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Social impact of oral disease among older adults.

by

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LIST OF ABBREVIATIONS

Abbreviation [page first used]	Description and source (where applicable)
CPITN [p 52]	Community Periodontal Index of Treatment Needs (WHO, 1987)
DIP [p 34]	Dental Impact Profile (Strauss and Hunt, 1993)
DMF [p 2]	Decayed, Missing or Filled index of caries experience (WHO, 1987)
DVA [p 248]	Department of Veterans' Affairs health card
GOHAI [p 33]	Geriatric Oral Health Assessment Index (Atchison and Dolan, 1990)
IWB [p 12]	Index of Well-Being (Kaplan et al, 1976)
NHP [p 19]	Nottingham Health Profile (Hunt et al, 1986)
NIDR [p 134]	National Institute of Dental Research
OHIP [p 65]	Oral Health Impact Profile
PHBC [p 248]	Pensioner health benefit card
SADLS [p 10]	South Australian Dental Longitudinal Study
SIP [p 12]	Sickness Impact Profile (Gilson et al, 1975)
StdDev [p 56]	Sample standard deviation
StdErr [p 176]	Sample standard error
WHO [p 6]	World Health Organization

ABSTRACT

Assessment of the social impact of disease has been recognized as a vital component in understanding health behaviours and in planning and evaluating health care. This research investigates the social impact of oral disease among older adults in South Australia. A pilot survey of 178 persons aged 60+ years was followed by additional research to develop a self-complete questionnaire entitled the Oral Health Impact Profile (OHIP). The OHIP draws on contemporary concepts of health and disease and describes seven dimensions of impact characterized as: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. The OHIP was used in an epidemiological survey among 1,650 persons aged 60+ years in order to assess the distribution of and factors associated with social impact. Social impact was reported frequently: 91.5 per cent of persons reported some impact, and 6.6 per cent reported impact in all seven dimensions. Quantitative OHIP scores were obtained by weighting the 49 separate questions according to severity and frequency. Edentulous persons reported more functional limitation and physical disability than dentate persons, while mean scores for psycho-social impacts were similar between the two groups. Multivariate analyses among dentate persons revealed relatively consistent effects on the seven dimensions of: missing anterior teeth, missing unreplaced posterior teeth, and root decay. There were additional independent effects of non-epidemiological factors which related to: access to and use of dental care; financial hardship; and general health status. These effects and interactions between epidemiological and non-epidemiological factors suggest that dental care and socioeconomic resources provide a substantial buffer between oral disease and the experience of social impact. Relationships between dimensions of social

impact were investigated in separate analyses. Higher levels of disability were recorded as both functional limitation and physical pain increased. However a combination of moderate functional limitation and moderate pain was associated with significantly more physical disability among edentulous persons compared with dentate persons. The findings suggest that edentulism modifies the reaction to dysfunction and pain directly, because edentulous persons must rely on prostheses which are less efficient than natural teeth, and indirectly because of a sense of complete dependence on dentures. This indirect effect of dependence was confined to physical disability rather than psychological or social disability supporting the notion that they constitute theoretically distinct dimensions of social impact.

SIGNED STATEMENT

The thesis contains no material which has been accepted for the award of any other degree or diploma in any university and, to the best of the candidate's knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

The author consents to the thesis being made available for photocopying and loan, if applicable, if accepted for the award of the degree.

Gary D. Slade

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CHAPTER 1. INTRODUCTION

Symptoms of pain and discomfort represent frequent consequences of oral disease. The progress of oral disease, or deficits which are left after treatment of oral disease, can create anatomical changes and persistent reductions in function. The high prevalence and high rate of recurrence of oral disease means that most individuals can expect to experience a number of episodes of oral symptoms or dysfunction at one time or another. More severe or recurrent problems can lead to persistent dysfunction or discomfort which in turn can cause distress or affect everyday activities. These subjective experiences of the consequences of oral disease can be referred to collectively as the social impact of oral disease.

There is potential for substantial levels of social impact within populations. The potential is confirmed in anecdotes by most people who can recall a past dental problem. Koestler's *Darkness at Noon* (1973) provides a classic account of the pain of a persistent, aching tooth-root and its impact on Rubashov's psyche, while the contemporary entertainment industry capitalizes on the widespread fear of dental pain in movies such as *Marathon Man* and *Little Shop of Horrors*.

Despite the potential scope for social impact within populations, there is a serious deficiency in systematic knowledge about the frequency of, and factors contributing to, the social impact of oral disease. The deficiency is more surprising when it is recognized that the clinical dimensions of oral disease have been so extensively examined, both in clinical research and oral epidemiological studies. In many countries there exist, for example, high quality data describing the clinical parameters of caries experience collected from large monitoring surveys of child dental health. Those data allow quite precise quantification of the epidemiology of caries experience

within and across nations. Such surveys contribute to the identification of factors which can influence disease rates. However it is uncommon to have comparable data collections describing the subjective reactions to and social consequences of dental caries among those same groups. Consequently, while improvements can be documented among children in their clinical manifestations of caries experience (that is, DMF), it can only be presumed that commensurate improvements have occurred in the frequency of social impact.

There is strong endorsement of the principal that assessment of oral health is a necessary and logical first step in the process of public health planning and resource allocation (Spencer, 1985). Recently the formulation of Dental Health Goals (Green, 1983; Health Targets and Implementation Committee, 1988) has placed a new emphasis on the assessment of health as a tool to plan and evaluate health services. However, during the last two decades dental researchers in a variety of settings have drawn attention to limits in the capacity of traditional epidemiological indices to achieve those purposes. They have called for a broadening of the basis for assessing oral health through research into the functional, psychological and social impact of oral disorders. Reisine (1985) emphasized the value of assessing social impact in order to allocate resources, to understand the scope of oral health problems and to evaluate dental programs. Kiyak (1989) highlighted the relevance of the perceived importance of oral health disorders as a predictor of the use of dental services.

Major discrepancies therefore can be identified between:

- the narrowly defined measures of oral health (confined predominantly to biological markers of disease);

- the potentially broad range of subjective reactions to and social consequences of oral disease; and

- the requirements for health indices in planning dental services and understanding health behaviours.

The lack of systematic data about the social impact of oral disease can be attributed to a number of factors. There is a prevailing bio-medical model within dental science which contributes to a general belief among dentists that information and research should be concentrated on clinical parameters. The bio-medical model, with its orientation towards pathological processes and treatments directed at those processes, is in contrast to a sociological perspective of health. The sociological perspective places greater emphasis on the subjective experience of illness and the consequences of illness for the behaviours of individuals (Locker, 1989). The general lack of attention to the social impact of oral disease in the past therefore reflects both the dominance of a bio-medical orientation within dentistry and a failure of sociologists to develop a focus on oral health.

However during the last two decades there has been growing interest in the social impact of oral disease. Nearly two decades ago Cohen and Jago (1976) drew attention to the lack of information about "socio-dental indicators", which they described as assessments of non-clinical parameters of oral health and disease. They called for the development of indices describing behavioural consequences of oral disease and argued that those indices should be used to assess oral health and evaluate dental care.

The importance of socio-dental indicators is not acknowledged by other researchers, who argue instead that oral health problems are quite distinct from most other illness conditions, and any consequences of dental

problems are insubstantial. For example, Davis (1976) suggested that, aside from pain or rare life–threatening neoplasms, oral disease is associated only with aesthetics or perceptions of self–esteem, rather than effects on social roles. Holtzman (1988) offers a more qualified interpretation based on research among older adults. He stated that, while older persons recognize oral symptoms, "Good oral health is simply not 'dramatic'." Berkey and Shay (1992), referring to the significance of the mouth, argue that its "central importance to nutrition, communication, and self-image is taken for granted in health when mastication, deglutition, phonation, facial expression, and other forms of affection occur spontaneously and without extraordinary effort or discomfort."

