was completed, information became available on deaths amongst the sample. Of the

464 women interviewed (including the R1 Re-invite not analysed in this chapter), four had died (one Arndale ER and three Pt Augusta Re-screen cases). Again, it was not considered warranted to redo all the analyses.

7.4 Follow-up of Attenders

This section considers the re-attendance rates of women who did attend following the 1995 invitation, and compares these to the 1995 non-attenders. The number of attenders following the invitation in early 1995 are shown in Figures 6.2.5 to 6.2.9 in Chapter 6 ('Total Attended' box). Table 7.4.1 compares the proportions with an attendance between the 1995 invite date and June 1997 by their attendance status in 1995. It can be seen that those who attended in 1995 were significantly more likely to re-attend in 1997, for all three invitation types, and for both clinics. Further, the attrition rate decreases by the number of attendances. For the ER attenders in 1995 (which was their first screen with the SABXRS) 68% of the Arndale cases and 77% of the Pt Augusta cases re-attended in 1997. However, for the 1995 Re-screen attenders, the proportions re-attending in 1997 were 81% for Arndale and 87% for Pt Augusta, overall. However, the re-screens comprise women with a varying number of attendances. Those whose invitation was Round 2 in 1995 had previously attended once, that is, they were being invited for their Round 2 screen. The Round 3 group had previously attended two screens, and so on. It can be seen that for Arndale the proportion screened in 1997 increases by round, 78% for Round 2 to 88% for Round 4. For Pt Augusta the proportion remains high, at around 85% for all rounds. Except for Round 4, the proportion screened in 1997 is significantly higher for those who did not miss their screen in 1995. However, the numbers for Round 4 are quite small as can be seen from Table 7.4.2. For Arndale 35 women were issued a Round 4 invitation in 1995 and 17 of those attended as a result of that invitation in 1995. The corresponding figures for Round 4 Port Augusta invitations are 19 and 13. The Round 4 cases who attended in 1995 would have received a Round 5 invitation in 1997, whereas the non-attenders in 1995 would have received another Round 4 invitation.

7.5 Discussion

Amongst non-attenders who were sent an ER invitation for a first screen in early 1995, overall, 20% from Pt Augusta and 11% from Arndale had had a screen by June 1997 (Table 7.2.1). However, differences are evident by outcome category. Women who had actually taken the trouble to make an appointment (*Made appointment*), but subsequently missed it, were more likely to have attended in 1997 than those who had made no contact at all (*No response*). Those who *Cancelled* had intermediate rates. Only 8% of the R1 Re-invite cases had had a screen. These are not good results and suggest that the Service will have difficulty recruiting the last 10% or so of the target 70% of women aged 50-69. However, approximately 30% of the ER cases who continue to remain non-attenders had had a mammogram outside the SABXRS prior to their 1995 interview. A significant proportion of these may have continued to be screened outside the Service. The next part of this thesis examines mammography experience for the whole community, which will supplement the information about SABXRS clients or contacts thus far, in the endeavour to predict the overall pattern of mammography use in South Australia.

While about half of the women who missed their re-screen appointment in 1995 eventually returned, that still leaves a significant proportion who appear to have dropped out (Table 7.2.1).

These data on re-screen rates, and those by round presented in Table 7.4.1 will be used to calculate possible attrition over time, and project rescreen rates in the last part of this thesis.

From the analyses of the interviewed sample it is difficult to make definitive statements due to the small numbers. Very few variables seemed to predict which cases would have a screen in 1997, but some patterns emerge. One variable that showed a consistent association across all four samples was age, showing that younger women were more likely to attend/reattend, a result consistent with most other studies. Employed women from Arndale were more likely to attend amongst the ER group, which is probably related to the age variable. As with previous analyses, knowledge about mammography, and of the age at risk or incidence, did not appear to predict attendance. Neither did knowing others who had had a mammogram or breast cancer. Personal experience with mammography, however, was associated with attendance for the Arndale ER sample; those who had had a mammogram outside the Service were more likely to attend.

Although barriers proved to be strong predictors in the case-control study reported in earlier chapters, in this study, barriers reported in 1995 did not appear to be associated with attendance in 1997. This suggests that structural barriers (eg, distance, time) or external factors (eg, medical problem, family commitment) no longer existed, and that perceptions may have changed in the intervening period. Similarly, although intentions were a strong predictor in the case-control study, and this part of the analysis did show a relationship, it was far from perfect. From the interviews in 1995, 203 women across all samples stated that they 'Definitely will' have a mammogram within the next 2 years, and 83% of these said they would use the SABXRS. However, only 30% had had one with the SABXRS by June 1997. It is unlikely that the other 70% had a mammogram elsewhere. For women who showed less conviction about future mammography, the actual rates were lower. Amongst those who said they 'Probably will' have a mammogram, only 15% had had one, and only 3% amongst those who said 'Probably won't, Definitely won't' or 'Don't know'. However, though small in number, some women who said they 'Definitely won't' have one, did in fact attend the SABXRS, showing that although intention and behaviour are definitely related, intentions can change.

In conclusion, the group of non-attenders in this study based on invitations sent in early 1995, from a mature Service in its sixth year of operation, are clearly more difficult to recruit than the early non-attenders studied in the case-control study reported in Part 11. The key premise of this thesis that non-attenders represent a number of sub-groups which will require a range of recruitment strategies is further supported by the data presented in this Part of the thesis. Not only have differences in non-attenders been shown at any given point in time, but the range of non-attenders has also been shown to vary at different stages in the development of the screening program. While intentions were found to be highly predictive of future behaviour for the early non-attenders analysed in the case-control study, this was not found to be the case for these later non-attenders. It is not known whether these women changed their mind about screening or are being screened outside the formal screening program. The next part of this thesis examines mammography at the community level.

Table 7.2.1 Non-attenders in 1995: Attended by June '97 by Clinic, Invitation Type and Outcome to invitation

	ARNDALE		PT AUGUSTA	
Invitation Type	N	% Attended[1]	N	% Attended[1]
ELECTORAL ROLL				
OVERALL	911	11.3	216	20.4
INITIAL OUTCOME				
No Response	723	7.6	146	17.8
Cancelled	84	14.3	39	30.8
Return to Sender	47	12.8	29	17.2
Made Appointment	57	52.6	2	50.0
ROUND 1 RE-INVITE				
OVERALL	0	na	349	8.3
INITIAL OUTCOME				
No Response			226	5.3
Cancelled			51	5.9
Return to Sender			52	13.5
Made Appointment			20	35.0
RE-SCREEN				
OVERALL	339	52.5	282	46.1
INITIAL OUTCOME				
No Response	137	38.7	154	38.3
Cancelled	43	37.2	70	57.1
Return to Sender	17	23.5	28	39.3
Made Appointment	142	73.9	30	66.7

[1] Attended SABXRS for mammogram between 1995 invite and June 1997.

Table 7.2.2 Re-screen Non-attenders in 1995: Attended by June '97 by Clinic and selected variables from screen prior to 1995

	% WITH VARIABLE CHARACTERISTIC					
	ARNDALE			PT AUGUSTA		
	Attended by June '97[1]			Attended by June '97[1]		
Variable	Yes N = 128	No N = 211	*P-value*	Yes N = 100	No N = 182	*P-value*
ABORIGINAL	0.0	0.6	*nc*	5.4	8.6	*0.31*
SPEAK OTHER LANGUAGE	18.5	30.0	*0.01*	7.7	6.6	*0.70*
PREVIOUS MAMMOGRAM	25.8	31.3	*0.27*	19.4	15.1	*0.35*
LUMP AT TIME OF FIRST SCREEN	2.8	1.9	*0.73*	3.1	1.3	*0.42*
BREAST PROBLEM AT TIME OF FIRST SCREEN	9.6	11.9	*0.49*	12.4	5.9	*0.06*
PAST BREAST PROBLEM	23.0	23.1	*0.98*	20.9	27.0	*0.24*
FAMILY HISTORY	0.6	1.3	*0.60*	0.0	0.0	*nc*
RECOMMENDED FOR FURTHER ASSESSMENT	2.3	1.9	*1.00*	0.8	2.0	*0.63*

[1] Attended SABXRS for mammogram between 1995 invite and June 1997.

Table 7.2.3 Non-attenders in 1995: Attended by June '97 by Clinic, Invitation type and Interview status

Invitation Type	ARNDALE N	ARNDALE % Attended[1]	PT AUGUSTA N	PT AUGUSTA % Attended[1]
ELECTORAL ROLL				
Interviewed No Response	223	7.2	26	19.2
All No Response	723	7.6	146	17.8
All Non-attenders	911	11.3	216	20.4
ROUND 1 RE-INVITE	0	na		
Interviewed No Response			84	1.2
All No Response			226	5.3
All Non-attenders			349	8.3
RE-SCREEN				
Interviewed No Response	66	37.9	65[2]	44.6
All No Response	137	38.7	154	38.3
All Non-attenders	339	52.5	282	46.1

[1] Attended SABXRS for mammogram between 1995 invite and June 1997

[2] Note: One Pt Augusta case was sent both an ER and Re-screen invitation (duplicate in SABXRS system), but was selected and interviewed as an ER non-attender. However, this women had attended in 1993, and was actually a Re-screen non-attender in 1995, thus was excluded from the analyses in Chapter 6. However, for the purposes of the follow-up she has been included in the Pt Augusta Re-screen group, since this was her correct status, thus increasing the number to 65 rather than 64 as reported in the previous chapter and Figure 6.2.7.

Table 7.3.1 Interviewed non-attenders in 1995: Attend Status by June '97 by Clinic and Invitation Type by Socio-Demographic characteristics (column percent)

	ARNDALE				PORT AUGUSTA			
	Electoral Roll		Re-Screen		Electoral Roll		Re-Screen	
	Attend by June '97		Attend by June '97		Attend by June '97		Attend by June '97	
Variable	Yes N = 16	No N = 207	Yes N = 25	No N = 41	Yes N = 5	No N = 21	Yes N = 29	No N = 36
AGE AT INVITE								
< 60	68.8	28.5	64.0	48.8	100.0	76.2	48.3	30.6
60+	31.3	71.5	36.0	51.2	0.0	23.8	51.7	69.5
P-value	*< 0.001*		*0.23*		*nc*		*0.14*	
ABORIGINAL								
Yes	0.0	0.0	0.0	0.0	0.0	19.0	3.4	11.1
No	100.0	100.0	100.0	100.0	100.0	81.0	96.6	88.9
P-value	*nc*		*nc*		*nc*		*0.37*	
COUNTRY OF BIRTH								
Australia	81.3	57.0	56.0	39.0	60.0	85.7	82.8	86.1
Other	18.8	43.0	44.0	61.0	40.0	14.3	17.2	13.9
P-value	*0.06*		*0.18*		*0.24*		*0.74*	
SPEAK OTHER LANGUAGE								
Yes	18.8	25.1	32.0	48.8	20.0	9.5	10.3	11.1
No	81.3	74.9	68.0	51.2	80.0	90.5	89.7	88.9
P-value	*0.77*		*0.18*		*0.49*		*1.00*	
POST-SCHOOL QUALIFICATION								
Yes	0.0	10.6	8.0	9.8	0.0	19.1	0.0	16.1
No	100.0	89.4	92.0	90.2	100.0	81.0	100.0	86.1
P-value	*nc*		*1.00*		*nc*		*nc*	
EMPLOYED								
Yes	56.3	14.5	12.0	19.5	20.0	38.1	24.1	13.9
No	43.8	85.5	88.0	80.5	80.0	61.9	75.9	86.1
P-value	*< 0.001*		*0.51*		*0.63*		*0.29*	

Table 7.3.2 Interviewed non-attenders in 1995: Attend Status by June '97 by Clinic and Invitation Type by Knowledge and Perceptions about Mammography and SABXRS (column percent)

	ARNDALE				PORT AUGUSTA			
	Electoral Roll		Re-Screen		Electoral Roll		Re-Screen	
	Attend by June '97		Attend by June '97		Attend by June '97		Attend by June '97	
	Yes	No	Yes	No	Yes	No	Yes	No
Variable	N = 16	N = 207	N = 25	N = 41	N = 5	N = 21	N = 29	N = 36
HEARD OF MAMMOGRAPHY								
Yes	100.0	94.7	na	na	100.0	95.2	na	na
No	0.0	5.3			0.0	4.8		
P-value		*nc*				*nc*		
HEARD OF SCREENING								
Yes	81.3	81.6	100.0	82.9	100.0	76.2	93.1	88.9
No/not sure	18.8	18.4	0.0	17.1	0.0	23.8	6.8	11.1
P-value		*0.97*		*nc*		*nc*		*0.68*
KNOW BENEFITS OF MAMMOGRAPHY								
Yes	93.8	74.4	96.0	82.9	80.0	47.6	100.0	91.7
No/never heard of mammogram	6.3	25.6	4.0	17.1	20.0	52.4	0.0	8.3
P-value		*0.13*		*0.14*		*0.33*		*nc*
KNOW PROBLEMS WITH MAMMOGRAPHY								
Yes	37.5	28.0	40.0	29.3	0.0	23.8	31.0	52.8
No/never heard of mammogram	62.5	72.0	60.0	70.7	100.0	76.2	69.0	47.2
P-value		*0.42*		*0.37*		*nc*		*0.08*
HEARD OF SABXRS BEFORE LETTER								
Yes	62.5	58.0	na	na	80.0	90.5	na	na
No	31.3	26.1			20.0	0.0		
Don't remember letter	6.3	15.9			0.0	9.5		
P-value		*0.85*				*nc*		
KNOW CLINIC LOCATION								
Yes	25.0	25.6	52.0	41.5	100.0	85.7	96.6	100.0
No	75.0	74.4	48.0	58.5	0.0	14.3	3.4	0.0
P-value		*1.00*		*0.40*		*nc*		*nc*
AGE MOST AT RISK								
In her 40s	12.5	18.8	32.0	19.5	40.0	4.8	3.4	13.9
In her 50s	56.3	28.5	28.0	24.4	60.0	33.3	41.4	36.1
In her 60s	0.0	10.6	4.0	0.0	0.0	4.8	3.4	0.0
Don't know	31.3	42.0	36.0	56.1	0.0	57.1	51.7	50.0
P-value		*0.40*[1]		*0.27*[1]		*nc*		*0.53*[1]
1 in 5	12.5	13.5	4.0	7.3	20.0	28.6	17.2	22.2
1 in 15	37.5	24.2	32.0	14.6	0.0	28.6	17.2	19.4
1 in 35	6.3	10.1	16.0	7.3	0.0	9.5	13.8	13.9
1 in 60	0.0	1.9	12.0	4.9	20.0	0.0	3.4	2.8
Don't know	43.8	49.8	36.0	65.9	60.0	33.3	48.3	41.7
P-value		*0.24*[2]		*0.09*[2]		*nc*		*0.82*[2]

[1] Categories 'In her 40s' and 'In her 50s' combined for test of significance
[2] Test of significance between correct category (1 in 15) and other combined

Table 7.3.3 **Interviewed non-attenders in 1995: Attend Status by June '97 by Clinic and Invitation Type by Exposure to and History of Mammography and Breast Cancer (column percent)**

	ARNDALE				PORT AUGUSTA			
	Electoral Roll		Re-Screen		Electoral Roll		Re-Screen	
	Attend by June '97		Attend by June '97		Attend by June '97		Attend by June '97	
Variable	Yes N = 16	No N = 207	Yes N = 25	No N = 41	Yes N = 5	No N = 21	Yes N = 29	No N = 36
DR SUGGESTED MAMMOGRAM								
Yes	56.3	35.7	76.0	73.2	40.0	47.6	17.2	16.7
No	43.8	64.3	24.0	26.8	60.0	52.4	82.8	83.3
P-value	*0.10*		*0.80*		*1.00*		*0.95*	
DR SUGGESTED DON'T NEED MAMMO								
Yes	0.0	1.9	0.0	0.0	20.0	0.0	0.0	0.0
No	100.0	98.1	100.0	100.0	80.0	100.0	100.0	100.0
P-value	*nc*		*nc*		*nc*		*nc*	
EVER HAD MAMMOGRAM								
Yes	62.5	29.5	na	na	40.0	33.3	na	na
No	37.5	70.5			60.0	66.7		
P-value	*0.01*				*1.00*			
MAMMOGRAM ELSEWHERE SINCE BXRS								
Yes	na	na	16.0	2.4	na	na	6.9	5.6
No			84.0	97.6			93.1	94.4
P-value			*0.06*				*1.00*	
WHEN LAST MAMMOGRAM[1]								
≤ 2 years/ ≤ 1 year	18.8	17.3	8.0	2.4	40.0	23.8	6.9	2.8
> 2 years/ > 1 year	43.8	12.1	8.0	0.0	0.0	9.5	0.0	2.8
No mammogram	37.5	70.5	84.0	97.6	60.0	66.7	93.1	94.4
P-value	*0.17*[5]		*nc*		*nc*		*nc*	
PURPOSE OF LAST MAMMOGRAM								
Diagnostic	18.8	14.5	na	na	40.0	23.8	na	na
Screening	43.8	15.0			0.0	9.5		
No mammogram	37.5	70.5			60.0	66.7		
P-value	*0.32*[5]				*nc*			
KNOW SOMEONE WHO HAD MAMMO								
Yes	68.8	69.6	80.0	70.7	60.0	61.9	93.1	80.6
No	31.3	30.4	20.0	29.3	40.0	38.1	6.9	19.4
P-value	*0.95*		*0.40*		*1.00*		*0.17*	
BREAST LUMP AT INVITE								
Yes	0.0	2.9	12.0	0.0	20.0	14.3	6.9	0.0
No	100.0	97.1	88.0	100.0	80.0	85.7	93.1	100.0
P-value	*nc*		*nc*		*1.00*		*nc*	
BREAST PROBLEM AT INVITE								
Yes	0.0	3.4	0.0	4.9	20.0	0.0	3.4	0.0
No	100.0	96.6	100.0	95.1	80.0	100.0	96.6	100.0
P-value	*nc*		*nc*		*nc*		*nc*	
PAST BREAST PROBLEM								
Yes	31.3	19.3	40.0	22.0	20.0	28.6	24.1	25.0
No	68.8	80.7	60.0	78.0	80.0	71.4	75.9	75.0
P-value	*0.25*		*0.12*		*1.00*		*0.94*	
HAD BREAST CANCER								
Yes	0.0	0.0	0.0	0.0	0.0	9.5	3.4	2.8
No	100.0	100.0	100.0	100.0	100.0	90.5	96.6	97.2
P-value	*nc*		*nc*		*nc*		*nc*	

Table 7.3.3 continued

	ARNDALE				PORT AUGUSTA			
	Electoral Roll		Re-Screen		Electoral Roll		Re-Screen	
	Attend by June '97		Attend by June '97		Attend by June '97		Attend by June '97	
	Yes	No	Yes	No	Yes	No	Yes	No
Variable	N = 16	N = 207	N = 25	N = 41	N = 5	N = 21	N = 29	N = 36
KNOW SOMEONE WITH BREAST CANCER								
Yes	68.8	66.2	76.0	61.0	60.0	52.4	65.5	66.7
No	31.3	33.8	24.0	39.0	40.0	47.6	34.5	33.3
P-value	*0.83*		*0.21*		*1.00*		*0.92*	
ANY FAMILY HISTORY								
Yes	18.8	15.0	16.0	22.0	0.0	23.8	27.6	11.1
No	8103	85.0	84.0	78.0	100.0	76.2	72.4	88.9
P-value	*0.72*		*0.75*		*nc*		*0.09*	
CLOSE FAMILY HISTORY[2]								
Yes	12.5	11.6	16.0	22.0	0.0	23.8	17.2	8.3
No	87.5	88.4	84.0	78.0	100.0	76.2	82.8	91.7
P-value	*1.00*		*0.75*		*nc*		*0.45*	
FAMILY HISTORY - 1ST DEGREE[3]								
Yes	6.3	4.3	4.0	12.2	0.0	4.8	13.8	5.6
No	93.8	95.7	96.0	87.8	100.0	95.2	86.2	94.4
P-value	*0.53*		*0.40*		*nc*		*0.39*	
VERY STRONG FAMILY HISTORY[4]								
Yes	0.0	1.9	4.0	7.3	0.0	0.0	6.9	5.6
No	100.0	98.1	96.0	92.7	100.0	100.0	93.1	94.4
P-value	*nc*		*1.00*		*nc*		*1.00*	

[1] Categories $\leq$ 2 years & > 2 years applies to electoral roll; $\leq$ 1 year & > 1 year applies to rescreens for mammograms since the last screen with SABXRS.
[2] Mother, sister, daughter, aunt or grandmother
[3] Mother, sister or daughter
[4] 1st degree relative had breast cancer before age 50 *or* 1st degree relative had bilateral breast cancer (any age) *or* more than one 1st degree relative had breast cancer (any age).
[5] Test of significance excludes 'No mammogram'

Table 7.3.4 Interviewed non-attenders in 1995: Attend Status by June '97 by Clinic and Invitation Type by Response to invitation and Reasons for not attending (column percent)

	ARNDALE				PORT AUGUSTA			
	Electoral Roll		Re-Screen		Electoral Roll		Re-Screen	
	Attend by June '97		Attend by June '97		Attend by June '97		Attend by June '97	
Variable	Yes N = 16	No N = 207	Yes N = 25	No N = 41	Yes N = 5	No N = 21	Yes N = 29	No N = 36
REMEMBER RECEIVING LETTER								
Yes	93.8	84.1	92.0	90.2	100.0	90.5	58.6	69.4
No	6.3	15.9	8.0	9.8	0.0	9.5	41.4	30.6
P-value	*0.48*		*1.00*		*nc*		*0.36*	
HAPPY ABOUT LETTER								
Yes	93.8	81.6	92.0	90.2	100.0	85.7	58.6	69.4
No	0.0	2.4	0.0	0.0	0.0	4.8	0.0	0.0
Don't remember letter	6.3	15.9	8.0	9.8	0.0	9.5	41.4	30.6
P-value	*nc*		*nc*		*nc*		*nc*	
REASON FOR NOT MAKING APPOINTMENT (all reasons)[1]								
Private mammogram	15.8	11.4	42.0	37.8	15.4	13.5	7.3	0.0
Barriers								
Structural barriers	10.5	3.8	2.0	2.4	7.7	0.0	2.4	3.5
Perceived barriers	10.5	13.1	4.0	8.5	7.7	5.8	43.9	56.9
Apathy/no need	47.4	39.0	26.0	20.7	0.0	15.4	24.4	10.3
External factors								
Breast problem	5.3	5.5	4.0	0.0	7.7	15.4	2.4	0.0
Other clinical problem	0.0	16.5	4.0	18.3	15.4	13.5	7.3	15.5
Other	10.5	10.6	18.0	12.2	46.2	36.5	12.2	13.8
P-value	*0.29*[2]		*0.97*[2]		*1.00*[2]		*1.00*[2]	
MAIN REASON FOR NOT MAKING APPOINTMENT								
Private mammogram	12.5	10.1	12.0	7.3	20.0	0.0	6.9	0.0
Barriers								
Structural barriers	12.5	1.9	4.0	4.9	20.0	0.0	3.5	5.6
Perceived barriers	12.5	13.0	4.0	7.3	20.0	9.5	3.5	22.2
Apathy/no need	37.5	35.3	24.0	22.0	0.0	28.6	17.2	5.6
External factors								
Breast problem	6.3	4.4	8.0	0.0	20.0	28.6	0.0	0.0
Other clinical problem	0.0	11.6	40.0	29.3	20.0	23.8	10.3	22.2
Other	12.5	7.7	8.0	19.5	0.0	0.0	17.2	13.9
Don't remember letter	6.3	15.9	8.0	9.8	0.0	9.5	41.4	30.6
P-value	*0.60*[3]		*0.81*[3]		*1.00*[3]		*0.66*[3]	

[1] For this variable multiple responses allowed; N = 19, 236, 50, 82, 13, 52, 41 & 58 for groups as they appear across the table.
[2] Test of significance between *Barriers* versus others combined.
[3] Test of significance between *Barriers* versus others combined, excluding 'Don't remember letter'.

Table 7.3.5 Interviewed non-attenders in 1995: Attend Status by June '97 by Clinic and Invitation Type by Intentions regarding Mammography (column percent)

	ARNDALE				PORT AUGUSTA			
	Electoral Roll		Re-Screen		Electoral Roll		Re-Screen	
	Attend by June '97		Attend by June '97		Attend by June '97		Attend by June '97	
Variable	Yes N = 16	No N = 207	Yes N = 25	No N = 41	Yes N = 5	No N = 21	Yes N = 29	No N = 36
WHO WOULD INFLUENCE								
No-one	20.0	40.4	23.3	51.2	20.0	27.5	54.3	70.3
Doctor/health professional	45.0	41.3	53.3	43.9	20.0	20.0	11.4	16.2
Relative	25.0	12.4	16.7	2.4	60.0.	50.0	34.3	13.5
Friend/other	10.0	6.0	6.7	2.4	0.0	2.5	0.0	0.0
P-value	*0.10*[2]		*0.02*[2]		*0.88*[2]		*0.16*[2]	
WILL HAVE MAMMOGRAM WITHIN 2 YEARS								
Definitely will	68.8	42.0	84.0	75.6	40.0	47.6	93.1	38.9
Probably will	25.0	19.3	12.0	12.2	40.0	19.0	6.9	38.9
Probably won't	0.0	15.5	0.0	1.0	20.0	28.6	0.0	11.1
Definitely won't	6.3	16.4	4.0	9.8	0.0	4.8	0.0	8.3
Don't know	0.0	6.8	0.0	0.0	0.0	0.0	0.0	2.8
P-value	*0.04*[3]		*0.42*[3]		*1.00*[3]		*<0.001*[3]	
WILL HAVE MAMMOGRAM WITH SABXRS								
Yes	81.3	46.4	92.0	87.8	80.0	33.3	96.6	75.0
No/not sure	12.5	15.0	4.0	0.0	0.0	33.3	3.4	2.8
Won't have mammo	6.3	38.6	4.0	12.2	20.0	33.3	0.0	22.2
P-value	*0.01*[4]		*0.70*[4]		*0.13*[4]		*0.03*[4]	
WHAT WOULD PROMPT TO HAVE MAMMOGRAM[1]								
Preventive action	30.4	12.0	28.1	34.6	30.0	33.3	69.4	43.2
If referred by doctor	21.7	33.7	34.4	25.5	10.0	29.2	2.8	18.2
Symptoms/problems	34.8	38.8	31.3	27.3	40.0	25.0	8.3	13.6
Other	13.0	10.1	6.3	10.9	20.0	8.3	19.4	22.7
Nothing	0.0	5.4	0.0	1.8	0.0	4.2	0.0	2.3
P-value	*0.04*[5]		*0.82*[5]		*0.67*[5]		*0.40*[5]	

[1] For this variable multiple responses allowed; N = 23, 276, 32, 55, 10, 24, 36 & 44 for groups as they appear across the table.

[2] Test of significance combines last 2 categories.

[3] Test of significance between 'Definitely will' and other categories combined.

[4] Test of significance between 'Yes' and others combined.

[5] Test of significance between 'Preventive action', 'Symptoms/problems' and others combined.

Table 7.4.1 All invitees: Percent Attended by June '97 by Attend status in 1995 by Clinic and Invitation type

	% ATTEND IN 1997					
	ARNDALE			PORT AUGUSTA		
Invitation type	Attend in 1995		*P-value*	Attend in 1995		*P-value*
Round in 1995[1]	Yes	No		Yes	No	
Electoral Roll	68.4	11.3	*< 0.001*	77.2	20.4	*< 0.001*
R1 Re-invite	na	na		56.3	8.3	*< 0.001*
Re-screen						
Overall	81.3	52.5	*< 0.001*	86.7	46.1	*< 0.001*
Round 2	79.6	45.0	*< 0.001*	86.8	43.5	*< 0.001*
Round 3	83.0	61.0	*< 0.001*	85.7	62.1	*0.01*
Round 4	88.2	72.2	*0.40*	84.6	66.7	*0.56*

[1] Only applies to Re-screens; all ER and R1 Re-invite by definition were Round 1 in 1995.

Table 7.4.2 Re-screen cases: Round in 1995 by Attend status in 1995 by Clinic and Invitation type

	ARNDALE		PORT AUGUSTA	
	Attend in 1995		Attend in 1995	
Round in 1995	Yes	No	Yes	No
Overall	434[1]	339[1]	826[1]	282[1]
Round 2	216	189	740	246
Round 3	200	131	70	29
Round 4	17	18	13	6

[1] The overall figure is greater than sum of Rounds due to missing Round variable

PART IV

CROSS-SECTIONAL COMMUNITY SURVEYS AT STATE AND NATIONAL LEVELS

CHAPTER 8 CROSS-SECTIONAL COMMUNITY SURVEYS

8.1 INTRODUCTION

This Chapter focuses on mammography at the community level in South Australia and Australia. Section 8.2 presents data from five community ('Omnibus') surveys conducted in South Australia over the period 1990 to 1995, while section 8.3 presents data from two ABS National Health Surveys conducted in 1989/90 and 1995. Two logistic regression models are discussed, one from the 1990 Omnibus relating to all South Australia women and the other from the 1989/90 NHS relating to all Australian women. These models complement the case-control study base-line models which relate to SABXRS 'clients' (had contact with or from Service). Except for the sections presenting models which rely on statistical methods, the focus of this chapter is on examining patterns which are of practical relevance, rather than statistical significance. Some chi square tests of association are presented in tables where such tests may add strength to an argument, for example, in testing for differences in factors associated with mammography uptake between regions. However, particularly in the early years, the numbers on which these were based were quite small and are indicative only. Also, confidence intervals have been presented where it was considered that conclusions may be drawn from an apparent pattern which may be unreliable due to the small numbers concerned.

These surveys comprise an important component of Part V of this thesis which evaluates the likely attainable participation rate for mammography overall, but particularly for the SABXRS. The extent of screening outside the Program is critical to the cost-effectiveness of the program, and also has implications for the appropriateness and quality of service for women screened outside the Service. It is acknowledged that there would be a margin of error from these self-reports, both in relation to the reason for a mammogram (diagnostic or screening) and whether it occurred inside or outside the Program. A survey commissioned by the National Breast Cancer Centre, sought consent to validate self-reported screening within the Program against Program databases (Barratt *et al.*, 1997). Of the 819 women Australia-wide who reported a mammogram with the National Program, 669 (82%) agreed to provide their names and address, and a random sample of 148 was selected for further follow-up. Of these, 127 (85%) returned a signed consent form, and 120 were able to be matched against Program records; 95% of the 120 were found to have been screened in the Program. Further, 92% of women correctly reported their date of attendance to within 12 months, and 81% within six months. However, the authors acknowledge that these results may overestimate the accuracy of self-reports due to the selection process.

It should be noted that data presented for 'Australia' include South Australia.

8.2 HEALTH OMNIBUS SURVEYS (1990, 1991, 1992, 1994, 1995)

8.2.1 Introduction

The mammography section of the 1990 South Australian 'Omnibus' survey was planned by the investigator as an integral component of this thesis to supplement the principal component, namely the case-control study, with a community perspective. Following the initial 1990 survey, the SABXRS included a few questions in subsequent years to gauge screening at the community level over time, and permission was granted to use these additional data for this thesis.

The Health Omnibus Surveys are commissioned by the South Australian Health Commission to cover a range of health topics. The surveys are conducted by personal interview with a random sample of about 3,000 persons across the whole state. The first survey in October 1990 was conducted by the ABS, and from 1991 the surveys have been contracted to a private market research company. The cost of the Omnibus surveys is shared on a user-pay basis, according to the number of questions. Each user is provided with unit record data for the specific questions commissioned, plus a number of socio-demographic variables, including age, sex, marital status, country of birth, education, occupation and income. The data are weighted by age, sex and region (metropolitan, non-metropolitan), therefore the proportions are representative of the population.

The samples are drawn from census collectors' districts (CDs) used by the ABS for the Adelaide metropolitan area. Only private dwellings are included. CDs are selected first, with the probability of selection proportional to their size. Within each CD a random start point is selected, and from this point 10 dwellings chosen by selecting every fourth dwelling. In the non-metropolitan area the sample includes all towns/cities with a population of 10,000 or more, and a selection, proportional to size, of towns with a population of over 1,000 but less than 10,000. As with the metropolitan sample, random starting points are selected and a cluster of 10 dwellings chosen. Within each selected household, one interview is conducted with the person aged over 15 who had their birthday last. For the October 1995 survey, 4,200 households were selected, and 3,016 interviews conducted with a response rate of 74.2% (Harrison Health Research, 1996).

The SABXRS participated in the October surveys in 1990, 1991, 1992, 1994 and 1995. The mammography section of the 1990 survey was the most detailed, and included questions about barriers and knowledge not included in subsequent surveys. The other four Omnibus surveys provide summary information about mammography rates over time in the South Australian community, both within and outside the SABXRS. Appendix F, Table F1 lists the mammography questions from the Omnibus surveys and the year each was included.

Section 8.2.2 presents a multivariate model derived from the 1990 survey data, which as mentioned above included additional questions on knowledge as well as on perceived barriers. Section 8.2.3 compares results across the five Omnibus surveys in relation to mammography behaviour and examines change over time, while section 8.2.4 examines intentions about future mammography and knowledge about the incidence of breast cancer. From Appendix F, Table F1 it can be seen that only four core questions were asked in all five surveys. In 1995 two new questions were introduced regarding invitations to the SABXRS and these data are presented in section 8.2.5.

8.2.2 Multivariate Analysis of 1990 Omnibus Survey

The logistic regression analysis reported here was conducted by the Australian Bureau of Statistics (ABS) to the investigator's instructions, so that a wider range of variables could be examined than those available to the investigator (with permission from the owners of the data). As indicated above, the SABXRS was provided with unit record data only for the questions commissioned and the demographic variables. Only summary results are presented, since the detailed results are reported elsewhere (Australian Bureau of Statistics, 1993a). The SAS statistical package (SAS Institute Inc., 1989) was used to analyse the data by the method of backward elimination, using $P > 0.10$ to exclude variables at each step, as recommended by Hosmer and Lemeshow (1989).

Results from 550 women aged 40 years and over who responded to the 1990 Health Omnibus Survey were used in three logistic regression models. The dependent variable for Model 1 was ' Ever had a mammogram', for Model 2 'Intend to have a mammogram (anywhere) in the next 2 years', and, for Model 3 'Intend to have a mammogram with the SABXRS in the next 2 years'. Appendix F, Table F2 lists the variables examined in these analyses. It also shows which variables were entered into each of the three multivariate analyses on the basis of $P < 0.25$ from the bivariate analysis, again as recommended by Hosmer and Lemeshow (1989). This was also the cut-off level used in the case-control study reported in Part II of this thesis. In addition, variables which remained in the final model also are indicated in Table F2. A ✗ denotes a variable not entered into the multivariate analyses at all, a ✓ denotes entry into the initial model but exclusion in one of the steps of backward elimination, and ✓✓ denotes variables that remained in the final best fit models. Also listed are statistics in relation to the assessment of the goodness of the fit of the final models. The sensitivity was 90% or greater for all three models, while the specificity ranged from 74% to 81%. The proportion of false positives ranged from 10% to 17% and false negatives from 12% to 17%. Overall, the proportion correctly predicted was 88% for Model 1, 86% for Model 2 and 86% for Model 3, indicating that the variables included in the final models were reasonably good predictors of the observed differences between the two groups of each of the dependent variables.

Variables significant at $P < 0.05$ in the final models are listed in Table 8.2.1 below. The traditional level of statistical significance is used here rather than the $P < 0.10$ for the case-control studies since the numbers are larger. For Model 1, six of thirty five variables examined were statistically significant at $P < 0.05$ in the final model. None of the demographic variables such as age, education and occupation remained in the final model. Of those which did, the variable DOCYES 'Has your doctor ever suggested to you that you should have a mammogram?' was found to have the strongest influence; women whose doctor suggested a mammogram were 48 times more likely to have ever had a mammogram. Other factors predicting prior mammography were RATHER NOT THINK ABOUT IT, HEARD SABXRS OTHER PAPER, HEARD SABXRS GP, HEARD SABXRS OTHER, and INCIDENCE OF BREAST CANCER. Women who had had a mammogram were three time less likely to agree with the statement that they would 'rather not think about it', or conversely, those who had not had a mammogram were more likely to agree. Those who had had a mammogram were three times more likely to give as their sources of information about the SABXRS 'other paper' (other than the local paper, usually meaning the state-wide paper), four times as likely to mention their general practitioner, and 3 times as likely to mention other sources (including seminars, pamphlets, workmates). Overall, although other variables were not statistically significant, the direction of association indicates a more positive attitude to mammography and the screening service amongst women who had had a mammogram.

In Model 2, which examined predictors of intention to have a mammogram in the next two years (anywhere), thirteen of the 41 variables were included in the final model and nine were significant at $P < 0.05$. Although a doctor's recommendation was again a strong predictor, the direction of association was opposite to that of Model 1. Women who intended to have a mammogram were nearly 7 times *less* likely to have had a doctor recommend a mammogram. The variable WHEN

LAST MAMMOGRAM shows that compared to women who have never had a mammogram, those who had had a mammogram were many times more likely to state future intention, regardless of when they had their last mammogram. However, they were also three times more likely to agree that a mammogram was painful than women who did not intend to have one. Perhaps this reflects experience of mammogram being painful, but acceptance of it as necessary. Women with positive intentions were also 64 times more likely to say they would have a mammogram just as a checkup than those who would only have one if their doctor suggested it. Further, they were more likely to have a family history of breast cancer (mother, sister or daughter), have a friend who had had breast cancer, and be younger. Three demographic variables remained significant in this model (occupation, hours worked and age). The hours worked and occupational variables show somewhat incongruent results. All occupational groups were more likely to intend having a mammogram than women who did not work outside the home, yet women who worked in the last week were less likely than those with zero hours. The age variable shows that compared with women aged 40-44, those aged 65-69 were seven times less likely to intend having a mammogram.

The same 41 variables examined in Model 2 were also examined in Model 3, with 20 included in the final model, seven significant at $P < 0.05$. This model examined intention to have a mammogram at the SABXRS within the next 2 years. Women who agreed that symptoms are required to have a mammogram were less likely to intend having a mammogram with the SABXRS. However, those who agreed that having a mammogram would be 'too much trouble' were 21 times more likely to intend having a mammogram with the SABXRS, which is a difficult result to interpret. Perhaps it was too much trouble in the past, but they intended to take the trouble in future. A further breakdown of the data shows that only 3% of women who have already had a mammogram agreed that a mammogram was 'too much trouble' compared with 13% of those who have never had a mammogram. It seems therefore that this apparently incongruous result occurs because a sufficiently high proportion of women who have never had a mammogram in the past intend to have one in future (38% 'definitely' or 'probably' will), even though women who had previously had a mammogram are more likely to intend having a future one (53%). Model 3 also found (as with the Model 2) that intention was high amongst women who would have a mammogram just as a check-up. The occupation, hours worked and age variables also show similar results.

8.2.3 Omnibus Survey Results: Mammography Behaviour Over Time

Table 8.2.2 below shows the total number of women sampled by year and age group, the proportion of women who have ever had a mammogram, and the purpose of the mammogram for those who had ever had one, that is, whether for screening or diagnosis of a symptom. Purpose was determined from responses to the question "Why did you have your last mammogram". Those who reported breast symptoms were coded as *diagnostic*, and all others as *screening*, encompassing a personal or family history of breast cancer as well as screening/check-up.

For women in the target population of 50-69, the proportion reporting ever having had a mammogram increased significantly over the period; 28% 1990, 37% in 1991, 45% in 1992, 72% in 1994, and 82% in 1995. The proportion reporting a screening mammogram, that is without symptoms, was about 10% less each year. For women in their 30s there has not been an increase in the proportion of women having mammograms overall, but a small increase in diagnostic mammograms over the period. However, for women in their 40s, there has been an increase from 25% in 1990 to 51% in 1995 in mammography overall, with proportions rising in both the screening and diagnostic components. For women in their 70s there has been an increase in screening mammography from 10% in 1991 to 28% in 1995, while diagnostic mammography remained steady over the period at about 6%.

The previous table (8.2.2) relates to ever having a mammogram. Table 8.2.3 presents the same categorisations as the previous table, but examines compliance to the National Program's recommended screening interval of two years. The National Program defines a compliant participant in the Program as a woman having a mammogram within 27 months, allowing a three month window (from internal Program data dictionary). Within the Program this can be calculated from screening dates, but due to reporting error from surveys a broader definition was used in the tables examining compliance; mammograms in the year of the survey and the two preceding years were included. It is acknowledged that this would overestimate compliance, since for some respondents it could be nearly three years since their last mammogram. This methodology corresponds to that used by the National Program data definition to calculate period to last mammogram from self-reports when women first enter the Program.

From Table 8.2.3 it can be seen that for women in their 40s, the proportion having screening mammograms within the compliance period rose sharply from 12% in 1990 to 26% in 1992, but since then has remained at below 30%. This corresponds to a change in policy by the SABXRS, where women in their 40s were specifically informed that the benefits of mammography were equivocal for younger women, and while they were not denied a screen, they were not sent a reminder letter after two years as was the case before 1993. However, for women in the 50-69 year age group, aggressively targeted by the Program both in South Australia and at the national level, the proportion of the population reporting a screening mammogram within the compliance period in 1995 was 68%. This suggests that at the current time South Australia would have achieved or be close to achieving the target participation rate.

Table 8.2.4 further classifies the data according to whether or not women used the SABXRS for their mammogram. Only compliant participants, as defined for Table 8.3.3 are included. Two sets of proportions are presented in Table 8.2.4. The first uses the total sample in the relevant age group as the denominator. Hence, in 1990, 10.8% of women aged 50-69 had had a mammogram with the SABXRS and a further 12.5% had had mammogram outside the Program. This sums to 23.3% overall being compliant participants in 1990, which corresponds to the proportion shown in the first set of figures in Table 8.2.3. The second set of proportions in Table 8.2.4 (shown in brackets) are calculated using the number of women who had a mammogram within the compliance period as the denominator, thus the proportion having their mammogram at the SABXRS and outside the SABXRS sum to 100%. It can be seen that a high proportion of women in the target population of 50-69 obtained their screen at the SABXRS, the proportion increasing from 46% in 1990 to 83% in 1995. Thus the proportion of the target group having a mammogram within the compliance period outside the Program fell from 54% in 1990 to 17% in 1995.

While the Program targets women aged 50-69, all women aged 40 years and over can access it free of charge. From Table 8.2.3 it can be seen that in 1995, 39% of women in their 40s reported having a mammogram (screening and diagnostic combined) within the compliance period. The breakdown in Table 8.2.4 (first set of proportions) shows that 22% occurred inside the Program and 16% outside the Program. For women in their 50s, 75% were compliant participants in 1995, 59% inside and 15% outside the Program. The corresponding figures for women in their 60s were, 74% compliant participants, 65% inside and 10% outside. For women aged 70 and over, 22% were compliant, 16% inside and 5% outside. Hence, the proportion of women in the population having a mammogram outside the Program decreases with age, except for the older women (70 and over). For this age group it would be expected that a high proportion of outside mammograms are for diagnostic purposes, given the increasing incidence of breast cancer with age. However, for younger women the proportion of the population having a mammogram outside the Program exceeds the level that would be indicated by the proportion truly eligible for a Medicare rebate (those with true breast cancer symptoms or a family history).

From the second set of figures (in brackets) it can be seen that in 1995, 58% of women in their 40s had their mammogram at the SABXRS in contrast to the 83% for women 50-69 and 75% for women 70+. However, 26% of compliant participants in their 30s, also reported that their last mammogram was with the SABXRS, although the SABXRS does not accept women in their 30s. It is known that a proportion of women falsify their age in order to have a mammogram with the Service. However, it is unlikely to be around 2% of the population as suggested by these data. The Estimated Resident Population of women aged 30-39 in 1995 was 116,200 (Australian Bureau of Statistics, 1996c). If 1.7% of women in the population in 1995 had actually attended the SABXRS in the previous 2-3 years as reported, the actual number would have been 6,800 which is an unlikely figure. However, given the low proportion of women in their thirties who reported having a recent mammogram with the SABXRS, and the small sample numerically (only 5 women) on which this proportion was based, the standard error is large. The 95% confidence interval around the 1.7% estimate is 0.6% to 4.1%. Apart from random error around the true estimate, it is possible that these data also suffer from systematic error, due for example, to women who participate in mammography having a greater chance of inclusion.

The next two sets of data in Table 8.2.4 provide separate details for screening and diagnostic mammograms as reported at interview. The split is not as clear as expected even allowing for reporting error. Although the majority of women aged over 40 have their screening mammograms with the SABXRS, a significant proportion do not. Within the target age group (50-69), 9.5% of women in the population reported having a screening mammogram outside the Program in 1995, or 14% of those who had a screening mammogram within the compliance period. Of the 6.6% women aged 50-69 who reported having a diagnostic mammogram within the compliance period, over half (52.2%) stated that this was with the SABXRS. As stated in the Chapter 6, even though the SABXRS attempts to screen out women with symptoms on the telephone, a significant proportion of women report symptoms when they attend for their screen. However, about half of these are not considered as significant for breast cancer by the Service's clinicians (for example, general breast pain in both breasts). It is probable that a significant proportion of women referred for 'diagnostic' mammograms outside the Program by doctors also do not have significant symptoms.

Table 8.2.5 cross-classifies 'Ever had mammogram' with other variables available. The percents shown in each cell refer to the proportion of women who have ever had a mammogram in South Australia (anywhere) for the particular variable category listed on the left. Due to small numbers in some cells, categories were necessarily collapsed which may have masked potential differences. For example, the 'Other' country of birth category covers all countries other than Australia, UK and Ireland, and while some differences are apparent from the raw numbers, it is not possible to make statements about specific groups. This demonstrates the difficulty of general population surveys in targeting specific problems or specific groups. This could be achieved by over-sampling, which was not an option with the Health Omnibus Survey, but had it been, the cost would have been prohibitive.

The patterns for the socio-demographic variables in Table 8.2.5 appear to match those expected from the literature. The Country of Birth variable in 1995 shows that 85% of women born in Australia had ever had a mammogram compared with 80% for women from the UK and Ireland, and 71% for other overseas born women. Hence the difference is especially marked between Australian born women and migrants from countries other than the UK and Ireland. In fact in the years from 1990 to 1994 the highest rates of mammography were amongst women from the UK and Ireland. Further special migrant studies would be required to determine which specific groups are affected amongst the 'Other' category. Marital status in 1995 shows that 85% of married women had ever had a mammogram compared with 73% for those not married. This pattern is evident over the whole time period but the difference more marked in 1995. Within the 'Not married' group, the 'Never married' have a particularly low proportion who have ever had a mammogram at 43%. However, the 95% confidence interval is broad (12% to 80%) given that only 7 women were interviewed aged 50-69 and never married. The education variable shows that in 1990 (that is, the early days of screening) the uptake was higher amongst women with higher education, but over time this disparity appears to have disappeared.

For the two additional health behaviour variables in Table 8.2.5, the Smoking variable shows the predicted pattern (smokers less likely to have a mammogram) in the first and last two years (1990, 1994 and 1995), but not the middle years. Ever having a Pap Test shows a clear association with ever having a mammogram for the three years where this variable was available (1990, 1994 and 1995), and is also statistically significant in the latter two years ($P < 0.001$ in 1995).

Table 8.2.6 presents the same variables as for Table 8.2.5, but relates to the proportion of women who ever had a mammogram with the SABXRS (using the same total population denominator). It should be noted some of the numbers on which the percents are based are quite small particularly in the early years. Nevertheless, in general the pattern for Country of birth and Marital status is similar to that of the general community. However, it appears that these data support the suggestion made in evaluating the case-control data that the SABXRS under-represents the higher educated women. The two additional health behaviour variables, Smoking and Pap Test show similar patterns to the general community, however the difference for the latter is less marked. That is, while having a pap test appears strongly associated with having a mammogram per se, the strength of the association with having a mammogram in or out of the National Program appears significantly less. From the base-line case-control analyses, the smoking and pap test variables were significant for the both the Spontaneous and GP FTA groups, but neither of the Cancel groups, indicating the FTA cases resemble the community non-attenders. It was suggested in the reporting of the case-control study results that the FTA cases resembled the non-attenders from the literature based on community samples more so than the Cancel cases.

8.2.4 Omnibus Survey Results: Intentions about mammography and Knowledge of Incidence of breast cancer

From Appendix F, Table F1 it can be seen that intention to have a mammogram at the SABXRS was included in the 1990, 1991, 1992 and 1994 surveys. The latter three surveys also asked how frequently women intended having a mammogram in the coming years. Knowledge of the incidence of breast cancer was asked in 1990, 1994 and 1995.

Table 8.2.7 shows intention to use the SABXRS in the next two years, separately for women aged 40-49 (who the Service accepts but does not specifically target) and the target age group 50-69. For women in their 40s a similar trend can be seen as for the overall levels of screening in the previous section, in that the proportion who 'Definitely' intend being screened increased to 1992, then levelled or fell. Nevertheless, in 1994, about a third of these women stated that they 'Definitely' intended being screened at the SABXRS, with a further 25% stating they 'Probably will'. For women in the target age range there was a marked increase in the proportion stating that they 'Definitely' intended being screened at the SABXRS from 20% in 1990 to 54% in 1994, while those 'Not sure' showed a corresponding decrease. Around 10% of both age groups throughout the period stated they 'Definitely won't' have a mammogram with the SABXRS in the next two years.

Table 8.2.8 relates to a general question about intended frequency of mammography over the coming years. This was asked only in 1991, 1992 and 1994, and relates to mammography generally, and not just with the SABXRS. For women in their 40s about 20% stated an intention to have an annual mammogram in the first two surveys, but this fell to 12% in 1994. However, 38% of women in their 40s stated an intention to have a biennial mammogram in 1994, which when combined with those intending to have an annual mammogram, indicates that half these women believe they should be having regular mammograms. For women in the target group, the proportion intending to have biennial mammograms (the recommended interval) increased significantly from 32% in 1992 to 52% in 1994 ($P < 0.001$), while those choosing 'Every year' fell from 16% to 11% ($P = 0.6$). In 1994, the proportion 'Not sure' was about 40% for women in their 40s and 25% for women in their 50s. This can be interpreted as uncertainty regarding having a mammogram at all, as well as uncertainty regarding the interval.

Table 8.2.9 shows knowledge about the incidence of breast cancer by age for the three surveys in which this was asked (1990, 1994 and 1995). It can be seen that for both age groups the proportion choosing an inflated incidence of 1 in 5 increased over time, with 39% of women in their 40s and 30% of women in the target group choosing this category in 1995. The same proportion in both age groups (31%) chose the correct category of 1 in 15.

Knowledge of the SABXRS amongst women who have not used the Service is shown in Table 8.2.10. It can be seen that knowledge of the SABXRS rose sharply in all age groups from 1990 to 1991, and thereafter remained steady. In 1991, 72% of women aged 40-49, 81% of women aged 50-69 and 67% of women aged 70 and over who had not used the Service knew about it. This was before mass advertising by the National Program, indicating that the SABXRS had been successful in its advertising strategies in the early days of the Program.

8.2.5 Omnibus Survey Results: Invitations to SABXRS; 1995 Omnibus Survey

The 1995 Omnibus survey included a new question regarding receipt of an invitation from the SABXRS. This was asked of women aged 40 years and over who had not reported having a mammogram at the SABXRS, and was followed by a question seeking reasons for not responding to the invitation. Table 8.2.11 presents data relating to mammography (within and outside the Service) and receipt of an invitation from SABXRS. A split by region (total South Australia, metropolitan Adelaide or country SA) is presented to determine whether country women were disadvantaged due to the longer distances they need to travel to access mammography (as suggested by the literature). These data show that within the target population, South Australian country women are not disadvantaged. In fact, the reverse appears to be the case, particularly for mammography with the SABXRS. The proportion of women who have ever had a mammogram at the SABXRS in the 50-59 year group was 57% for Adelaide and 72% for the country regions. The higher proportion in the country corresponds with the higher response rates to invitations reported in Part III of this thesis. Further, all women on the electoral roll in all country regions except those close to Adelaide had been sent an invitation from the SABXRS by October 1995.

Regarding invitations for women not screened at the SABXRS, for women in the target age group (50-69), overall 33% stated they had received an invitation from the SABXRS; 29% in the 50-59 group and 38% in the 60-69 group (Table 8.2.11). For women in Adelaide the proportion in the two age groups 50-59 and 60-69 is about the same at 35%, but in the country a higher proportion of women aged 60-69 (43%) reported receiving an invitation than 50-59 (7%). However, the country proportions are based on small numbers. Nevertheless, it would be reasonable to expect a lower proportion in the 50-59 year group, since a significant proportion of women in their early 50s would not have received an invitation yet, since this occurs every two years at each location when the van visits. The proportion who reported having received an invitation in the 40-49 age group, although quite low, is higher than would be expected on the basis of age error in the files provided from the electoral office. Those in the 70+ group probably relate mostly to invitations sent when the woman was aged less than 70.

Seventeen percent of women who reported receiving an invitation, stated as their reason for not responding to the invitation that they had a mammogram outside the Service. About 5% reported each of the following reasons; concern about pain, fear of test result, rather not knowing, and embarrassment. However, the remaining 64% were coded as 'other' (a breakdown of this category was not provided).

8.3 ABS NATIONAL HEALTH SURVEYS (1989/90 and 1995)

8.3.1 Introduction

The Australian Bureau of Statistics (ABS) has been conducting National Health Surveys (NHS) approximately every 5 years, the first in 1977/78. Subsequent surveys were conducted in 1983, 1989/90 and 1995. This section reports on results from the 1989/90 and 1995 surveys, which included questions about mammography. The 1989/90 survey was conducted during the 12 months October 1989 to September 1990, and covered approximately 22,000 selected private and special dwellings (eg, hotels, motels, boarding houses) around Australia (Australian Bureau of Statistics, 1992b). The 1995 survey was conducted over the 12 months from January 1995 to January 1996, and sampled around 23,800 private and special dwellings around Australia, yielding a sample of 57,600 persons (Australian Bureau of Statistics, 1996b).

The mammography data from the two National Health Surveys were collected as part of a self-completed additional Women's Health Form by female respondents after the main personal interview. For the 1989/90 survey only women aged 18-64 were asked to complete this form, but for 1995 all women aged 18 years and over were included. This researcher had direct input into the design of the mammography questions for the 1995 survey. Special tables not published in the ABS outputs were provided by the ABS for these analyses.

Sections 8.3.2 to 8.3.5 present the results from the 1989/90 NHS Section 8.3.2 presents a multivariate model from the 1989/90 NHS while section 8.3.3 compares this model with the 1990 Omnibus model presented above (8.2.2). Section 8.3.4 presents overall mammography rates and compares them to the 1990 Omnibus survey, while section 8.3.5 presents additional data from the 1989/90 NHS for South Australia. The 1995 NHS results are presented in sections 8.3.6 (comparison with 1995 Omnibus) and 8.3.7 (1995 NHS comparison between South Australia and Australia). No multivariate modelling is presented for the 1995 NHS as the Unit Record File had not been released in time for inclusion into this thesis. Section 8.3.8 compares the results of the two National Health Surveys. Comparisons are made with the relevant Omnibus surveys where appropriate.

It should be noted that the Omnibus surveys only covered private dwellings in the sample frame, whereas the ABS surveys included special dwellings (hotels, boarding schools, hospitals, nursing homes, prisons, other). From the 1991 census, 3% of the total South Australian population resided at a special dwelling on census date, and 1.5% of the population in hospitals or nursing homes/homes for the aged, the categories of special dwellings most likely to accommodate the women aged 40 and over. Given that the 1.5% figure includes all ages and both sexes, the impact on overall mammography rates of women aged 40 and over living in special dwellings would be minimal.

One other point should be made regarding the data from the National Health Survey. The data provided to the investigator for 1995 show the number of 'not stated' cases within the tables (this was not provided for the 19898/90 data), and in some cases the proportion of 'not stated' cases is significant. For example, for women aged 40-49, 3% of those who had had a mammogram in Adelaide did not specify the reason for the last mammogram, with the corresponding proportion for county women (rest of state) being 8%. The data presented in the tables used the stated cases as the denominator. It is possible that the not stated cases could differ from the stated cases in terms of mammography behaviour. Further, because the Women's Health survey was not compulsory, unlike the main survey, non-response was greater for that segment. Again bias may be an issue, if non-responders differed from respondents. Although it cannot be proved, it is suggested that women who have had a mammogram may have been more likely to complete the women's survey, hence the mammography rates reported may be inflated.

As multiple comparisons are made in this section, it was considered appropriate to conduct statistical tests of association between mammography behaviour and other factors examined, and these are presented in the tables. However, some cells have quite small numbers, therefore should not be used as the basis for making conclusions. As indicated above this chapter is mainly exploratory and investigates patterns of practical relevance.

8.3.2 1989/90 National Health Survey: Multivariate Results for Australia

The logistic regression analysis reported here was conducted by the Australian Bureau of Statistics (ABS), by the same unit which conducted the multivariate analysis of the 1990 Omnibus survey reported in the section 8.2.2. As for the Omnibus survey, the analysis was guided by the researcher, but the detailed analysis was provided as a report to the SABXRS by the ABS (Australian Bureau of Statistics, 1993b). Appendix F, Table F3 lists the variables examined and shows the variables which entered and remained in the multivariate analyses, using the same notation as for Table F2. The SAS statistical package (SAS Institute Inc., 1989) was again used to analyse the data using the method of backward elimination and $P > 0.10$ to exclude variables at each step. However, in determining which variables to enter into the first multivariate step, $P < 0.15$ in the bivariate analysis was used, rather than $P < 0.25$ as for the Omnibus and case-control study models. This smaller P level was used as the cut-off due to the large number of variables examined. The model from the NHS relates to Australia as a whole, with state being entered as an independent variable. Summary results are presented below.

The analysis included 6,740 women aged 40-64 across Australia who completed the Women's Health Form. The dependent variable for the logistic regression model was 'Ever had a mammogram'. Variables examined covered a range of socio-demographic characteristics and health behaviours, including medication use. The final model contained 21 of the 52 variables included in the analysis. As with the Omnibus models $P < 0.05$ is used to determine statistical significance. Seventeen of the variables had a significant association at $P < 0.05$ in at least one of the category comparisons with the reference category. These are listed in Table 8.3.1 below. The final model had a sensitivity of 90.0%, specificity of 29.5%, a false positive rate of 24.5% and false negative rate of 44.6%. Overall, the model was 72.4% correct. Compared with the three Omnibus models which had both high sensitivity as well as specificity, this model had high sensitivity (correctly predicts a high proportion of women who have had a mammogram) but not specificity (does not correctly predict those who have not had a mammogram), which reflects the high false negative rate in this model. This suggests variables important in predicting mammography behaviour were included in the Omnibus models, but not the NHS model.

Women from the states of New South Wales (NSW) and Queensland were significantly more likely to have had a mammogram than women from South Australia (SA). These other two states commenced organised screening prior to SA, intensively recruiting within particular geographical areas. At that time 10 pilot screening projects were part of the national evaluation described in Chapter 1; one in SA, one in Victoria, two in Western Australia, three in NSW, and three in Queensland. However, it is not known what proportion of mammograms reported in the NHS occurred within these pilot screening services, as this information was not collected. Therefore, the higher rates for NSW and Queensland may not be attributable to the fact that these states had the highest number of pilot programs, but rather to more aggressive promotion of private mammography by doctors generally in those states.

Age did not enter the multivariate analysis at all, as was the case for the Omnibus model with the same dependent variable (that is, "Ever had a mammogram", Model 1). The demographic variable household type shows that women in the referent group (wife with no dependent children) were more likely to have had mammograms than the other categories. The referent category implies a married couple, either living alone or with non-dependent children only. Language spoken at home also predicted mammography use, with non-English speaking women being *more* likely to have had a mammogram. However, as section 8.3.5 which presents the bivariate data for this survey shows, this result appears to be dominated by the higher rate of mammography amongst overseas born women aged 40-49 from countries other than the UK and Ireland, for South Australia at least. This model relates to Australia as a whole and it is not known if the variation seen in South Australia with regard to this variable applies universally.

The occupation variable shows that women who were plant or machine operators were significantly more likely to have had a mammogram than women who stayed at home. None of the other occupation categories was significant. Women whose income was from 'Other' sources (including private business or superannuation) and 'Government pension/benefit' were more likely to have had a mammogram than those whose income was from wages or salary.

The remaining significant variables relate to health behaviours. The highest OR was for breast exam by a doctor (OR = 7.9, $P < 0.001$) which is probably related to the fact that a large proportion of these early mammograms would have occurred outside the pilot screening programs, thus requiring a referral from a doctor. It is likely that a breast exam would have been carried out during the visit for a referral. A recent visit to the dentist predicted mammography use although the effect was small (OR = 1.2), as did having a recent pap smear (OR = 1.6) and breast self exam (OR = 1.5).

Changing of diet over the last two years was also related to mammography use. Women who changed for medical reasons were no different than women who had not changed their diet at all. However, those who changed for other reasons were more likely to have had a mammogram. Although the 'Other' category is the only one significant at $P < 0.05$, the 'To lose weight' category had a P value of 0.08, and the 'To improve general health' category 0.06. 'Other' included changing diet due to ageing and change in activity levels.

Current smokers were less likely to have had a mammogram than women who never smoked, whereas frequent drinkers of alcohol (had a drink within last 7 days) were more likely than women who never drank alcohol. Women on certain types of medication were also more likely to have had a mammogram; medications for stomach problems, sleeping and 'other'. This result is difficult to interpret, but it may represent those with less serious illnesses, since those taking medication for cough, pain, hypertension or nervous conditions were not significant at $P < 0.15$ in the bivariate analysis. Having cancer was inversely related to mammography use, again indicating that the presence of more serious health issues may reduce the incentive to have a mammogram. This variable refers to having any type of cancer at the time of the survey (hospitalised for cancer in the past year or visited a health professional for cancer in the last 2 weeks).

The most significant, an obvious predictor was having heard of mammography, and probably should have been excluded from the model, given the extremity of the OR and confidence interval. However, this analysis can not be re-run without significant cost.

8.3.3 1989/90 National Health Survey: Concordance with 1990 Omnibus Model

A direct comparison of the logistic regression model using the 1989/90 NHS data and 1990 Omnibus data is not appropriate. Although the NHS and Omnibus surveys both represent community samples, the timing of the surveys was different, and in the context of increasing promotion of mammography, this difference is pertinent. Further, although some variables were common to both studies, others variables considered for inclusion in the models differed. In addition, the different cut-off point for inclusion in the multivariate analyses may affect the final outcomes. Nevertheless, some interesting contrasts can be drawn.

The NHS analysis which related to all Australian women in the community can be contrasted with the 1990 Omnibus Model 1 ('Ever Had Mammogram') results presented in Table 8.2.1 which related to South Australian women in the community. A major difference between the two analyses was the inclusion of variables relating to knowledge, barriers and intentions about mammography in the Omnibus survey which were not collected in the NHS. Common variables considered in both models relate to age, marital status, age at which they left school, post-school qualifications, occupation, hours worked, source of income, smoking, pap smear and self-rated health. Two variables were statistically significant at $P < 0.05$ in the bivariate analysis for both analyses; qualifications and pap smear. A third (smoking) was significant at $P < 0.05$ in the NHS and $P = 0.06$ in the Omnibus. In the multivariate analyses, none of the common variables were significant at $P < 0.05$ in the Omnibus analysis, but occupation, source of income, dentist, smoking and pap smear were significant in the NHS analysis.

The strongest predictor for the Omnibus analysis with an Odds Ratio of 47.6 (CI 26.1-72.5) was having had a doctor suggest a mammogram. Other predictors related to barrier items. It should be noted that the strongest predictor of attendance to the SABXRS for all four case-control base models reported in Chapter 4 related to a doctor's recommendation, with perceived barriers also strongly associated. The NHS did not include any questions relating to a doctor's influence on mammography behaviour nor perceived barriers. Apart from having heard of a mammogram, which is an obvious prerequisite of having a mammogram, the strongest predictor in the NHS model was having had a breast exam by a doctor. As indicated above, this variable may also be a proxy for recommendation from a doctor, since the majority of mammograms conducted at the time of the 1989/90 NHS would have been outside the pilot screening programs, and thus requiring a referral from a doctor. It is likely that a proportion of these recommendations would have occurred opportunistically by doctors in favour of mammography screening. Hence, it appears that for the Omnibus analysis the effect of the variables not included in the NHS totally masked the others. It would be interesting to re-analyse both surveys only with the common set of variables, but this is not possible with the data available. However, this would be of interest only, and of greater utility would have been the inclusion of the specific mammography related variables (especially barriers) in the NHS analysis.

8.3.4 1989/90 National Health Survey: Overall Mammography Rates

Table 8.3.2 compares the overall mammography rates by age group between South Australia and Australia from the 1989/90 NHS. In addition, the South Australian rates are compared with the 1990 Omnibus survey. The results for the 1990 Omnibus survey presented in section 8.2 were segregated by the age groupings of interest to the current National Screening Program (40-49, 50-69, 70+). Here they are presented by the age groupings of 40-49 and 50-64, to make them comparable with the 1989/90 NHS results. As noted above, the 1989/90 NHS excluded women aged 65 and over from the Women's Health component. However, the exclusion of women 65-69, part of the current target group, is not so problematic for analyses of mammography in South Australia in 1989/90, given the policy of the SABXRS at the time. Prior to October 1990, the Service only offered screening to women aged 50-64.

It can be seen that for South Australia, the proportions from the NHS are slightly lower than the Omnibus figures, but these differences are not statistically significant. Nevertheless, the rate from the Omnibus survey would be expected to be higher on the basis of the different timing of the surveys. The ABS survey was conducted over a whole year from October 1989 to September 1990, in the context of increasing mammography rates, whereas the Omnibus survey was conducted during the last quarter of 1990.

Comparing the proportion of women who had ever had a mammogram in South Australia with Australia from the NHS, it can be seen from Table 8.3.2 that the differences are statistically significant for both age groups. For South Australia 22% of women aged 40-49 and 28% of women aged 50-64 had had a mammogram compared with 30% in both age groups for Australia. The higher national figure corresponds to Medicare claims for bilateral mammography as shown in Figure 8.3.1. For all age groups the proportion of the population making a claim was higher for Australia than South Australia. However, from Figure 8.3.2 it can be seen that the rate of increase over the preceding year was high for all age groups both in South Australia and overall for Australia. This rise in Medicare claims for bilateral mammography, suggests a high proportion of 'pseudo' screening, and was a contributing factor to the decision to establish a National Screening Program, as outlined in Chapter 1. It can be seen that the rate of growth in South Australia was higher amongst the younger women who were not eligible to be screened at the SABXRS. From the 1990 Omnibus survey, 8% of the 40-49 age group and 41% of the 50-64 year age group who had ever had a mammogram, specified the SABXRS as the place of their last mammogram. These data corresponds to the high proportion of women in their 40s making Medicare claims, since those who wanted a mammogram were ineligible for the SABXRS service.

8.3.5 1989/90 National Health Survey: Additional Results for South Australia

Table 8.3.3 presents additional variables for South Australia from the 1989/90 NHS, cross-classified by age and 'Ever had mammogram'. A difference in mammography rates by region is evident for both age groups, despite the small numbers. Within Adelaide, the highest proportion was for women living in the Western region for both age groups. For the 50-64 year age group this would have been related to the fact that the first screening service was opened in the Western region at the Queen Elizabeth Hospital with the Coordination Unit co-located at the same site. At the same time, mammography was also being promoted in that region by both the Queen Elizabeth Hospital and a private hospital in the region, which probably accounts for the higher mammography rate for the younger women in this region. The lowest rate in Adelaide for the 40-49 year old group was in the Southern region, and for the 50-64 year old group in the Northern region. These rates were both lower than the rate for the Rest of State. The low rate in the target group of 50-64 year olds for both the Northern Adelaide region and Rest of State would partly be attributed to the fact that no SABXRS service existed in the Northern region at that time, nor the mobile service for country clients. Eastern Adelaide was serviced by a clinic in central Adelaide (at the Royal Adelaide Hospital), and Southern Adelaide by a clinic at the Flinders Medical Centre.

The pattern for marital status and country of birth differs for the two age groups. For women aged 50-64 the data show married women had higher rates of mammography than those not married, while the reverse appears to be the case for women aged 40-49. For country of birth, women born in the UK and Ireland had the highest mammography rates were amongst those aged 50-64 but the lowest for those aged 40-49. The official ABS publication on this survey reported a higher rate of mammography in overseas born women than Australian born women; 19.3 of overseas born women reported having had a mammogram compared with 17.2% for Australian born women (Australian Bureau of Statistics, 1992b). This publication related to all women 40-64. The highest rates amongst the overseas born women were for women from English-speaking countries; 23.3% for women born in the UK and Ireland and 22.7% for those from Northern America. The rates for women from overseas birthplaces other than UK, Ireland and Northern America were; 20.9% for Europe, 19.6% for the Middle East and Northern Africa, 10.0% for Asia, and 15.4% for other countries (Australian Bureau of Statistics, 1992b). Hence, the rate from the main non-English speaking areas from which older Australian migrants are drawn (Europe) emerges as higher than Australian-born women overall. However, from Table 8.3.3, amongst the 50-64 year age group the rate for those born in overseas countries other than the UK and Ireland was significantly lower than those born in Australia ($P = 0.02$) as well as those born in the UK and Ireland ($P = 0.002$). The higher rates for women from the UK and Ireland are concordant with the Omnibus results observed from Table 8.2.4.

Table 8.3.3 also shows that for women aged 50-64, those with post-school qualifications had higher mammography rates than those without (this was statistically significant). Other patterns that emerge relate to the 40-49 year group only; women in labouring occupations had lower rates of mammography, while women working full-time and those with private health cover had higher rates.

8.3.6 1995 National Health Survey: Comparison with 1995 Omnibus Survey

Table 8.3.4 compares the mammography rates of the 1995 Omnibus and NHS surveys by the age groupings of 40-49, 50-69, 70+, which are those of relevance following the implementation of the National Screening Program in 1991. The National Program offers screening to women aged 40 and over, but targets only women aged 50-69. It should be noted that the results are not directly comparable due to the differing survey periods. As mentioned above, the NHS was conducted over 12 months January 1995 to January 1996, whereas the Omnibus survey was conducted during the last quarter of 1995. Hence, it would be expected that the NHS survey rates would be lower, given that the proportion of women screened through the National Program would have increased over the period, and that 1995 was a year of intensive advertising and promotion both nationally and at the state level.

Comparison of the two South Australian results shows that the mammography rates from the Omnibus survey were higher for the three age groups 40-49, 50-59 and 60-69, both overall and broken down by Adelaide and Rest of State. For the 70+ age group, the Omnibus survey shows a lower proportion overall and for Adelaide, but not Rest of State. The lower overall figure for the 70+ would be dominated by the Adelaide result, since 77% of women aged 70+ in 1995 were estimated to live in Adelaide (Australian Bureau of Statistics, 1996c). As indicated above, it would be expected that the proportions from the Omnibus survey would be higher due to the later timing, and this was found to be the case for women 40-69 but not 70+. However, given the lower numbers in the older age category, the apparent difference can be explained statistically. Using the table of standard errors provided by the ABS, the estimate of the proportion of 70+ women who had ever had a mammogram for South Australia ranges from 33.4% to 42.7% (95% confidence interval). This range includes the Omnibus estimate of 34.3. On the other hand the 95% confidence rates for the 50-59 year group are 66.5% and 78.6%, with the upper limit still below the Omnibus estimate of 84.6%.

Comparing the proportion of women screened in South Australia versus Australia from the NHS, it can be seen from Table 8.3.4 that almost identical proportions were shown for the 50-59 and 70+ groups. However, a lower proportion of younger women (40-49) had had a mammogram in South Australia (48%) than Australia (52%), but the reverse in the 60-69 year group (73% for South Australia versus 68% for Australia). This perhaps reflects the policy of the SA Screening Program of not re-inviting women in their 40s (as does Victoria but not the other states), and the fact that the SA Screening Program in 1995 was ahead of other states in the proportion of the target population screened. Nevertheless, these differences were not statistically significant. Further, the proportions relate to all mammography, both screening and diagnostic, and in and out of the Screening Program.

8.3.7 1995 National Health Survey: Comparison between South Australia (SA) and Australia

Table 8.3.5 presents additional variables for both South Australia and Australia from the 1995 NHS cross-classified by age. Given the large numbers, chi square tests were performed to compare the South Australian and Australian proportions within each of the age groupings, but none were statistically significant at $P < 0.05$. For the variable REASON FOR LAST MAMMO the categories were collapsed to 'symptoms' (that is, diagnostic) and the other three combined to represent those assumed to have had a 'screening' mammogram. However, the screening proportions may be inflated. While those who had a mammogram because of a family or personal history of breast cancer can readily be classified as screens together with women who stated their reason as 'check-up', some of those included in the 'other' category may be questionable. The most common reason in the 'other' category was 'availability of screening program'. Theoretically, these should all be for screening purposes, although in reality a significant proportion of women in the Program attend with symptoms. In South Australia a lower proportion gave the response 'availability of screening program' than Australia amongst the 40-49 year age group, which may reflect the SA policy of not encouraging women in their 40s to join the screening Program. Other responses in the 'other' category include 'don't know' and 'other medical reasons', presumably not breast symptoms.