These comments appear to touch on a lay perception which can be summarized in the proposition that oral health and diseases can be seen effectively as inconvenient interruptions unrelated to general health status. Some researchers have supported that view with studies indirectly examining lay perceptions. For example, Gerson (1972) found a general belief that oral conditions should not constitute a justification for exemption from work. Because the conditions were rarely associated with the classical "sick role" it was concluded by Gerson that oral disease was not viewed as illness.

Dunnell and Cartwright (1972) argued that very frequent complaints such as headaches, rashes, burns and troubles with teeth were seen as "trivial" problems, and not recognized or accepted as ill health. Indeed, persons with those conditions were found to report better health status than persons with none. Westert et al (1987) asked 1,622 Dutch residents to list all their health problems from the preceding year and found that only 13 mentioned an oral health problem. The authors concluded that the low level of recall demonstrated a very limited impact of oral conditions on daily life.

These studies did not directly ask individuals about the types of impacts caused by oral conditions. Consequently, the findings provide indirect evidence about lay beliefs concerning oral conditions, illness and social impact. There is a stark contrast between this indirect evidence and empirical evidence obtained about impacts of oral disease throughout populations. Spencer and Lewis (1989) used data from the Australian Health Survey and calculated that there were 646,000 days lost from school and 1.1 million days lost from work in Australia during 1983 because of oral problems. There were also 3.2 million days of reduced activity due to oral disorders. Reisine (1985) has reported comparable findings from the USA, referring to these as measures of "societal impact". More recent data from the 1989 US National Health Interview Survey (NHIS) clarified the nature of work-loss, days absent from school, days of reduced activity and factors associated with those measures (Gift et al, 1992). There were more days of restricted activity among females compared with males, adults compared with children and disadvantaged socioeconomic groups.

Measures of work-loss, days absent from school and disability days, when used in this manner, can be described as societal indicators of oral disease. They provide relatively little information about the more subtle experiences of individuals which affect day-to-day activities and social roles. Indeed, when societal indicators of work-loss were examined among a cohort of workers it was concluded that they provide insufficient detail of the impact of oral disease among individuals (Reisine and Miller, 1985). Gift et al (1992) observed from the 1989 NHIS data that the average of 1.48 hours of work lost per person was of little consequence for the individual, although it represented a substantial societal impact.

This, in part, can be related to the limited dimensions of the illness experience which are captured in measures such as work-loss. For

example, even quite severe levels of discomfort or distress can occur without causing work-loss. Furthermore, many individuals are not in the workforce. There are additional technical factors associated with sick-leave entitlement and the nature of work which limit the validity of work-loss for the purpose of comparing individuals' social impact of oral disease. For example, 95 per cent of work-loss episodes in the baseline study of Reisine (1984a) were due to preventive or curative treatment. It follows that there are features of the organization of dental care and provision of dental services which exert a strong influence on the measure.

There are other theoretical reasons to reject the view that the impact of oral disease is either inconsequential or sufficiently uncommon that it can be disregarded as a matter of health. This follows an acknowledgement that the very nature of health and disease in developed countries has changed dramatically this century. The current epidemiological profile of general health status is dominated by chronic conditions which are not immediately life-threatening and which are caused by a number of modifiable behaviours embedded in our culture or "lifestyle". This is a dramatic change from previous centuries in which there were epidemics of acute, infectious, and often life-threatening diseases.

This changing epidemiological profile has been accompanied by the development of new concepts in which health is seen as a personal state of well-being, and not simply the absence of disease (WHO, 1980). The Director General of the WHO has emphasized the role of health as a resource that "enables a person to lead a socially and economically productive life" (Mahler, 1981). Coupled with a recognition that professional health services were having little impact on traditional mortality and morbidity statistics, these concepts led to advocacy for development of more appropriate indices of general health status which capture behavioural

consequences of illness and aspects of life quality (Elinson, 1974). At the same time, there has been a call for health services to focus on the restoration of function and provision of care, instead of the biomedical emphasis on the cure of pathological processes (Williams and Hadler, 1983). Indeed, Priester (1992) argues that the "moral importance" of health care must be judged according to its capacity to "adequately protect and restore normal functioning".

It is uncertain if lay perceptions of health and disease have undergone similar changes. If they have, it might be appropriate to formulate new research questions to investigate oral health and its impact. For example, it may be more useful to contrast lay views about oral symptoms in comparison with the symptoms of comparable conditions, rather than the notions of sick role behaviour and expectations of work exemption.

Contemporary concepts of health and disease therefore create additional motivation for investigations into the social impact of oral disease. In the first instance, these concepts place greater emphasis on the behavioural dimensions of the illness experience – outcomes which cannot be ascertained from oral epidemiological measures of caries experience. Furthermore, contemporary concepts call for greater attention to the effects on well-being of conditions which generally are not life-threatening. If health nowadays can be seen to encompass broader aspects of life quality and not simply questions of life and death, then it is essential to consider the social impact of oral disease.

In addition to providing a perspective of oral health which is consistent with these contemporary views, there are practical benefits to be obtained from improved knowledge about the social impact of oral disease. Reisine and Bailit (1980) have emphasized the importance of social impact

in influencing illness behaviour, particularly the use of dental services. Tugwell et al (1985) advocate the use outcome measures such as dysfunction and disability in the very process of identifying the "burden of illness". Quantification of those outcomes then can be used as the basis for assigning priorities, planning and evaluation of health care. Davis (1980) has gone further by arguing that a "more pragmatic criterion of oral health would displace the current reliance on the disease analogy", and by calling for a oral health needs to be defined according to criteria of impairment and disability. Another tangible use for information about the social impact of oral disease is in advocating for oral health and appropriate dental care (Nikias, 1985). For example, measures such as work-loss highlight the impact of oral disease on the economy, while individuals' experiences of dysfunction and discomfort can emphasize the extent of personal suffering and distress.

This thesis examines the social impact of oral disease among older adults in South Australia. The focus on older adults has been adopted primarily for two reasons.

1) In Australia there is a high frequency of disease and impairment among older adults. Researchers in geriatric dentistry elsewhere have indicated that this creates "a complex of emerging oral health problems" (Ship and Ship, 1989). Furthermore, Ettinger and Beck (1982) have drawn attention to major generation differences between the "new–old" and "old–old" age groups which can be expected to contribute to differences in the impact of oral conditions. In South Australia, it was anticipated that the same factors would contribute to variations in social impact which would readily be observed among older adults.

2) Older adults within the Australian population represent an important group in dental public health due to projected demographic and oral health status changes. It is expected that an increasing number of persons and "pool of teeth" will create growing requirement for dental care among current and future generations of older adults (National Health Strategy, 1992). During the next decade, the percentage of edentulous persons aged 60-64 is expected to reduce from 40 per cent to 27 per cent, and among the oldest group (aged 85+) from 89 per cent to 80 per cent (Spencer and Lewis, 1989). Howe (1988) has gone further and predicted an increase of 259 per cent in the number of teeth retained by persons aged 65+ in Australia, and an increase of 505 per cent in the number of elderly persons seeking dental care.