Overall, 90% of women aged 40 years and over had heard of a mammogram in 1995, the proportion being highest in the target population of 50-69, and lowest amongst the older age group. Over 70% of women aged 50-69 reported ever having a mammogram, about 50% of those aged 40-49 and 39% of those aged 70 and over.

For the NHS the variable relating to time since last mammogram was collected using pre-coded categories; < 1 year, 1 year - < 2 years, 2 years - < 3 years, etcetera, to 5 or more years. Hence, it was not possible to categorise the data as for the Omnibus data which used the Program definition of a compliant participant. Table 8.3.5 shows the proportions occurring both within 2 years and within 3 years. Of course, there is likely to be an element of error in the self-reporting of the timing of the last mammogram, but unless there was a bias in the direction of misreporting, it can be assumed that the figures are indicative of the true proportion. For the target group of 50-69 in South Australia, 64% of women had had a mammogram within 2 years and 70% within 3 years. Thus the compliant population as defined by the Program (within 27 months) would fall between these figures. The corresponding figures for Australia were 59% and 66%. However, given that the National Program is a screening service, then the relevant proportions are those having a screening mammogram. In SA 12.3% of women who had had a mammogram reported that the last mammogram was due to symptoms. The corresponding Australian figure is 14.5%. If these proportions are excluded on the basis that they represent diagnostic mammograms, then it can be deduced that 56% of the SA population had had a screening mammogram within 2 years and 61% within 3 years. The corresponding figures for Australia would be 51% and 56%.

The proportion of women screened in the target age group was significantly higher than both younger and older women. Hence, although the proportion screened in the target group falls short of the target of 70%, overall the acceptance of mammography by targeted women was high. Further, of those who had had a mammogram, a high proportion of the target group had had their last mammogram with 3 years (95% for SA and 92% for Australia).

Table 8.3.6 presents the same data as the previous table, but comparing Adelaide with the rest of South Australia. Two statistically significant differences were found, both for the 40-49 year old group, but it should be noted that some of the numbers, particularly for the 70+ group in Rest of State, are small. For women aged 40-49, a lower proportion had had a mammogram in the country regions (36% versus 52%) and a lower proportion of country women had had a mammogram within the last 3 years. The greater access to mammography in Adelaide both within and outside the Program would explain this difference, whereas for the 50-69 year group significant effort is made to target these women at each location of the mobile screening service. Hence, in South Australia women in the country do not appear to be disadvantaged in terms of access to mammography in the target population.

The Women's Health Form also collected information about other breast behaviours; whether women have regular breast exams by a doctor, whether they perform Breast Self Examination (BSE) and frequency of BSE. Overall, both breast exam by a doctor and BSE were related to age, with older women being less likely to engage in these activities, particularly exam by a doctor. Table 8.3.7 shows the proportions who engage in other breast behaviours by mammography experience; for example, for HAVE REGULAR BREAST EXAM in the 40-49 year group in SA, 74% of those who had had a mammogram also have regular breast exams by a doctor, while 53% of women who have never had a mammogram have regular breast exams. For all age groups, both in South Australia and for Australia as a whole, women who had had a mammogram were significantly more likely to report that they had regular breast exams. The differences were marked and the P-value < 0.001 across all groups. In contrast, BSE was not found to be associated with mammography behaviour in South Australia. For Australia as a whole, women aged 50 years and over who had had a mammogram were more likely to have regular breast exams than those who had never had a mammogram, but the differences were not as marked as with the previous variable (the large numbers in the Australian data allow the detection of small differences). Frequency of BSE was found to be associated with mammography behaviour for women in the 40-49 and 50-69 year age groups, both in SA and Australia, with a higher proportion in the 'monthly' category amongst women who had had a mammogram.

8.3.8 Comparison of Mammography Rates Between 1989/90 and 1995 National Health Surveys

Table 8.3.8 shows the proportions who had ever had a mammogram by the age groups 40-49 and 50-64, as mammography data were not collected for women aged over 64 in the 1989/90 survey. Similar increases occurred in South Australia and Australia, and for both metropolitan and country South Australia. The proportion of women aged 50-64 who had had a mammogram by 1995 was the same for both South Australia and Australia. Within South Australia, the proportion was higher in Adelaide than the rest of state, but this difference is not statistically significant.

8.4 Summary and Discussion

The early surveys reported in this chapter, the 1990 Omnibus and 1989/90 National Health survey, were undertaken prior to the official introduction of the National Program in July 1991. Multivariate analysis was undertaken for both of these surveys, the former relating to South Australia and the latter to Australia. The dependent variable 'Ever had a mammogram' was modelled for both surveys. Although some variables were common to both, several were unique.

For the 1990 Omnibus model of 'Ever had mammogram', the strongest predictor was a doctor's suggestion to have a mammogram, while in the NHS analysis having a breast exam by a doctor was the strongest predictor. Having a breast exam by a doctor was not asked in the 1990 Omnibus, and it was suggested that in the NHS analysis this variable may be a proxy for the influence of a doctor in the decision to have a mammogram, especially given that most mammography would have occurred outside the pilot screening programs at that time, and have required a doctor's referral. Other strong predictors in the Omnibus analysis were perceived barriers, including a belief that mammography was only required if a woman had symptoms, that mammography was too much trouble and that the woman would 'rather not think about it'. However, questions about perceived barriers were not included in the NHS, and other factors that predicted ever having a mammogram from that survey related to other health behaviours, including doing BSE, having a pap smear, being a non-smoker, drinking alcohol and visiting a dentist frequently. Knowledge about breast cancer and mammography, included in the Omnibus only was not found to predict mammography behaviour. State of residence included in the NHS model found that women from

NSW and Queensland were more likely to have had a mammogram than women from South Australia, and it was suggested that at this early stage, mammography was more intensively promoted in the larger states.

Age was not found to be predictive in either of these early analyses which modelled 'Ever' having a mammogram. However, in two additional models using data from the 1990 Omnibus survey to predict 'Intention' to have a mammogram within two years overall and specifically with the SABXRS, age was significant, showing that younger women had higher intentions. In the model which predicted overall intention, a doctor's recommendation was found to have a strong negative effect, but intention was also strongly related to prior mammography suggesting that once a woman had the experience, the influence of a doctor was no longer important. Overall, the Omnibus models explained more of the variance than the NHS model, suggesting that perceived barriers (included in the former, but not the latter) are important predictors of mammography use, at least during the early phases of a screening program.

Having a breast exam (the strongest predictor in the 1989/90 NHS model) was also included in the 1995 NHS. While multivariate analysis was not performed for the 1995 NHS it was highly correlated with mammography use for all age groups in bivariate analyses at $P < 0.001$. On the other hand, BSE was found to be significantly related to mammography use in 1989/90 (both bivariate and multivariate analyses) but not in 1995. This suggests that BSE may differentiate the early adopters in Rogers terminology (Rogers, 1983), but not the 'late adoptors' or 'laggards', while the influence of a doctor pervades for initiating mammography behaviour. Having a recent Pap Test (within 12 months) was found to be associated with mammography in the 1989/90 NHS model. From the series of Omnibus surveys, ever having a pap test was associated with mammography in the three years it was asked (1990, 1994 and 1995), but the association appears to have been stronger in the latter two years. This suggests that the National Cervix Screening Program introduced in 1992 and which also targeted older women may have had an impact.

Demographic variables examined over time (1989/90 to 1995) from both the Omnibus and NHS show that women from the UK and Ireland were accessing mammography in greater proportions than Australian born women. The data suggest that the rates vary for women from other countries, but the samples were not large enough to provide detailed analyses. Higher educated women were more likely to have a mammogram in the early years, but education does not appear to be a factor in later years. On the other had, married women were more likely to have mammograms throughout the period, particularly in the target age group.

From the five Omnibus surveys from 1990 to 1995, mammography use overall (ever having a mammogram) in the target population increased from 28% in 1990 to 82% in 1995 for South Australia. For those who had screening mammograms (without symptoms) the proportions were 18% and 73% respectively. The 1989/90 NHS did not survey women 65-69 about mammography. For women aged 50-69, the 1995 NHS showed that 74% of women in South Australia had ever had a mammogram and 72% for Australia as a whole. The similarity in the proportion ever having a mammogram in South Australia and Australia for women in the target age group from the 1995 NHS is also shown for other age groups. For women aged 40-49 the corresponding proportions for South Australia and Australia were 47.8% and 52.2%, and for women aged 70 years and over, 38.7% and 38.9%. The lower figure in South Australia from the 1995 NHS than the 1995 Omnibus survey would be expected on the basis of the different timing, the former conducted over a full year and the latter at the end of 1995. However, some differences may be due to the method of surveying. The Omnibus was face-to-face interview, while the NHS was a self-completed questionnaire.

The increase in the proportion of the population having a mammogram from 1989/90 to 1995 from both the Omnibus and National Health Surveys show that Australian women have generally accepted and adopted mammography. An objective of the National Program was "To achieve, after 5 years, a 70 per cent participation in the National Program by women in the target group (50-69)". A compliant participant in the National Program is defined as having a mammogram in the last 27 months. For the analysis of the Omnibus surveys women who reported having a mammogram in the year of the survey and the two preceding years were defined as 'compliant participants' (see section 8.2.3). For the National Health Surveys, both 2-year and 3-year cut-offs were presented.

From the 1995 NHS, 64.0% (95% CI 58.9-68.9%) of women in the target group of 50-69 in South Australia had had a mammogram within two years and 69.7% (CI 64.7-74.4%) within three years. Hence, the proportion of compliant participants could be said to be at least 65%. For Australia as a whole, overall 59.4% (CI 57.3-61.5%) had had a mammogram within two years and 65.9% (CI 63.9-67.9%) within three years. Hence, while the overall proportion ever having a mammogram are similar for South Australia and Australia, a higher proportion in South Australia had had a recent mammogram.

The proportions summarised in the preceding paragraph relate to all mammograms (diagnostic and screening) occurring both within and outside the National Program. The National Program was established for screening purposes only, hence the objective of 70% participation of women aged 50-69 in the Program implies a further proportion would be expected to have mammograms for diagnostic purposes outside the program. From self reports in the 1995 NHS, 10.8% of women in South Australia and 13.2% of women in Australia who had a mammogram in the last three years stated that their mammogram was due to symptoms. This difference is statistically significant ($P <$ 0.001), but unlikely to reflect real differences in the proportion of clinically symptomatic women. Hence, in reporting the proportions having screening mammograms, this anomaly needs to be considered.

Using these self reports of reason for mammography, and excluding symptomatic women in 1995 57.2% of women aged 50-69 had a screening mammogram within the last two years in South Australia (CI 52.0-62.3%) and 52.2% in Australia (CI 50.0-54.3). The three year figures are 62.1% for South Australia (CI 56.9-67.1%) and 57.2% for Australia (CI 55.1-59.3). From the Omnibus survey conducted in late 1995, 67.8% (CI 62-6-72.2%) of women aged 50-69 in South Australia reported having a screening mammogram within the period defined as encompassing compliant participants (between two and three years). This estimate is higher than the NHS estimate of 3 years, but this occurs because the Omnibus survey was run in late 1995 while the NHS was run over the whole year during a phase of increasing participation. Although the Omnibus estimate provides an inflated estimate of compliant participants than the National Program definition (within 27 months), it can been concluded that by the end of 1995 about 65% of women in the target population were compliant participants in South Australia. Further, it can be concluded that the proportion of the target population reporting a screening mammogram was higher in South Australia than Australia. However, as indicated above, some of this difference is due to a higher proportion of mammograms in South Australia being reported as 'screening' than in Australia overall, and this is likely to reflect reporting and classification differences rather than true underlying differences.

The proportion of women having screening mammograms overall is encouraging, although below the target of 70% five years into the Program. However, a significant proportion of these screening mammograms occur outside the official screening program. The detail regarding screening in or out of the Program was not collected in the NHS. Data from the 1995 Omnibus survey shows that 58.3% of compliant participants aged 50-69 in South Australia had a screening mammogram in the Program and a further 9.5% outside the Program (totalling 67.8% overall as reported in the preceding paragraph). Over the period 1990 to 1995 the proportion screened within the Program increased significantly. Of women who had a screening mammogram, 86% of those aged 50-69 used the SABXRS in 1995 compared with 61% in 1990. For women in the 40s the corresponding figures were 67% in 1995 and only 9% in 1990. The low early figure relates to the fact that the SABXRS did not offer a service to women in their 40s until October 1990.

While a proportion of screening mammograms are occurring outside the program, the reverse is also the case. From the 1995 Omnibus survey, 3.5% of compliant participants aged 50-69 reported having a diagnostic (with symptoms) mammogram in the Program. Hence, mammography rates generally reported by the national Program, include a proportion of diagnostic mammograms. Further, the extent of diagnostic mammography within the various programs across Australia would vary according to State-specific policies on symptomatic women.

It should be noted, that although mammography outside the SABXRS has been referred to as screening or diagnostic on the basis of information from the subject, those women who reported a 'screening' mammogram outside the SABXRS would have required a referral by a doctor for 'diagnostic' purposes, unless the woman was prepared to pay the full cost herself, or had a personal or family history of breast cancer. This suggests that a considerable level of 'pseudo' screening is still occurring.

Within South Australia, women in the target age group living outside Adelaide were not found to be disadvantaged in relation to access to the National Program. Rather the reverse was found; 59% of women aged 50-69 in Adelaide reported ever having a mammogram at SABXRS compared with 72% for the rest of state (from the 1995 Omnibus survey). For those who had not used the SABXRS, a higher proportion of women in country areas aged 60-69 reported having received an invitation from the SABXRS (36% in Adelaide and 43% in country). Clearly the mobile screening service provides a equitable method for targeting rural women. In South Australia the mobile service is the most cost-effective in Australia (Carter and Cheok, 1994).

The Omnibus surveys also questioned women about mammography intentions generally and to the SABXRS in particular. For women in the target age range there was a marked increase in the proportion stating that they 'Definitely' intended being screened at the SABXRS from 20% in 1990 to 54% in 1994, while those 'Not sure' showed a corresponding decrease. Around 10% of both age groups throughout the period stated they 'Definitely won't' have a mammogram with the SABXRS in the next two years. Regarding intended frequency of future mammograms, there was an increase from 32% in 1992 to 52% in 1994 in the target age group who intended having biennial mammograms, the recommended screening interval. A further 11% of women aged 50-69 in 1994, stated an intention to have an annual mammogram. For women in their 40s, about 38% stated an intention to have a mammogram biennially in 1994, with a further 12% annually. Hence, it appears that some doctors may be promoting annual mammography, although the rates fell from 1992 (16% in the 50-69 group and 19% in the 40-49 year group). Further, a high proportion of women in their 40s have intentions regarding mammography in 1994, despite intense promotion by the National Program at this time which only recommended mammography for women 50 and over.

The correct knowledge of the incidence of breast cancer (1 in 15) was specified by about 30% of both women in their 40s and the target age group in the 1995 Omnibus survey. However, these proportions had not improved from the 1990 proportions, but what did change over the period was that a higher proportion (about a third) of both age groups specified an inflated rate (1 in 5).

Knowledge of the SABXRS amongst women who have not used the Service was high in all age groups by 1991 in South Australia, and it remained high over the years; about 80% of women aged 40 and over knew about it in 1995. Amongst these, about a third of women in the target population remembered receiving an invitation from the SABXRS. Although the data provided on reason for not taking up the offer of the invitation was poor (64% coded as 'Other'), from the specific responses given, it appears that perceived barriers feature highly (pain, fear of result, rather not knowing and embarrassment).

In summary, this chapter provides an overview of mammography in South Australia and Australia to 1995, four years into the National Program. Although it does not appear that the 70% target within 5 years (June 1996) will be achieved, the Australian program has nevertheless achieved commendable rates. However, the ability to enrol the 'laggards' (Rogers, 1983) now left unscreened may be difficult, given that these women know about the Program, and in South Australia at least, a high proportion have already been invited. Further, from the 1994 Omnibus survey, 8% of women aged 50-69 stated they 'Definitely won't' have a mammogram with the SABXRS in the next two years (Table 8.2.7), and 8% also stated they 'Never' intend having a mammogram anywhere in future (Table 8.2.8), with a further proportion being uncertain about future mammography. The final part of this thesis considers whether it is likely that the target will be met, by drawing together the data presented thus far, and reviewing recently reported results from other studies on mammography in Australia.

Table 8.2.1 1990 Omnibus survey; Adjusted Odds Ratio and 95% Confidence Interval for variables associated with past mammography and future intentions at P < 0.05 level in at least one of the three logistic regression models (N = 550 women aged 40-69)

	MODEL		
	Ever had Mammogram OR (95% CI)	Intend Mammogram within 2 years OR (95% CI)	Intend Mammogram at SABXRS within 2 yrs OR (95% CI)
DOCTOR SUGGESTED (referent group = No)			
Yes	47.6 (26.1-72.5)***	0.15 (0.04-0.56)***	NE
WHEN LAST MAMMOGRAM (referent group = Never had mammogram)			
Before 1987	NE	17.54 (3.00-102.58)**	NE
During 1987		6.24 (0.29- 135.36)	
During 1988		1.12 (0.09-13.58)	
Jan-June 1989		38.23 (5.54-263.67)***	
July-Dec 1989		30.40 (4.51-205.05)***	
Jan-June 1990		35.94 (6.51-198.47)***	
July-Oct 1990		4.37 (0.49-38.78)	
NEED SYMPTOMS (referent group = Disagree)			
Agree	0.46 (0.21-1.01)	NE	0.34 (0.13-0.86)*
TOO MUCH TROUBLE (referent group = Disagree)			
Agree	0.30 (0.08-1.12)	NE	21.27 (3.80-119.17)***
RATHER NOT THINK ABOUT IT (referent group = Disagree)			
Agree	0.38 (0.15-0.93)*	NE	0.45 (0.16-1.22)
PAINFUL (referent group = Disagree)			
Agree	NE	2.66 (1.08-6.56)*	NE
HEARD SABXRS OTHER PAPER (referent group = Heard)			
Not heard	3.05 (1.08-8.65)*	1.36 (0.04-41.50)	0.28 (0.003-29.75)
HEARD SABXRS GP (referent group = Heard)			
Not heard	3.84 (1.31-11.23)*	1.88 (0.05-75.46)	0.46 (0.004-57.97)
HEARD SABXRS OTHER (referent group = Heard)			
Not heard	2.85 (1.30-6.23)**	0.41 (0.01-14.01)	0.07 (0.001-8.13)
PROMPT FOR MAMMO (referent group = Only if doctor suggested)			
Symptom	NE	0.05 (0.24-1.29)	0.50 (0.20-1.26)
Checkup		64.24 (20.95 196.99)***	51.94 (16.52 163.31)***
Other		41.64 (6.61-262.44)***	17.82 (3.55-89.36)***
Don't know		7.01 (1.00-48.92)*	6.27 (0.82-47.91)
None (definitely will have)		53464 (ns)***	47949 (ns)*
Nothing (definitely wont have)		0.57 (0.19-1.73)	0.0004 (ns)***
INCIDENCE OF BREAST CANCER (referent group = Don't know)			
1 in 5	0.81 (0.35-1.87)	NE	NE
1 in 15	0.67 (0.32-1.38)		
1 in 35	0.62 (0.25-1.55)		
1 in 60	0.12 (0.03-0.50)**		
FAMILY HISTORY[1] (referent group = yes)			
No	NE	4.93 (1.53-15.84)**	NE
FRIEND HAD BC (referent group = yes)			
No	NE	2.01 (1.00-4.27)*	NE

Table 8.2.1 continued

	MODEL		
	Ever had Mammogram OR (95% CI)	Intend Mammogram within 2 years OR (95% CI)	Intend Mammogram at SABXRS within 2 yrs OR (95% CI)
AGE LEFT SCHOOL (referent group = < 14)			
14	NE	NE	0.24 (0.06-1.02)
15			0.22 (0.05-1.00)*
16			0.35 (0.08-1.58)
17			0.20 (0.04-1.09)
18+			0.65 (0.07-6.00)
OCCUPATION (referent group = Home duties)			
Managerial	NE	4.31 (0.74-24.95)	4.04 (0.49-33.17)
Professional		17.81 (4.81-75.89)***	4.85 (0.91-25.74)
Para-professional		13.41 (2.58-69.81)**	3.93 (0.68-22.58)
Tradesperson		3.66 (0.57-23.70)	4.07 (0.56-29.64)
Clerk		12.07 (4.06-35.87)***	10.93 (3.34-35.73)***
Sales		4.36 (1.25-15.16)*	2.20 (0.55-8.87)
Plant operator/ driver		15.44 (2.52-94.55)**	17.63(2.13-146.32)**
Labourer		5.14 (1.49-17.72)**	6.27 (1.73-22.75)**
HOURS WORKED (referent group = None)			
0-24	NE	0.23 (0.08-0.64)**	0.22 (0.07-0.69)**
25-34		0.28 (0.07-1.13)	0.21 (0.04-0.97)*
34+		0.30 (0.09-1.08)	0.11 (0.03-0.51)**
AGE (referent group = 40-44)			
45-49	NE	0.73 (0.24-2.29)	0.60 (0.20-1.82)
50-54		0.29 (0.09-0.90)*	0.10 (0.03-0.37)***
55-59		0.61 (0.18-1.99)	0.79 (0.21-2.89)
60-64		0.43 (0.13-1.47)	0.11 (0.02-0.54)**
65-69		0.15 (0.04-0.57)**	0.14 (0.03-0.67)*

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$

OR, odds ratio. CI, confidence interval NE, not entered in model

ns, large OR and very wide confidence interval to be meaningful

[1] Mother, sister or daughter had breast cancer.

Table 8.2.2 Omnibus surveys: Number of women sampled and Percent who Ever Had Mammogram by Purpose of Mammogram by Year by Age

AGE GROUP	YEAR OF SURVEY 1990	1991	1992	1994	1995
NUMBER SAMPLED					
30-39	253	na	309	301	301
40-49	206	264	256	265	269
50-59	146	194	175	178	182
60-69	150	200	173	169	166
70+	na	208	190	204	207
PERCENT EVER HAD A MAMMOGRAM					
30-39	11.5	na	14.2	15.6	13.3
40-49	24.8	38.6	44.9	47.2	51.3
50-59	34.3	40.2	46.3	73.6	84.6
60-69	22.7	33.0	42.8	70.4	78.3
50-69	*28.4*	*36.6*	*44.5*	*72.1*	*81.6*
70+	na	15.9	14.7	31.9	34.3
PERCENT EVER HAD SCREENING MAMMOGRAM[1]					
30-39	4.4	na	4.2	4.7	3.0
40-49	12.1	23.7	29.3	28.7	34.6
50-59	19.2	27.8	35.4	56.7	70.9
60-69	16.0	24.5	37.6	62.1	74.7
50-69	*17.6*	*26.1*	*36.5*	*59.4*	*72.7*
70+	na	9.6	10.0	26.0	28.0
PERCENT EVER HAD DIAGNOSTIC MAMMOGRAM[1]					
30-39	7.1	na	10.0	10.6	10.6
40-49	12.1	14.9	15.6	18.5	16.7
50-59	15.1	12.4	18.9	16.3	13.2
60-69	5.3	8.5	5.2	7.7	3.6
50-69	*10.1*	*10.4*	*8.1*	*12.1*	*8.6*
70+	na	6.3	4.7	5.9	6.3

na, not available (1990 excluded women aged > 70, 1992 Survey excluded women < 40)

[1] Percent Screening plus percent Diagnostic may not add to overall percent due to missing data for PURPOSE.

Table 8.2.3 Omnibus surveys: Percent of women who were Compliant Participants by Purpose of Mammogram by Year by Age

AGE GROUP	PERCENT COMPLIANT PARTICIPANTS[1] 1990	1991	1992	1994	1995
ALL MAMMOGRAMS					
30-39	8.7	na	8.4	11.0	6.0
40-49	20.9	29.0	36.7	35.1	38.7
50-59	28.8	32.0	36.6	62.9	74.7
60-69	18.0	25.5	35.8	63.9	74.1
50-69	*23.3*	*28.7*	*36.2*	*63.4*	*74.4*
70+	na	6.7	9.0	19.6	21.7
SCREENING MAMMOGRAM[2]					
30-39	3.6	na	1.3	3.3	1.3
40-49	11.7	18.3	25.8	23.0	28.3
50-59	19.2	23.2	30.8	50.0	64.3
60-69	15.3	21.5	32.4	56.8	71.7
50-69	*17.2*	*22.3*	*31.3*	*53.3*	*67.8*
70+	na	4.8	5.8	16.7	18.8
DIAGNOSTIC MAMMOGRAM[2]					
30-39	5.1	na	7.1	7.6	5.0
40-49	9.2	10.7	10.6	12.1	10.4
50-59	9.6	8.3	6.3	12.9	10.4
60-69	2.7	4.0	3.5	7.1	2.4
50-69	*6.1*	*6.1*	*4.9*	*10.1*	*6.6*
70+	na	1.4	3.2	2.9	2.4

na, not available (1990 excluded women aged > 70, 1992 Survey excluded women < 40)

[1] Compliant participant defined as having screen in year of survey or two preceding years

[2] Percent Screening plus percent Diagnostic may not add to overall percent due to missing data for PURPOSE.

Table 8.2.4 Omnibus surveys: Percent of women who were Compliant Participants by Purpose and Place of Mammogram by Year by Age

AGE GROUP	PERCENT COMPLIANT PARTICIPANTS[1] 1990	1991	1992	1994	1995
ALL MAMMOGRAMS -SABXRS [2]					
percent of total sample (percent of those who had a mammogram)					
30-39	0.0 (0.0)	na	1.3 (16.0)	2.0 (18.2)	1.7 (26.3)
40-49	1.9 (9.5)	4.6 (16.4)	15.6 (42.6)	16.6 (46.8)	22.3 (57.7)
50-59	15.1 (52.4)	13.4 (41.9)	25.7 (69.2)	45.5 (73.0)	59.3 (79.4)
60-69	6.7 (37.0)	10.5 (41.2)	22.5 (62.9)	55.0 (86.1)	64.5 (87.0)
50-69	*10.8 (46.4)*	*11.9 (41.6)*	*24.1 (66.1)*	*50.1 (79.5)*	*61.7 (83.0)*
70+	na	1.0 (14.3)	4.2 (47.1)	10.3 (52.5)	15.9 (75.0)
ALL MAMMOGRAMS - OUTSIDE PROGRAM [2]					
percent of total sample (percent of those who had a mammogram)					
30-39	8.7 (100.0)	na	6.8 (84.0)	9.0 (81.8)	4.7 (73.7)
40-49	18.5 (90.5)	23.1 (83.6)	21.1 (57.5)	18.9 (53.2)	16.4 (42.3)
50-59	13.7 (47.6)	18.6 (58.1)	11.4 (30.8)	16.9 (27.0)	15.4 (20.6)
60-69	11.3 (63.0)	15.0 (58.8)	13.3 (37.1)	8.9 (13.9)	9.6 (13.0)
50-69	*12.5 (53.6)*	*16.8 (58.4)*	*12.4 (33.9)*	*13.0 (20.6)*	*12.6 (17.0)*
70+	na	5.8 (85.7)	4.7 (52.9)	9.3 (47.5)	5.3 (25.0)
SCREENING MAMMOGRAM -SABXRS [2]					
percent of total sample (percent of those who had screening mammogram)					
30-39	0.0 (0.0)	na	0.0 (0.0)	1.0 (30.0)	0.3 (33.3)
40-49	1.0 (8.7)	4.2 (24.4)	13.3 (50.8)	12.8 (55.7)	18.6 (66.7)
50-59	13.8 (74.1)	12.4 (53.3)	22.3 (75.5)	41.6 (83.2)	54.4 (84.6)
60-69	6.7 (45.5)	8.5 (39.5)	21.4 (66.1)	52.1 (91.7)	62.7 (87.4)
50-69	*10.2 (61.2)*	*10.4 (46.6)*	*22.1 (70.6)*	*46.7 (87.6)*	*58.3 (86.0)*
70+	na	1.0 (18.2)	3.7 (63.6)	9.3 (55.9)	14.5 (76.9)
SCREENING MAMMOGRAM - OUTSIDE PROGRAM [2]					
percent of total sample (percent of those who had screening mammogram)					
30-39	3.6 (100.0)	na	1.3 (100.0)	2.3 (70.0)	0.7 (66.7)
40-49	10.2 (91.3)	13.0 (75.6)	12.9 (49.3)	10.2 (44.3)	9.3 (33.3)
50-59	4.8 (25.9)	10.8 (46.7)	7.4 (24.5)	8.4 (16.9)	9.9 (15.4)
60-69	8.0 (54.6)	13.0 (60.5)	11.0 (33.9)	4.7 (8.3)	9.0 (12.6)
50-69	*6.4 (38.8)*	*11.9 (53.4)*	*9.2 (29.4)*	*6.6 (12.4)*	*9.5 (14.0)*
70+	na	4.3 (81.8)	2.1 (36.4)	7.4 (44.1)	4.4 (23.1)
DIAGNOSTIC MAMMOGRAM - SABXRS [2]					
percent of total sample (percent of those who had diagnostic mammogram)					
30-39	0.0 (0.0)	na	1.3 (18.2)	1.0 (13.0)	1.3 (26.7)
40-49	1.0 (10.5)	0.4 (3.6)	2.3 (21.4)	3.4 (28.1)	3.4 (32.1)
50-59	1.4 (13.3)	1.0 (12.5)	2.9 (41.7)	3.9 (31.8)	5.0 (47.4)
60-69	0.0 (0.0)	2.0 (44.4)	1.2 (33.3)	3.0 (41.7)	1.8 (75.0)
50-69	*0.7 (10.5)*	*1.5 (24.0)*	*2.0 (38.9)*	*3.5 (35.3)*	*3.5 (52.2)*
70+	na	0.0 (0.0)	0.5 (16.7)	1.0 (33.3)	1.5 (60.0)
DIAGNOSTIC MAMMOGRAM - OUTSIDE PROGRAM [2]					
percent of total sample (percent of those who had diagnostic mammogram)					
30-39	5.1 (100.0)	na	5.8 (81.8)	6.6 (87.0)	3.7 (73.3)
40-49	8.3 (89.5)	10.2 (96.4)	8.6 (78.6)	8.7 (71.9)	7.1 (67.9)
50-59	8.9 (86.7)	7.2 (87.5)	4.0 (58.3)	8.4 (68.2)	5.5 (52.6)
60-69	2.7 (100.0)	2.5 (55.6)	2.3 (66.7)	4.1 (58.3)	0.6 (25.0)
50-69	*5.7 (89.5)*	*4.8 (76.0)*	*3.2 (61.1)*	*6.3 (64.7)*	*3.2 (47.8)*
70+	na	1.4 (100.0)	2.6 (83.3)	2.0 (66.7)	1.0 (40.0)

na, not available (1990 excluded women aged > 70, 1992 Survey excluded women < 40)

[1] Compliant participant defined as having screen in year of survey or two preceding years

[2] Percent at SABXRS plus percent OUTSIDE PROGRAM may not add to overall percent having screening/diagnostic mammogram in Table 9.2.2 due to missing data for PLACE.

Table 8.2.5 Omnibus surveys: Percent of women aged 50-69 who Ever Had Mammogram (anywhere) by Year by selected variables

Variable	PERCENT EVER HAD MAMMOGRAM				
	1990 N = 296	1991 N = 394	1992 N = 348	1994 N = 346	1995 N = 348
COUNTRY OF BIRTH					
Australia	29.2	35.7	46.1	69.8	84.9
UK & Ireland	30.6	38.5	49.2	75.0	80.0
Other	23.1	36.0	33.3	77.3	70.5
MARITAL STATUS					
Married	30.6	35.5	45.8	74.0	84.9
Not married	21.1	38.5	39.8	65.9	72.7
EDUCATION					
Left school age ≤ 15	23.3	31.9	43.0	67.9	78.4
Left school age> 15	24.5	38.4	52.7	74.1	84.3
Trade qualification	13.3	40.9	35.7	72.2	85.7
Certificate/diploma	45.6	47.4	35.4	74.2	85.7
Degree or higher	50.0	40.0	45.5	80.0	73.9
SMOKING					
Smoke now	21.4	31.7	51.4	60.8	78.6
Ex-smoker	33.3	31.6	45.7	74.3	83.5
Never smoked	33.3	38.7	41.8	74.2	82.1
PAP TEST[1]					
Ever had	36.7	na	na	74.1	84.1
Never had	20.0			51.7	56.3

na, Not Available
[1] Only asked of women aged 50-64 in 1990

Table 8.2.6 Omnibus surveys: Percent of women aged 50-69 who Ever Had Mammogram at SABXRS by selected variables

Variable	PERCENT EVER HAD MAMMOGRAM AT SABXRS				
	1990 N = 296	1991 N = 394	1992 N = 348	1994 N = 346	1995 N = 348
COUNTRY OF BIRTH					
Australia	12.7	14.0	25.1	49.8	66.4
UK & Ireland	10.9	12.3	41.0	53.6	63.6
Other	14.3	12.2	19.3	58.5	56.7
MARITAL STATUS					
Married	13.1	13.8	28.8	54.5	66.8
Not married	10.3	12.1	21.2	46.1	55.7
EDUCATION					
Left school age ≤ 15	10.0	11.5	24.7	50.7	63.3
Left school age> 15	12.2	14.9	30.9	51.4	69.7
Trade qualification	6.7	13.6	35.7	50.0	64.3
Certificate/diploma	20.0	19.3	25.0	58.1	61.9
Degree or higher	14.3	13.3	27.3	47.4	43.5
SMOKING					
Smoke now	9.5	12.7	24.3	30.0	60.7
Ex-smoker	15.7	14.1	25.7	36.2	63.3
Never smoked	12.1	13.4	20.7	48.9	65.1
PAP TEST[1]					
Ever had	14.1	na	na	43.7	65.1
Never had	15.4			40.0	53.1

na, Not Available
[1] Only asked of women aged 50-64 in 1990

Table 8.2.7 Omnibus surveys: Intention to use SABXRS in next 2 years by Age by Year (column percent)

	1990	1991	1992	1994
WOMEN AGED 40-49	N = 206	N = 264	N =256	N = 264
Definitely will	22.8	28.2	40.2	34.2
Probably will	25.9	29.8	28.9	24.7
Probably won't	25.4	16.4	16.0	18.6
Definitely won't	10.9	8.8	4.7	10.6
Not sure	16.1	16.8	10.2	11.8
WOMEN AGED 50-69	N = 296	N = 394	N =348	N = 346
Definitely will	20.1	27.9	32.2	53.9
Probably will	17.8	25.4	27.6	20.5
Probably won't	25.9	16.8	13.8	6.1
Definitely won't	11.6	11.7	8.9	8.1
Not sure	24.7	18.3	17.5	11.5

Table 8.2.8 Omnibus surveys: Intended frequency of mammograms in coming years by Age by Year (column percent)

	1991		1992		1994	
FREQUENCY	40-49 N = 264	50-69 N = 394	40-49 N = 256	50-69 N = 348	40-49 N = 264	50-69 N = 346
Every year	18.3	11.7	19.1	16.1	11.8	11.2
Every 2 years	§	§	34.4	32.2	38.0	52.4
Every 3 years or more	§	§	11.0	2.3	6.1	3.3
Never	3.4	11.7	3.1	13.8	5.7	8.4
Not sure	45.0	45.5	32.4	35.6	38.4	24.8

§ Categories not comparable; 1991 categories were every year, 2-5 years, 6-10 years

Table 8.2.9 Omnibus surveys: Knowledge about Incidence of Breast Cancer (column percent)

	1990		1994		1995	
INCIDENCE	40-49 N = 206	50-69 N = 296	40-49 N = 264	50-69 N = 346	40-49 N = 269	50-69 N = 348
1 in 5	22.5	17.8	26.6	22.2	38.5	30.0
1 in 15	39.2	28.0	41.1	32.5	30.7	30.8
1 in 35	13.2	16.1	12.5	11.0	13.0	13.5
1 in 60	6.4	7.7	4.6	6.3	7.0	4.3
Not sure	18.6	30.4	15.2	28.0	10.7	21.3

Table 8.2.10 Omnibus surveys: Knowledge of SABXRS amongst women who have not used the Service

	1990		1991		1992		1994	
Age group	N [1]	% [2]	N [1]	% [2]	N [1]	% [2]	N [1]	% [2]
40-49	189	43.9	246	71.5	212	65.5	215	78.6
50-59	112	52.7	163	80.4	125	76.8	93	82.8
60-69	115	54.8	176	81.8	130	73.1	72	76.4
50-69		*53.7*		*81.1*		*74.9*		*80.0*
70+	na	na	204	66.7	176	71.0	174	74.7

na not available

[1] N = Women who have not used SABXRS

[2] Percent of N WHO KNOW SABXRS

Table 8.2.11 1995 Omnibus Survey: Age by Mammography use and Invitation to SABXRS

	AGE GROUP				
Variable	30-39	40-49	50-59	60-69	70+
TOTAL SOUTH AUSTRALIA	**N = 300**	**N = 269**	**N = 182**	**N = 166**	**N = 207**
EVER HAD MAMMOGRAM					
Percent Yes	13.3	51.3	84.6	78.3	34.3
EVER HAD MAMMOGRAM AT SABXRS					
Percent Yes	3.0	26.8	61.5	66.3	19.3
HAD INVITATION FROM SABXRS[2]		N = 198	N = 69	N = 56	N = 167
Percent Yes	na	5.6	29.0	37.5	4.8
METROPOLITAN ADELAIDE[1]	**N = 204**	**N = 187**	**N = 124**	**N = 115**	**N = 154**
EVER HAD MAMMOGRAM					
Percent Yes	15.2	55.1	83.1	76.5	34.4
EVER HAD MAMMOGRAM AT SABXRS					
Percent Yes	3.9	27.3	56.5	63.5	18.2
HAD INVITATION FROM SABXRS[2]		N = 136	N = 54	N = 42	N = 126
Percent Yes	na	7.4	35.2	35.7	5.6
COUNTRY SOUTH AUSTRALIA[1]	**N = 97**	**N = 82**	**N = 58**	**N = 51**	**N = 55**
EVER HAD MAMMOGRAM					
Percent Yes	10.3	42.7	87.9	82.4	34.5
EVER HAD MAMMOGRAM AT SABXRS					
Percent Yes	1.0	24.4	72.4	72.6	21.8
HAD INVITATION FROM SABXRS[2]		N = 62	N = 15	N = 14	N = 42
Percent Yes	na	1.6	6.7	42.9	4.8

na, not available (not asked of women < 40)
[1] N for metropolitan and country combined may not sum exactly to state total due to weighting factor
[2] N = women who have not attended SABXRS

Table 8.3.1 1989/90 National Health Survey: Adjusted Odds Ratio and 95% Confidence Interval for variables associated with Ever had Mammogram at P < 0.05 level in final logistic regression model (N = 6,740 women aged 40-64).