The significance of the social impact of oral disease is given further emphasis in view of theoretical considerations suggesting that functional, psychological and social consequences of disease are critical for older adults (Rothman et al, 1989). This is due to the nature of disease, which may be multiple and chronic, as well as the importance of health for the social well–being of the elderly.

Within dentistry there are strong reasons to believe that information about the social impact of oral conditions would be a valuable tool in clinical decision making (Ettinger, 1984). Despite evidence that health care professionals fashion treatment plans around their own perceptions of a patient's quality of life, those perceptions are poorly correlated with the patient's own rating of quality of life (Gift and Redford, 1992).

Despite the practical importance of functional status and disabling oral conditions among older adults, there is a lack of research in the area. Reports from a 1985 symposium of the Gerontological Society of America

(Miller, 1987) contained assertions about the importance of oral health for oral functioning, and the psychological and social well-being of older adults. Anecdotal evidence of improvements in social confidence associated with improved oral health were reported (Ettinger, 1987). However a lack of empirical information was noted consistently and a need for research into the links between oral status and general health, psychological well-being and functional status was highlighted (Thines et al, 1987).

1.1 Structure of the thesis

This thesis presents findings from three consecutive phases of research: a pilot survey, methodological research into the measurement of social impact, and a comprehensive survey of oral health and social impact among older adults entitled the South Australian Dental Longitudinal Study (SADLS). The thesis begins with a literature review (Chapter 2) and a statement of aims (Chapter 3). Chapters 4, 5 and 6 present descriptions of the three consecutive phases of the research. Within those three chapters are presented the methods, results and discussion for the respective phases of research. Methods are described under the conventional headings of design, source of subjects, data collection methods and analysis. The description of methods also contains a discussion of the rationale underlying the use of the methods. Details of participation, including some analysis of potential response bias, are presented before each results section. A set of overall conclusions is presented in the Chapter 7. The appendices contain copies of survey instruments.

CHAPTER 2. LITERATURE REVIEW

This section begins with a review of general health indices which have been influential in the development of social impact measures in oral health. Those indices also have helped to define separate dimensions of social impact. Some examples are provided of oral health surveys which have investigated separate dimensions of social impact. Theoretical frameworks for oral health are investigated next followed by an analysis of existing multidimensional measures of the social impact of oral disease. Finally there is a review of methodological approaches which, it is argued, are appropriate for a more thorough assessment of the social impact of oral disease.

2.1 Dimensions of social impact

Within a clinical framework, eating, speech and smiling represent the main functions expected of the teeth and oral structures. Sheiham and Croog (1981) have suggested a more extensive scope for the social impact of oral disease to include: work performance and productivity; economic consequences; quality of life; family interaction; emotional tone of the family; personality and intellectual functioning; effects upon the health level and way of life of the community; and decision making by individuals with regard to dental behaviours. This is more consistent with the general health literature where separate dimensions of social impact have been described regarding: behavioural and performance dimensions; pain and discomfort; feeling states; and quality of life. Each of them is considered below.

2.1.1 Behavioural and performance dimensions

The Sickness Impact Profile (SIP) represents a significant starting point in the growth of socio-medical indicators of health. Gilson et al (1975), who designed the SIP, defined three measurable dimensions of ill health: clinically defined disease; descriptions of subjective or "feeling states"; and behavioural or performance dimensions of ill health. The SIP was designed specifically to capture the latter. The instrument contains questions such as "I am walking shorter distances" and "I often act irritable towards [others]". The rationale was that behavioural consequences represent generic, overall indicators of the impact of illness. Furthermore, behavioural consequences could be reported by subjects themselves or by observers (such as clinicians), and the behavioural consequences of illness should be amenable to health care.

In capturing behavioural manifestations of illness, the SIP advances much earlier work by Katz et al (1963) who defined a simple set of "activities of daily living" consistent with health for older adults: feeding, continence, mobility, toileting, dressing and bathing. Another major index among the general health status indicators is the Index of Well-being (IWB – Kaplan et al, 1976) which contains three dimensions: mobility, physical activity and social activity. Hence, it also draws on the notion of interruptions to behaviours and normal social roles. However the IWB has two features distinguishing it from the SIP - the IWB is designed for measuring social impact of populations or large subgroups and it is computed from the separate assessments of the level of well-being and the prognosis for that level.

A consistent notion within these indices of general health status is the separation of physical disability and social disability. While there is an

expected correlation between the two forms of disability, there is justification for maintenance of a theoretical distinction based on findings from large surveys of health status. In an early United States National Health Interview Survey, one third of persons with extreme mobility limitation (physical disability) were able to carry on their major social roles (Greenblum, 1979).

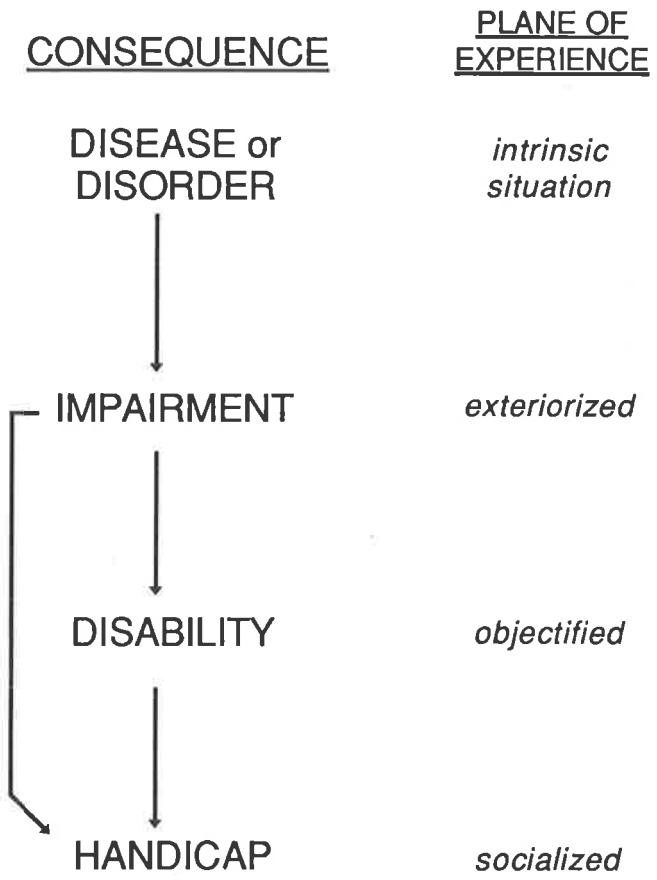
Parts of the SIP have been used to examine the social impact of oral disease. Reisine et al (1989) assessed four dental patient groups and found the highest rate of social impact among those with temporomandibular (TM) disorders. More than one third reported impacts within the SIP subscales of rest and sleep, home tasks, intellectual function, speech/communication, work and leisure. Some 81 per cent of persons reported social interaction impacts. In a six-month follow-up of the treated TM patients (Reisine and Weber, 1989) values for mean SIP subscales indicated significant improvements for rest/sleep, home tasks, work, and leisure activities.

Other behavioural consequences, more specifically related to oral conditions, have revealed variations among oral health status groups. Oosterhaven et al (1989) asked about behaviours such as "cover mouth with hand when laughing" and "not laughing on a photograph" to assess the impact of missing teeth. Individuals with missing front teeth reported higher levels of behaviour change than persons with missing premolars or persons with no missing teeth.

More sophisticated concepts about the nature of general illness and its behavioural consequences were developed by the WHO (WHO, 1980). The WHO model, displayed in Figure 1 proposes a hierarchy of responses, each which manifests as a different "plane of experience". It begins with disease, defined as a pathological process. Impairment is a loss of function, while disability is an inability to perform activities or fulfil roles, and

handicap represents the disadvantage experienced by diseased individuals. The category of impairment recognizes aspects of ill health which precede the behavioural manifestations of disability. Impairment therefore, represents a category of impact not included in the SIP. Moreover the WHO model extends the SIP by including the more abstract notion of disadvantage (handicap) as a qualitatively different, and probably more serious, consequence. While handicap may be observed in the behaviour of individuals (for example, being unable to obtain employment), it encompasses other forms of disadvantage such as social stigma.

FIGURE 1 WHO MODEL OF DISEASE, IMPAIRMENT, DISABILITY AND HANDICAP*



* From WHO, 1980.

The hierarchy implicit within the WHO model should not be regarded as an indicator of "severity" of underlying conditions, but rather the extent to which impact becomes an "external" rather than "internal" event. The "planes of experience" (Figure 1) have been described as:

1) Something abnormal occurs within the individual (disease) regarded as an intrinsic situation;

2) Someone, usually the diseased person, becomes aware of such an occurrence (impairment) which means that the disease is "exteriorized";

3) The individual's performance or behaviour is altered (disability) so that it becomes "objectified"; and

4) The individual is placed at a disadvantage (handicap), when the condition becomes "socialized".

A characteristic of the WHO model and the SIP is the exclusion of internal feeling states. As well, the SIP excludes functional capacity. Functional capacity, which conforms with functional limitation in the WHO model, reflects the potential to perform specific tasks (say, walking up a flight of stairs), whether or not those tasks fall within the usual range of activities performed by the individual. Within general health, numerous indices exist to measure functional capacity: for example, tests of visual acuity are used routinely within general medical care.

Within dentistry, measures of oral functional capacity are not common. The clinical and self-reported ("anamnestic") indices of temporomandibular disorders include assessments of jaw opening capacity

(Helkimo, 1974). Leake (1990) has developed an index of chewing capacity which asks individuals about their ability to chew or bite six common foods. Others have asked about nominated foods such as root vegetables, fruit, meat and porridge (Ranta et al, 1987). Both methods have the advantage that they contain precise criteria. A less satisfactory (although more widespread) approach is to ask individuals to provide a simple self-rating of their chewing capacity (Lappalainen and Nyyssonen, 1987).

Earlier, researchers investigating masticatory performance used sieves to measure the efficiency of comminution of regular-sized foods such as diced carrot and nuts (Kapur and Soman, 1964). A related approach, reported by Giddon et al (1954), assessed functional gustatory capacity in detection of sweet sensations. There has been a consistent observation in studies of masticatory performance that dentures provide less chewing efficiency than natural teeth, although additional changes in behaviour (such as food selection) or nutritional intake (such as calories or micro-nutrients) do not usually follow (Gordon et al, 1985). Although these measures have not become popular within dental practice in the way that vision tests and other functional assessments have within general medicine, they draw attention to functional capacity as an important dimension of social impact.

Ettinger (1987) called for a broader view of the impact of chewing dysfunction, and argued that "chewing, tasting and mastication are essentially pleasurable and emotionally necessary for well-being". A good example is provided by the survey of edentulous, non-institutionalized older adults in the United Kingdom (Smith and Sheiham, 1979). While 30 per cent of persons reported difficulty chewing, only five per cent had changed their diet. However, nine per cent felt uncomfortable chewing in front of others, and 13 per cent reported embarrassment during social interaction.

2.1.2 Internal feeling states

Internal feeling states represent a qualitatively different aspect of social impact compared with the behavioural and performance dimensions considered so far. Potentially they can include pain, discomfort, mood, self esteem and quality of life.

2.1.2.1 Pain and discomfort dimensions

Researchers in general health have developed an array of questionnaires to assess pain and discomfort (McDowell and Newell, 1987). Haig et al (1989) have extended the usual concept of discomfort to include: general (whole of body) phenomena such as fatigue or malaise; physical sensations such as pain, nausea or itch, each related to a part of the body; and psychological distress such as worry or anxiety.

Despite a long standing lay recognition (and probably fear) of the potential for painful dental conditions, early research into the population impact of pain has not been illuminating. Sindet-Pedersen et al (1985) asked dentists to report on the number of their patients who consulted for pain, although there appeared to be no attempt to introduce consistency into the assessments made by the 62 dentists involved in the study. They reported only 2.1 per cent of patients attending for pain. This is in marked contrast to findings from other settings, such as public dental clinics in Australia which have recorded some 35 per cent of patients attending for relief of pain or discomfort (Dental Statistics and Research Unit, 1993). A study of 236 nursing mothers and their husbands in the United Kingdom led to the estimate of an average three days of toothache per person per annum (Miller, 1978).

Comprehensive research into the distribution and consequences of pain has been very recent. The Nuprin pain survey in the USA found that 27 per cent of adults reported "dental pain" (Reisine, 1988). Davis (1987) reportcd findings from the WHO international collaborative study which asked questions about the occurrence during the previous year of painful gums, mouth and toothache. After allowing for variations in edentulism (which has an obvious confounding effect on toothache) there was considerable similarity among the five nations involved in the study. Sore gums were reported by 14 to 32 per cent of persons, sore mouth by eight to 20 per cent, and toothache by 14 to 39 per cent. Canterbury (New Zealand), with the highest prevalence of edentulism, tended to report lower levels of pain, while Yamanashi (with a low rate of edentulism) had higher levels of pain.

Locker and Grushka (1987) conducted a mail survey of adults in Toronto, Canada. Some 14.1 per cent of respondents reported toothache during the previous four weeks, 26.3 per cent reported sore and bleeding gums and 28.8 per cent reported pain in teeth with hot or cold foods. Locker (1988a) also described a "symptom iceberg", referring to the low proportion of persons (less than one in two) who sought clinical attention for their painful episodes.

Previously a similar disparity between symptoms and use of services had been reported for edentulous older adults in the United Kingdom (Smith, 1979) and the United States (Hunt et al, 1985). Holtzman and Akiyama (1987) reported that older adults rated the seriousness of painful teeth or gums 25th and irritated tongue or mouth 36th in a list of 53 common medical symptoms. However toothache was relatively more likely to be regarded as needing professional care: it was rated 10th and irritated tongue or mouth as 27th in the priority for seeking professional care.

This discrepancy between the experience of a painful condition and the adoption of concrete behaviours highlights the value of considering pain and discomfort as an element of social impact which is separate from the behavioural or performance dimensions. Undoubtedly the behavioural consequences of pain represent the "tip of an iceberg" compared with the total amount of suffering experienced by individuals. There would be many instances in which persons experiencing pain would report no impact within an instrument such as the SIP. However there are good reasons to believe that pain itself constitutes a form of suffering (and therefore represents a separate dimension of the impact of disease), even in the absence of behavioural consequences. Patrick et al (1973) argued for an extension of the concept of "functional disturbance" to include symptoms and pain, even if they have no outwardly visible manifestations or disruptions to social roles, simply because they represent deviations from a normal (modal) state. This argument has been pursued by Locker (1988b) who adds to the WHO (1980) dimensions in his formulation of a model of oral health and disease.