Variable	Odds Ratio	95% Confidence Interval
STATE (referent group = South Australia)		
New South Wales	1.67***	1.32 -2.10
Victoria	1.19	0.93 - 1.52
Queensland	1.29*	1.00 - 1.67
Western Australia	1.22	0.92 -1.63
Tasmania	0.77	0.50 - 1.17
Northern Territory	0.64	0.25 - 1.69
Australian Capital Territory	1.49	0.90 - 2.46
HOUSEHOLD TYPE (referent group = Wife with non-dependent children)		
Wife with dependent children	0.64***	0.54 - 0.76
Single parent with dependent children	0.81	0.55 - 1.18
Single parent with non-dependent children	0.87	0.67 - 1.12
Lives alone	1.01	0.82 - 1.25
Lives with others	0.82	0.61 - 1.10
LANGUAGE SPOKEN AT HOME (referent group = English)		
European	1.63***	1.24 - 2.13
Other	1.46	0.95 - 2.22
OCCUPATION (referent group = Home duties/unemployed)		
Manager/administrator	0.92	0.70 - 1.21
Professional	1.10	0.86 - 1.42
Para professional	1.14	0.82 - 1.58
Tradesperson	0.67	0.42 - 1.07
Clerk	0.94	0.78 - 1.13
Sales/service	1.19	0.95 - 1.50
Plant/machine operator	1.68*	1.00 - 2.80
Labourer	1.08	0.85 - 1.39
SOURCE OF INCOME (referent group = Wages or Salary)		
Government pension/benefit	1.22	1.00 - 1.50
Other	1.24*	1.04 - 1.48
DENTIST (referent group = Other)		
Visited < 12 months ago	1.17*	1.02 - 1.34
Visited 12 - 2 years ago	1.18	0.99 - 1.40
TOOK STOMACH MEDICATIONS IN LAST 2 WEEKS (referent group = Yes)		
No	1.21*	1.01 - 1.45
TOOK SLEEP MEDICATIONS IN LAST 2 WEEKS (referent group = Yes)		
No	1.40**	1.02 - 1.34
TOOK OTHER MEDICATIONS IN LAST 2 WEEKS (referent group = Yes)		
No	1.22**	1.02 - 1.34
CHANGED DIET OVER LAST 2 YEARS (referent group = No)		
Yes, due to medical condition	1.05	0.89 - 1.25
Yes, to lose weight	1.21	0.98 - 1.50
Yes, to improve general health	1.18	0.99 - 1.41
Yes, to other reasons	1.32**	1.08 - 1.61
SMOKING (referent group = Never smoked)		
Current smoker	0.82*	0.71 - 0.96
Ex-smoker	1.14	0.97 - 1.32
ALCOHOL (referent group = Never drinks)		
Frequent drinker	1.25*	1.01 - 1.53
Infrequent drinker	1.11	0.89 - 1.37

Table 8.3.1 continued

Variable	Odds Ratio	95% Confidence Interval
PAP SMEAR (referent group = Never had)		
Had < 1 year ago	1.57**	1.20 - 2.06
Had 1 year to < 3 years ago	1.08	0.82 - 1.42
Had 3 year to < 5 years ago	0.93	0.67 - 1.27
Had 5 or more years ago	0.97	0.73 - 1.29
BREAST EXAM BY DOCTOR (referent group = No)		
Yes	7.86***	6.13 - 10.07
BREAST SELF EXAM (referent group = No)		
Yes	1.47***	1.28 - 1.68
HEARD OF MAMMOGRAM (referent group = No)		
Yes	4568.77***	ns
HAS CANCER (referent group = No)		
Yes	2.27***	1.72 - 2.99

na, not applicable
* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$
ns, large OR and very wide confidence interval to be meaningful

Table 8.3.2 1990 Omnibus and 1989/90 National Health Surveys: Percent of women who Ever Had Mammogram by Survey by Age group

	PERCENT WHO EVER HAD MAMMOGRAM				
	1989/90 National Health Survey			1990 Omnibus survey	
Age group	South Australia	Australia	*P-value*[1]	South Australia	*P-value*[2]
TOTAL					
40-49	22.0	29.8	*< 0.001*	24.8	*0.36*
50-64	27.6	30.1	*0.004*	31.5	*0.21*

[1] Test between South Australia and Australia, National Health Survey
[2] Test between National Health Survey and Omnibus surveys for South Australia
na, not applicable

Table 8.3.3 1989/90 National Health Survey, South Australia: Percent of women who Ever Had Mammogram by Age by Region by various socio-demographic characteristics.

	EVER HAD MAMMOGRAM			
	40-49 (N = 324)[1]		50-64 (N = 336)[1]	
Variable	Percent	*(P-value)*[2]	percent	*(P-value)*[2]
REGION				
Northern Adelaide	25.7	*0.07*	21.1	*0.22*
Western Adelaide	32.7		36.1	
Eastern Adelaide	27.0		32.5	
Southern Adelaide	14.8		30.3	
Rest of State	15.7		22.8	
MARITAL STATUS				
Married	20.9	*0.27*	29.1	*0.24*
Not married	27.2		22.2	
COUNTRY OF BIRTH				
Australia	23.5	*0.48*	28.6	*0.01*
UK & Ireland	15.7		39.4	
Other	22.0		14.8	
EDUCATION				
Left school age ≤ 14	22.9	*0.99*	24.7	*0.17*
Left school age 15	22.5		37.2	
Left school age 16	21.5		22.7	
Left school age 17+	21.3		27.3	
POST-SCHOOL QUALIFICATION				
No qualification	21.8	*0.93*	26.9	*0.04*[3]
Trade qualification	19.6		30.7	
Certificate/diploma	24.4		31.5	
Degree or higher	17.6		-	
EMPLOYMENT STATUS				
Employed	23.4	*0.34*	28.7	*0.74*
Not employed	18.7		27.4	
OCCUPATION				
Mang/Admin/Prof/Para-prof	29.8	*0.19*	26.4	*0.58*
Clerk	23.4		34.1	
Sales/service	28.4		38.7	
Trade/machine op/labourer	14.2		21.7	
HOURS WORKED				
1-24	19.5	*0.22*	32.2	*0.71*
25-34	19.6		23.6	
35+	28.7		26.5	
SOURCE OF INCOME				
Wages or salary	22.7	*0.57*	23.1	*0.68*
Government pension	18.8		28.7	
Other	24.6		28.3	
INCOME				
Up to $20,800	20.6	*0.52*	27.4	*0.99*
$20,800-28,600	25.8		27.8	
Over $28,600	29.3		30.7	
PRIVATE INSURANCE COVER				
Yes	24.4	*0.10*	29.6	*0.32*
No	15.2		24.1	

[1] Age weighted sample
[2] Test between Had and Never Had Mammogram within age category
[3] Test excludes last category
- nil or small number

Table 8.3.4 1995 Omnibus and 1995 National Health Surveys: Percent of women who Ever Had Mammogram by Survey by Age group

	PERCENT WHO EVER HAD MAMMOGRAM		
	1995 Omnibus survey	1995 National Health Survey	
Age group	South Australia (N = 841)[1]	South Australia (N = 841)[2]	Australia (N = 4 890)[2]
TOTAL			
40-49	51.3	47.8	52.2
50-59	84.6	74.5	74.9
60-69	78.3	73.1	68.4
70+	34.3	38.7	38.9
ADELAIDE			na
40-49	55.1	52.2	
50-59	83.1	75.0	
60-69	76.5	74.5	
70+	34.4	40.2	
REST OF STATE			na
40-49	42.7	35.5	
50-59	87.9	73.0	
60-69	82.4	69.4	
70+	34.5	33.2	

[1] N = Age weighted sample.
[2] N = Actual sample (not weighted). Denominator for calculation of precents excludes missing/not stated
na, not applicable

Table 8.3.5 1995 National Health Survey: South Australia and Australia by Age by selected mammography variables (percent in 'Yes' category of variable)

	AREA					
	South Australia			Australia		
Variable	40-49 (N = 298)[1]	50-69 (N = 367)[1]	70+ (N = 176)[1]	40-49 (N = 1903)[1]	50-69 (N = 2139)[1]	70+ (N = 848)[1]
HEARD OF MAMMOGRAM	90.3	94.8	86.4	89.7	93.7	81.4
EVER HAD MAMMOGRAM	47.8	73.9	38.7	52.2	72.1	38.9
HAD WITHIN LAST 2 YEARS						
percent of population	32.2	64.0	21.8	37.1	59.4	24.7
percent of had mammogram	68.8	86.7	56.2	71.9	82.6	64.5
HAD WITHIN LAST 3 YEARS						
percent of population	38.5	69.7	27.9	43.6	65.9	29.3
percent of had mammogram	82.3	94.5	72.0	84.6	91.7	76.4
REASON FOR LAST MAMMO[2]						
Symptoms	36.2	12.3	9.5	33.4	14.5	13.3
Family History	16.0	7.7	1.6	11.6	8.4	6.3
Breast cancer	1.6	1.8	7.0	1.4	2.7	4.4
Checkup/other	46.2	78.2	81.9	53.6	74.3	76.0

[1] N = Actual sample (not weighted). Denominator for calculation of percent excludes missing/not stated
[2] Test of significance between Symptoms (diagnostic) and other 3 categories combined (screening)
* P < 0.05 comparing South Australia with Australia within age group (*none were significant*)

Table 8.3.6 1995 National Health Survey: South Australia by Region by Age by selected mammography variables (percent in 'Yes' category of variable)

Variable	REGION					
	Adelaide			Rest of State		
	40-49 (N = 222)[1]	50-69 (N = 275)[1]	70+ (N = 148)[1]	40-49 (N = 76)[1]	50-69 (N = 92)[1]	70+ (N = 28)[1]
HEARD OF MAMMOGRAM	91.9	94.2	83.7	86.1	96.3	96.5
EVER HAD MAMMOGRAM	52.2	74.8	40.2	35.5*	71.3	33.2
HAD WITHIN LAST 2 YEARS						
percent of population	34.2	65.7	22.9	26.7	59.0	17.7
percent of had mammogram	66.3	88.1	56.8	79.5	82.8	53.2
HAD WITHIN LAST 3 YEARS						
percent of population	42.2	71.4	30.7	28.2*	65.0	17.7
percent of had mammogram	82.0	95.7	76.3	83.8	91.2	53.2
REASON FOR LAST MAMMO[1]						
Symptoms	36.3	11.4	8.7	35.6	14.9	13.1
Family History	17.5	6.5	1.9	9.7	11.3	-
Breast cancer	0.7	1.7	8.6	5.3	1.8	-
Checkup/other	45.5	80.3	80.7	49.4	72.1	86.9

[1] N = Actual sample (not weighted). Denominator for calculation of percent excludes missing/not stated
* $P < 0.05$ comparing South Australia with Australia within age group

Table 8.3.7 1995 National Health Survey: South Australia and Australia by Age by Other Breast Behaviours (percent with positive response to behaviour)

Behaviour	AREA					
	South Australia			Australia		
	40-49 (N = 298)[1]	50-69 (N = 367)[1]	70+ (N = 176)[1]	40-49 (N = 1903)[1]	50-69 (N = 2139)[1]	70+ (N = 848)[1]
HAVE REGULAR BREAST EXAM						
Had mammogram	74.0	75.7	33.0	76.0	76.3	56.0
Never had mammogram	52.8	47.8	12.8	48.8	39.5	24.4
P-value[2]	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
BREAST SELF EXAMINATION (BSE)						
Had mammogram	76.0	73.8	63.8	75.9	73.7	69.4
Never had mammogram	72.1	78.1	59.8	73.3	70.7	58.0
P-value[2]	*0.26*	*0.17*	*0.44*	*0.07*	*0.03*	*<0.001*
FREQUENCY OF BSE						
Had mammogram						
- monthly	82.9	78.1	64.7	79.5	77.8	74.5
- 6 monthly	13.3	18.1	30.8	17.4	17.5	17.9
- yearly	2.0	1.2	0.0	2.5	3.1	3.7
- other	1.8	2.5	4.5	0.6	1.6	3.9
Never had mammogram						
- monthly	72.1	75.7	66.9	69.5	73.6	68.7
- 6 monthly	23.2	15.1	25.8	24.9	22.3	23.6
- yearly	2.8	4.3	5.2	3.7	2.9	5.4
- other	1.9	5.0	2.1	1.9	1.2	2.3
P-value[2]	*0.02*	*0.03*	*0.63*	*<0.001*	*0.003*	*0.06*

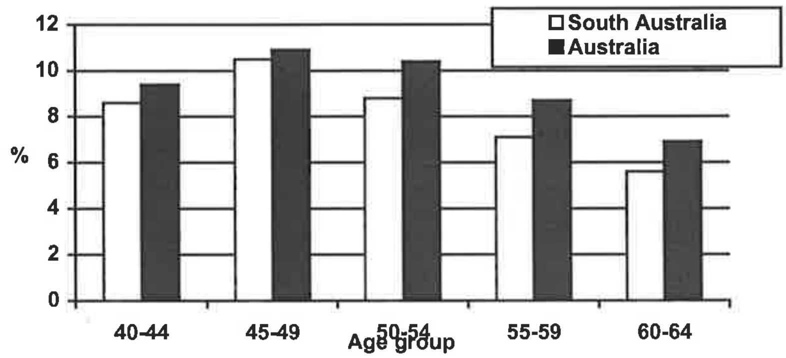
[1] N = Actual sample (not weighted). Denominator for calculation of percent excludes missing/not stated
[2] Statistical test comparing Ever had mammogram with Never had mammogram

Table 8.3.8 National Health Surveys (1989/90 & 1995): Percent ever had mammogram

	AREA					
	South Australia			Australia		
AGE	1989/90	1995	(*P-value*)[1]	1989/90	1995	(*P-value*)[1]
40-49						
All 40-49	22.0	47.8	*< 0.001*	29.8	52.2	*< 0.001*
Adelaide	24.2	52.2	*< 0.001*	na	na	
Rest of State	15.7	35.5	*0.003*	na	na	
50-64						
All 50-64	27.6	73.9	*< 0.001*	30.1	73.6	*< 0.001*
Adelaide	29.5	75.0	*< 0.001*	na	na	
Rest of State	22.8	70.8	*< 0.001*	na	na	

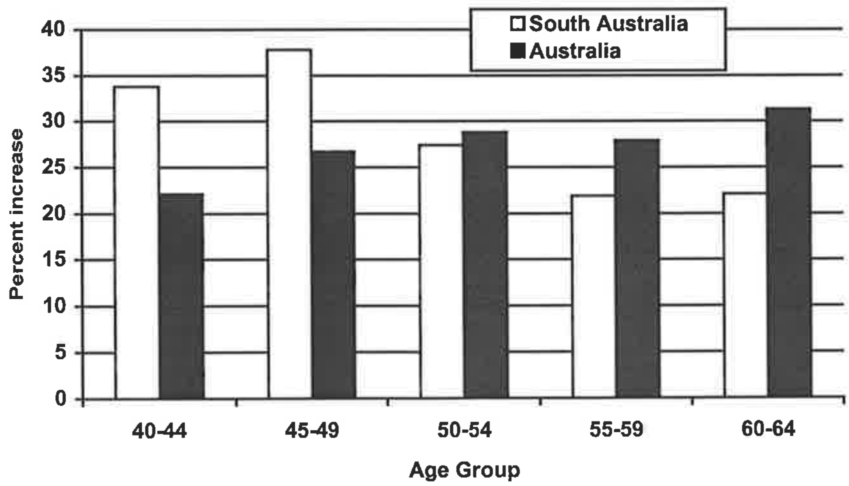
[1] Test between proportion Had in 1989/90 and Had in 1995
na, not applicable

Figure 8.3.1 Percent of women claiming Medicare rebate for Bilateral Mammography by Age, 1989-90



Source: Health Insurance Commission, 1991

Figure 8.3.2 Percent increase in Medicare claims for Bilateral Mammography by Age, 1988/89 to 1989/90



Source: Health Insurance Commission, 1991

PART V

SUMMARY AND RECOMMENDATIONS

CHAPTER 9 KEY FINDINGS AND SUMMARY

9.1 OVERVIEW OF CHAPTER AND REVIEW OF STUDY AIMS AND LIMITATIONS

9.1.1 Introduction

This chapter first draws together the various studies presented in this thesis and reviews them against the study hypotheses and framework. This is followed by an update on the recent literature, before evaluating whether the screening mammography program in South Australia is likely to achieve the goal of screening 70% of women aged 50-69 within the Program, and projects the likely participation rate to 2001. The past and projected trends for South Australia are compared with Australian trends. Finally recommendations are made as to how this research can be further used (apart from evaluating likely participation rates) to develop recruitment strategies and inform on directions for future research.

Sub-section 9.1.2 below reviews the hypothesis that this study set out to test and the theoretical framework that underpinned the studies. The limitations of the study are outlined in sub-section 9.1.3 as a precursor to section 9.2 which summarises the results of each of the study components within the study framework and refers to the hypotheses as relevant. The individual study components are related specifically to Hypotheses 1 to 7. The recent literature is summarised in section 9.3 to determine whether developments in the literature since the review presented in Chapter 1 would have influenced Hypotheses 1 to 7. Hypothesis 8 about the ability to achieve the target participation rate is addressed as two sections. Section 9.4 examines participation in mammography in South Australia and Australia to date, both inside and outside the National Program, utilising the results of the various studies in this thesis and incorporating new Australian data which have recently been published. Section 9.5 considers the second part of Hypothesis 8 about the ability of the Program to achieve its target. Section 9.6 makes the final recommendations and conclusions of this thesis.

9.1.2 Review of Hypothesis and the Theoretical Framework

The following hypotheses were specified in Chapter 2:

1. Attenders and non-attenders to the SABXRS will differ with regard to six broad constructs;
   - Socio-demographic
   - Health Motivation and Control
   - Knowledge about Breast Cancer and Mammography
   - Susceptibility to Breast Cancer (perceived and actual)
   - Barriers (perceived and structural)
   - Influences (significant others, networks, sources of information).

2. The various sub-groups of attenders and non-attenders to the SABXRS (based on recruitment method) will differ with regard to the six broad constructs.

3. Overall, the barrier construct will have the greatest impact on participation.

4. Individually, a doctor's influence will have the greatest impact on participation.

5. Non-attenders will comprise women at various stages of readiness for adoption of mammography.

6. Intention regarding mammography predicts actual behaviour.

7. The profile of women in the community receiving mammograms will differ from the SABXRS clients.

8. A level of "screening" occurs outside the National screening program to an extent that will impact on the ability of the program to gain a 70% participation rate in the target population of women aged 50-69.

These hypotheses were examined within a framework informed by general models of health-related actions.

The theoretical framework which underpins the hypotheses was based loosely on the Health Belief Model supplemented by the Theory of Reasoned Action and the Transtheoretical Model of Readiness Stage, as outlined in Chapter 1. The basic conceptual framework adopted was that action with regard to mammography behaviour depends on stage of readiness for adoption of the behaviour, which in turn depends on personal and environmental factors. Personal factors include perceptions of severity, susceptibility, and a balancing of the pros and cons of adopting a behaviour. In this thesis, particular emphasis was given to factors that act as barriers to the adoption of mammography behaviour, and it was hypothesised that the barrier construct would have the greatest negative impact on participation while a doctor's influence would have the single most positive impact. It was also hypothesised that stage of readiness is not linear and women with a bad experience could slip back to an earlier stage. Rogers (1983) theory of the *Diffusion of Innovation,* was incorporated into the framework to describe more explicitly the stages of readiness in terms of five adopter categories; innovators, early adopters, early majorities, late majorities and laggards. Innovators and early adopters are described as more active information seekers, as having a more favourable attitude and wide interpersonal networks, and for whom mass media alone may lead to adoption. The late adopters and laggards are said to be more economically and socially disadvantaged. The rate of adoption is the relative speed with which an innovation is adopted. Rogers also describes *disenchantment discontinuance* which is the decision to reject an idea as a result of dissatisfaction with its performance; in relation to mammography screening this could be applied to women who fail to return for rescreening. It was hypothesised that late adopters would be more likely to discontinue than early adopters.

The reason for adopting a framework based 'loosely' on an expanded Health Belief Model and not developing a definitive model, was that although the expanded HBM was thought to provide the best available theoretical framework to study risk factors associated with mammography screening, the evidence from the literature was disappointing. Unlike some models of health behaviour, for example the Locus of Control model (Wallston and Wallston, 1981), where specific measurement instruments have been developed to test the model, the HBM comprises several components which have been interpreted variously by many investigators. The HBM, and the various adaptations and expansions of the model, generally specify causal links between the various components or constructs within the model. While the results for the expanded models provide better predictive power than the HBM alone, at best only half the variance was explained by any model from the review of the literature documented in Chapter 1. Further, not only were the causal relationships predicted by the models often not supported by the research, but some studies reported relationships in the reverse direction to those predicted. Several researchers suggested that greater attention was required on barriers to participation, and some recommended that barriers should be studied as a separate construct. Montano and Taplin (1991), suggested that mammography behaviour was more difficult to predict because it was more emotionally charged than other health behaviours, and recommended that further work was needed to measure the emotions and fears and to explore their interacting role with beliefs and attitudes. More recently the HBM has been criticised for its focus on rationality and the exclusion of emotions such as fear and denial (Ogden, 1996).

Based on the literature review and incorporating suggestions by other researchers as to how their own research might have been improved, six constructs were defined to encompass the broad areas of investigation within the framework for this study, including a separate barrier construct, which incorporated emotions and fears. The constructs adopted in this study were: Socio-demographic; Health Motivation and Control; Knowledge (about breast cancer and mammography); Susceptibility (perceived and actual); Barriers (perceived and structural); and Influences. No causal relationships between the various constructs were hypothesised.

This study addressed other major deficiencies identified in the literature, that of studying attenders and non-attenders as two homogeneous groups, and of relying on general community samples only to identify the two groups, rather than attenders and non-attenders to specific mammography services. It was suggested that these limitations contributed to the failure of many studies to discriminate between the two groups as predicted by the models. This study addressed these issues within the conceptual framework for this thesis. It was hypothesised that attenders and non-attenders comprise a number of sub-groups with different risk factors and at varying stages of readiness for adoption. This study examined sub-groups based on recruitment method as well as reason for non-attendance.

9.1.3 Limitations of Research and Challenges

The key component for which detailed information was collected, and which had the strongest study design was the case-control study, which sampled women during the early phase of the SABXRS. However, later components of the study showed that women who joined the Program early were clearly not representative of the phase in which the mass population is recruited. A high proportion of the cases or supposed non-attenders were found to in fact be early "innovators" with about half having had a mammogram outside the Service. This rate was far in excess of the rate in the general population at that time and of non-attenders during the later phases. This limitation provides a lesson for future researchers of other screening or preventive programs, that studying non-attenders too early may lead to erroneous projections, since the non-attenders from the case-control study were more likely to subsequently attend than later non-attenders.

Another limitation, again in relation to the cases-control study, was the loss of power that resulted from the need to analyse four sub-groups instead of the two initially planned. This resulted in small numbers particularly for the FTA cases (N=56) and some sub-groups of interest, for example non-English speaking women. The calculations of required sample size were based on the testing of hypotheses for two separate samples by method of recruitment. In hypothesis testing it is assumed that the null hypothesis is true unless proven false by a statistical test of significance. The *P*-value specifies the proportion of times that the null hypothesis will be rejected when it is true, or the probability of making a *type I error*. A reduction in power increases the likelihood of making a *type II error*, and rejecting the alternative hypothesis when it is true. To reduce the probability of rejecting the alternative hypothesis due to the loss of power, a *P*-value of < 0.10 was used instead of the conventional 0.05 as the test of significance. Although this increased the chance of accepting the alternative hypothesis when it was not true, this type of error was considered less problematic than missing possible associations in this study since the consequences of type I errors are not critical, as for example in a clinical drug study.

Another problem that should be noted is the risk of overtesting as a consequence of the focus on hypothesis testing, particularly given the number of variables. A large number of tests increases the probability of obtaining a statistically significant result just by chance and of over-interpretation.

A frustration and challenge for the researcher was conducting this research in the context of a fast moving social world. To ensure the research remained relevant additional studies and follow-up of subjects were undertaken. The imperative to update the research also became its strength. Early in the research it appeared certain that the goal of reaching 70% participation could never be reached. Then, in the middle phases as the uptake expanded dramatically over a relatively short period, it seemed that the target could possibly be reached within the Program's 5-year plan. Had this research ended a year or so ago, the outcome would have been more optimistic than the conclusion drawn at this point in time.

Clearly, the researcher was able to adapt to the changing environment and include new elements to the study, the end result being a tour through an evolving program from initiation to maturity and beyond.

Some limitations were beyond the researcher's control. In the community studies, the numbers of 'not stated' cases for individual questions, in addition to outright refusals, were not insignificant. It is the belief of the researcher that non-respondents are more likely to be non-users of mammography, and if this were the case, the community surveys would overestimate mammography rates. No information was available to assess bias from the Omnibus and National Health Surveys (NHS). It is suggested that the NHS, which collected the mammography data on a separate self completed questionnaire, would be more inflated than the Omnibus surveys where the mammography section was a small part of the overall main survey.

Also, as with most research, the available data are less than optimal. The researcher was able to collect detailed base-line information for the case-control study, but not the other studies. Hence, the range and comparability of variables was a major limitation in the comparisons across various studies. Further, as with all surveys, sampling error and bias (interviewer, respondent, misclassification) affects the estimates. While sampling error can be measured, the level of bias cannot be totally controlled or known, but can be minimised by adhering to good research standards.

9.2 INTERPRETATION OF STUDY RESULTS WITHIN THEORETICAL FRAMEWORK

9.2.1 Overview of Components of Study

The main component of this study, the case-control study reported in Part II related to women who had appointments with the SABXRS in 1990/91, during the early phase of the program. Non-attenders (cases) and attenders (controls) were interviewed in depth (face-to-face) regarding risk factors for attendance as ascertained from the literature. This component examined each of the six study constructs in detail. The literature suggested that one reason for the weak predictive power of most models was that the measures used were insufficient to capture the factors or construct they purported to measure. Each construct in the case-control study incorporated a wide range of items with the view to examining items which best represented the construct as independent predictors of attendance/non-attendance, and those which are confounders.

The case-control study initially set out to compare attenders and non-attenders from two sub-groups representing the two recruitment methods used at that time; women recruited through a personalised invitation (with a specified date and time) from their general practitioner (GP) and women who booked spontaneously. As that study evolved two further sub-groups were identified and analysed separately based on reason for non-attendance; whether a woman cancelled her appointment (Cancel) or simply failed to attend on the day without notice (FTA). This added weight to the hypothesis originally postulated regarding the heterogeneity of the sub-groups, but weakened the statistical power of the study. Attendance status of all case-control subjects at the SABXRS by 31/12/95 was ascertained and modelled against the base-line data; cases who had attended at follow-up were referred to as "Late adopters" and those who had still not attended as "Resistant cases".

The second component reported in Part III (Invitee study) examined the recruitment methods used by the SABXRS not covered by the case-control study, that of invitations directly from the service both for a first and subsequent screen. These invitations had a suggested appointment date but required the woman to telephone for an appointment time. The sample frame comprised invitations sent during the first quarter of 1995, during the mature phase of the program. By that time the Service used the electoral roll (ER) to recruit new clients and GP invitations were no longer issued. This component focused particularly on the most prevalent category of non-attenders following an invitation at the time (and currently still the case), that of 'No response', referring to no contact at all from the woman sent the invitation. Non-attenders selected from the *No response* category were interviewed face-to-face, principally on reasons for not responding to the invitation, ways to prompt them to attend in future, and a few items that would allow some comparison with attenders using data collected routinely at screening (attenders were not interviewed). As the range of data items was limited for this component of the study, it was not feasible to study the six constructs separately. Rather it focussed directly on the key aspects of the study framework, namely barriers, main influence and stages of readiness. Two samples were drawn for interview, one representing women from the city of Adelaide and another representing women from the country (non-Adelaide) regions of South Australia. Attendance status for the full population in the sample frame (all invitations in the selection period) was examined at June 30, 1997 more than two years after the 1995 invitations were issued.

To complement these studies of sub-groups within the screening program, Part IV reported on mammography generally and outside the program from the mammography sections of a series of community studies conducted over the period 1989/90 to 1995. Hence, this thesis studied various sub-groups inside and outside the formal screening program, both across time and over time.

9.2.2 Case-control Study and Follow-up of Case-control Subjects

Despite the loss of power resulting from the necessity to analyse separately data for four sub-groups, the study was able to detect strong predictors of non-attendance for each of the sub-groups: Spontaneous-FTA (booked of own volition, but failed to attend on the day); Spontaneous-Cancel (booked of own volition, but cancelled appointment); GP-FTA (invited by GP, but failed to attend on the day); and, GP-Cancel (invited by GP, but cancelled appointment). Initially, separate models were fitted for each construct as a method of data reduction. The independent predictors for each construct summarised below relate to the final overall models.

From the Socio-demographic construct, one factor predicted non-attendance to the SABXRS, both at base-line and at follow-up, relating to educational/occupation status. Having a managerial/professional occupation and/or Bachelor degree or higher was an independent predictor of non-attendance at baseline (for both GP sub-groups and the Spontaneous-FTA) as well as persistent non-attendance at follow-up (Resistant-cases or 'laggards' in Rogers terminology). Age predicted attendance at follow-up (older women being more likely to remain non-attenders) but not at baseline. These results suggest that the free screening program does not attract well-educated professional women at any stage, and that in the early phases of the program both young and old innovators are recruited, but over time the laggards tend to be older women.

An item included in the Health Motivation and Control construct on the basis of a similar case-control study conducted in the UK (Hobbs *et al.*, 1980) and later reported in two prospective UK studies (Calnan, 1984; Sutton *et al.*, 1994), was found to be a surprisingly robust predictor of non-attendance at baseline and at follow-up - visiting a dentist only when problems occurred rather than just for a check-up. This was an independent predictor of non-attendance in three of the base-line models (both Spontaneous and GP FTA) and at follow-up; those who visited a dentist only when problems arose at base-line were two and a half times more likely to have remained non-attenders four years later. The highest odds ratios were for the FTAs at base-line and Resistant cases at follow-up. Being a smoker was an independent predictor in the two base-line FTA models (but neither Cancel model), and predicted the Late-adopters but not the Resistant-cases at follow-up. Having a previous mammogram did not predict later attendance, which is at discord with most of the literature. That is, amongst the cases, those with a history of mammography outside the SABXRS were not more likely to attend later, once the variable was adjusted for other confounders (it was associated in the bivariate analysis). However, it should be recalled that about half the cases had a prior history of mammography at base-line, significantly above the population rate at the time. That is, at this early phase of the program, the case-control study subjects were not representative of women in the community studies which the literature were generally based on.

The Knowledge and Perceived susceptibility constructs contributed little to the understanding of predictors of non-attendance to the SABXRS. For one sub-group at base-line (Spontaneous-Cancel), susceptibility was predictive as measured by three of the variables included in the construct; concern that they may have breast cancer, spoken to a doctor about it and previous breast lump. However, the result was opposite to that expected from the literature - cases (non-attenders) were *more* concerned they may have breast cancer, more likely to have spoken to a doctor about it and to have had a previous breast lump. These women were also more likely to be Late adopters (but not Resistant cases) suggesting they cancelled the initial appointment at baseline due to their concern, possibly to have symptoms investigated, then shifted to the SABXRS. Other data appear to support this premise; amongst the Spontaneous-Cancel cases who at interview stated that they had had an outside mammogram, a high proportion stated that it was for diagnostic purposes (higher than any of the other three case groups).

Perceived barriers independently predicted non-attendance at baseline for all four models, but for the GP Cancel model a single item was significant (not believing mammography was important for their age) and not the BARRIER SCORE (comprising several items) significant in the other three models. In the three models where the BARRIER SCORE was predictive, cases with the lowest score (greater perceived barriers) were more likely to be non-attenders (odds ratios 4.3 to 9.3), and at follow-up were four and a half times more likely to be a Resistant-case and three times more likely to be a Late-adopter. Except for the GP Cancel cases, the hypothesis regarding the strength of barriers in the overall models was upheld, as the only other variables with such high odds ratios relate to a doctor's influence. The follow-up results suggest that these negative perceptions were sustained, although no definitive information was available to confirm this. Specific concerns within the BARRIER SCORE related to pain, radiation, fear of the result or a belief that mammography was only necessary with symptoms. In addition, at follow-up, being embarrassed by a female radiographer was significant in differentiating between the Late-adopters and controls, and it was further found that non-English speaking (NES) women (particularly Greek) were most embarrassed. Due to the small sample of NES women, further research was suggested in this regard. The finding that embarrassment by a male radiographer did not predict initial attendance or later attendance relates to the fact that a high proportion of all groups were embarrassed by a male. When specifically asked why they did not keep their appointment, the majority of cases stated that they did not need a mammogram or gave reasons labelled as 'apathy' (forgot, too busy, no time). It was suggested the underlying reason for some of the no need/apathy cases would be perceived barriers.

Amongst the structural barriers examined, one relating to access to a car was predictive at base-line and follow-up amongst the two FTA sub-groups only. This may have been a reason for them not attending on the day of appointment without notice.

From the Influence construct, it was found (in concordance with much of the literature and as hypothesised) that a doctor's recommendation was strongly associated with mammography use. Having had a doctor recommend mammography and stating that a doctor would influence them in having a mammogram was strongly related to attendance in all four sub-groups at baseline. Conversely non-attenders were less likely to have had a doctor recommend a mammogram in the past and more likely to state that they would not be influenced by a doctor to have a mammogram in the future. This latter variable remained a strong predictor over time differentiating between Late adopters and Resistant cases (laggards) based on strength of conviction at base-line. Compared with women who stated at baseline that they 'Definitely would' attend on a doctor's recommendation, those who said they 'Probably would' attend were 8 times more likely to be Resistant-cases than controls, and those who stated they 'Probably or definitely would not' take a doctor's advice were 24 times more likely to be Resistant-cases. It is probable that a proportion of these women would have received advice from a doctor in the ensuing four years to have a screening mammogram. A simple question as to whether they would accept a doctor's recommendation in the early phases of the program turned out to be a robust predictor of later behaviour.

The variable about whether a woman would act on a doctor's recommendation to have a mammogram was also found to be related to age; fewer older women stated they would accept a doctor's recommendation to have a mammogram. Older women were also less likely to state that a doctor had actually suggested a mammogram. This suggests that doctors' are less likely to advise older women about mammography. Further, women who stated they would not be influenced by a doctor perceived more barriers.