2.1.2.2 Worry, mood and self-esteem

Another group of internal feelings which potentially can be considered as forms of social impact relate to worry, mood and self esteem. In areas of general health status, these feeling states frequently are described under the broad umbrella of "well–being" or "quality of life", or they may be incorporated into multidimensional scales. A typical approach to the incorporation of feeling states into indices of the impact of disease is represented in the Nottingham Health Profile (NHP – Hunt et al, 1986). It includes feeling state dimensions such as energy and emotional reactions, in addition to pain and the individual's performance in roles (such as social life, looking after the home and employment). Like the SIP, the NHP has a number of methodological features including: the derivation of questions

from interviews with patients; empirical methods used to weight questions of different severity; and extensive work assessing validity and reliability.

There appears to be a widespread awareness of the potential for oral conditions also to cause impacts on feeling states. For example, the face is known to play an important role in the psychological processes involved in recognition and non-verbal communication. Facial clefts and malocclusions are conditions in which there are well established patterns of lay recognition and even stigma. Reisine (1984b) reviewed the literature concerning the impact of such conditions. The limited amount of research at that time had concentrated primarily on the impact of malocclusion although the findings were equivocal. Rutzen (1973) reported that the impact of orthodontic treatment may be confined to self-perceptions of appearance rather than outcomes such as occupational status or courtship patterns. More recently, Kenealy et al (1989) used the Rutter questionnaire, a measure of emotional and behavioural disturbance, to assess the impact of malocclusion among school children in the United Kingdom. They reported few correlations between judgements of facial attractiveness and emotional or behavioural impact, although they noted that the questionnaire may not have related specifically to the "psychological cost" of malocclusion.

The limited research into feeling states among other age groups has been less equivocal. However, an assessment of relationships between psychological impact and more general aspects of oral health was conducted among institutionalized older adults by Berkey et al (1988). They reported negative correlations between dental problems and self esteem among dentate persons in a nursing home.

2.1.3 Quality of life dimensions

Quality of life itself is multidimensional, although there is not universal agreement concerning its range of dimensions. For example, Kutner et al (1992) regard ill health as influencing quality of life through physical function, social function, emotional states, mental states and pain. These effectively are the dimensions which have been reviewed already.

A more conventional view distinguishes between quality of life and other "social impact" dimensions of ill health. Ware (1976) devised the Health Perceptions Questionnaire as an index to be distinct from four specific components of health (physiological, physical, mental and social) or measures of observable phenomena (days off work, days of reduced activity). The Health Perceptions Questionnaire contains perceptions in eight areas: current health rating, prior health, resistance/susceptibility, health outlook, health worry/concern, sickness orientation, rejection of sick role and attitude towards attending a doctor.

Some of those perceptions have been captured in attitudinal surveys concerning oral health. For example Schuurs et al (1990) assessed the subjective value placed on teeth by asking about attitudes to tooth loss and dental visits. Norman et al (1986) asked about perceived severity of dental caries and perceived benefits of preventive action among older black Americans. A moderately strong correlation was observed between clinically assessed denture quality and general quality of life among 31 edentulous Dutch persons aged 55+ years (Heyink and Schaub, 1986). Unfortunately the measure used to assess quality of life was not described.

Gift and Redford (1992), commenting on the ill-defined nature of the quality of life, emphasized that it is a composite of clinical and socio-

behavioural factors. They called for an improved understanding of "oral quality of life" through a definition incorporating: clinical goals, prosthetic replacement for aesthetics, freedom from pain, freedom from unacceptable intrinsic anomalies, a functional and cosmetically acceptable occlusion, and oral function which is integral with general health.

Assessments of the quality of life within oral health surveys commonly have been made using questions about "satisfaction" with oral health. The construct of "satisfaction" clearly represents an important aspect of the quality of life for older adults (Herzog and Rodgers, 1986) and there are valid reasons to include satisfaction as a dimension of social impact (Andrews, 1981). However, satisfaction concerning oral health usually has been assessed as a single question with responses ranging from satisfied to dissatisfied. This positive and negative aspect of satisfaction draws attention to one of the special features of the quality of life which differs from the previously examined, unidirectional dimensions.

Numerous oral health surveys have examined satisfaction with dentures (for example, Berg, 1984) and the findings highlight another issue concerning satisfaction - namely, the importance of the clinician and the process of clinical care in individuals' judgements about satisfaction. Satisfaction with the process of dental care has been assessed with specific indices (Davies and Ware, 1981; Chapko et al, 1985). It is quite distinct from the notion of satisfaction with oral health and will not be pursued here.

Ranta et al (1987) investigated characteristics of oral health satisfaction which suggest that it is a dimension quite separate from oral status or function. In the Mini-Finland oral health survey, satisfaction was greater among edentulous persons than dentate although fewer edentulous than dentate persons were able to chew hard foods. Within the edentulous

group, satisfaction increased with age while ability to chew hard foods decreased with age.

2.2 Theoretical frameworks for evaluating social impact

The review so far has identified the dimensions of social impact which have emerged from general health indices and examined studies of oral health which have assessed, in some way, those dimensions. However the oral health studies frequently have been confined to single questions and single dimensions of social impact, and many draw only on dental patients or special groups within the population. As a result the studies do not completely address the more complex requirements for research in sociodental indicators which were been identified nearly two decades ago (Cohen and Jago, 1976).

An editorial by Nikias (1985) provided an update of research in the area and concluded that there still was a lack of comprehensive methodological research into sociodental indicators. She also argued that studies of oral health which used general health indicators (such as the SIP) demonstrated a lack of sensitivity to the impact of oral conditions. She called for the scope of sociodental indicators to include, in addition to disability, five dimensions: effects on interpersonal relations; social interaction; vocational stability; family life; and leisure activities.

While numerous researchers have described the dimensions of social impact which should be included in sociodental indicators, there have been only three substantial discussions of a theoretical framework for those dimensions. The first was developed by Reisine (1981) who based a theoretical framework around the Parsonian "sick role" and various modifications of it. Roles were viewed within the social-psychological

paradigm as norms which were socially defined and which influenced individuals' behaviours. Although the Parsonian sick role was structured around behaviours appropriate for acute, potentially life threatening illness, Reisine based her theoretical framework around more contemporary views, including the work of Davis (1976). The sick role encompassed a broader range of illnesses including chronic conditions (regarded by Davis as "conditionally legitimate" bases for sick role behaviour) and stigmatized conditions such as congenitally missing teeth (regarded as "illegitimate" bases for sick role behaviour).

Reisine (1981, 1984b) emphasized some problematic aspects of the sick role as a framework for sociodental indicators, such as differing expectations about work exemptions - an important parameter of the Parsonian sick role (Reisine, 1981). For example, groups with higher socioeconomic status would be likely to see periodontitis as providing limited work exemptions, while lower socioeconomic groups would be likely to regard it as providing no exemptions. As well, Reisine (1981) acknowledged the importance of other quality of life parameters within the framework for social impact, such as self image, times to do things, and financial impact. Despite (or perhaps because of) these more complex theoretical aspects of the sick role and social impact, she called for a limited set of research goals. First, there should be research to identify the specific oral conditions which lead to sick role and illness behaviour. Second, "structural constraints" (such as socioeconomic status) which affect sick role exemptions should be accounted for. And third, oral conditions should be incorporated into the SIP or other existing scales (Reisine, 1981).