Overall, the base-line case-control results most closely support the literature which reported on attendance to free mammographic screening (Rimer *et al.*, 1989b; Hobbs *et al.*, 1980; French *et al.*, 1982; Maclean *et al.*, 1984) rather than the literature that reported attendance to fee for service mammography. Further, as in a similar UK case-control study (Hobbs, et al., 1980) the Spontaneous and GP samples clearly represented different population sub-groups. The decision to further categorise these samples by two further sub-groups (FTA and Cancel) was vindicated by the outcomes. The Cancel cases, particularly from the GP sample, in many regards resembled the controls more than the FTA cases in the base-line analyses. The FTA cases more closely resemble non-attenders as suggested from the literature review. At follow-up, FTA cases were twice as likely to remain non-attenders (Resistant cases) than Cancel cases who were more likely to become Late adopters. Further, of the cases who did eventually attend, FTA cases took longer than the Cancel cases. However, at follow-up, initial recruitment method (Spontaneous or GP) did not predict later attendance.

Also, these data confirm the findings of other studies that mammography behaviour intentions can predict actual behaviour, as indicated by intentions to take a doctor's advice. Another intentions variable, asking subjects at base-line specifically about their intention to use the SABXRS in future, was also found to predict actual behaviour. This was tested in the follow-up analysis; women who at base-line stated they would 'Definitely not' use the SABXRS in future were 6 times more likely to be Resistant-cases (still not attended) than those who 'Definitely would'. Those who specified 'Probably not' had an odds ratio of 3.1 and the 'Probably would' cases had an odds ratio of 1.7, showing a definite trend of probability related to strength of intention.

At follow-up, amongst the cases, the following proportions had attended in descending order; 68% of the Spontaneous Cancel cases, 56% of the GP Cancel cases, 54% of the Spontaneous FTA cases and 48% of the GP FTA cases. This is exactly the order that would have been expected following the base-line analyses. The follow-up also examined re-attendance amongst the controls (attenders) in the case-control study. About 90% re-attended which is higher than the National Program target of 75%, suggesting that this group of early adoptors may be quite different from later adoptors, not only in having an initial screen early in the Program, but also in being highly likely to return for a repeat screen. Some of the 10% who did not re-attend would be classified as Rogers' *disenchantment discontinuance* group. It was found with re-attendance (as with initial attendance) that intention and action were highly correlated; most attenders who at base-line indicated they would not re-attend the SABXRS in future did not, and visa versa. A proportion of the cases with a prior history of mammography, who had not attended the SABXRS at follow-up, would also probably comprise the *disenchantment discontinuance* group, that is, women distressed by the actual experience of mammography in some way.

Using Rogers' (1983) classification, the controls would be described as the innovators or early adopters, while the Late-adopters would be either the early or late majority depending on how long after interview they attended, and the Resistant-cases would be the laggards.

Overall Hypotheses 1 to 6 which are relevant to the case-control study were supported by the results, despite the loss of power in further splitting the sample. With regard to Hypothesis 1, some constructs contributed little to the models as summarised above, but where they did contribute they were able to differentiate between attenders and non-attenders. For Hypothesis 2, differences were found on the basis of recruitment method (Spontaneous versus GP) at base-line, but greater differences were found between the FTA and Cancel sub-groups. Hypotheses 3 to 6 were supported without qualification.

9.2.3 Invitee Study

As indicated above, the data were not available to evaluate the study constructs and the comparisons between attenders and non-attenders were limited. However, this study was extremely important in showing that the populations examined in the case-control study were quite different from these later groups targeted by the Service.

The initial interview results from the non-attenders surveyed (Chapter 6) showed that between 40% and 50% of the Round 1 non-attenders intended having a mammogram with the SABXRS in the next two years and nearly 90% of the Re-screen non-attenders. It was concluded that a significant proportion of non-attenders to invitations could be recruited, especially in country areas, since women in the country gave more practical reasons (breast or other clinical problems, being away, other family commitments) for not attending than their city counterparts (where 'Apathy/no need' was the main reason). The exception from the country was the R1 Re-invite women who also gave 'Apathy/no need' as the main reason and were the least likely to indicate an intention to have a mammogram. Also, the electoral roll (ER) was found to exclude 12% of women aged 50-69 from the Arndale area in Adelaide (and especially non-English Speaking (NES) women) and 5% of the target population in Port Augusta which represented a country region.

The follow-up of these non-attenders (invited early 1995) for attendance at the SABXRS by June 1997 found that although intention and action were related, the strength of the association was considerably weaker than for the case-control subjects (Chapter 7). Amongst the Round 1 group, only 11% of the city ER non-attenders had attended, 20% of the country ER non-attenders and 8% of the R1 Re-invite. Further, only about 50% of the Re-screen non-attenders had attended (53% from Arndale and 46% from Pt Augusta).

Not only was the relationship between intentions and action weaker amongst this group, but so was the influence of a doctor amongst those remaining non-attenders (fewer mentioned that a doctor would influence them at interview). Those who stated that 'No-one' would influence them were more likely to remain non-attenders amongst both Re-screen groups and the city ER group (but not country ER group).

Attenders in 1995 from these recruitment methods were also followed up in 1997 for re-attendance. Those who attended in 1995 had significantly higher attendance rates in 1997 than the non-attenders amongst all groups. Overall, a higher proportion of Re-screens attended/re-attended in 1995/1997 followed by the ER Invitees then the R1 Re-invitees. Amongst the Re-screen women who attended in 1995, 81% re-attended in 1997 from the city and 87% from the country. Amongst the ER attenders in 1995, 68% re-attended in the city and 77% in the country, while 56% of R1 Re-invite attenders (from the county, no city R1 Re-invite studied) re-attended. This latter group required a second invitation before they attended initially in 1995 whereas the ER group attended in response to the first invitation. Amongst the Re-screens were women who had attended up to four times, most being self-referred initially. Hence, re-attendance rates are related to level of effort required by the SABXRS to recruit, which supports Rogers (1983) thesis in relation to innovators being self motivated information seekers.

From the case-control study, 46% of cases (Round 1 non-attenders) had attended the SABXRS within two years of interview (51% within three years), compared with the 8% to 20% of the Round 1 non-attenders from these samples attending from between 27 to 30 months later. Amongst the Round 1 women who attended in 1995 (analogous to controls from the case-control study) 68% of the Arndale and 77% of the Port Augusta re-attended in 1997. This compares with 83% of the case-control study controls re-attending within two years after interview (88% within three years). These data clearly show variation in stage of readiness both across time and over time, and support the hypothesis that late adopters are more likely to discontinue than early adopters. Also, the early non-attenders from the case-control study were more likely to eventually attend than the later non-attenders from these studies.

It was also found that the specific non-attendance category (reason for not attending) was associated with later attendance. The non-attender categories are *No response* (no contact at all), *Cancelled* (rang to cancel), *Return to Sender* (letter returned) and *Made Appointment* (made an appointment in response to the invitation, but did not keep it). The *Made Appointment* group were more likely to have attended at follow-up, followed by those who *Cancelled.* The other two categories were similarly low (see Chapter 7, Table 7.2.1). Hence, as expected those who made some contact with the Service were more likely to attend. It could be suggested that a reason for the others not attending may be that they were no longer resident at the address on the SABXRS system. However, the proportion who attended at follow-up was no greater for the interviewed *No response* women (hence, those whose address was known) than those not interviewed (a significant proportion of whom could not be contacted due to a change of address).

These samples show that, in general, this population is less innovative and less reliable in carrying out intentions than the case-control subjects, but also that across these samples clear differences emerge at both points in time. The R1 Re-invite non-attenders who remained non-attenders in 1997 would truly fit Rogers' category of 'laggards'; they did not book of their own volition and refused two invitations by early 1995, six years into the Program. More than two years later, at 30 June 1997, only 8% of these women had attended. Most of the electoral roll non-attenders who remained non-attenders in 1997 would also probably be classified as 'laggards'. The ER non-attenders who attended in 1997 would probably be classified as the late majority. ER attenders (in 1995) in their early 50s would probably be labelled as an early majority within their age cohort, since they would not have been targeted by the SABXRS until they turned 50. A proportion of re-screen non-attenders who remained non-attenders would fit Rogers *disenchantment discontinuance* group from the SABXRS perspective, but may have moved to the private sector.

Clearly, the inclusion of this study contributed greatly to the understanding of the various sub-populations who have had some connection with the SABXRS, either directly or indirectly. Apart from showing that populations vary across time, it is also evident that they differ over time. These studies were particularly relevant to Hypotheses 3 to 6.

9.2.4 Community Surveys

The community surveys examined in this thesis were five South Australian Omnibus surveys conducted in the period 1990 to 1995 and two National Health Surveys (NHS) in 1989/90 and 1995. The Ominbus series provides for South Australia an overview of trends in mammography behaviour in this state, both overall rates and the proportions using the official screening program. The National Health Surveys provide overall rates for Australia but no information on where women had their mammograms. These data on rates of mammography are critical in testing Hypothesis 8 on the likelihood of the National Program reaching its target of 70% participation of women aged 50-69 in the Program. This hypothesis will be examined in sections 9.4 and 9.5 in conjunction with new Australian data on patterns of mammography inside and outside the National Program. This section examines Hypothesis 7 about the profile of women receiving mammograms differing between the community and SABXRS clients.

For the first Omnibus and NHS surveys, logistic regression models provided data on independent predictors at the community level for South Australian and Australian women undergoing mammography. These are contrasted below with the independent predictors for the SABXRS sub-populations from the case-control study, all relating to the very early phases of the introduction of mass screening in Australia. Adjusted analyses from community surveys were not performed for later years as data were not available at the required level. However, some mammography variables were collected over time from the Omnibus surveys and these are summarised at the end of the section from the bivariate analyses.

Comparison of predictors of attendance between community samples and SABXRS clients around 1990

Subjects for the case-control study were chosen from women who made contact with the SABXRS themselves or were invited to the Service between March 1990 to March 1991 which straddles the period of the 1990 Omnibus survey (October-December); both represent the early period of screening uptake in South Australia. Although the number of variables that the investigator was able to include in the Omnibus were restricted (due to cost), several of the barrier items (including those which comprised the BARRIER SCORE) were included, as well as some knowledge variables to provide a community comparison.

The NHS and Omnibus surveys were designed as general population health surveys with mammography sections. Non-mammography variables were included to meet other interests, and those selected by the investigator for inclusion in the logistic regression analyses, though informed by the literature, were necessarily restricted. Further, although some variables were common to both studies, other variables considered for inclusion in the models differed. The variables examined in the case-control study models were all drawn specifically from the literature on mammography participation. The purpose of this section is not to make direct comparisons, but to contrast the various models, and determine whether any particular factors were predictors of mammography behaviour early in the Program at all levels (SABXRS, state and national).

The 1989/90 NHS and the 1990 Omnibus survey models for the common dependent variable 'Ever Had Mammogram' were contrasted in Chapter 8, and the significant variables for these two final models presented in Table 8.2.11 for Omnibus and Table 8.3.3 for NHS. None of the common variables remained significant at $P < 0.05$ in both models. The strongest predictor for the Omnibus analysis was having had a doctor suggest a mammogram. Other predictors related to barrier items which were not included in the NHS. The NHS did not include any direct questions relating to a doctor's influence on mammography behaviour. Apart from having heard of a mammogram, which is an obvious prerequisite of having a mammogram, the strongest predictor in the NHS model was having had a breast exam by a doctor. It was suggested in Chapter 8 that this may be a proxy for the influence of a doctor in the decision to have a mammogram, since most mammography at that time would have occurred outside the pilot screening programs and would have required a doctor's referral.

The contrast between the 1990 Omnibus multivariate analysis and the analyses of the case-control study is more pertinent than the comparison of the latter with the NHS due to the greater overlap in variables examined, and the fact that both relate to South Australian women. All questions included in the mammography section of the 1990 Health Omnibus Survey were also asked of subjects included in the case-control study. The strongest predictor of women's attendance to the SABXRS for all four case-control base-line models was stating they would have a screening mammogram on a doctor's recommendation (future influence of a doctor). As mentioned above, the strongest predictor of ever having had a mammogram (anywhere) from the Omnibus analysis was having had a recommendation by a doctor in the past. Although this variable (past recommendation) was also highly predictive in the bivariate analyses for the case-control study, the additional future influence variable was more important; this latter variable was not asked in the Omnibus survey. If the assumption that having had a breast exam by a doctor may be a proxy for a doctor's recommendation for the Australian population (from the NHS) in the absence of direct questioning in this regard, then it is clear that the influence of a doctor in encouraging women to attend for mammography during the early phases was important both for the SABXRS sub-groups and the community in general.

Other important conclusions can also be drawn from comparing the NHS, Omnibus and case-control study models during this early phase. Knowledge about breast cancer and mammography, included in the Omnibus and the case-control analyses (but not the NHS) were not found to predict mammography behaviour. In both the Omnibus survey and the case-control models the strongest predictors, after in the influence of a doctor, related to common barrier factors included in both studies. These showed that women who perceived barriers were less likely to have ever had a mammogram at all for the community population, or to have ever had one at the SABXRS for the case-control populations. For the case-control study, a composite barrier score was included in the final models rather than the individual items, due to small numbers. Models with the individual barrier items were also presented, which had high odds ratios and wide confidence intervals. Nevertheless, the items that had the strongest influence on the barrier score were the same items that were most significant in the community sample ('need symptoms', 'too much trouble', and 'painful'). Women who believed that it was only necessary to have a mammogram if they were symptomatic, that having a mammogram was too much trouble, and that mammography was painful, were less likely to have attended for a mammogram, both at the SABXRS and outside the Program. Another significant barrier in the Omnibus analysis was 'rather not think about it', which implies avoidance or denial. Barrier factors were not available for the NHS analysis.

Other variables, apart from the influence of a doctor and perceived barriers, which showed a consistent association across the case-control study base-line models and found to be significant in more than one model are listed below. Also listed are the models in which the variable was statistically significant and the variable category (shown in brackets) more likely to be associated with non-attendance to the SABXRS.

- lifetime occupation; Spontaneous FTA, GP FTA, GP Cancel (managerial/professional)
- smoking; Spontaneous FTA, GP FTA (smokers)
- dentist; Spontaneous FTA, Spontaneous Cancel, GP FTA (visit only when dental problems)
- cancer most common; Spontaneous Cancel, GP FTA (believe lung cancer most common)

- asked back for tests; all four models (believe being asked back after mammogram means breast cancer)
- access to car; Spontaneous FTA, GP FTA (no access)
- family/friend informed about SABXRS; both GP models (yes).

Of these, smoking and dentist were also significant in the NHS model, showing the same effect. This suggests that taking preventive action in terms of smoking and dental visits predicts mammography behaviour, not only for the general Australian population of women aged 40-64, but also for specific sub-groups associated with the SABXRS. It should also be noted that the smoking variable was an independent predictor only for the FTA cases indicating as previously suggested that the FTA cases more closely resembled the profile of non-attenders from the literature and were thus more like the community non-attenders. The dentist variable was significant in both FTA models and the GP Cancel model but not the Spontaneous Cancel group, the latter being the group least likely to match the profile of non-attenders from the literature.

The dentist variable was not included in the Omnibus survey. Smoking was included, but not found to be an independent predictor. However, it cannot be concluded that the South Australian and Australian communities differ in this regard, nor that the general South Australian population differed from specific South Australian sub-populations represented in the case-control study. As indicated above, none of the models used a common set of variables. Had this occurred then the differences could be interpreted as reflecting differences in population groups being studied. From the 1990 Omnibus survey, only 1.9% of women in the community aged 40-49 and 10.8% of those aged 50-69 had had a mammogram at the SABXRS within the compliance period. A further 18.5% of women aged 40-49 and 12.5% of women aged 50-69 had had a mammogram outside the SABXRS. Given that most mammograms were outside the SABXRS, a doctor's referral would have been required. Therefore it is not surprising that a doctor's influence would override other factors. For the NHS, the doctor variable was not included, nor the barrier items, hence health behaviours were predominant. Apart from smoking and dentist visits, other health behaviours which were significant were doing BSE, having a pap smear, a change of diet (for non-medical reasons) and consuming alcohol. Women who participated in other health preventive behaviours clearly were more likely to also participate in mammography. However, the Omnibus and case-control study analyses show that regardless of their other health behaviours, women who also perceive negative views about mammography will generally not participate in mammography.

Additional information from the NHS model shows that women from the states of New South Wales and Queensland were significantly more likely to have had a mammogram than South Australian women, and the data suggest that the ACT particularly, and also Western Australia, had higher rates. It was suggested that in the early days of mammography the proportion of innovators was higher in other states.

Apart from modelling 'Ever had a mammogram', the 1990 Omnibus analyses also modelled intention to have a mammogram, both in general and with the SABXRS. Intention was found to be most strongly related to having a previous mammogram, not needing a specific prompt (that is happy to have one just as a check-up) and being younger. Thus, although age did not predict 'Ever had a mammogram', it did predict intention to have mammogram in general, as well as specifically to the SABXRS.

Some common themes emerge from the comparison of the models relating to the early phases of mammography. Women who attended were strongly influenced by a doctor, while those who did not attend exhibited strong perceived barriers. Other preventive health behaviours were associated with mammography use. The FTA cases (SABXRS) more closely resembled community non-attenders. Age was not a predictor in any of the models using 'Ever had' as the dependent variable - the base-line case-control study models, the 1990 Omnibus model and 1989/90 NHS model. Yet age predicted later attendance of the case-control subjects (in 1995) as well as future attendance (in 1997) of the 1995 invitee study subjects. It appears therefore that age may not be important in the early phases of mass mammography screening (both inside and outside the program), but the 'late adoptors' or 'laggards' in Rogers terminology (Rogers, 1983) are older women.

Apart from informing on Hypothesis 7, the community surveys also further validated the importance of a doctor's influence in encouraging mammography and demonstrated the effect of perceived barriers in discouraging mammography (Hypotheses 3 and 4).

Profile of participants over time

Variables examined from the five Omnibus surveys provided a general description of community attenders and non-attenders over time. However, the number of variables available was limited, and only descriptive data were presented. The profile of women having mammograms in the community generally supports that predicted from the literature. However, it also appears that the profile from the literature applies more to the early years. For example, within the target age group of 50-69 in 1990, 29% of women 50-59 were compliant participants (as defined in Chapter 8) but only 18% of those aged 60-69, supporting the evidence of higher rates of participation in younger women[1]. In contrast to the 1990 Omnibus, the proportions of compliant women aged 50-59 and 60-69 from the 1995 Omnibus were similar, indicating that more older women were recruited over time, and supporting Rogers' thesis that the late adoptors are likely to be older.

Married women in the community were more likely to participate than non-married women throughout the period. From the case-control study this only applied to the two FTA sub-groups, but neither of the Cancel groups, supporting other indicators that the FTA samples more closely resembled non-attenders from the literature and that the Cancel cases resembled SABXRS attenders in many respects. The literature also suggests that women with higher education are more likely to participate. This pattern is apparent from the Omnibus data, but was more evident in the early years, supporting Rogers' premise that the innovators were more likely to be higher educated. However, as indicated above the reverse was found for SABXRS populations, and it was suggested that the free SABXRS in the early years attracted innovators of a lower socio-economic class. From the Omnibus series, it also appears that

[1] This seems at odds with the finding that age was not a significant predictor in the 1990 Omnibus model. However, the model included women 40 to 64, and the rate for women in their 40s was similar to older women (60+).

non-English speaking women in the target age group have remained lower attenders overall; this also applies to the FTA cases but not Cancel cases from the case-control study.

The health related behaviours of smoking and having a pap test were also related to mammography in the community (as predicted by the literature), and the relationship was maintained over time, particularly for pap test. In 1995, 84% of those who had had a pap test had also had a mammogram but only 56% of those who had not had a pap test. The Omnibus surveys were able to compare women by self reported place of mammogram (SABXRS or other), and, although the smoking and pap test variables show a similar pattern for both, the association is weaker for the comparison of non-attenders with attenders to the SABXRS than non-attenders with community attenders overall. That is, having a pap test and being a non smoker were associated more with having a mammogram per se, and less with having a mammogram in the National Program. As stated above, from the base-line case-control analyses, the smoking variable was significant for the both FTA groups (likened to community non-attenders) but neither Cancel groups. It appears therefore, that that National Program has achieved wider coverage of the population and that the private sector attracts a more select clientele.

9.2.5 Summary

Overall, the conceptual framework for this thesis is supported; mammography behaviour depends on stage of readiness for adoption of the behaviour, which in turn is dependent on personal and environmental factors. Further, areas judged as deficiencies (following the literature review) which this study set out to investigate were found to have been justifiable concerns, particularly the need to focus more on barriers to attendance and the need to study the various sub-groups of non-attenders separately.

A major lesson from this thesis is that the study of participation at an early stage of an organised screening program will not provide the answers for informing recruitment strategies as the program matures. Subjects in the case-control study (both attenders and non-attenders) selected during the early phase of the SABXRS were clearly different from those selected in early 1995. The follow-up of both sets of clients has proven to be extremely beneficial in further understanding the process of adoption of mammography behaviour within the Program. Further, the supplementation with what was occurring outside the program resulted in a comprehensive investigation of the adoption of mammography in South Australia, and to the investigator's knowledge, the most thorough investigation in Australia.

Subjects from the case-control study did not represent the general population of women being targeted. The cases (non-attenders to SABXRS and hence never screened by the Service) were found to have has an extremely high rate of mammography experience; 59.4% of Spontaneous cases and 51.2% of GP cases had had a prior mammogram in the private sector, that is, outside the Program. This was an unexpected finding. From the 1990 Omnibus survey, 28% of women aged 50-69 had ever had a mammogram. Hence, the cases were clearly not representative of the general population at that time. When examined more closely significant differences were found within the case groups. Those who actually rang to cancel their appointment were found to differ from women who simply did not attend on the day, the former resembling the controls (attenders) in many regards.

In Rogers' classification, the controls in the case-control study and those having screening mammograms in the community at that time would be the innovators, women who require little prompting to adopt new behaviours and who seek information themselves, hence responsive to mass media strategies alone. Both Rogers' theory and the Health Belief Model would suggest that innovators are more likely to be higher educated. The case-control study found that professional/managerial women and those on high incomes were more likely to be non-attenders at base-line, and remain non-attenders at follow-up (four years later). Clearly this type of result alone could lead to erroneous policy decisions if not complemented with information on what was occurring outside the program. Overall the proportion of women aged 50 and over with no post-school qualification (71%) was no different for the case-control population than the overall community from the 1990 Omnibus (73%). However, the 1990 Omnibus survey found that higher educated and professional women were more likely to have had a mammogram (in contrast to the case-control study result). Given that in 1990 over half the mammograms in South Australia for women 50-69 were occurring outside the Program, then it is understandable why, for the community sample, mammography behaviour was more likely to fit the model (of innovators being more educated), since a high proportion would have had to pay the difference between the Medicare rebate and the gap for private mammography. In a large population, while the characteristics on average show innovators as higher educated, the range will include women less educated to very highly educated. It appears that the free SABXRS attracted those at the lower end of the scale in those early days. The 1995 Omnibus showed no difference in mammography behaviour by education in the community, which would be the expected result given the mammography had widely been diffused by that time.

From the case-control study it is evident that the cases (non-attenders) are not a homogeneous group. Clearly this group represents all innovator categories as described by Rogers. The fact that half of them had been exposed to mammography outside the SABXRS shows that as a group they were far more innovative than the general community population of non-attenders to mammography. Within the cases were the innovators, who rang the SABXRS to cancel their appointment, giving as their reason that they were to have (or had) a mammogram privately. Some of these women did so because they found the waiting period too long, while others stated that they had symptoms they wanted investigated. A group of cases attended the SABXRS shortly after the interview, before receiving any further direct prompt (for example an invitation letter); these women would be early adopters. Yet another group attended after being prompted by a letter from the Service or after further advertising or obtaining information from some other source. These would be the early majority. Others required additional prompting, but did attend by the end of 1995 (the late majority). However, 39% of the original cases had still not attended by 31/12/95. From the perspective of the Program these women are truly "laggards". However, from the community perspective, they would only be laggards if they were not being screened elsewhere. It is not known whether these women were, or are, being screened (after interview) outside the SABXRS. From their baseline data, 45% had had a mammogram outside the Service prior to the baseline interview. This compares with 62% amongst the cases who did eventually use the SABXRS.

Had this thesis only examined and followed the case-control subjects, it may have been concluded that it would not be difficult to recruit non-attenders. The study of non-attenders from other recruitment methods and from a later time period (1995) contributed greatly to the understanding of the various populations who have had some connection with the SABXRS, either directly or indirectly. The follow-up of both the case-control subjects and the subjects from the non-attender surveys showed that women who are likely to be future laggards can be identified. One way to identify those within the SABXRS clientele is by reason for non-attendance. The case-control study found that those who cancelled were more likely to attend in future than those who failed to attend without notice. From the non-attender study of invitees to the SABXRS in 1995, non-attenders from the category *Made Appointment* (made an appointment in response to the invitation, but did not keep it) were most likely to have attended at follow-up, followed by those who *Cancelled.* Attendance at follow-up by non-attenders from the *No response* (no contact at all) and *Return to Sender* (letter returned) categories were similarly low. These data are readily available to the Program, and suggests that greater effort is required in following up women who do not respond to invitations, who now represent the main outcome of new invitations issued by the Service.

Both the early group of non-attenders to the SABXRS (from the case-control study) and later non-attenders to the SABXRS (drawn from 1995) were shown to be heterogeneous groups. However, the composition at the different points in time varied. Both include women ranging from those who required little further prompting to those who will never have a mammogram, but the proportions vary. The later non-attender group is characterised by more laggards than the earlier sample. As indicated above a far lower proportion of these women attended at follow-up that the non-attenders from the case-control study. The R1 Re-invite group are the most resistant group with only 8% attending at follow-up more than two years later (having previously received two personalised invitations from the SABXRS prior to interview). In the city only 11% of electoral roll invitees (sent one personalised invitation from the SABXRS prior to interview) had attended at follow-up compared with 20% of the country electoral roll non-attenders. This contrasts with 46% of the cases from the case-control study attending within two years.

It could be argued that part of the difference may be explained by the different recruitment methods being studied in the two sets of SABXRS studies rather than a time difference; non-attenders from a GP invitation or Spontaneous appointment for the case-control study versus electoral roll for the later non-attender studies. The case-control study follow-up found no difference in later attendance by the initial recruitment method (Spontaneous or GP). A comparison between GP non-attenders and electoral roll non-attenders cannot be made as the SABXRS stopped using the GP recruitment method after 1991. It is not known for certain whether new clients recruited by this method now would be less responsive than the early GP clients, but it is suggested that this would be the situation. Given the generally high rates of screening overall, those left to be recruited would have to be labelled as 'laggards' given that they had not attended after years of exposure to a range of recruitment strategies. The GP method may yield higher response rates than the electoral roll, though not as high as the early rates obtained in South Australia of 69% (Dorsch *et al.*, 1991). Chapter 1, section 1.5 presented the results of other studies on GP recruitment in Australia, showing that recruitment rates from other states in Australia were far lower than this; 41% in Melbourne, Victoria (Cockburn *et al.*, 1990) and 32% in Sydney, New South Wales (Irwig *et al.*, 1990). A key factor which is likely to have inflated the

Adelaide result is that the study was not randomised and represented a group of GP practices generally supportive of the SABXRS at the time, while those from the interstate studies drew representative samples of GPs. However, the differences may also partly be due to differences in the populations, women in the smaller city of Adelaide being more responsive than women from the large cities of Melbourne and Sydney. More recently reported results of recruitment intervention trials in rural communities of New South Wales found higher participation rates to GP involvement than the earlier Sydney study (Clover *et al.*, 1996). This more recent study reported that a rural town which received family physician involvement obtained an attendance rate of 68% compared with 51% for a matched town which received community participation intervention. In the same study, two other towns which received mass media promotion both achieved attendance rates of 34% compared with the rates for two matched towns (63% and 51%) which received community participation as the intervention.

It was suggested above that it is not known whether the higher attendance rate from the early GP invitations to the SABXRS compared with the later electoral roll invitations was due to recruitment method or time difference. The early interstate studies mentioned above in Melbourne and Sydney also compared the response to GP invitations with direct invitations from the screening service. Both studies found similar recruitment rates (see Chapter 1, 1.5). This suggests that the difference in the Adelaide rates may relate more to time. It is suggested therefore that had the Service continued to utilise the GP recruitment method the response would have dropped over time, though perhaps not to the extent it fell for the electoral roll invitations. Another factor which would have led to a high response rate for the early GP invitations was that a specific appointment time was given to the woman in the letter. This would not have been sustainable for the Service. The study by Hurley *et al.*, (1992) reported in Chapter 1 (section 1.5) found that a personalised invitation with a specified appointment time achieved the highest attendance rate (44%), but was the most expensive at a cost of \$19.99 per woman recruited, compared with a personalised invitation without an appointment time followed by a reminder letter (36% attendance and \$10.52). Hence, viewed from the perspective of cost-effectiveness and not just effectiveness, the clear decision would be not to use invitations with specific appointment times. Yet too often the issue of cost is ignored to the detriment of overall health benefits. For example, based on the results of a study in Israel which showed that compliance increased threefold from baseline using a letter with a specified time, the particular program "decided to implement…..(*this method*)…..on a regular basis" (Ore *et al.*, 1997).

The profile of women participating in mammography overall from the community surveys also showed a change over time. While the profile supports that predicted from the literature, the association appears weaker over time. This could not be tested to any great extent due to the lack of data. However, it appears that by 1995 the 'laggards' in the community more closely resembled the 'laggards' from the case-control and non-attender studies. Most women in the community who had not been screened by the SABXRS knew about the Service and a significant proportion in the target age group even recalled receiving an invitation from the SABXRS which they rejected (from the 1995 Omnibus). For those where a reason was available, perceptions of barriers dominated. It is therefore suggested that at this phase of the Program attention needs to be focussed on barriers for both rejecters of the National Program and general non-attenders in the community.

A recent Australian study by Cockburn *et al.*, (1997b) reported predictors of attendance at a relocatable mammography service for rural women in Victoria, Australia using a cohort design. The sample (women aged 50-69 who had not had mammogram in the 6 months prior to interview) was interviewed two weeks prior to the service opening and following a recruitment campaign which included generalised strategies and a personalised letter of invitation to women aged 50-69 on the electoral roll (not previously screened in the program). Independent predictors of attendance were not having a prior mammogram, higher perceived risk of breast cancer, stated intention to attend, knowing the location of the service and lower education. The finding that a prior history of mammography was negatively associated with use of the service shows that a high proportion had been screened outside the Program. However, it does not necessarily imply that these women would not join the Program in future. This study was conducted in 1995 by which time mammography was well established in Australia. As indicated elsewhere, the Victorian Program was behind that of South Australia and some other states in providing a service, especially to rural women. Women who had had a mammogram in the previous 6 months were excluded from the survey, but those who had had a mammogram prior to this (and included in the survey) may have been excluded from screening by the Program. In South Australia, the Program allows women screened at 6 months or more to join the mobile when it first visits to enable them to switch to the Program, but it is not known what the Victorian policy is in this regard. The finding regarding lower education is in accordance with the various studies in this thesis of women attending the South Australian Program. This study also corroborates the finding in this thesis that intention predicts action.

9.3 REVIEW OF RECENT LITERATURE ON PARTICIPATION IN MAMMAGRAPHY

9.3.1 Introduction

The following summarises some recent additional literature relevant to this thesis. Since mammography has been, and still is, an expanding field in terms of the literature, it was not feasible to update continually throughout this research. However, the investigator continued to search and read the literature throughout. In general the conclusions drawn following the in-depth literature review in 1995 (Chapter 1) still stand, and the limitations found in this research are also being reported internationally.

Given the volume of new literature, only key recent studies are referred below which have particular relevance to the underlying framework of this thesis and to strategies for increasing participation. Recognition of the need for multifaceted and specifically targeted recruitment strategies is reflected in the recent literature with more research on particular groups, most based on versions of the expanded HBM, and recently a greater focus on the Transtheoretical Model. Particular groups studied in the US have been African American, Hispanic, low-income, inner city, rural, older, and so on, either singly or in combination, for example: low-income inner-city women using a public hospital testing the expanded theory of reasoned action (Montano *et al.*, 1997); older low-income Mexican-American women (Suarez *et al.*, 1997). The former study concluded that multiple methods are required to deliver targeted messages and the latter that that wide-scale cancer screening interventions consistent with the beliefs of the specific population are needed. Essentially, despite an explosion of studies in mammography participation, researchers are still advocating that further research is required in this difficult and emotionally charged area.

9.3.2 Theoretical framework

Since the initial literature review for this thesis the focus of behavioural research has been on the Transtheoretical Model of behaviour change, and this has been showing some promising results. However, it is also apparent that with mammography screening, no single model or theory has yet to encompass all aspects of behaviour.

Stoddard, *et al.*, (1998) model stage of adoption based on the Transtheoretical Model (TTM) across a sample of over 11,000 women in the US on a range of variables, including those comprising a 'pro' scale (positive attitudes to screening) and 'con' scale (negative attitudes), demographic characteristics, type of health insurance, having a clinical breast exam (CBE) and having a mammogram recommended by a doctor. Stage of adoption was based on past and intended use of mammography, and the five TTM stages collapsed to three; precontemplation/relapse, contemplation, action/relapse risk[2]. Independent predictors of being in contemplation versus precontemplation/relapse were being younger, having had a mammogram recommended, greater perception of pros and lower perception of cons. Independent predictors of being in action versus contemplation were being older, having had a mammogram recommended, lower perception of cons (perception of pros not associated) and having a recent CBE. This study shows that while barriers are important for all groups of non-attenders (precontemplation/relapse/contemplation), the pros were only important in distinguishing precontemplation/relapse women from those in contemplation.

Another study which analysed mammography use by stage of adoption, categorised as precontemplation, contemplation and action, focused on older women (average age 72.5 years), and particularly older African American women (Skinner *et al.*, 1998). Independent predictors of stage were lower barriers, having a doctor/nurse recommend mammography, receiving regular medical care and age < 75. It found that knowledge was associated with contemplation, but barriers affect whether contemplation leads to action, and concluded that interventions for older women should combine provider recommendation with barrier-reducing interventions. This conclusion, which is also supported by this thesis, persists both over time and for all population groups whether they be defined by age, race or culture.

An earlier US study examined change in the "decisional balance" component over a one year period (Pearlman *et al.*, 1997). It reported that a shift toward less favourable perceptions about mammography was related to being a smoker and not having a recent clinical breast exam and pap test. Less favourable attitudes also related to the following dimensions of a woman's information

2 The precontemplation group had never had a mammogram and had no intention, the relapse group had had one but not in the last 24 months and did not intend having another in the next year or two, the contemplation group had not had one in the last 24 months but intended to in the next year or two, the action group had one in the past 24 months and intend having another in the next year or two, and the relapse risk group had one in the last 24 months but did not intend having another in the next year or two.

environment; rating a doctor's opinion as somewhat or not important, having at least one family member or friend discourage them, lacking enough people in their social network with whom they could discuss health concerns. These dimensions were included as part of the Influence construct in this thesis.

A doctor's recommendation continues to show the strongest association with mammography use, even for women faced with conflicting recommendations for mammography screening, as reported by Taplin *et al.*, (1997). This study found that women who did not recall being advised to have a screening mammogram were 71% less likely to receive one than those who reporting that their physician did recommend it (controlling for conflicting advice and other factors).

A study which utilised longitudinal data on screening behaviour, supplemented with questionnaire data, analysed the relationship between past behaviour, determinants, intention and future participation in the Netherlands screening program (Lechner *et al.*, 1997). The questionnaire was based on the ASE (attitude-social influence-efficacy) model which suggests that intention is the best predictor of behaviour. Participants and non-participants to the second screening round differed in ASE determinants, and past behaviour and intentions independently predicted participation in the second round. Self-efficacy (belief in ability to perform the behaviour) proved to be the best predictor of intention for previous participants (to the first round), whereas anticipated regret (feeling that would regret not attending if cancer detected at a later date) was the best predictor of intention to participate in the second round for non-participants to the first round. The implications of this research are that the service must ensure that as few barriers as possible are encountered at the first screen and that health education messages need to be tailored for different groups. Similar conclusions were drawn from this thesis. The studies selected below offer strategies that have been tested in the recent literature.

9.3.3 Strategies to Target Specific Groups

A study by Zabora *et al.*, (1997) related to uninsured/underinsured women entering a free, state-funded mammography screening service. The following strategies were employed (developed following a survey to identify risk factors) to increase compliance to rescreening; a reminder telephone call on the day before the appointment, reimbursement of travel expenses for women without transport, provision of child care facilities and flexibility (for example, being amenable to arranging "spur-of-the-moment" mammograms).