The second theoretical model was adapted from Reisine's and explicitly acknowledged "medical" and "social" models of health (Davis, 1987). Davis argued that acute and some chronic oral conditions conform

to a medical model of impact due to their immediate effects on roles and social activities. Toothache due to dental caries would represent one such condition. However he partitioned the effects into disruption of activities (for example, work-loss) or adaptation of activities (modified work routines). The other class of impacts was identified within a "social model" of health, referring to the "illegitimate" sick roles which he (Davis, 1976) and Reisine (1984b) had previously fostered. Examples of socially defined impacts included disruption (for example, to friendships) or adaptation (for example, to compensate for aesthetic deficiencies). Aesthetic defects were regarded as conditions which could create impacts within these social dimensions of health.

It is clear that the two theoretical perspectives of Reisine (1981, 1984b) and Davis (1987) are related. Davis's model, which in his text is cited as an adaptation of Reisine's (1984b), is presented in Figure 2. The "medical model" refers to the traditional view of impact conceptualized within the Parsonian sick role; that is, impacts on socially defined roles performed by individuals. The "social model" captures impacts on the desired participation in social interaction.

FIGURE 2 DAVIS'S MODEL OF SOCIAL IMPACT*

	Medical model Performance of social roles	Social model Participation in social interaction
Adaptation	Avoidance of certain foods Less vigorous sport Modified work routines Less strenuous housework	Strategies for the concealment of "blemishes" in eating, smiling, speaking and presentation of self
Disruption	Sleeping Eating Work/school attendance Household duties	Friendship Marriage and family Social life Work and life satisfaction
Typical Oral Problems	Caries, periodontal disease, oral cancer, dental trauma, severe dento-facial anomalies and denture problems.	Cleft, malocclusion, mandibular and masticatory dysfunction, dental trauma, denture wearing.

* From Davis, 1987.

Davis (1987) advocated the model in Figure 2 after a careful critique of the very role of modern health care in shaping and reacting to "social" definitions of disability. He was particularly cautious about the potential for dentistry to exacerbate hurtful consequences of socially constructed labels. He cites the capacity of the "scientific gloss" associated with clinical

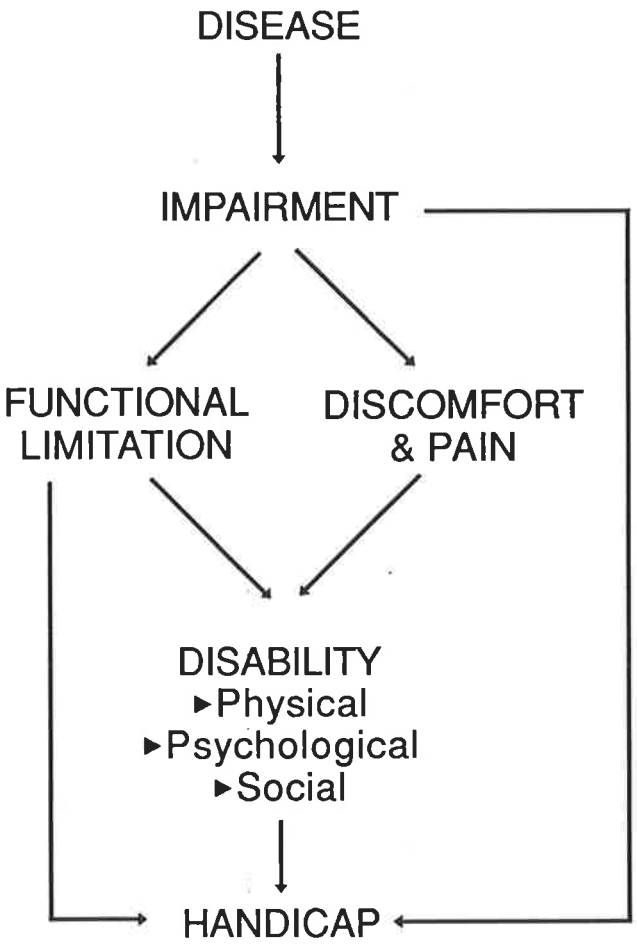
orthodontic measures to worsen the impact of nicknames applied to children with malocclusion, simply by giving credence to the notion that the occlusion is abnormal or "deviant". Davis advocates as a solution the identification of separate physical, clinical and social elements of oral disorders which provoke labelling and therefore create handicap. Those three elements should allow "a relatively objective social indicator of handicap" to be developed which could guide the decision to provide and evaluate treatment (Davis, 1987).

The third major theoretical perspective is provided by Locker (1988b), and it provides some clear contrasts in orientation. He begins by rejecting the "narrow focus of sociodental indicators" which he regards as a term to describe the population impact of ill health when "...the health of a society is too broad or complex to measure in its entirety". Locker describes shortcomings in the capacity of the Parsonian sick role to reflect adequately the more complex dimensions of health and disease within contemporary society. He points out that the sick-role theory has a structural-functional basis from which follows the view that health can be regarded simply as the capacity to be a productive member of society. Whereas productivity is seen within contemporary Western society primarily as a capacity to undertake household duties, parental duties, or to work effectively, Locker argues that contemporary views of health are based on quite different criteria. He cites the WHO definition of health as "a complete state of physical, mental and social well-being, and not merely the absence of illness". He describes self esteem as a practical contrast between this view of health and the "sick role" orientations. While diminished self esteem constitutes a personal problem which may affect individual life chances it has few, if any, ramifications for society's productivity.

Locker (1988b) describes a conceptual model of oral health, based around the WHO (1980) model which creates a hierarchy from biological to

behavioural and then social impacts. The essential elements of the model are: impairment, referring to anatomical loss such as tooth loss; functional limitation, such as reduced chewing efficiency; discomfort, including physical pain and psychological feeling states; disability, a behavioural concept indicating a limitation in or lack of ability to perform activities of daily living; and handicap, which represents the extent of disadvantage experienced by persons with disease. The model is presented in Figure 3. (The model is discussed in more detail in Chapter 5.) Locker (1988b) calls for research to identify the scope of impacts caused by oral conditions, to create a suitable index which can assign numerical value to those impacts, and to examine relationships between clinical conditions and social impact.

FIGURE 3 LOCKER'S MODEL OF ORAL HEALTH*



* From Locker, 1988b.

When examined critically, the different theoretical perspectives reviewed here can help to guide different approaches to assessing impact. Theoretical models structured around the sick role, itself a socially constructed set of behaviours reflecting society's norms and preferences, are probably best able to guide the development of "societal indicators" of population impact. Social impact measures based around those models therefore may be the most appropriate way to measure society's valuation of different states of oral health. In contrast, the model of Locker (1988b),

which is constructed around the WHO's view of health as a resource for individuals, should guide the development of indices to measure personal levels of social impact.

2.3 Multidimensional measures of social impact

The growth of interest in non-clinical consequences of oral disease has led to the development of several multidimensional measures of social impact. This part of the literature review examines the instruments which have been used in previous research. The focus is on numerical indices or scales which use as their theoretical basis more than one dimension of social impact. Consequently, surveys of oral pain alone or of chewing incapacity alone (many of them mentioned in previous sections) have been excluded.

Three questions from the RAND health insurance survey were used to construct a "subjective dental health index" (Gooch et al, 1989). The three questions concerned pain, worry and avoidance of conversation, each answered on a four point Likert-type scale. The index was compared with sociodemographic characteristics and clinical indices among 1,658 persons aged 18–61 years who were a subset of the baseline enrollees in the RAND survey. The strongest associations between the index and clinical indices were observed for the number of decayed teeth and Russell's periodontal index. There were weaker associations with filled and missing teeth, although the authors commented that the data did not allow discrimination between missing anterior and posterior teeth. Non-whites, persons with lower educational attainment and with lower income reported higher amounts of impact. Earlier analyses of individual items from all persons in the same survey (Spolsky et al, 1983) had demonstrated associations with the DMFT index: 24 per cent of persons with DMFT of 12 or less reported

pain or distress compared with 31 per cent of persons with DMFT of 23 to 28.

Kiyak et al (1984) developed a scale of psycho-social impact which was used among orthognathic surgery patients. The scale was described in further detail by Reisine and Weber (1989). It contained 15 questions referring to discomfort associated with function, aesthetics, general health and social activities. Respondents indicated their level of discomfort on a seven point scale from none (1) to much (7) discomfort. In the study of 30 TM patients (Reisine and Weber, 1989) improvements within the social activities subscale were observed six months after treatment, although function, aesthetics and general health did not change significantly. They attributed the improvements in social activities to a reduction in oral pain, a change observed using a separate pain index.

Cushing et al (1986) developed a scale of dental impact containing 14 questions referring to eating, communication, pain/discomfort and aesthetics. The questionnaire was used in a survey of 414 employed persons aged 16–60 in the United Kingdom. Respondents were asked to indicate if they had experienced any of the impacts, and individual items were counted to create subscale scores and a total impact score. Edentulous persons reported significantly more eating impact (54 per cent) and discomfort (72 per cent), compared with dentate denture wearers (35 per cent and 48 per cent respectively) or dentate persons without dentures (14 per cent and 50 per cent respectively). Within the dentate sample, the number of functioning teeth (representing the number of filled and sound teeth present) was negatively associated with the level of impact, while the number of decayed teeth was positively correlated.

Fiske and Watson (1990) devised a "sociodental measure of dental handicap" containing 11 questions referring to four dimensions: function, comfort, social interaction and self-image. The number of dimensions with affirmative responses was added to provide a score ranging from zero to four. In a survey of 100 handicapped older adults receiving routine dental care, there were marked reductions in impact after treatment. At baseline, all persons had an impact score of one or more, whereas six months after treatment, 74 per cent reported no impact.

The most noticeable similarity among the three indices described by Kiyak et al (1984), Cushing et al (1986) and Fiske and Watson (1990) is the commonality in three of the dimensions: function, aesthetics, and social activities. Furthermore, the Kiyak scale and the Cushing scale create separate scores for those dimensions. However the questionnaires specify different criteria against which to mark a response. The Kiyak scale asks about the level of "discomfort" associated with each item. However the Cushing and Fiske scales refer to levels of difficulty with activities (such as eating) and levels of dissatisfaction (with appearance). While there are some close similarities in the conceptual dimensions of impact, there are marked differences in the criteria for their measurement.

Rosenberg et al (1988) provided some findings from a 25 item "dental functional status questionnaire" containing four dimensions: psychosocial (personal contact, embarrassment), mechanical (speech, food consumption and opening wide), role limitation (work-loss) and self care (ability to floss or brush). The index appears to have similar dimensions to the ones examined already, and the questions are scored to provide quantitative measures. However the individual items or response categories for the dental functional status questionnaire were not published. The questionnaire was used among 159 patients aged 16 to 72 years at a dental clinic in the United

States. Significant correlations were observed between dental functional status and: reported symptoms, periodontal status (obtained from radiographs and dental charts using an unstated index) age and reported exercise frequency. However other clinical indices obtained from charts and radiographs had no statistically significant associations in multivariate analyses.

Gift and Redford (1992) described the use of "oral quality of life" dimensions within the second International Collaborative Study. The dimensions included perceived oral symptoms, perceived physical and aesthetic well-being, and level of physical and social functioning. The latter included avoidance of laughing or smiling, avoidance of conversations, inability to chew hard food, limitations in usual activities, trouble with sleeping, and denture-related problems. All social function variables were associated with dentition measures, and problematic teeth (untreated, treated or extracted) were considered by respondents to represent a lower level of oral well-being.

A different approach which combined numerous dimensions into one scale was adopted by Atchison and Dolan (1990) who developed the Geriatric Oral Health Assessment Index (GOHAI). The questionnaire consists of 12 items, nine referring to health problems and three referring to a positive aspect of oral health such as "How often were you pleased or happy with the looks of your teeth and gums, or dentures?". Most questions specified behavioural reactions such as "How often did you limit the kinds or amounts of foods...". However others referred to feeling states such as "pleased or happy" and "worried or concerned". As well there were two questions about discomfort and pain. Responses were made on a three point scale to indicate the frequency from always through to never. Low scores on the index referred to more severe levels of social impact.

The GOHAI was used in a survey of 1,755 older Americans who were Medicare recipients, and a smaller group of 714 who attended a screening examination (Atchison and Dolan, 1990). The strongest correlation with the GOHAI score was observed for the number of natural teeth (r=0.33). Other epidemiological measures which had weaker, although statistically significant correlations were: tooth mobility, root caries, coronal caries, oral hygiene index and the number of oral pathological conditions. Correlation was higher (r=0.49) with a single item rating of dental health status.

Strauss and Hunt (1933) adopted another methodology for the Dental Impact Profile (DIP) which asked questions about individuals' perceived value of their oral health. Respondents indicated if they believed their teeth or dentures had a good effect, no effect or bad effect on 25 experiences such as eating. An individual who, for example, believed that they had a discoloured tooth may not necessarily believe that it had a bad effect on their appearance. The questionnaire contained 25 separate questions and revealed information about the positive and negative aspects of oral status. For example, "chewing and biting" was reported to have a positive (good) effect by 42 per cent of older adults, while it was reported to have a negative (bad) effect by 30 per cent. On all items except breath, the responses were more positive than negative. Although not reported by Strauss and Hunt (1993), the individual DIP questions have been used to construct a quantitative scale and subscales.

A different technique to obtain positive and negative valuations of the "psychologic impact" of oral conditions was reported by Oosterhaven et al (1988). They assessed 21 items separately for affect (good, satisfied, uncertain and irritated) and severity (feeling not at all through to feeling strongly, using a five point scale) among a group of 81 Dutch dental patients. They reported that strong negative feelings were uncommon, and

varied only to a small extent among tooth loss groups. In contrast, positive feelings were stronger, and tended to vary more among tooth loss groups. An interesting contrast existed with reported behavioural (as distinct from psychologic) dimensions: over 10 per cent of persons with tooth loss reported chewing less well, eating softer food or needing more time to finish a meal. Those percentages were twice as high as reported by a group of persons without posterior tooth loss. Consistent with these effects were lower rates of masticatory efficiency among persons with posterior tooth loss, as assessed using a sieve test. Oosterhaven et al (1988) concluded that the findings about psychologic and social impact were difficult to interpret, in part because of the phenomenon of reduction in cognitive dissonance, and in part because of the nature of the small sample of patients, all of whom attended for prosthodontic care.

Both the DIP and the psychologic impact measure move beyond the unidirectional notion of dysfunction and its unwanted effects to consider the potential positive effects of oral function and oral health. There are benefits in such an approach. As Oosterhaven et al (1988) observed, there appeared to be greater variation in positive rather than negative psychologic aspects of tooth loss. They also commented, with regard to their measure of changes in eating behaviour, that: "The assumption is that these changes of behaviour are undesirable. However, nothing is known about the subjects' appreciation of these changes." In other words, there may be substantial variation among individuals in the salience of dysfunction or behaviour change – the main constituents of the WHO (1980) model and of measures such as the SIP.