A randomised study targeting low-income inner city women in New York who had not had a mammogram in at least two years, found that the intervention group were nearly three times as likely to obtain a mammogram (Weber and Reilly, 1997). The intervention comprised a follow-up letter in simple English and Spanish followed by case-management comprising telephone calls, home visits and mail-outs to identify and remove barriers. Cost-effectiveness was also calculated on the basis of the incremental cost of the intervention per estimated year of life saved. This study emphasises the need to consider a range of strategies and to include a cost-effectiveness analysis.

Another randomised intervention by Grady *et al.*, (1997) tested three techniques to increase referrals by physicians; education only (controls), education plus cue using mammography chart stickers, and education plus cue plus feedback and token rewards. The study involved 61 small community based practices and examined the referrals, completions and compliance of nearly 12,000 women aged 50 years and over through chart audits. Referral and completion rates increased in all three groups, but at a higher rate in the two intervention groups (but with no significant difference between the two intervention groups). For compliance, there was an increase only in the two intervention groups. It was concluded that the chart stickers were an effective way to target large numbers of older women in small community practices.

A study by Janz *et al.*, (1997) reported a mammography screening intervention for older women (65 and older). The intervention group were sent a physician letter (with coupon incentive) followed by a call from a trained peer counsellor (based on HBM dimensions of susceptibility, benefits and barriers). Over the 12 month trial 38% of the intervention group obtained a mammogram compared with 16% of the controls. Counsellors were retired health workers of similar age to subjects and calls averaged 5.2 minutes. The independent effect of the call was not assessed.

A small (N=202) study in the US found that reminder letters from a HMO were relatively ineffective; although 72% of women remembered receiving them, only 5% responded to the recommendations in the letter. It was suggested that strategies which target the referral behaviour of physicians would have a greater impact (Simon *et al.*, 1998). A meta-analysis of the effect of mailed patient reminders on mammography screening in the US concluded that they were effective in increasing screening, but that their cost-effectiveness and effectiveness across different groups (race, education, income and type of insurance) need to be assessed (Todd and Wagner, 1998). This study included 16 published randomised controlled trials using mailed reminders, 11 US studies and four outside the US. It was found that studies conducted outside the US had a "dramatically greater success rate". Three of the external studies were Australian studies reported in this thesis: Irwig*et al.*, 1990; Turnbull *et al.*, 1991; and, Hurley *et al.*, 1992.

An issue often raised in relation to mammography screening is that of the psychological side effects and the extent to which women should be pursued to adopt mammography behaviour. A trial in the Netherlands compared false positives with matched normal mammography cases from the screening program over a 12 month period, and both with a random reference group of non-screened women (Scaf-Klomp *et al.*, 1997). Face-to-face interviews were conducted at 8-10 weeks after screening and at 6 months after the first interview. Psychological status measured mood (distress, depression, anxiety), somatisation (somatic symptoms, loss of appetite, sleep disturbances) and cancer variables (fear of cancer, breast cancer worries, frequency of BSE). At 8-10 weeks the false positives scored higher on variables indicating psychological disfunctioning than women with normal mammograms, but did not differ from the reference group. Women with normal mammograms had the lowest scores. The same pattern persisted at 6 months. The conclusion drawn was that the negative group showed signs of relief rather than the false positives showing distress, and that overall screening did not generate adverse psychological effects. This result suggests that other studies which compared false positives with negatives only would draw the wrong conclusion. Some possible biases are discussed. An earlier Australian study (Cockburn *et al.*, 1994b) had also included a community control group but measured psychological functioning (emotional, social and physical) more frequently. Normal mammography cases were measured at screen, before receiving the results, one week after receiving the results and at eight months. False positives were measured at the same points but with an additional measure at the recall clinic (to investigate abnormality). The control group were measured at one, two and three weeks and at eight months. No differences were found at any points between the normal mammography group and controls, but the false positives differed significantly in emotional and physical dysfunction at recall and one week after notification. However the difference disappeared by either months, suggesting that the Scaf-Klomp *et al.*, (1997) study may have missed the possible immediate effect by not measuring earlier.

In summary, the recent literature has been increasingly focusing on specific strategies to target specific subgroups and particularly to barriers to attendance, and recommends further research is still required in this regard. The premise on which this thesis was based was sound and the Hypotheses just as relevant today as when they were defined a number of years ago. The various studies in this thesis did not provide all the answers and raised many questions. However, internationally researchers are still grappling with similar issues.

9.4 PARTICIPATION IN MAMMOGRAPHY: SOUTH AUSTRALIA AND AUSTRALIA

9.4.1 Introduction

This section reviews participation in mammography in South Australia and Australia from 1989/90 during the pilot phase of the National Program to its maturity. The focus here is to bring together data on participation rates from a range of sources, partly addressing Hypothesis 8 on the level of mammography in and out of the Program. This is required as a precursor to appraising the Hypothesis 8, and ultimately the aim of this thesis - the implications of the level and pattern of mammography on the ability of the Program to achieve the goal of screening 70% of women aged 50-69 within the program, which is addressed in the next section (9.5).

Section 9.4.2 describes overall mammography rates and the breakdown by purpose of mammography (screening or diagnostic) while section 9.4.3 describes the pattern of mammography use within and outside the National Program, introducing data from a new national survey. Section 9.4.4 summarises participation rates as reported by the National Program.

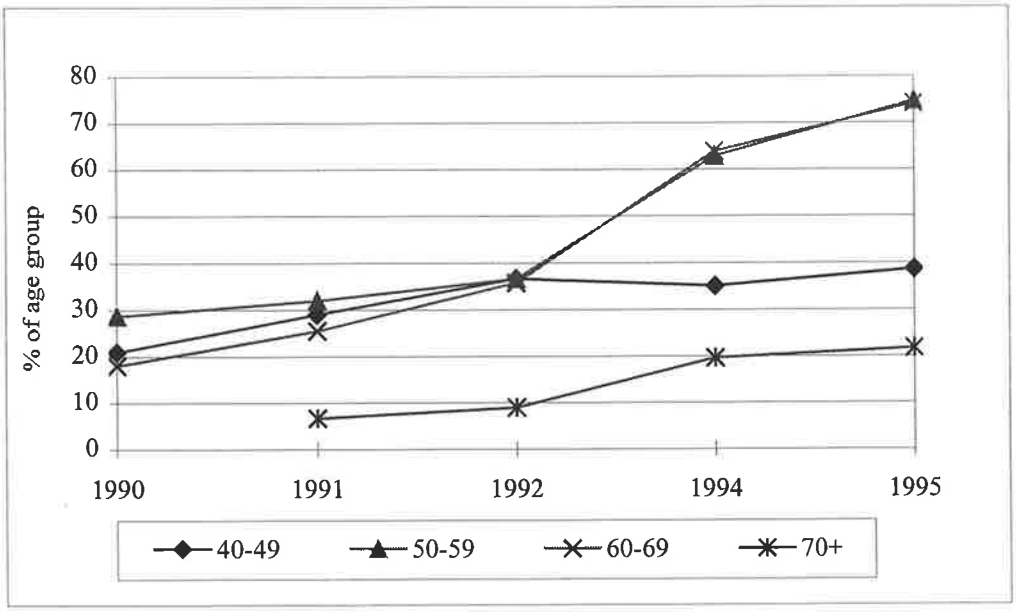
The main source of information on trends in mammography use in South Australia, including information on whether mammography occurred within (IN) or outside (OUT) the National Program, was the five Omnibus surveys conducted over the period 1990 to 1995. In reporting these surveys in Chapter 8, participation was examined using the National Program's definition of a compliant participant (last mammogram within 27 months). This was approximated by counting mammograms in the year of the survey or the previous 2 years, which is the method used by the National Program for determining compliance to the guidelines for new recruits, since for these women compliance is determined by self report on entry into the program (by asking if and when they had their last mammogram). For comparative Australian rates the two National Health Surveys (1989/90 and 1995) were used. These collected the time of the last mammogram at yearly intervals, hence data were presented for both the last two years and three years in Chapter 8. The NHS did not collect information on whether the last mammogram was IN or OUT of the Program.

Recently published data from a national survey (Barratt *et al.*, 1997) which will be referred to below provides the breakdown of mammography IN or OUT of the National Program for Australia. This study reported the rates of mammography in exactly the last two years. To provide a direct comparison between the Barratt *et al.*, (1997) and the Omnibus rates, the investigator re-examined the Omnibus data with the view to calculating period to last mammogram in exactly the last two years. However, it was found that 20% of cases who had had a mammogram had recorded the year but not the month of last mammogram. Estimates based only on cases with complete data with regard to mammography behaviour (whether had a mammogram, and if so, month and year of last mammogram) are not valid since the chance of having missing data was skewed (missing data (month) only occurs in the group who had had a mammogram). This would have provided an underestimate of rate of mammography in the population in the last 2 years. One method of adjustment would be to reduce the 'no mammography' group by the proportion of missing cases in the 'had mammography group' providing a proportionally reduced overall denominator. This method provided an estimate for 1995 close to that for "compliant participant" used in Chapter 8. Given that the focus of this section is on the most recent Omnibus, the rates in Chapter 8 for "compliant participants" are used as estimates for two year mammography. There is no obvious advantage in using alternatives given that all options have deficiencies and that chosen appears a reasonable estimate for comparative purposes.

9.4.2 Mammography rates in South Australia and Australia; overall and screening versus diagnostic

From the Omnibus surveys conducted over the period 1990 to 1995, it was reported that the use of mammography overall (ever had a mammogram) in the target population increased from 28% in 1990 to 82% in 1995 in South Australia. Figure 9.4.1 shows the trend over time in the proportion of compliant participants in South Australia by age group from the Omnibus surveys. For the target population the proportion rose from 23.3% in 1990 to 74.4% in 1995. It can be seen that the increase for women in their 40s levelled off after 1992 while there has been a slow but steady increase for women over 70. However, for women in their 50s and 60s there was a sharp increase from 1992, corresponding to the expansion of the SABXRS. This figure also shows that those who accessed mammography at an early stage (the innovators) were more likely to be younger. These data relate to all mammograms, both with the SABXRS and externally. Before October 1991 women in their 40s were not accepted by the SABXRS, hence all or almost all women in their 40s would have had an external mammogram. Despite discouragement from the formal screening program, the proportion of women in their 40s who had had a mammogram in 1991 was higher than that of women in their 60s.

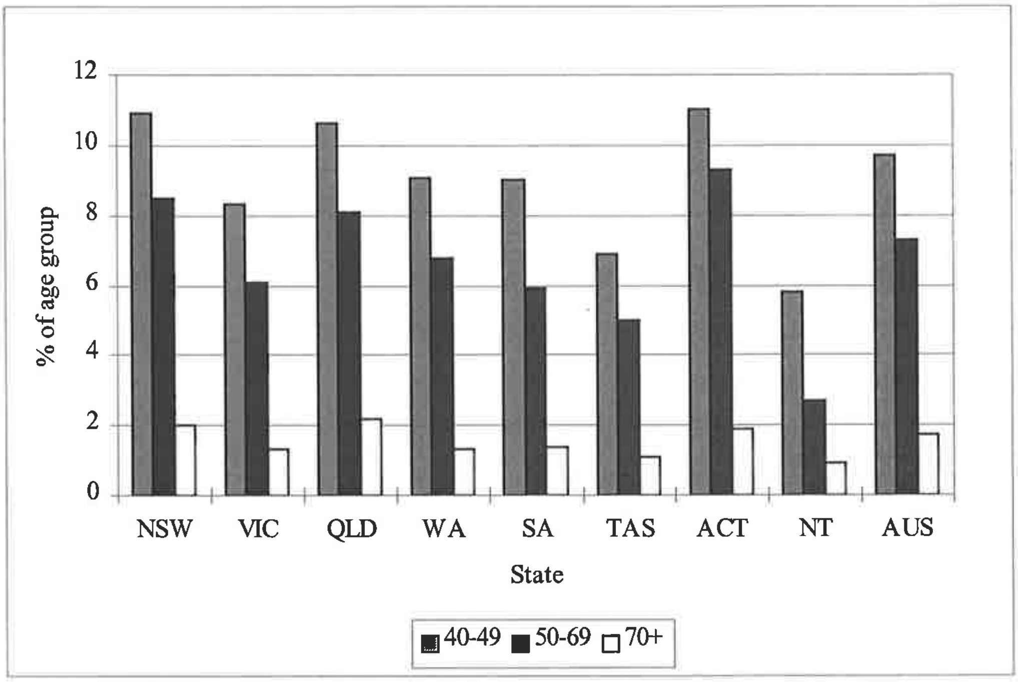
Figure 9.4.1 Omnibus Surveys: Compliant participants, South Australia



Data from National Health Surveys (NHS) allow comparison between South Australia and Australia. Data for mammography in the last 2 years were not available for the 1989/90 NHS (period collected as< 1 year, 1-3years, 3-5 years and 5+years), therefore only the rates for *ever* had a mammogram will be compared. At that time mammography rates were relatively low and few women would have had had a mammogram more than 3 years previously. For women aged 40-49, 22% had ever had a mammogram in South Australia in 1989/90 compared with 30% for Australia. The corresponding figures for women aged 50-64 (data not collected for women aged 65 and over) were 28% and 30%. Although the differences are not large, it appears that younger women in other states were even more likely to be 'innovators' than in South Australia.

From the 1989/90 NHS model for Australia summarised above, it was found that women from the states of New South Wales and Queensland were significantly (statistically) more likely to have had a mammogram than women from South Australia, with those from the Australian Capital Territory and Western Australia also showing higher rates. However, the specific rates by state from that survey were not available. Given that much of the mammography occurred outside official screening programs at that time, data on Medicare claims for bilateral mammography for 1989/90 provide a good indication of trends in mammography at that time. These are presented in Figure 9.4.2 which shows the proportion of women by age group making claims in 1989/90 for each state.

Figure 9.4.2 Medicare Claims for Bilateral Mammography by State/Territory and Australia, 1989/90



Source: Medicare Estimates Statistics Section, Commonwealth Department of Human services and Health, 1994.

For women in their 40s, New South Wales, Queensland and the Australian Capital Territory were higher than South Australia, while Western Australia was about the same. For women aged 50-69 all states were higher than South Australia except Tasmania and the Northern Territory. At that time pilot mammography screening programs were established in South Australia (statewide program), Victoria (one local program), New South Wales (three local programs), Queensland (three local programs), Western Australia (two local programs). It can be seen that the level of Medicare claims was related to the number of pilot screening programs, suggesting that the promotion of mammography by these programs also encouraged an increase in mammography through the Medicare system. The only state that differs in this regard is the Australian Capital Territory (ACT) where the level of mammography through Medicare is the highest for both women 40-49 and 50-69 despite having no pilot program. It is suggested that women in the ACT would most closely fit the criteria of innovators as described by Rogers (more educated information seekers) and the mammography literature which suggests those who require little prompting would be younger and more educated. From Table 9.4.1 it can be seen that women in the ACT were younger and more higher educated than women from other states. The Northern Territory (NT) which also has a young population (but only half the proportion of highly educated females of the ACT) has low rates of mammography. Part of the explanation for a low rate in the NT was simply one of access (there were no mammography facilities in the Territory at the time), but it could be suggested that the NT women would have been less innovative in any case. It should be noted that the NT has a higher rate of educated women than SA reflecting underlying age differences (that is, the data are not age adjusted).

Table 9.4.1 Age and Qualifications by State: 1991 Census

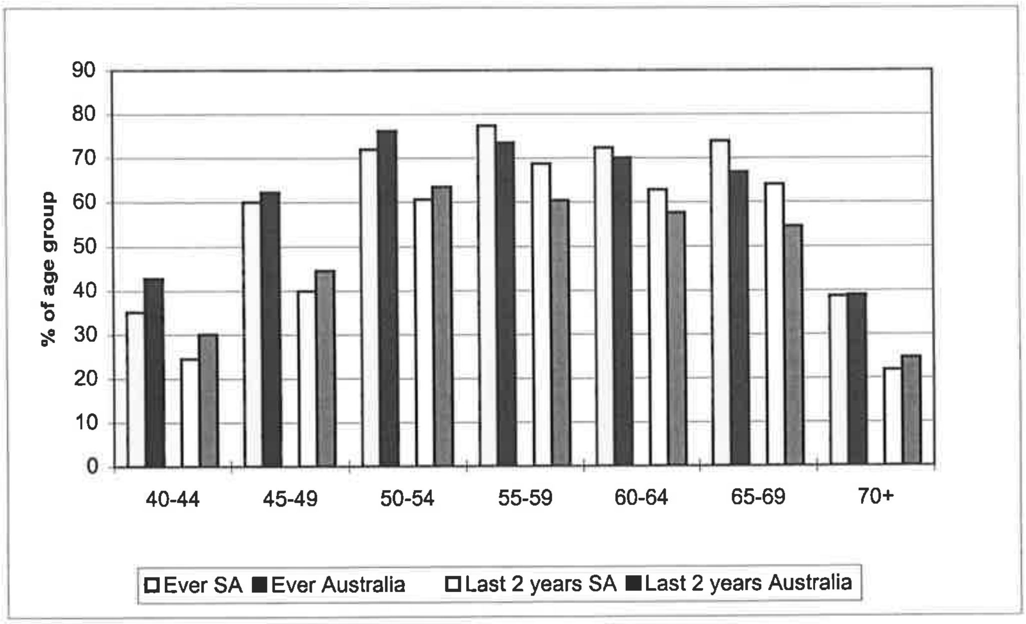
	STATE							
	SA	Tas	Qld	NSW	Vic	WA	NT	ACT
Age [1]	32.2	33.3	33.8	32.6	33.9	36.1	46.3	46.1
Qualifications [2]	5.5	5.6	5.5	6.9	7.7	6.4	7.5	15.1

[1] Women aged 40-49 as % of women 40+
[2] Women with Bachelor Degree or higher as % of all women
SA, South Australia; Tas, Tasmania; Qld, Queensland; NSW, New South Wales; WA, Western Australia; NT, Northern Territory; ACT, Australian Capital Territory.

The 1989/90 NHS provides an overview of mammography during the early phase of the promotion of mass screening in Australia, when it was being promoted by each of the state pilot programs but not nationally. The 1995 NHS provides an overview five years later, when the National Program was in its fifth year and in its seventh in South Australia. From Chapter 8, it was seen that for *ever* had a mammogram, South Australia maintained a lower rate for women aged 40-49 (48%) than Australia (52%), and for women 50-64 (the age group available from the 1989/90 NHS) the rate for South Australia and Australia was the same at 73%. For women 50-69 the rates were 74% for South Australia and 72 % for Australia.

Basically for ever had a mammogram, by 1995, South Australia was on par with Australia, based on the NHS results. However, the proportion of women aged 50-69 who had had a recent mammogram (in the last two years) was higher for South Australia (64%) than Australia (59%). Figure 9.4.3 shows mammography rates for 'Ever had' and 'Had in last 2 years' for South Australia and Australia by five year age groups from the 1995 NHS.

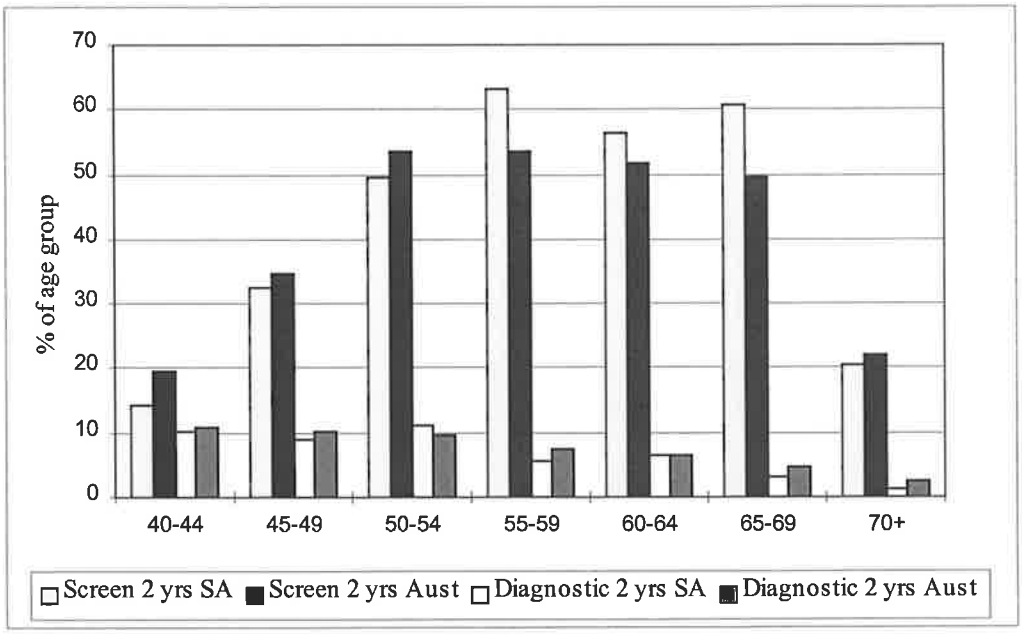
Figure 9.4.3 1995 National Health Survey: Mammography rates (Ever and Last 2 years)



Not only was South Australia ahead of Australia overall (which includes SA) in the proportion of women having a recent mammogram, but it was also more successful in focusing on the target population. For women aged 40-49, Australia had higher proportions than South Australia both for 'Ever had' a mammogram and 'Had in the last 2 years', with the difference being greater for recent mammography. This difference is likely to be related to the policy at the SABXRS of informing women in their 40s that the efficacy of mammography was equivocal for women under 50. For women aged 50-54 the same pattern is evident, but the difference is less for recent mammography. This age group includes women who, when they had their last mammogram, would have been aged less than 50. A similar pattern is seen for women aged 70 years and over for recent mammography. Again this is likely to be related to SABXRS policy, where women in this age group were not sent a invitation for re-screening. However for women clearly in the target age group, those aged 55 to 69, the bars in the graph are reversed for mammography in the last 2 years.

The above relates to all mammography, both diagnostic and screening. The 1989/90 NHS did not collect data on reason for last mammogram. A comparison between South Australia and Australian on reason (diagnostic or screening) from the 1995 NHS is presented in Figure 9.4.4.

Figure 9.4.4 1995 National Health Survey: Screening and Diagnostic Mammography in the Last 2 Years



The pattern is similar to that seen in the previous figure. In 1995 South Australia was ahead of Australia in the proportion of women having a recent *screening* mammogram in the target age group. The pattern for women 50-54 includes both women within and outside the target age range, but for those clearly in the target age group in the last two years (55-69) South Australia has a higher proportion having a screening mammogram and a lower proportion stating they had a diagnostic mammogram. However, for both younger women (40-49) and older women (70 and over) Australia has higher screening as well as diagnostic mammography rates than South Australia. It would be expected that the proportion of diagnostic mammography across the states should be similar. In the last chapter it was suggested that the true underlying rates probably do not differ, but relate to whether mammograms were occurring inside or outside the National Program.

Trends over time, in the level of diagnostic and screening mammography are available for South Australia (from the Omnibus surveys), but not for Australia. These data were presented in Chapter 8 (Table 8.2.3) for compliant participants, and show that the level of reported 'diagnostic' mammography for women aged 50-69 has remained steady over time from 1990 (6.1%) through to 1995 (6.6%) in South Australia. Over the same period, the level of reported screening mammography increased from 17.2 in 1990 to 67.8 in 1995 for women aged 50-69. Diagnostic levels also remained steady for the other age groups.

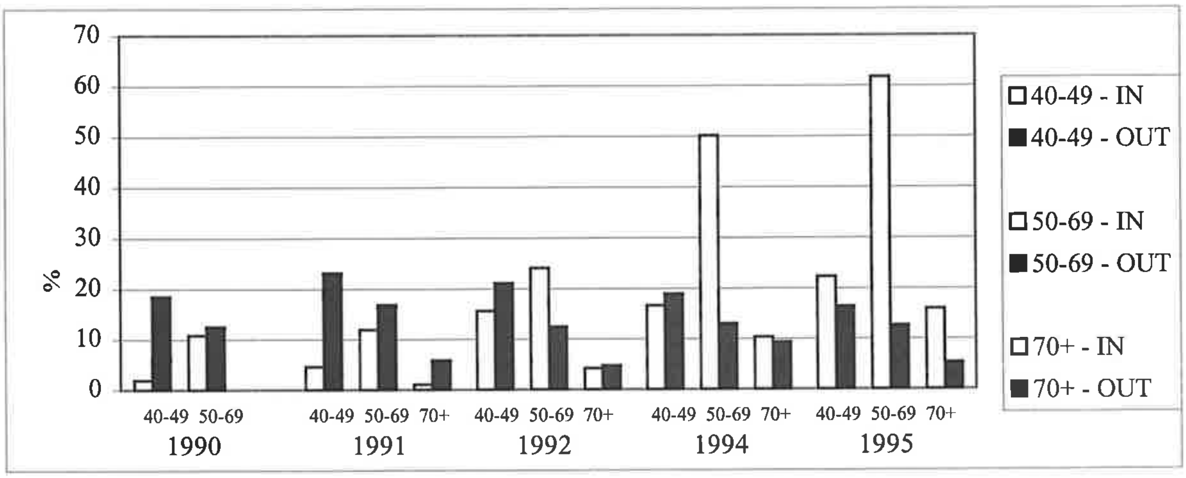
The 1995 South Australian rates of diagnostic and screening mammography from the Omnibus can now be compared with Australian rates from the recently reported National Breast Health Survey (NBHS) commissioned by the National Breast Cancer (Barratt, et al., 1997). The NBHS was conducted in April 1996 and interviewed 2,935 English-speaking women aged 30-69 around Australia by telephone. This study reported that 83.4% of women aged 50-69 had ever had a mammogram. This compares with 81.6% in South Australia from the 1995 Omnibus survey conducted between four and six months prior to the NBHS. The NBHS survey also reported that 70% of women aged 50-69 had *ever* had a *screening mammogram*, and that approximately 60% of women aged 50-69 had a *screening mammogram in the last two years*. The comparable figures for South Australia from the 1995 Omnibus survey are 72.7% ever having a screening mammogram and 67.8% in the 'last two years' (as approximated from compliant participants). Hence, given that the South Australian data relate to an earlier period, though only a few months, this suggests South Australia was still ahead of the other states in 1996 in the proportions having a recent screening mammogram.

Overall, by 1995/96, Australian women had accepted and adopted screening mammography, although it was also evident that the goal of screening 70% of women aged 50-69 at the recommended interval by year five (mid 1996) was not achieved. South Australia had a higher proportion screened overall than Australia for women in the target age group, and the difference was greater for recent mammography. Overall, about 65% of South Australian women reported a screening mammogram in the last 2 years by the end of 1995, not far off the 70% target. However, the target relates to screening mammograms in the Program, whereas the data presented in this section relate to all screens. The success of the Program depends on the level of mammography, and more specifically, screening mammography within the Program. The ability to achieve the Program's target will be affected by the level of screening outside the National Program. This is examined in the next section.

9.4.3 Mammography Rates IN or OUT of the National Program - South Australia versus Australia

The case-control study reported in Part II of this thesis, found that a high proportion of cases (non-attenders) had had a mammogram outside the Service, and it was suggested that a high level of 'pseudo' screening was occurring amongst women having mammography at that time (1990/91). While the Omnibus surveys collected information on whether women received mammography inside and outside the Program, the NHS did not. Therefore trends over time are only available for South Australia. Figure 9.4.5 presents the trend for mammography IN and OUT of the Program (that is, the SABXRS) for South Australia from the Omnibus surveys.

Figure 9.4.5 Omnibus Surveys: Complaint participants screened IN or OUT of program

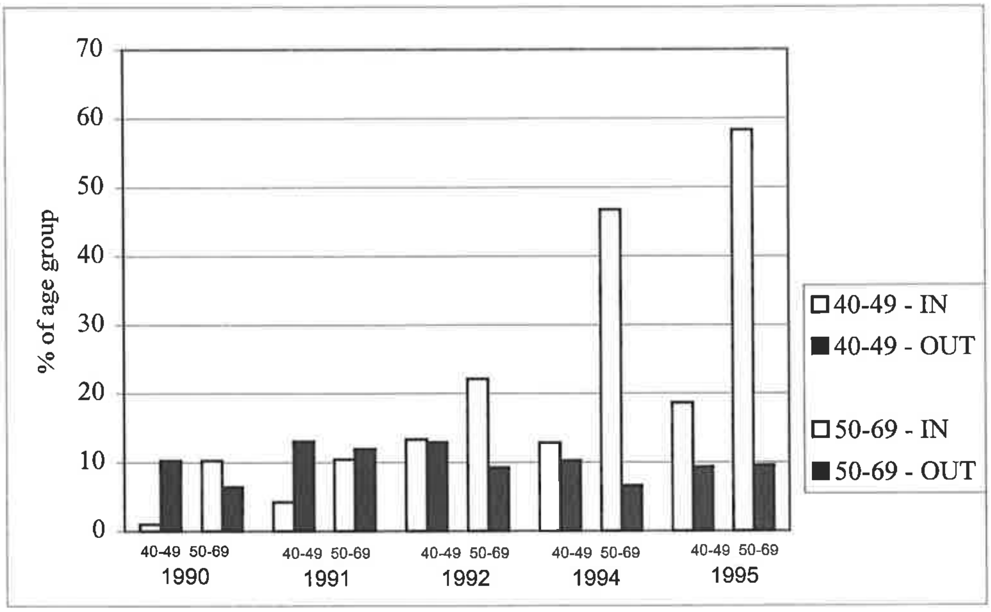


In 1990, a lower proportion of women in the target age group in South Australia had had a recent mammogram IN the Program (10.8%) than OUT of the Program (12.5%). However, by 1995, 61.7% of women had had a recent mammogram at the SABXRS and a further 12.6% OUT of the Program. In 1990 and 1991 the capacity of the SABXRS for new recruits was limited; in fact in the latter half of 1991 the Service had a long waiting list of potential new recruits as the available capacity was increasingly required for women due for re-screen. It can be seen that during the period of limited access to the Service, more women in the target population had mammograms outside the SABXRS than within for both 1990 and 1991. Further, the exclusion of younger women by the formal screening program in South Australia was clearly not a barrier to access to mammography generally. The SABXRS recruitment strategies at the time (including the general media, pamphlets, talks, letter drops, and GP invitations) only targeted women aged 50 and over. Yet it can be seen that without any media or other promotion by the SABXRS, women in their 40s were actively participating in mammography. This indicates that younger women are more likely to be innovators, and more likely to seek information themselves as suggested by Rogers (1983). This is further supported by the data presented in the previous chapter showing a higher proportion of Medicare claims for bilateral mammography, and a higher rate of growth, in younger women (Chapter 8, Figures 8.3.1 and 8.3.2) prior to the implementation of the National Program.

Women who attended the SABXRS in 1992 when the capacity of the Service expanded considerably within a short period of time, and the Service began extensive recruitment campaigns, would be classified as the early adoptors. The Omnibus series excludes 1993, but it can be seen from Figure 9.4.5 that by 1994 most women in the target age group had their mammogram at the SABXRS. New participants from 1994 would be considered the late majority since they waited until mammography was quite entrenched.

Figure 9.4.6 presents the same breakdown by age and whether IN or OUT of the Program for screening mammograms in the last two years. Women aged 70 and over were excluded from this graph due to small numbers. It can be seen that the proportion having a recent screening mammogram OUT of the Program remained reasonably constant over the period for both women in their 40s and those in the target age group. The proportion of women in the target age group having a recent screening mammogram IN the Program (SABXRS) in 1990 was 10.2% rising to 58.3% in 1995, with a further 6.4% having a screening mammogram OUT of the program in 1990 and 9.5% in 1995.

Figure 9.4.6 Omnibus surveys: Screening mammography in last 2 years by IN or OUT of program



As mentioned above, comparable national data are not available from the NHS. The National Breast Health Survey (NBHS) provides a breakdown by IN or OUT of the National Program for Australia for 1996 (Barratt, et al., 1997), which can be compared with the 1995 Omnibus. For all Australian women aged 50-69, the NBHS reported that 50% had had a screening mammogram IN the National Program in the last two years and 10% OUT of the Program. As mentioned above, the corresponding South Australian data are 58% and 10%. Hence, the objective of screening biennially 70% of the target population within the National Program by five years fell short by 20% for Australia and 12% for South Australia, with an additional 10% being screened outside the program both in South Australia and nationally.

From the 1995 Omnibus survey an additional 3.5% of women aged 50-69 reported having a diagnostic (with symptoms) mammogram IN the Program in the last 2 years. These data were not reported officially from the NBHS, but the following details were provided to the investigator (*pers com*). Of the women who said they had ever had a mammogram within the National Program the following proportions reported that the most recent mammogram IN the program was diagnostic (with symptoms); 26.2% for women aged 40-49, 6.8% for women aged 50-59 and 5.2% for women aged 60-69. The corresponding figures from the 1995 Omnibus survey are 18.3%, 8.9% and 4.5%. Currently the National Program reports participation rates as the proportion of the population who had a mammogram in the Program during the previous 27 months, which includes 'diagnostic' mammograms. It is suggested that the Program should report screening and diagnostic mammography separately. Given the variation in Program policies regarding the inclusion of women with symptoms, difficulties arise in comparisons of participation rates across the various states without this breakdown.

9.4.4 Reported Participation Rates by National Program

The reported participation rate for the target population from the SABXRS as at June 1996 was 55% overall, 53% for women residing in Adelaide and 63% for women residing outside Adelaide (*internal report made available to investigator*). However, from the 1995 Omnibus survey it was reported that 61.7% of the target population had had a mammogram at the SABXRS in the compliance period. Some of this variation in estimates can be explained by sampling error for the Omnibus data; the 95% confidence interval for the 61.7% estimate ranges from 56.4 to 66.9. This still suggests that the Omnibus figures may be inflated, and also that the respondents to the survey may be more likely to be mammography participants than non-respondents. Further, amongst respondents, a level of reporting error either in the time or place of the last mammogram is likely. The NBHS found that 95% of reports of mammography in the Program that could be matched were accurate, and of these 81% correctly reported the timing to within 6 months of the actual date and 92% within 12 months (Barratt, et al., 1997). However, these figures were based on a possibly biased sample of those women agreeing that their information could be verified (82% consented) and matched. It was not reported whether the incorrect dates were more likely to be biased in a particular direction. Whatever the true level, the fact remains that self-report suffers from a level of inaccuracy which affects the estimates, compounded by sampling error.

The reported participation rate (last 27 months) from the SABXRS for women in their 40s was 17.6% at June 1996, the rate being almost equivalent for city and country women. This shows that the SABXRS has been successful at capping the rate for women in their 40s. For women aged 70 and over, the SABXRS reported a participation rate of 9.5%. From the 1995 Omnibus survey 22.4% of women 40-49 were reported as having a mammogram in the compliance period (CI 17.6 - 27.8), and 15.9% for women 70 and over (CI 11.4 - 21.8). These data also show that while surveys can provide useful information that cannot be collected routinely, the data need to be used cautiously where the numbers are small. Given that the Omnibus figures from 1995 are higher for all age groups (even using the lower CI limit for some figures) than Service figures the implication is that the Omnibus samples are biased towards participants. It is suggested that this would also be the case for the national surveys.

A more recent SABXRS report showed participation rates at the end of 1996 (BreastScreen SA, 1997). The rate for women in the target population was 57.8% for South Australia, 2.3% higher than six months previously. The rate for women in their 40s was the same as the previous report at 17.1 and slightly lower for women aged 70 and over at 8.3%. For women 50-69, the rate in Adelaide was 55% and for country regions 65%, thus the 10% disparity between city and country was not bridged at all. Participation rates from this report show considerable variation by the ABS Statistical Local Area Boundaries. However, it is not within the scope of this thesis to examine small area variation. The

Service can examine these and determine the types of populations residing in those areas from the 1996 Census. What this study can offer are data to assist in the targeting of those population subgroups from the in depth interviews of both attenders and non-attenders. For example, the SLAs with the lowest rates in Adelaide are those with high rates of NES women. The non-attender survey of Arndale women suggests that the task of increasing the rates in such areas to the target 70% will be a challenge.

Recently reported statistics on participation rates in the National Program (had in last 27 months) presented at the BreastScreen Australia Conference in August 1997, are shown in Table 9.4.2.

Table 9.4.2 State statistics presented at the BreastScreen Australia Conference - August 1997

	State/Territory						
	SA	Tas	Qld	NSW	Vic	WA	NT
Women screened by age group in period 1 January - 31st December 1996							
40-49	18%	29.7%	30%	22%	10.6%	24.7%	36.8%
50-59	43%	37.8%	34%	36%	42.0%	41.5%	43.8%
60-69	34%	27.7%	24%	29%	44.5%	27.5%	15.3%
70-79	5%	4.4%	11%	12%	12.3%	4.2%	3.8%
80+	<1%	0.4%	1%	1%	0.7%	0.3%	0.3%
Participation rate by age group: screened in the 27 months 1/1/95 to 31/3/97							
40-49	17%	31%	24.3%	23.9%	14.1%	16%	13.6%
50-69	58.3%	57%	39.0%	54.4%	63.3%	53%	38.8%
70+	13%	11%	28.1%	25.7%	32.7%	18%	19.3%
Re-screening rate: women aged 50-69 returning for screening in the 27 months 1/1/95 to 31/3/97							
	68%	76%	71.1%	65.3%	83.0%	69%	66.7%

SA, South Australia; Tas, Tasmania; Qld, Queensland; NSW, New South Wales; WA, Western Australia; NT, Northern Territory; ACT, Australian Capital Territory.
Source: BreastScreen SA 1989-1997

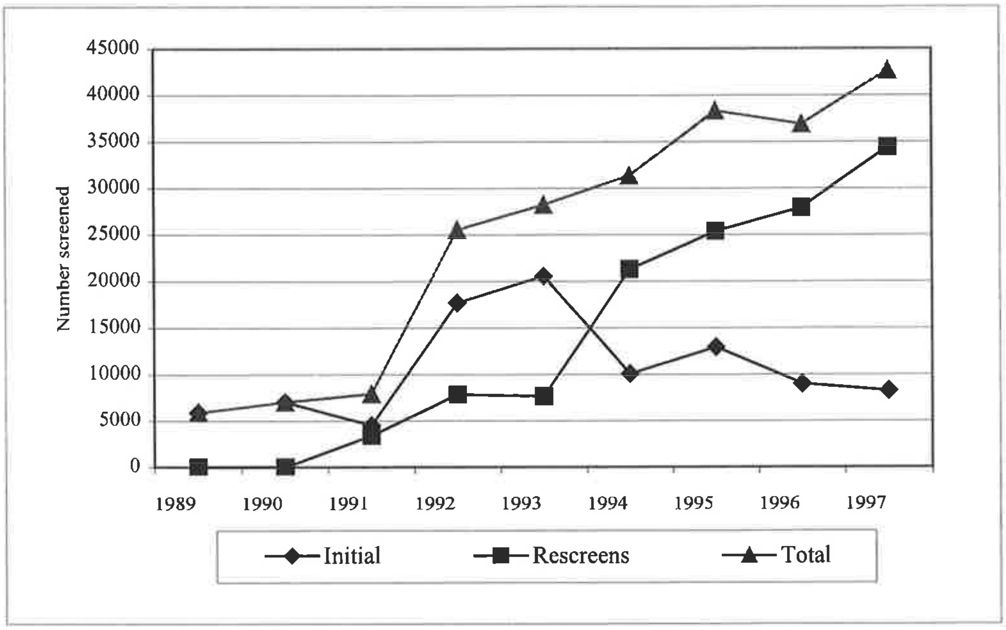
For South Australia, there was no increase over the rate at the end of 1996. South Australia had the second highest proportion (58%) of women participating in the target age group behind Victoria at 63%. Queensland and the Northern Territory had the lowest rates at 39%. These data indicate that while Queensland was quick to establish screening in the pilot phase, it has been less successful at rolling out since joining the National Program. These data include diagnostic mammograms (with symptoms), and the extent to which the data includes symptomatic women varies. Victoria's policy is to exclude symptomatic women while in South Australia women are questioned about symptoms and counselled to have a mammogram elsewhere (by a nurse or doctor) if it is thought they may have symptoms related to breast cancer. Other states exclude only on the basis of age. Apart from reporting on the level of screening versus diagnostic mammography, the various state Screening and Assessment Service policies should be published if valid comparisons are to be made. These policies may also account for variations in other quality assurance Program indicators, including cancer detection rates.

9.5 WILL THE NATIONAL PROGRAM'S PARTICIPATION TARGET BE ACHIEVED IN SOUTH AUSTRALIA?

9.5.1 Update on Trends in Screening Levels and Response to Invitations at SABXRS (now BreastScreen SA) for Women in Target Population (50-69)

Figure 9.5.1 shows the level of screening for women aged 50-69 from the commencement of the SABXRS in 1989 to the end of 1997.

Figure 9.5.1 Number of women screened annually in the target population at BreastScreen SA, 1989-1997



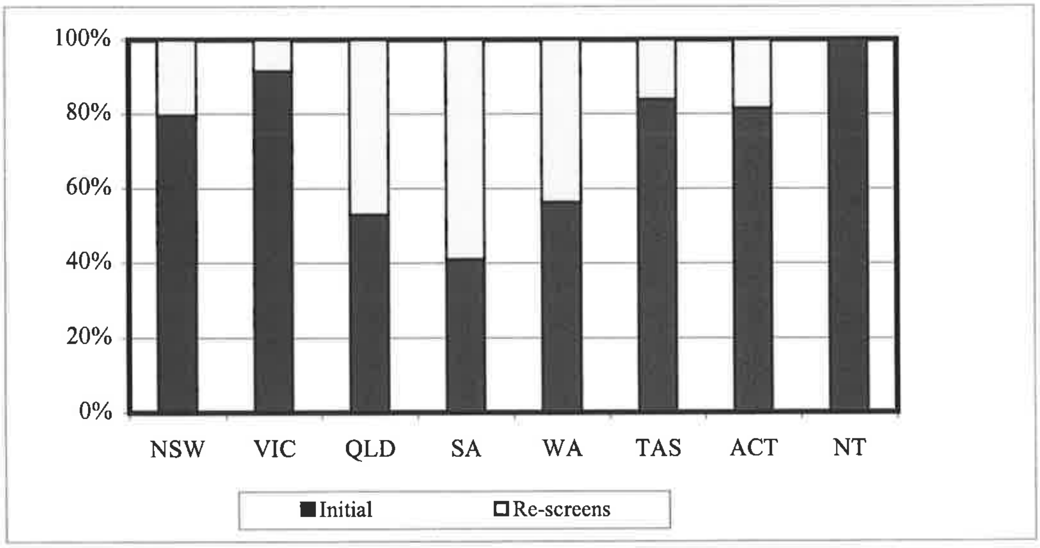
Source: BreastScreen SA

It can be seen that the number increased sharply in 1992 following the significant expansion of the Program in late 1991, then increased steadily since, except for a small decline in 1996. From this graph a continued upward trend could be assumed and hence confidence of achieving the goal in the near future. The SABXRS participation rate at the end of 1997 was 60.4 (*pers com*), an increase of 2.6% over the previous year. From Figure 9.5.1, it can be seen that this increase was due to an increase in rescreens and that numerically the number of new women aged 50-69 entering the Program has been falling. This would be the expected trend if most women were already in the Program. Whether this has occurred too early in the Program will be evaluated in the next section.

To increase and sustain the participation rate the Service will need to attract previously unscreened women and maintain a high proportion once they enter the Program. Table 9.4.2 above (from data presented at the BreastScreen Australia Conference) also shows re-screening rates, defined as having a rescreen in the Program in the 27 months from 1/1/95 to 31/3/97. South Australia's rate of 68% is lower than the National Program standard of 75%. Only Victoria and Tasmania achieved this standard. It should be noted that the National Program's Advisory Committee has recommended that future compliance rates be calculated as those occurring in exactly two years for comparability with overseas data. While this is important, the implications on compliance rates should not be overlooked. In South Australia most women reattend within the three month window from 24 to 27 months. For women aged 50-69 having a Round 1 screen during the first six months of 1992, only 6.5% of had their Round 2 screen within exactly 2 years, and a further 71.8% within the window from two years to 27 months, summing to 78.3% within 27 months (*data supplied by Service to investigator*). For women moving from their Round 2 to Round 3 screen (aged 50-69), 5.2% had been rescreened within exactly 2 years and a further 83.0% within the window, summing to 88.2% within 27 months. The Service would need to change their invitation policy to ensure a high proportion of women attend within the two years. Rather than suggesting an appointment date on, or near, the date of the previous mammogram on the letter, an earlier date would need to be suggested. The result would be a significant proportion of women having mammograms at less than two year intervals with resource and cost implications.

The rescreening rates presented in the previous paragraph (referring to rescreens in 1994) are higher than the more recent overall rescreen rate (all rounds combined) presented at the Conference (68%). This suggests a fall in the proportion returning for rescreening over time. It is suggested that the states with higher rates than South Australia from the data presented at the Conference will also find that the re-screen rate will decrease with time, unless additional strategies are implemented to prevent this. Figure 9.5.2 shows the proportion of Initial and Rescreens by state for 1994-95 as reported by the National Program for the Early Detection of Breast Cancer (1996).

Figure 9.5.2 Proportion of Initial and Re-screens by State, 1994-95

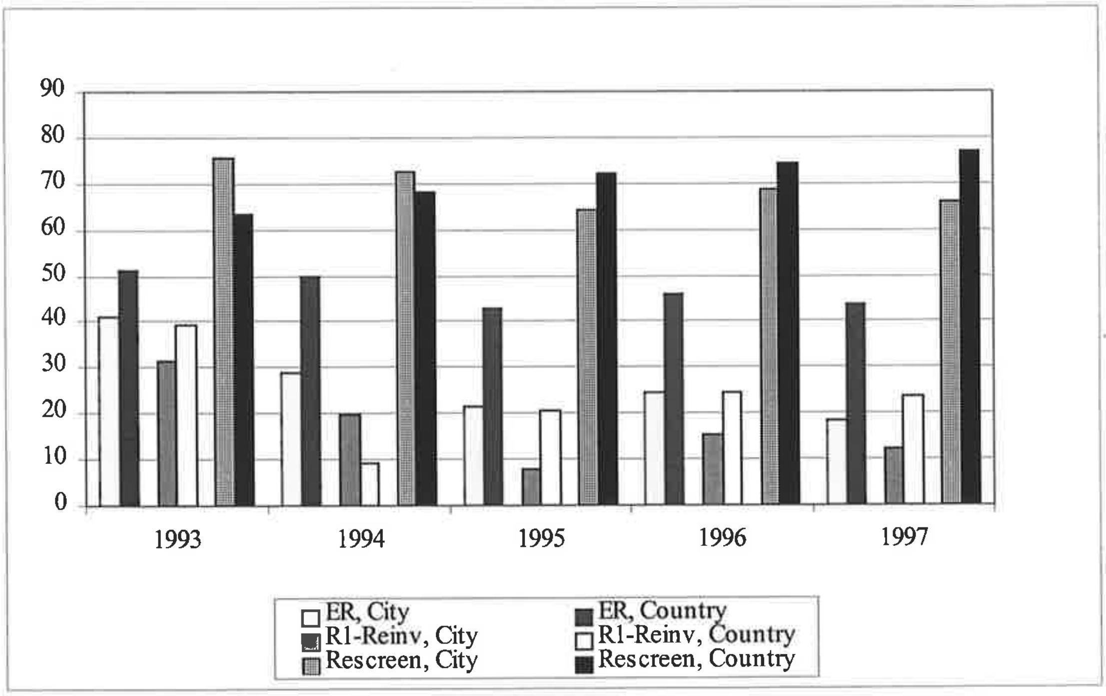


It can be seen that South Australia had the highest proportion of rescreens. The lower rescreen rate in South Australia now compared with the earlier rates, provides further support for this study's finding from the various surveys that women in the Program for a longer period (and those which joined earlier in the program) are more committed. The rates presented at the Conference reflect Screening and Assessment Services at different stages in the implementation. While Victoria had a pilot program in 1989, it serviced only a small area. A huge expansion in the number of Screening and Assessment

Services and screening numbers occurred in Victoria in the two years or so prior to the Conference. An indicator of the stage of a program is the proportion rescreens. From Figure 9.5.2, 41% of total screens were initial screens in South Australia compared with 80% for New South Wales, 92% for Victoria and 53% for Queensland. For 1997 only 19% of screens in South Australia were initial screens (from Figure 9.5.1).

Chapter 6 examined the response to the various types of invitation letters issued by the SABXRS in 1995. Response rates in 1997 show that non-response is still a major concern for the Service. Figure 9.5.3 plots the proportion of women actually attending as a result of an invitation within 90 days of their appointment (if an appointment was made) or 90 days of the invitation date on the letter (if no appointment was made). It can be seen that while the attendance rate from electoral roll invitations in the country has remained steady at just over 40%, those in Adelaide have continued to decline, and in 1997 the rate in the city of Adelaide was only 18%. The attendance rates following R1 Re-invitations in 1997 were 12% in the city and 23% in the country. Given the low response to the initial electoral invitations, it seems worthwhile to issue this second invitation to the same women. In the city, the attendance rates following a rescreen invitation fell from 76% in 1993 to 66% in 1997, while those in the country rose from 63% to 77%. This increase would be due to the deployment of the second mobile unit to service country areas in the latter half of 1994, and the intensive localised promotion of the Service, prior to and during, each visit to specific locations.

Figure 9.5.3 Invitations from SABXRS: % attending within 90 days



ER, electoral roll; R1Re, Round 1 Re-invitation; Resc, Rescreen invitation
City, Adelaide; Country, non-Adelaide, SA

9.5.2 Estimate of Participation

The Omnibus surveys and the 1996 Breast Health Survey found that a significant proportion of screening mammograms occur outside the official screening program. This issue is critical in assessing whether the target of screening 70% of women aged 50-69 in the National Program will be achieved. Apart from screening outside the National Program, another issue that requires critical assessment is the ability to recruit those not yet in the Program and keep those who have joined. It may be that the maximum or near maximum participation rate may have been reached, and those left may be difficult to recruit, given that a high proportion of these women know about the Program, and in South Australia at least, a high proportion have already been invited (from 1995 Omnibus survey). This could possibly lead to a reduction in the participation rate if the recruitment of new women entering the target age range does not compensate for those leaving.

Estimates of participation to the SABXRS (now BreastScreen SA) to the year 2001 are presented in this section. Ideally it would have been preferable to base the estimates on actual trends of individual cohorts of women by birthyear from the inception of the Program. Such a longitudinal analysis was reported for the Nijmegen screening program over a 17 year period (Scaf-Klomp *et al.*, 1995). Following individual birth cohorts would provide information on precisely the number of women who have not joined the Program, and hence allow estimates to be made of the proportion of new clients expected to join the Program, based of the trend for the cohort. Also, the pattern of participation in the Program over time by each cohort would provide more accurate predictions of future rescreening rates. A recent Australian study estimated screening rates by birth cohort from 1910 to 1975 using published data and annual reports from the screening programs as well as Medicare data (Kricker, 1998). Data by birthyear from the Program were not available. To estimate new participants into the Program, the Kricker study assumed that 20% of women who had not had a screen would enter the Program annually, based on observed Victorian rates. Annual rescreening rates were assumed at 75%, the Program's accreditation standard. The study predicted that for 1999, 80% of women aged 56-69 and 50% of women 50-55 will have had at least one screen in the Program. It also predicted that the rate of increase would have slowed by 1999 with 7% of women aged 50-69 having an initial screen in that year and 25% having a rescreen, making a total of 32% having a screen overall. That study also projected expected trends to the year 2006, showing a continued increase (but at a slowing rate) in total screens with about 33% of the target population being screened in 2001 and 34% in 2006 (68% biennially).

Data by single birthyear cohorts could not be made available to the investigator to calculate participation rates for the SABXRS, therefore estimates were made using available data provided; actual numbers of initial and rescreens by 5-year age groups for each year from the commencement of the program in 1989 to the end of 1997. These data were used to calculate the proportion of unscreened women entering the Program each year and the cumulative proportion screened at least once. Based on the past trends for initial and rescreens from these data, and information from the various studies in this thesis, projections were made for 1998 to 2001.

Without single birthyear data it was necessary to estimate the number of women moving from one 5-year age group to the next each year to calculate the cumulative proportion screened. For example in 1990, the cumulative number of women aged 50-54 ever screened in the Program equals the number of 50-54 year olds screened in 1989 less the 54 year olds (who in 1990 are included in the 55-59 year cohort) plus new women aged 50-54 recruited as initial screens in 1990 (the latter from Service data provided). Within each 5 year age group, each single age represents about 20% of the total population, although this is varies for the different age groups over time[3]. From data presented in this thesis, it was shown that the proportion screened decreases by age, hence within each age group, it would be expected that the oldest single age moving out of the age group would represent less than 20% of screened women in the group. On this basis only 15% of screened women were moved to the next age group in the following year; for example, 15% of women screened in 1989 from the 50-54 year group (representing 54 year olds screened) were transferred to the 55-59 age group cohort in 1990, and so on each year. Similarly, 15% of the 59 and 64 year olds were transferred to the next 5 year age group, while the 69 year olds were removed (no longer in the target population). Accumulating the number of women previously screened in the Program in this way provided an estimate of the number of women *never* screened in the Program by 5-year age groups (by subtracting cumulative number screened from the population total). The proportion of new unscreened clients in each age group joining the Program by year could then be calculated (initial screens for that year/number never screened*100). Table 9.5.1 summarises the results of this exercise.

Table 9.5.1 Percent of unscreened women entering the South Australian Program and cumulative percent of women screened in Program; 1991 to 2001 (based on actual to 1997, projected 1998-2001)

	% of unscreened population joining Program				% of population ever screened in Program			
	Age Group				Age Group			
Year	50-54	55-59	60-64	65-69	50-54	55-59	60-64	65-69
1991	5.5	4.7	3.5	1.5	14.7	17.2	14.3	5.9
1992	18.8	17.1	14.7	10.5	29.8	31.3	27.3	16.1
1993	23.5	22.7	20.7	17.0	43.5	47.0	43.1	31.0
1994	17.1	13.4	11.4	8.5	49.6	53.7	50.3	37.3
1995	23.9	18.9	16.6	12.3	58.4	62.3	59.2	45.6
1996	22.2	14.7	12.1	8.4	63.8	67.8	65.0	50.9
1997	23.1	14.7	11.2	7.5	67.3	*72.4*	68.4	56.1
1998	*25.0*	*15.0*	*12.0*	*8.0*	*72.1*	*75.1*	*71.3*	*60.6*
1999	*25.0*	*15.5*	*12.0*	*8.0*	*75.7*	*77.3*	*73.8*	*64.8*
2000	*25.0*	*15.0*	*12.0*	*8.0*	*78.6*	*79.1*	*76.0*	*68.8*
2001	*25.0*	*15.0*	*12.0*	*8.0*	*80.9*	*80.5*	*77.9*	*72.5*

Source data for 1989-1997: BreastScreen SA 1989-1997
Population projections 1998-2001: Australian Bureau of Statistics, 1998

The estimated rate for the proportion of unscreened women joining the Program used for 1998-2001 was based on the average for the previous two years for the age groups 55-59, 60-64, and 65-69. It can be seen that for these three age groups there has been a downward trend, and an alternative method would have been to base the projected rate on the downward trend. However, given the low rates by 1997, it was decided to maintain a steady rate, assuming the Service would act to halt the decline. For the 50-54 year age group the rates in 1996 and 1997 were 22.2% and 22.1% respectively. For 1998-2001 a rate of 25% was assumed, again on the basis that the Service would aim to recruit a high proportion of new 50 year olds not previously targeted. Also, it was assumed that a reasonably high proportion of 50 year old women would be motivated to join of their own volition when they reached

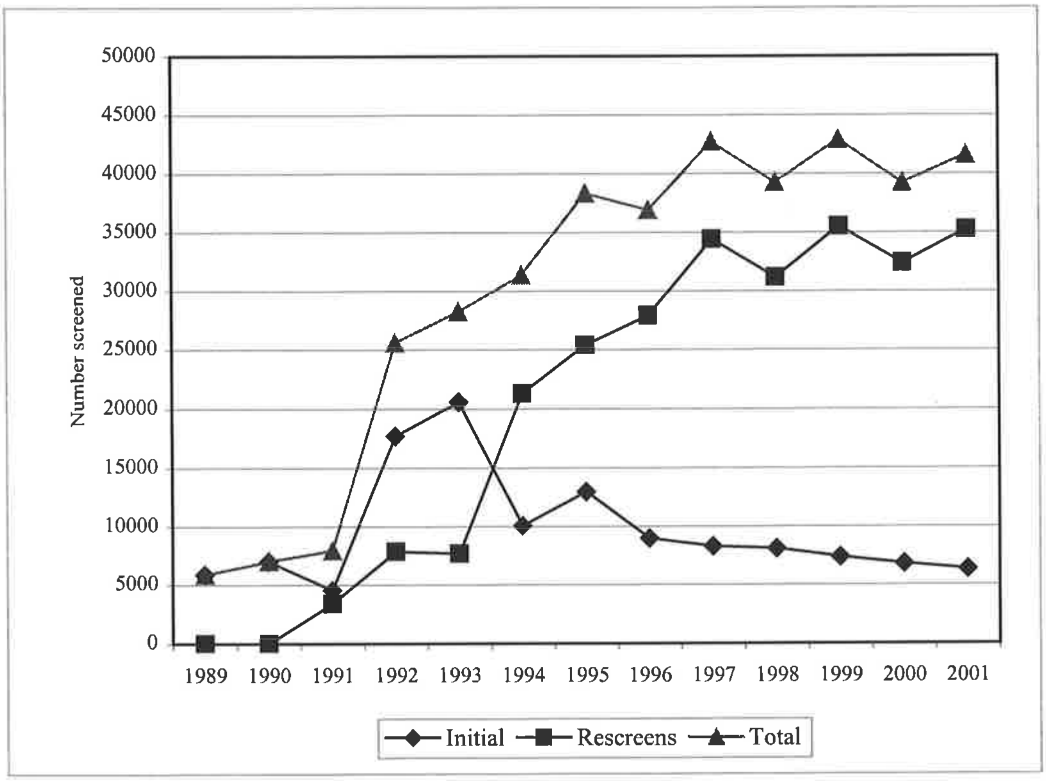
3 For women aged 50-54, 19.2% of this population group was aged 54 in 1992 and 18% in 1996. For women aged 65-69, the corresponding proportions are 19.5% and 20.0%.

the age promoted by the Program. In addition, the proportion of 50 year old women in the 50-54 year age group has shown a marked increase in the 1997 population estimates as the 'baby boomers' enter the cohort. In 1996, 50 year old women represented 21.5% of the 50-54 year age group, while the estimate for 1997 is 24.2% (Australian Bureau of Statistics, 1997). Table 9.5.1 also shows the cumulative proportion ever screened in the Program. It can be seen that by 2001 it is expected that 80.9% of women aged 50-54 will have had at least one mammogram in the Program, the corresponding proportions for women aged 55-59, 60-64 and 65-69 being 80.5,77.9 and 72.5.

The projected proportions returning for rescreening were also based on past trends. The Service reported a return rate of 68% in 1997 (Table 9.4.2) for all Rounds combined. However, an examination of rescreen rates early in the Program shows that the recently reported rate is lower than previously. For women having an initial screen in 1991, 82% returned for a Round 2 screen within 27 months, while 91% of those having a Round 2 screen in 1991 had a Round 3 screen within 27 months. The corresponding figures for women having a screen in the first half of 1992 were 78% (Round 1 to Round 2) and 88% (Round 2 to Round 3). Both the case-control and invitee studies in this thesis established that earlier cohorts were more likely to return. The rescreen rates for women followed from the case-control study (Chapter 5) showed a 90% return by the controls who joined the Program in the early stages, while the follow-up of SABXRS Invitees (Chapter 7) shows that the return rate was lower for women who joined the program later but increased by Round. Of those who attended a Round 1 screen in 1995 as a result of an invitation, 79% of women aged 50-59 returned for a Round 2 screen by mid 1997 (27 to 30 months later) and 64% for women aged 60-69. The corresponding figures for the two age groups for women attending a Round 3 screen in 1997 were 85% (50-59) and 80% (60-69). Using these sources of data combined, the following rescreen rates were assumed for 1998 to 2001: for women 50-59, 75% return from Round 1 to Round 2 and 85% return for subsequent rounds; for women 60-69, 70% return from Round 1 to Round 2 and 80% return for subsequent rounds. These rates are higher than the 68% reported by the Service in 1997, but it is anticipated that the Service would attempt to increase the rate following that result.

Using the assumptions above the estimates of rescreens for 1998 to 2001 were calculated using the total number of screens two years previously, by five year age groups; the 1998 rescreen estimate was based on the total number of screens in 1996, and so on. About 40% of the 45-49 year old cohort was aged 48 and 49 in 1996 (thus 50 and 51 in 1998), but because a higher proportion of women aged 48 and 49 were screened than younger women in the cohort, 60% of women in the 45-49 cohort were assumed eligible for a rescreen in 1998. The actual number expected to return were then calculated using the rescreen rates specified in the previous paragraph. All women aged 50-55, 55-59 and 60-64 in 1996 were eligible for rescreening in 1998. From the 65-69 cohort, 80% were considered eligible for rescreen on the basis that the numbers screened decreases with age in older women; women aged 68 and 69 who moved out of the cohort in 1998 represent 40% of the population aged 65-69, but it was assumed only 20% of screened women. The resulting overall number of screens for the target population are shown in Figure 9.5.4.

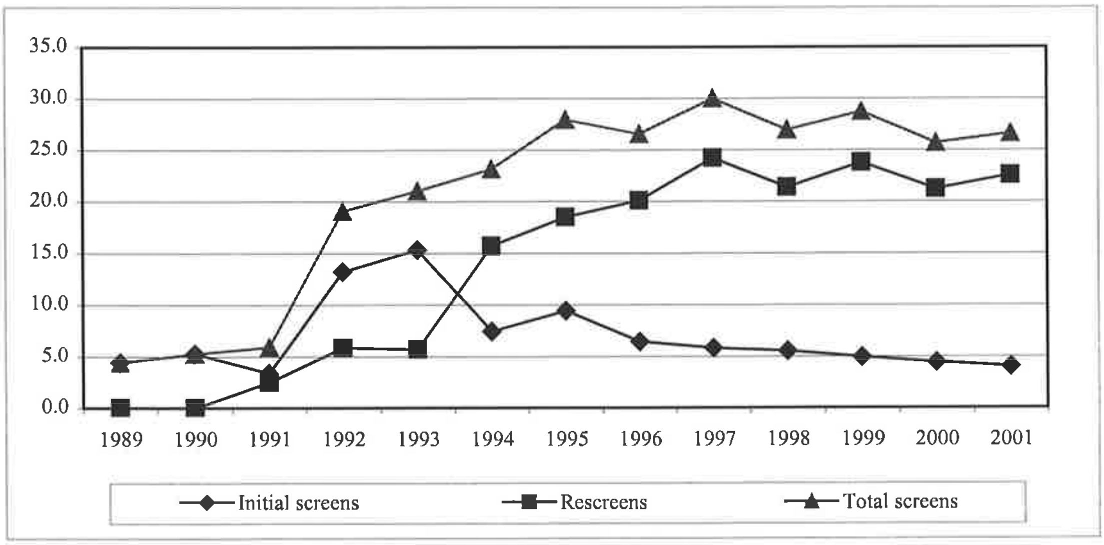
Figure 9.5.4 Number of women screened annually in target population (50-69) at Breast Screen SA; actual to 1997 and projected 1998-2001



It can be seen that a drop in total screens is shown for 1998. This corresponds with the fall in total screens in 1996, thus fewer rescreens in 1998, combined with the steady decline in initial screens. However, after a slight increase in 1999, the total number of screens again falls in 2000 and 2001. Given that these estimates are based on rescreening rates which are higher than those actually observed for the Service recently, the total number of screens will continue to decline unless significant effort is made to encourage high proportions of women to reattend. Alternatively a higher proportion of initial screens could be encouraged than those estimated in Table 9.5.1. However, the follow-up of non-attenders from the invitee surveys (Chapter 7) suggests that this will be extremely difficult given the initial response to invitations and the low proportion who had attended at follow-up. Another option would be to convince the 10% of women aged 50-69 being screened outside the Program to convert.

When the numbers in Figure 9.5.4 are translated to proportions of the population screened, it can be seen from Figure 9.5.5 that it is projected that by 2001 only 26.6% of women will have a mammogram with BreastScreen SA or 53.2% over two years, a significant decline from the 1997 rate of 30% or 60% over two years. The 2001 estimate is based on 4.1% having an initial screen and 22.6% a rescreen. These projected estimates are at odds with the Kricker (1998) estimates referred to above for Australia as a whole. That study predicted that in 2001, about 6% would have an initial screen and 27% a rescreen, making a total of 33% having a screen overall, or 66% over two years.

Figure 9.5.5 Percent of women aged 50-69 screened by year at BreastScreen SA: actual to 1997 and projected 1998-2001



Figures 9.5.6 to 9.5.8 superimpose the data in Figure 9.5.5 with the Kricker (1998) estimates. To avoid confusion by plotting six sets of data on one graph, separate graphs are presented for initial, rescreens and total screens. It can be seen that marked increases occurred in both the South Australian Program and the overall Australian Program, but these occurred earlier for South Australia.

The results for the South Australian projections were unexpected, and the differences between the two sets of estimates can largely be explained by the assumptions. The Kricker study assumed that 20% of unscreened women would enter each year. However, actual rates for South Australia show that the rate for women aged 55-69 has been declining. The assumptions used are in accord with the South Australian trends, and imply that unless changes are made to halt these trends then the results suggested are a likely and worrying outcome. It is suggested that the data which Kricker used reflected an earlier phase in the Program than that of the South Australia Program and that in time the Australian data would show similar trends. Kricker used Victorian data to estimate the proportion of unscreened women who would join annually (20%) and the National Program guidelines regarding rescreens. The Victorian Program was in a phase of enormous expansion with several new services established over a relatively short period. Had the estimates for the South Australian Program been made say two years ago, the outcome would have been more optimistic.

Figure 9.5.6 Actual and projected initial screens: Australia (Kricker, 1998) and SABXRS

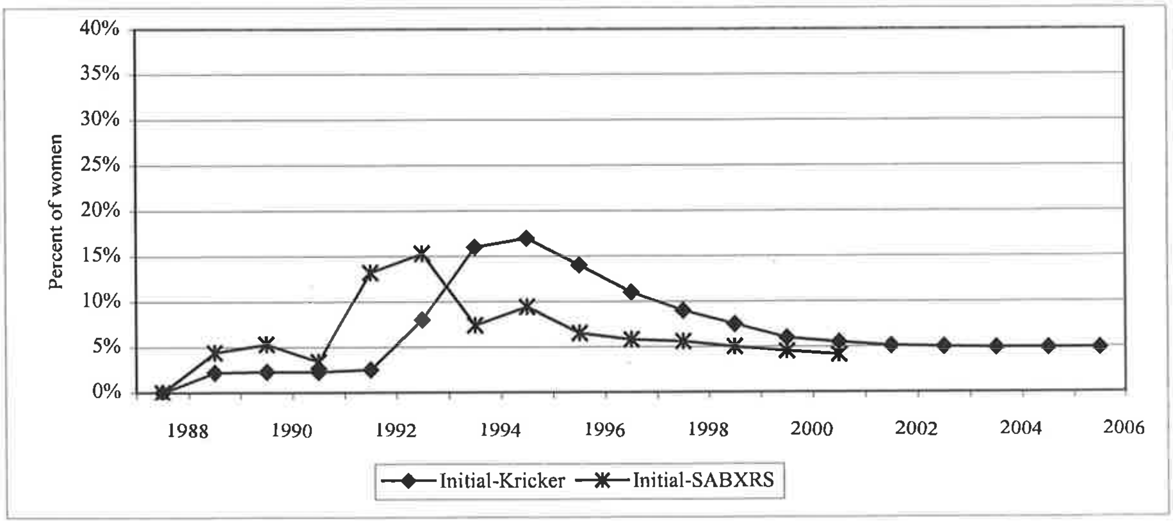


Figure 9.5.7 Actual and projected rescreens: Australia (Kricker, 1998) and SABXRS

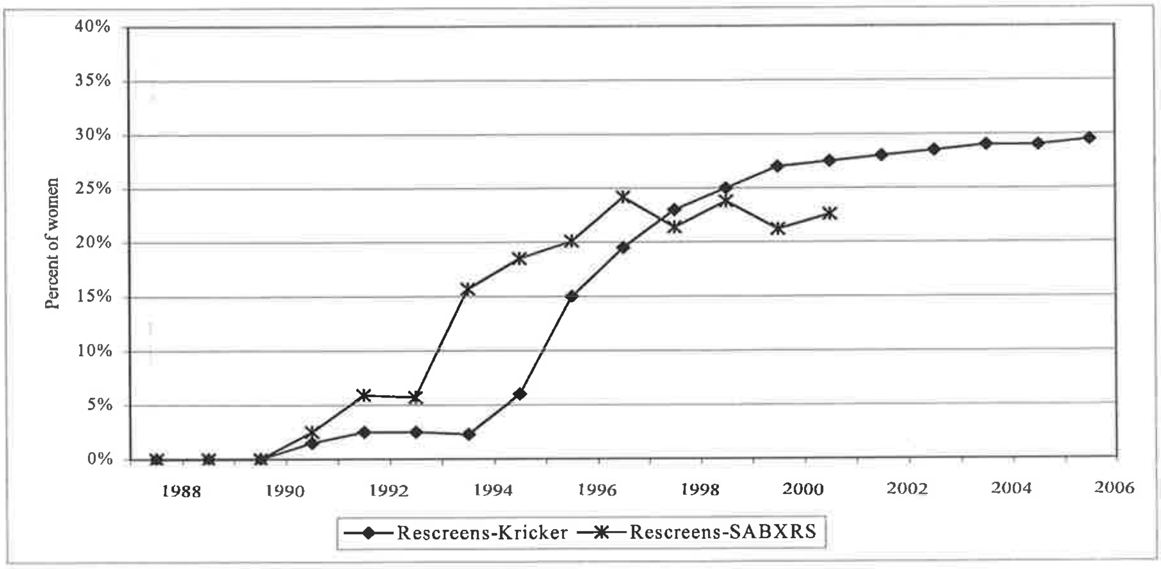
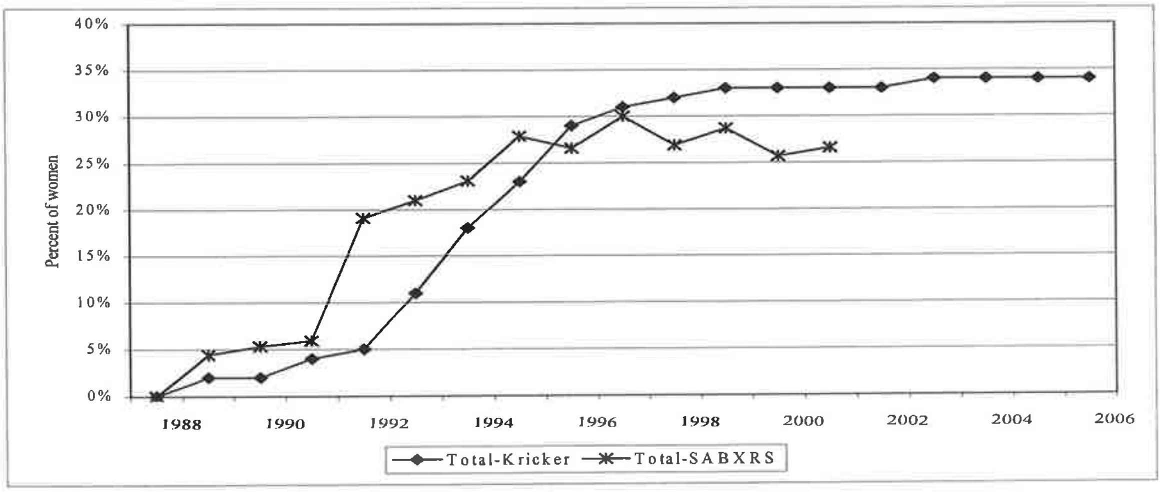


Figure 9.5.8 Actual and projected total screens: Australia (Kricker, 1998) and SABXRS



9.6 Recommendations and conclusions

This thesis studied participation in mammography at the SABXRS (now BreastScreen SA) from the commencement of the Program in 1989 through to 1997. All the various recruitment methods used by the Service were examined, non-attenders were followed up to assess later attendance and attenders to assess reattendance. The studies which examined participation in the State Program were complemented by community surveys, both state and national, which gave a broad overview of mammography in South Australia and information about screening outside the Program.

Ultimately, the Program is about reducing deaths from breast cancer. The reason for focussing on participation is the evidence which shows that high participation is critical to the success of the program. As mentioned above, BreastScreen SA reported a participation rate of 60.4% at the end of 1997 (*pers com*). That rate was calculated on the basis of unique women screened in the 27 months to December 1997. The same rate is shown in Figure 9.5.7 on the basis of number of women screened annually; in 1997 30% of women aged 50-69 had a mammogram at BreastScreen SA which corresponds to 60% over two years. The compatibility of the two figures suggests a consistency in the pattern of recalling women due for rescreening, such that the proportion having a mammogram between 24 and 27 months is similar over time. This is probably true since the policy is to send women invitation letters for a rescreen with a date as close as possible to their previous screen.

The SA Program has been reported as being on track in terms of quality and appears to match the Swedish trials in terms of prognostic features of the cancers detected. An examination of SABXRS breast cancers diagnosed in 1989-95 concluded that the "prognostic features of screen-detected cancers met the criteria recommended for quality appraisal of screening by researchers associated with the Swedish 'two-county' trial. Moreover, similar diameters were found for screen-detected lesions in South Australia as that trial". A comparison of SABXRS-detected with matched controls (non-SABXRS-detected breast cancers matched by age (± 5 years), year of diagnosis, tumour histology and laboratory of histopathological diagnosis) projected that "mammography-related reductions in mortality will be at least 30% 14 years from diagnosis" (South Australian Cancer Registry, 1996). However, this reduction relates to the population of women participating in mammography, not the overall population. The 1998 Cancer Registry report just released shows a reduction in mortality from breast cancer in 1997; the age standardised (world standard) mortality rate for female breast cancer was 16.6 per 100,000 women in 1997 compared with 20.4 per 100,000 in the period 1993-96 (South Australian Cancer Registry, 1998). It is anticipated that the screening-related reductions amongst women first screened during the early phases of the Program in South Australia may be starting to emerge. This is supported by the reductions in tumour size and prognostic features of breast cancers. In 1997 the proportion of cases with tumours less than 15mm amongst women 50-69 was 40% compared with 13% in 1980-86. Further, 12% of female breast tumours were in-situ in the period 1994-97 compared with 4% in 1986-89, and as shown in the earlier (1996) report screen-detected cancers are more likely to be detected at an early stage and be node-negative.

The 1997 Cancer Registry report also reported a change in the socio-economic trends in cancer diameter. Multivariate analysis found that prior to the commencement of the screening program (1980-86), women aged under 50 and those residing in the upper socio-economic suburbs were more likely to have small breast cancers (< 15mm) detected, but in 1997 small cancers were more common in women aged 50-69 and the socio-economic differences had disappeared. This also reflects on the success of the South Australian Program in recruiting women from lower socio-economic backgrounds. The case-control study found no differences between attenders and non-attenders by socio-economic status. In fact the reverse appears to be true; women of higher education and higher income appear to be less likely to join the free mammographic screening Program, and it was suggested that these women are either being screened in the private sector, or not at all. Also, women in the target age group in South Australia are not disadvantaged by distance. Rather, the Program has been more successful at recruiting women from rural areas; at the end of 1996, the reported participation rate for women aged 50-69 in Adelaide was 55% compared with 65% for women outside Adelaide (BreastScreen SA, 1997). This difference is also reflected in population survey data; 59% of women aged 50-69 in Adelaide reported ever having a mammogram at SABXRS compared with 72% for the rest of state in the 1995 Omnibus survey. Further, for those who had not used the SABXRS, a higher proportion of women in country areas aged 60-69 reported having received an invitation from the SABXRS (36% in Adelaide and 43% in country). Clearly the mobile screening service provides a equitable method for targeting rural women. In addition, the South Australian mobile service is the most cost-effective in Australia (Carter and Cheok, 1994).

These data all suggest that the South Australian Program has been extremely successful, although it fell 10% short of its screening target. Can the SA Program increase participation from 60% to 70%? It is suggested that this task will be difficult. Moreover, the Program needs to assess the cost-effectiveness of attempting to increase participation from 60% to 70% - does the marginal cost of increased participation warrant the additional expected reduction in mortality? The effort required may not be worthwhile. Data presented in this thesis show that women who have already attended are more likely to reattend, and the likelihood increases with number of attendances. Yet amongst those in the Program, the proportion not reattending is increasing with time. This issue needs to be addressed urgently if the Program is to be sustained, let alone expanded.

RECOMMENDATION 1: THE PROGRAM NEEDS TO URGENTLY ADDRESS THE ISSUE OF FALLING RESCREEN RATES AND THE PROSPECT OF A DECLINING OVERALL PARTICIPATION RATE IN THE TARGET POPULATION.

Screening which occurs outside the Program cannot be ignored. Women screened inside the Program have their mammograms double read, but outside the Program generally only single read. The main effect of double reading appears to be a reduction in diagnostic investigations rather than the detection of more cancers. Hence, the issue of 10% of women being screened outside is also one of economics as well as possible increased anxiety for women who may be more likely to receive unnecessary investigations. In South Australia the radiologists who read the Program's mammograms all work in the private sector, but it is not known what proportion of external mammography work they deal with. Quality may be an issue for women screened externally, particularly since both the Omnibus surveys in South Australia and the national National Breast Health Survey (NBHS) estimate that 10% of women in the target age group are being screened externally. The SA Cancer Registry 1996 report referred to above showed that SABXRS-detected breast cancers were smaller and more likely to be node negative than those detected outside the Program. It is not known what proportion of the external breast cancers were detected following a 'screening' mammogram versus diagnosis of symptoms.

Data on detection rates of small cancers, such as that in the Cancer Registry reports could be used to educate general practitioners who are referring screening cases privately, since women would need to be referred for a private mammogram by their doctor. The South Australia Program also has available to it methods of collecting community survey data quickly and efficiently, including the Omnibus data reported in this study. However, the South Australian Health Commission (now part of the Department of Human Services) also runs a series of telephone SERCIS (Social Environmental Risk Context Information System) surveys for departmental purposes, at no direct cost to individual units. BreastScreen SA should put a submission to the SERCIS Steering committee to consider the inclusion of a set of questions on the agenda. These would aim to elicit more information from women regarding both their use of external mammography, and for those never screened, more detailed questioning to advise on whether it would be worthwhile to expend resources trying to recruit them.

RECOMMENDATION 2: THE PROGRAM NEEDS TO BETTER UTILISE AVAILABLE DATA AND COLLECT ADDITIONAL INFORMATION FROM WOMEN SCREENED OUTSIDE THE PROGRAM AS WELL AS THOSE NEVER SCREENED AS INPUT INTO EDUCATIONAL MATERIALS FOR WOMEN AND DOCTORS.

The cost of the National Program can only be justified if high proportions of the population participate. The participation estimates above (section 9.5.2) show that on current trends the number of women entering the program will not match those leaving it from 1998 onwards and that the proportion of the target population screened annually will fall. The South Australian Program, which is at a mature stage, is unlikely to attract a high proportion of those women who have never been screened. The surveys of non-attenders following an invitation showed that a high proportion of those never screened have essentially decided that mammography is not for them. The most recent Omnibus survey showed that most women in the community aged 50-69 who had never been screened knew about the Service and had received an invitation. The effort required to change these women's perceptions may not be worthwhile. Resource use and expenditure may best be utilised by maintaining women in the Program than chasing the 'laggards' who have been shown from this research to be extremely resistant to adopting mammography. This thesis showed that the reattendance rates differ according to when women join the Program and how old they were when they joined; women who joined during the early phase and/or at a younger age were more likely to continue attending. A longitudinal analysis of the Nijmegen program over 17 years also reported that compliance was lower for older women, and that "starting with large scale screening of older women does not seem to be very effective" (Scaf-Klomp, et al., 1995).

Whilst this thesis was based on the premise that high participation rates are essential for the success of the screening program, this view has been challenged. Torgerson and Donaldson (1994), two prominent health economists in the UK argue that from the perspective of overall efficiency the objective of high compliance may be detrimental. They argue that the increased benefits from the increased compliance in mammography screening may be less than the benefits of using the resources elsewhere. This argument is correct if the broader perspective is taken of allocative efficiency for the system as a whole (either the health system or overall community welfare). One aspect of the UK program which Torgerson and Donaldson criticise is the UK recommendation that recruitment for breast screening should be by fixed appointment rather than open invitation. They did not have cost data available, but argue that the wasted appointments using this method results in fewer women being screened overall due to the wasted slots. In Chapter 1, a cost study in Australia showed that although the method of fixed appointment achieved the highest participation rate, it was the most costly, and the most cost-effective method was a personalised invitation without a specified appointment followed by a reminder letter (Hurley *et al.*, 1992). Torgerson and Donaldson also question the UK program's exclusion of women aged over 65 and suggest that it may be more cost-effective to expand the target population than pursue increased compliance in younger women. They conclude by suggesting that the screening objective of compliance needs to be reassessed:

> *Is 70% sufficient or 80%? If it is 70%, what happens if a screening program achieved a compliance level of only 69%. If 90% compliance produces a 30% fall in breast cancer, should a screening program be judged a failure because it only has a 15% fall in breast cancer but at half the cost?*

The issue of efficiency cannot be ignored. The question posed earlier in this section - *does the marginal cost of increased participation warrant the additional expected reduction in mortality* - was asked in relation to increasing participation from the current 60% to 70% of the target population. Given the projections that show that participation is likely to fall below the current 60%, this question is even more pertinent. The imperative for assessing cost-effectiveness urgently cannot be ignored. Torgerson and Donaldson debate the use of resources to increase participation in mammography screening versus alternative uses of the resources; that is, the health benefits of using the resources elsewhere in the health system may be greater than the benefits achieved by screening. While most screening in the UK would occur within the national screening program, in Australia 10% of women in the target population are being screened in the alternative private health system. Therefore not only is there a need to measure the cost-effectiveness of increased compliance in the National Program, but also the public-private mix. In Australia, Glasziou and Irwig (1997) have questioned whether funds should be provided for the improvement or expansion of the National Program given the current expenditure of around $80 million per year. This question is particularly pertinent, with added pressure to expand the Program for women in their 40s following the results of recent meta-analyses using longer follow-up data from the seven randomised trials which suggest a positive but delayed benefit (National Institutes of Health Consensus Development Panel, 1997) Also, more information is now available to show that screening is efficacious for women at the older extreme. Follow-up of women aged 65 and over between 1975 and 1994 in the Nijmegen screening program concluded that breast cancer can be detected earlier in older women (van Dijck *et al.*, 1996). This study found that screen detected cancers were smaller and less likely to have node involvement than cancers detected in unscreened women for all age groups, 65-69, 70-74 and 75 and over. Clearly all policy options need to be debated, including increasing the age range and screening more women in the target age group.

Cost-effectiveness analyses also need to incorporate staffing resource issues, including current lost capacity due to shortages of staff, and expected requirements (and availability) in an expanded program. For example, the cost study of the National Program showed a linear inverse relationship between improvements in utilisation of capacity and decreases in cost per woman screened (Carter and Cheok, 1994). Utilisation is affected by both availability of staff (particularly radiographers and radiologists) and recruitment.

RECOMMENDATION 3: THE COST-EFFECTIVENESS OF ALLOCATING FURTHER RESOURCES INTO INCREASING PARTICIPATION NEEDS TO BE ASSESSED AGAINST THE LIKELY BENEFIT IN TERMS OF REDUCED MORTALITY FROM BREAST CANCER AND THE BENEFITS OF UTILISING THE RESOURCES ELSEWHERE.

Clearly, the Program now allocates a significant proportion of resources to recruitment and will continue to do so. The true cost of recruitment includes not only the resources expended by the Program but also external resources such as GP time. Recommendation 3 cautions against continued further allocation without an assessment of the likely impact. The various studies in this thesis support the premise on which this research was based, that a range of recruitment strategies are required to target the various groups of non-attenders. The Program needs to focus on three broad groups: women never screened; women screened outside the Program; and, women who have had at least one screen in the Program, but have not reattended or are at risk of not reattending. Within these broad groups, various sub-groups need targeting defined by stage of readiness to adopt mammography behaviour or by specific demographic groups not successfully recruited by current strategies.

Encouraging never screened women to join the Program

Barbara Rimer, a US researcher who has published extensively on participation in mammography screening states that "it may be a challenge to influence those women who have not yet obtained mammograms" (Rimer, 1997). Given that the majority of women who have never been screened by BreastScreen SA know about the Program, and a high proportion have already been invited, then the ability to enrol the 'laggards' now left unscreened may indeed be difficult. The 1994 Omnibus survey found that 8% of all women aged 50-69 stated they 'Definitely won't' have a mammogram with the SABXRS in the next two years, and 8% stated they 'Never' intend having a mammogram anywhere in future, while others were uncertain about future mammography. More information needs to be elicited from these women to determine if it is worthwhile (and perhaps ethical) to pursue them (see RECOMMENDATION 2).

From the Omnibus surveys, it is known that knowledge of the SABXRS amongst women who have not used the Service was high in all age groups by 1991 in South Australia, and it remained high over the years; about 80% of women aged 40 and over who had not used the Service knew about it in 1995. Amongst these, about a third of women in the target population remembered receiving an invitation from the SABXRS. The NBCS also showed that knowledge about the Program was high at the national level - nearly 90% of Australian women aged 30-69 knew about the Program (Barratt, et al., 1997). Knowledge of mammography has also been consistently shown to be high in the literature and in the various studies presented in this thesis. In the NBCS, 63% of the sample nominated mammography for detecting early breast cancer, 60% correctly identified 50 as the recommended starting age for screening and nearly 60% correctly reported the recommended screening interval as two years. However, as found in the literature review and confirmed by the various studies in this thesis, knowledge of mammography and the Program does not predict behaviour. That is not to say that it is not an important precursor, but it is certainly not sufficient without other factors being addressed.

BreastScreen SA will need strategies other than mass advertising and the use of the electoral roll if it is to encourage new women to participate. In particular, special attention is required in Adelaide where participation in the target age group is 10% lower than the country. This task will not be easy since the range of non-attenders is far more diverse than the areas targeted when the mobile units visit specific rural locations. Lessons from recruitment in rural areas should be applied to localised areas within Adelaide. The localised promotion that occurs prior to the van's visit in local papers, other media, shopping centres and other frequented venues clearly raises awareness and increases the likelihood of attendance for those ready to adopt the behaviour.

It appears that the greatest potential for recruiting women never screened may be to target women not on the electoral roll, since most women on the roll have already been invited, some twice. The Invitee surveys show the non-attenders to an electoral invitation (particularly those sent two invitations) will be difficult to recruit. In the city sample, a high NES area, it was found that not only were NES women over-represented as non-attenders (compared with attenders) amongst women invited from the electoral roll, but also that the roll itself under-represented the NES population. Further, NES women who had already had a first screen with the SABXRS were less likely to return for a rescreen than non-NES women. The numbers from which these data were derived were small, therefore larger numbers of NES women need to be surveyed to develop culturally appropriate strategies. An important strategy could be to target general practitioners whom NES women consult. As far as aboriginal women are concerned, the analysis of the country sample from the Invitee study (from an area with a high proportion of aboriginal women in the population) found that the Program was able to successfully recruit women for a first screen (but not maintain them for a rescreen). The Program could now utilise the 1996 ABS census data by Statistical Local Area to determine whether specific sub-groups are being missed based on screened proportions versus population proportions (for example by language spoken at home, aboriginality, housing status, residential location).

The case-control study follow-up found that being embarrassed by a female radiographer was associated with stage of adoption, and that NES women, particularly Greek, were more likely to be embarrassed. Being embarrassed by a male radiographer was not associated with attendance since a high proportion of both attenders and non-attenders were embarrassed by a male radiographer. The South Australian Program employs only female radiographers. It is suggested that this should be made policy and be advertised in promotional material.

RECOMMENDATION 4: THE PROGRAM WILL NEED TO PAY PARTICULAR ATTENTION TO RECRUITMENT STRATEGIES TARGETED AT THE VARIOUS GROUPS OF NON-ATTENDERS, PARTICULARLY WOMEN RESIDING IN THE CITY OF ADELAIDE, THOSE FROM NON-ENGLISH SPEAKING BACKGROUNDS, AND OTHERS BASED ON EVALUATION OF SMALL AREA POPULATION DATA.

Encouraging women screened outside the Program to switch

For women being screened outside the Service, the message that they would best be served by a dedicated service needs to be embraced by both women and doctors. The appropriateness of mammography screening outside the Program needs to be addressed as well as the cost. Unless women pay for the full cost of a bilateral mammogram, it is likely that having 10% of women in the target group screened outside the Program seriously affects the cost-effectiveness of mammography screening overall in Australia. An assessment is needed as to why such a high proportion are still being screened outside.

RECOMMENDATION 5: THE COST-EFFECTIVENESS OF MAMMOGRAPHY SCREENING OVERALL IN AUSTRALIA SHOULD BE ASSESSED TAKING ACCOUNT OF WOMEN HAVING SCREENING MAMMOGRAMS OUTSIDE THE PROGRAM AND MORE INFORMATION COLLECTED ON REASONS WHY 10% OF WOMEN AGED 50-69 ARE SCREENED OUTSIDE THE PROGRAM.

A corollary of inappropriate screening outside the Program is inappropriate diagnostic mammography inside the program, estimated at 3% of the population of women aged 50-69 in South Australia. It is suggested that the Service scrutinise more closely data on symptomatic women, and be explicit about these in the reporting of participation rates. All Screening and Assessment Services in the National Program should report screening and diagnostic mammography separately to gauge the extent of the problem and appropriateness. It may be that symptomatic women use the Program because it is free, whereas they may need to pay the Medicare gap outside the Program. Further they may perceive that the Program provides a better service. Such issues need to be explored.

RECOMMENDATION 6: SCREENING AND ASSESSMENT SERVICES SHOULD ROUTINELY REPORT DIAGOSTIC MAMMOGRAPHY SEPARATELY FROM SCREENING MAMMOGRAPHY.

Encouraging re-attendance for women screened in the Program

BreastScreen SA needs to urgently address the issue of reattendance if the viability of the Program is to be sustained. When this thesis commenced, the focus of research, nationally and internationally, was on encouraging initial attendance. Now there is an increasing focus on re-attendance. An Australian study by Cockburn *et al.*, (1997a) found that the effort required in recruitment for the initial attendance was related to reattendance, with women recruited spontaneously being more likely to reattend than those requiring a letter and a reminder. As summarised above, the relationship between attendance and reattendance according to the level of effort was a major outcome of this study. This thesis also corroborates other findings by Cockburn *et al*; a prior history of mammography, and prior diagnostic mammography were related to reattendance and stated intention predicted reattendance.

It is suggested that the Program should follow-up non-attenders for rescreening immediately for women who fail to attend without notice. This could be by letter, letter with telephone follow-up, or only telephone follow-up. Various options should be evaluated for cost-effectiveness. A telephone follow-up on its own may prove to be cost-effective given that a reasonably high proportion would be expected to attend subsequently. For women who cancel, more information should be sought on reason for cancelling. Recruitment staff require special training to elicit information in a sensitive and non-threatening way. Women dissatisfied with the Program in any way should be encouraged to express any concerns. The allocation of a specially trained recruitment officer to follow-up on rescreen non-attenders should be considered. A screening program in the US which offered telephone counselling (average of 5 minutes) to women who remained nonadherent after a reminder letter, found that it tripled the odds of a woman obtaining a mammogram (Rimer *et al.*, 1993). The goal of the counselling was to identify and overcome women's barriers to mammography. In South Australia this can only be undertaken if an appointment has been made (not necessarily kept), but this option should be given serious consideration for rescreen non-attenders and those who fail to keep an initial appointment. A study on the Dutch mammography screening program tested tailored leaflets (a simple version and a version with additional cues) versus a standard leaflet on rescreening rates, but found that neither tailored leaflet improved the rate (Drossaert *et al.*, 1996). The authors concluded that the additional cost and effort was not justified, and that addressing the issue of pain and having friendly staff may have more impact. As with new clients, the specific issues of the women need to be addressed.

Another method of eliciting information would be an exit interview/survey after women have their mammogram. A recent Canadian study used a self-report questionnaire immediately post-screening on satisfaction with screening, intentions on screening and anxiety about it. Overall the level of satisfaction was high (a typical finding in satisfaction surveys). Two areas of concern identified were discomfort and fear about radiation (Bakker *et al.*, 1998). It is suggested that BreastScreen SA should consider a similar study; although the Program currently conducts satisfaction surveys and seeks comments, it is suggested that more specific questioning is required to encourage women to express specific negative experiences or fears. An instrument developed in Norway which includes items specifically measuring discomfort and attitudes towards repeat adherence may provide a basis; this was found to detect lower levels of satisfaction than other satisfaction questionnaires (Loeken *et al.*, 1997).

RECOMMENDATION 7: THE PROGRAM MUST ADDRESS THE FALLING RESCREENING RATE AS A MATTER OF URGENCY AND REVIEW CURRENT FOLLOW-UP PROCEDURES FOR NON-ATTENDERS TO A RESCREEN INVITATION, INCLUDING THE FEASIBILITY OF A TELEPHONE COUNCELLING SERVICE AND EXIT SURVEY.

An issue raised above relates to the measurement of rescreening rates. Careful consideration needs to be given to the proposal to change the definition of compliance from 27 months to 24 months. A high proportion of rescreens occur at between 24 and 27 months in the South Australian Program. A requirement to screen within exactly 2 years would probably reduce the interval to less than 2 years for a large proportion of women. The desirability and impact of this should be evaluated. Perhaps, rather than changing practice to comply with international standards, the standard itself should be questioned and discussed. By how much does compliance to this standard increase cost and is this warranted? What is the difference in effect between screening women at exactly two years versus 27 months? Until these issues are evaluated it is suggested that both rates be presented. If it were desirable to change to 24 months, services would need to alter current recall protocols.

RECOMMENDATION 8: THE PROGRAM SHOULD CRITICALLY REVIEW THE PROPOSAL TO MEASURE COMPLIANCE AS HAVING A MAMMOGRAM WITHIN 24 MONTHS AND CONSIDER REPORTING BOTH A 24 AND 27 MONTH RATE INITIALLY.

Specific Issues in developing strategies for action

A key outcome of this study was the link found between negative perceptions about mammography and readiness to adopt mammography. Barriers were found to be consistently associated with non-attendance in the various studies of SABXRS clients, both in the early and later phases of the Program. Despite sample size problems, it appears that specific barriers relate to women believing that mammography is only required for women with symptoms, that mammography is painful and fear (of the result). A general barrier more difficult to address was the view that mammography was "too much trouble" or "not needed". Further research would assist in determining whether these common responses represented an underlying fear. Barriers were also found to be a strong predictor for the population in general from the 1990 Omnibus community survey. The detail on barriers was not repeated in future Omnibus surveys, but the 1995 survey asked non SABXRS clients who stated that they had received an invitation from the service (about a third had) why they did not take up the offer. From the specific responses available, it appears that perceived barriers feature highly (pain, fear of result, rather not knowing and embarrassment).

More recent studies from overseas uphold the view that the key to understanding mammography behaviour still lies in unravelling the barrier component. A study in the US (Rakowski *et al.*, 1997a) investigated an extended transtheoretical model of behaviour change, and confirmed that readiness to obtain screening (stage of adoption) was associated with the balance of opinions about mammography (pros and cons). They found that women in *precontemplation* (never had a mammogram and no intention in the next year or two) and in *relapse* (had a mammogram but not in last 24 months and no intention in the next year or two) had the most negative decision balance. Women in *contemplation* (planning to have one in the next year or two) had a less negative balance than women in *relapse risk* (had in last 24 months but no intention in the next year or two). It was concluded that women's stated intentions should be taken seriously since this was the key difference and recommended "that future research examine whether opinions regarding the cons of mammography are more individually specific than the pros".

Although this thesis did not categorise women in this way, the analogies are evident. Both the case-control study and the invitee surveys found that intentions can predict actual behaviour. This thesis also found that the strength of the association between intentions and actions diminishes as mammography becomes more entrenched, whereas the association with barriers remains strong. As those remaining to be recruited are the *laggards* and the risk of *disenchantment discontinuance* increases, intentions are less likely to predict behaviour. Although the decision to have a mammogram requires the balancing of pros and cons, it is suggested that it is a reduction in negative opinions that is more important than an increase in positive opinions at this stage of the South Australian program. Further research is required to specify the barriers more succinctly, and ascertain the possible negative opinions which underlie responses like "too much trouble" or "not needed". That is, although this thesis clearly demonstrated the negative role of barriers, more detail is required on current specific barriers for various groups of non-attenders or lapsed attenders. While the information available from this thesis can be used initially to prepare and test materials, further detail will be required given that the Service is now dealing with a higher proportion of clients (new or existing) who are less committed.

It will be more difficult to recruit current non-attenders; fewer attend with follow-up and the link between intention and action is weaker. Strategies that worked during the earlier phases of the Program will need to be reviewed. The SA Program should include several questions on the next Omnibus survey to canvass in more detail reasons for not using the Program. It is recommended that the SABXRS continue with population surveys asking about intentions and eliciting more information as to why women do not intend using the Program.

RECOMMENDATION 9: BREASTSCREEN SHOULD CONTINUE TO MONITOR POPULATION INTENTIONS AND LINK THESE TO CURRENT SPECIFIC BARRIERS BY STAGE OF READINESS.

Intrinsic in the development of recruitment strategies is the determination of the best communication channels, and this thesis informs on these. For example, television and local newspapers featured highly among sources most noticed by women. However, it appears that the role of generalised media strategies is greater in increasing knowledge of the Program, and to a lesser extent about mammography. But for behaviour modification, it is clear that the most appropriate channel would be general practitioners, given that a doctor's influence was found to be the strongest predictor of attendance, and a high proportion of older women visit a GP regularly. From a survey conducted in 1997, 91% of South Australian women aged 50-69 visited a GP in the 12 months prior to interview (South Australian Health Commission, 1997).

It appears that the influence of a doctor and perceptions of barriers are very much related. From the case-control and invitee studies, the follow-up of subjects showed that women who stated they would not be influenced by a doctor perceived more barriers. The effect of barriers was found to be enduring, that is, the negative perceptions about mammography appear difficult to change. This poses a dilemma as to how to best communicate information to address the barriers to these women. Doctors have been shown to be the major influence for women who have attended for screening. Although, a proportion of the laggards stated they would not be influenced by a doctor, it is suggested the reason for this is that perceived barriers have yet to be addressed, and even for these women, GPs would probably be the best couriers for messages that BreastScreen SA would like to convey. Doctors will need to be supported to improve their effectiveness in recruiting women through better education, but also in practical ways, such as assisting them to develop prompt systems (preferably computerised). The cost and feasibility of such options should be explored. A study be Stevens *et al.*, (1997) on an educational outreach program for general practitioners in relation to cervix screening in Victoria, Australia found no difference in the change in screening rates between the intervention and non-intervention regions. The intervention which involved a visit by a general practitioner educator cost $34 per visit. It is likely that a similar intervention in relation to breast screening would also not be effective.

Doctors will need to address not only stage of readiness, but also be aware of age issues. Although age was not found to predict attendance early in the program, it was certainly a factor later in the program. From the case-control study, fewer older women stated they would accept a doctor's recommendation to have a mammogram. Also, fewer older women had actually had mammography suggested to them by a doctor. Further, older women were less likely to attend at follow-up. The National Breast Cancer Survey (Barratt, et al., 1997) found that age is still an issue. Less than 5% of respondents nominated age as a risk factor for breast cancer, and nearly half believed women under 50 were more at risk. Women's lack of knowledge regarding the age factor is further compounded by evidence from women that doctors' are less likely to advise older women about mammography in South Australia. Coll *et al.*, (1989) found that the likelihood of a doctor advising a patient was related to age and education, and Hamblin (1991) also reported that doctors were significantly less likely to recommend screening mammography to older women. This latter study also found that doctors' were less likely to recommend mammography to poorer women, those with small breasts and those who lived in a nursing home or were retarded. They also recommended mammography less often if they were running behind schedule, perceived a more urgent medical problem or saw the woman for an acute visit. Most surveys of general practitioners have focussed on knowledge about mammography, however studies such as Hamblin's are also necessary. Wenberger *et al.*, (1991) also reported that doctors were less likely to suggest screening to older women, regardless of family history. It has been suggested that doctors may be less inclined to encourage older women to have mammograms because of the presence of other co-morbid conditions and the belief that the rate of progression of breast cancer in older women is indolent and slow growing (Bernard, 1993). Another US study which reviewed patient charts in a large academic centre found no association between age and the likelihood of being offered mammography, but a statistically significant association (in logistic regression) with breast disease (more likely if had disease) and severity of the patient's medical condition (more likely to offer if mild) (Schoen *et al.*, 1994).

The National Breast Cancer Survey (Barratt, et al., 1997) found that only 34.7% of women in the target age group reported that their GP had suggested they have a mammogram as part of the National Program. This question was not asked in the most recent Omnibus survey, hence it is not known what this proportion is for South Australia. However, from the interviews of non-attenders in the Invitee study, 37% of the electoral roll non-attenders from Arndale and 46% of the those from Pt Augusta stated that a doctor had suggested a mammogram; they were not asked whether this was with the Program. However, for the R1 Re-invite non-attenders (that is, those most closely likened to Rogers' 'laggards') only 9.5% reported that a doctor had suggested mammography. Hence, there is substantial scope for greater GP involvement. Doctors will need to be assisted in recognising the stage of adoption and tailoring messages accordingly. For the laggards, they will need ways of eliciting barriers to adoption. In particular, given that most women aged 50-69 in South Australia have had at least one mammogram, attention needs to be given to the disenchanted who have stopped having mammograms.

Apart from age being linked to advice from a doctor, it was also found to be an independent predictor of subsequent attendance, from the studies in this thesis and recent Australian work. Invitation letters and other promotional material (including educational material for doctors) should emphasise the continued importance of screening for older women.

The development of appropriate strategies for GP involvement should be taken up at the national level. Doctors are being asked to act as agents of change on several preventive and health promotion issues. Ways of increasing the focus of mammography screening needs to be seen in the context of multiple demands, a busy practice, lack of training in preventive counselling, and inadequate reimbursement. The development of promotional/education packages that incorporate a range of related health behaviours may be a cost-effective strategy given that women least likely to have mammograms are also less likely to have pap tests, and more likely to be smokers and to be older. The newly established Divisions of General Practice in Australia provide a mechanism for developing appropriate strategies.

RECOMMENDATION 10: DOCTORS WILL PLAY A KEY ROLE IN RECRUITMENT. BREASTSCREEN WILL NEED TO DETERMINE CURRENT DOCTOR PRACTICES WITH REGARD TO MAMMOGRAPHY (WHO, WHEN, HOW) AND DETERMINE HOW TO BEST ASSIST DOCTORS IN PROVIDING WOMEN WITH APPROPRIATE INFORMATION AND SUPPORT.

Although doctors will play a critical role, some women do not have a regular doctor and there will be others who will not take their doctor's advice. From the studies in this thesis a proportion of women categorically stated at interview that they would not be influenced by a doctor. Although, it was suggested above that some may change their opinion if doctors provided better information, this would not be the case for all these women. Thus, although recruitment through doctors should be encouraged, ways of targeting women who would not be influenced by a doctor also need to be addressed. A range of strategies will be required that incorporate the concerns of specific groups and a multifaceted approach will also be necessary.

The association between mammography and having a pap smear provides opportunities for both services to be promoted together. Although the cervix screening program targets a wider age group, the 50-69 year age groups is a primary target group. Strategies which cover both tests may be more cost-effective than separate strategies for some women. Rakowski *et al.*, (1997b) reported a prospective study of the combined use of mammography and pap testing based on the Transtheoretical Model of behaviour change, using a sample of women aged 40-74. An integrated 'Decisional Balance' score was calculated based on pro and con indices for both mammography and pap testing, and an integrated action index based on actual mammography and pap test behaviour. A significant association was found between the joint behavioural status and combined decisional balance; women with the most positive decisional balance score (more pros than cons) ranked highest on receipt of both exams. This study suggested that combined recruitment strategies may be effective for women regularly receiving both tests and those receiving neither test, but those adopting only one behaviour may better be targeted by interventions that address the behaviour singly. The Omnibus surveys in South Australia have usually included questions about pap testing. The two programs could consider a combined study similar to the Rawowski *et al.* study.

The finding that women who visit a dentist for check-ups are more likely to participate (both from the case-control study and the National Health Survey), also suggests the potential of increasing participation through pamphlets in private dentist rooms (targeted at women who attend for problems only) and in the rooms of the free government pensioner dental service. The latter would be used more by older, less well-off women, primarily when problems arise.

RECOMMENDATION 11: THE POTENTIAL FOR LINKING THE PROMOTION OF BREAST AND CERVIX SCREENING SHOULD BE EXPLORED AS WELL AS THE POTENTIAL OF THE ASSOCIATION BETWEEN MAMMOGRAPHY AND PREVENTIVE DENTISTRY.

Although several of the recommendations suggest that additional information will need to be collected to further fine tune recruitment strategies, the potential for better utilising existing data systems should not be ignored. The South Australian Program has available to it linked data which will permit the examination of cohorts of women from their first association with the service, either through personal contact (spontaneous clients) or the issue of an invitation from a doctor or from the Program using the electoral roll. Following the response pattern over time by individual birthyear cohorts provides an extremely valuable resource.

Based on evidence from this thesis on patterns of subsequent attendance, information available by reason for non-attendance can be also utilised to determine expected future attendance. Women who failed to attend without notice or respond in any way to an invitation letter (*no response* category) were difficult to recruit both for an initial and rescreen, than women who cancelled or made an appointment but failed to keep it; fewer attended initially and amongst those who subsequently attended the FTA and *no response* non-attenders took longer. The *no response* category is now the major outcome of invitations for an initial screen. It is suggested that non-attenders from an invitation for an initial screen, and spontaneous bookers who miss or cancel their appointment should be followed-up sooner than a 12 months re-invitation. Consideration should also be given to collecting more information from women who ring to cancel, and telephoning women who make an appointment but miss it, since a telephone number is collected when making a booking.

RECOMMENDATION 12: EXISTING INFORMATION SHOULD BE BETTER UTILISED AND CONSIDERATION GIVEN TO COLLECTING MORE DETAIL ON CANCELLATIONS AND TO INTRODUCING EARLIER FOLLOW-UP.

The projections of participation rates show a decline in participation. The resources needed to increase participation may have implications for cost-effectiveness, and it was recommended that cost-effectiveness should be critically examined. One possibility that the Program could consider is co-payment. The impact would need to be assessed in lost participation versus lower cost per woman screened. A question on willingness to pay for mammography in the case-control study found that a high proportion of both cases and controls were willing to pay. Overall, 30% of subjects stated they were not willing to pay, the proportion being higher for women who had never had a mammogram, for women who booked spontaneously (than GP invitees), for controls, and for older women. These results partly reflect actual experience (the controls did not pay) or knowledge that the Service was free rather than true willingness to pay, and it is not known how many of the controls would not have attended had there been a co-payment. Nearly 30% of the case-control subjects were willing to pay up to $40 and a further 20% more than $40, while just over 20% could not specify an amount. These data were collected in late 1991. From the 1990 Omnibus survey, the same proportion (30%) of women aged 50-69 were unwilling to pay in the community, 20% were willing to pay up to $40, 10% over $40 and 40% could not specify an amount. As with the case-control study more older women specified 'Nothing', but there was no difference by whether they had ever had a mammogram. It seems that co-payment would affect the recruitment of older women and perhaps reattendance of those in the Program. However, these data relate to the early phase of the Program, and it would be suggested that this question be asked of current attenders and non-attenders. If the Program continues to use the Omnibus survey vehicle to monitor recruitment, or is able to utilise the SERCIS vehicle, then the cost of collecting this information would be minimal. If a favourable response is found, the National Program might consider a co-payment for women who can afford to pay so that resources become available for other priorities, such as encouraging reattendance or the recruiting of the laggards.

RECOMMENDATION 13: THE PROGRAM MAY WISH TO CONSIDER THE OPTION OF A CO-PAYMENT BY FIRST COLLECTING DATA ON WILLINGNESS TO PAY FROM CURRENT COHORTS OF ATTENDERS AND NON-ATTENDERS.

This thesis has provided much information and confirmed that attenders and non-attenders comprise several sub-groups, each with women at various stages of adoption, requiring multifaceted and specifically targeted recruitment strategies. The suggestions and recommendations, include simple measures such as better use of administrative data for patterns of utilisation and identification of various sub-groups to suggestions for further research. When this study commenced, the focus was on new recruits, now it is on maintenance of mammography behaviour and utilisation outside the government funded National Program. This thesis can forewarn other states of possible falling participation rates without implementation of countermeasures, since BreastScreen SA is at a more mature phase, based on the proportion of screens which are rescreens. Finally, the issue of cost-effectiveness needs to be urgently addressed, particularly given the pressure to increase the target age range. Ultimately, Australia needs to determine at what level the costs outweigh the benefits. Should the fall in breast cancer deaths seen in South Australia be confirmed next year and beyond, then the value that society places on mammography screening may indeed be enhanced.