This should come as no surprise, since it is a well recognized phenomenon that individuals have highly variable reactions to clinically identical oral conditions – for example, oral pain or malpositioned teeth. It

has been noted already (Ranta et al, 1987) that relationships between oral status and satisfaction appear to be quite independent from the relationships between oral status and chewing capacity. While neither the DIP nor the psychologic impact scale ask directly about satisfaction, the previous findings provide some indication that there is independence between the criteria used to judge positive aspects of oral health and the criteria used to judge negative aspects of oral health.

2.4 Australian surveys of oral health among older adults

The few Australian studies of oral health among older adults have provided only limited information about the dimensions of social impact, usually by asking single questions about perceived chewing capacity or oral comfort. Furthermore, the surveys have been conducted among older adults living in institutional care. Homan et al (1988) asked 238 elderly residents of institutions in Brisbane about their oral symptoms. One in two reported functional problems, one in three reported loose teeth, one in five reported xerostomia, one in nine reported oral pain, and one in 10 reported concern about appearance. However the precise questions were not provided. Walker (1984) presented findings from a mail questionnaire of 1099 elderly residents of institutions in South Australia. Eleven per cent ate vitamized meals, 20 per cent were dissatisfied with their oral function, and 17.5 per cent were dissatisfied with aesthetics. An earlier South Australian survey of institutionalized older adults (Vowles et al, 1979) contained slightly more detailed findings: 13 per cent of edentulous persons could not eat satisfactorily compared with 10.6 per cent of dentate persons without dentures and 7.8 per cent of dentate persons with dentures. Dissatisfaction with appearance was reported by 12.1, 28.2 and 26.8 per cent respectively among those groups.

2.5 Methodological issues in measuring social impact

Reisine (1988) called for three components of research into social impact: development and testing of psychosocial indicators to assess oral health status; linkage of those indicators to traditional clinical indicators; and a study, using both psychosocial and epidemiological measures to assess the multidimensional character of oral health. Some of those requirements have been met within the indices reviewed previously, particularly the studies examining relationships between traditional epidemiological measures and social impact.

However there are four substantial deficiencies which can be identified within the existing research.

1) The lack of an explicit theoretical model. Batteries of questions used within many indices have combined numerous categories of impact (for example, chewing function, pain and social interaction) without stating any explicit relationship among the categories. In the case of the GOHAI (Atchison and Dolan, 1990) that approach was taken because empirical findings using factor analysis revealed an absence of multiple underlying factors. Where separate categories have been retained (Cushing et al, 1986) they appear to be normative groupings preferred by the researchers without a clear statement of the theoretical framework.

2) Normatively derived items. In the indices reviewed above, individual items used in questionnaires about social impact were derived predominantly from the researchers' own experience or reviews of existing literature. While some indices (such as the DIP - Strauss and Hunt, 1993) involved groups such as social scientists and students in

identifying the items, there were no indices in which the specific experiences or opinions of the lay public were sought.

3) Attachment of equivalent weight to all impact items. None of the social impact measures sought information about the relative significance of different items: for example, the pain scale of Cushing et al (1986) is computed by adding together impacts such as toothache and sensitivity. Dentists undoubtedly would rank toothache as a more severe form of pain, and it is conceivable that lay judgements could also differ.

4) Limitations of study samples and survey design. Many surveys drew on clinical samples of dental patients or other select groups. While such persons probably are convenient samples likely to be seeking care (and therefore reporting high levels of impact) they may provide a biased indication of relationships between clinical measures and social impact. The surveys of Cushing et al (1986) and Atchison and Dolan (1990) contained larger samples drawn from community groups, although the analyses were confined to bivariate relationships between clinical measures and social impact.

Consequently the research to date falls short of the systematic approach which has been advocated for development of health indicators. Rosser (1983) has described the basic process in formulating health indicators as the description of states of health followed by scaling of those states. Those were the basic steps used in the development of the Sickness Impact Profile (Gilson et al, 1975) and the Nottingham Health Profile (NHP – Hunt et al, 1986). In both cases, statements about the impact of illness were obtained from a large number of persons who had experienced different conditions. In the case of the NHP, 38 separate statements were drawn from

a total of 2,200 and they were grouped into six categories: physical mobility, pain, sleep, social isolation, emotional reactions, and energy levels. Statements within each dimension were then assigned weights by asking 200 persons to conduct paired comparisons. The scale was validated through studies of specific groups, including persons who consulted medical practitioners compared with persons who did not, and also in surveys of fit populations.

2.6 Conclusion

The first consistent theme which can be ascertained from this review is the strong endorsement within the literature of research to develop measures describing the social impact of oral disease. Indeed, there are several specific guidelines for additional research in the area. However there appear to be three additional themes within the literature which attract divergent opinions.

- How extensive and substantial is the social impact of oral disease? Researchers such as Davis (1987) suggest most forms of impact are confined to aesthetics and self–esteem, while others (Smith and Sheiham, 1979) have described oral disorders among older adults as handicaps.

- To what degree can the social impact of oral disease be seen as multidimensional? Many researchers have sought information about specific aspects of social impact (such as chewing dysfunction) while others (Atchison and Dolan, 1990) construct unidimensional measures of social impact from numerous reported problems. This is in contrast to some general health indices such as the SIP and NHP which have separate dimensions of social impact.

- Is it appropriate to construct a theoretical framework about social impact based around role disruption (Davis, 1987; Reisine, 1981) or a different scheme which captures a hierarchy from disease to handicap (WHO, 1980)? This question reflects fundamental perspectives about the very definition of health and illness. The concept of illness as an interruption to socially defined roles can be linked to Parson's (1979) early theories about the sociology of illness, while the hierarchy of impacts reflects the WHO's declaration that health is a resource which should allow individuals to lead a socially and economically productive life (Mahler, 1981). A significant ramification of the differences in these orientations is the broader scope of dimensions within the WHO (1980) model.

These three themes from the literature provide the motivation for this research. In the Chapters which follow, attention is directed primarily to the first two themes concerning the extent of social impact and the dimensions of social impact. The third theme, concerning theoretical models of health and illness, provides a general background to the research and attracts indirect commentary throughout the thesis.

CHAPTER 3. AIMS

This research aimed to examine the distribution of and factors associated with the social impact of oral disease among older adults. In this context, social impact describes the perceived levels of ill-health and the perceived effects of ill-health on the usual activities and well-being of individuals. Social impact therefore encompasses dimensions of dysfunction (such as difficulty chewing), discomfort (such as toothache and other feeling states) and disability (such as avoidance of foods) which individuals believe to be caused by oral conditions. The dimensions were conceptualized within the theoretical model of oral health described by Locker (1988b). The distribution of social impact refers to its frequency within a population of older adults. The factors associated with social impact include sociodemographic characteristics of individuals, their reported patterns of dental care and dentist-assessed oral epidemiological indices.

The aims are addressed through examinations of reported social impact within a population of older adults and relatively large subgroups within that population. The orientation of the research therefore is similar to the orientation of epidemiological studies, rather than the perspective of other methodologies such as medical anthropological investigations of the qualitative experiences of individuals.

3.1 Objectives

Within the broad aim of the research, there were four specific objectives. They were:

1. To develop and evaluate a survey instrument which could quantitatively assess different dimensions of social impact within populations;

2. To determine the frequency and extent of social impact within a representative sample of older adults;

3. To evaluate oral epidemiological and non-epidemiological factors associated with social impact; and

4. To examine relationships among dimensions of social impact (dysfunction, discomfort and disability), and the extent to which oral conditions may modify those relationships.

3.2 Hypotheses

Many of the questions addressed by this research were exploratory: could social impact be adequately measured?; what are the levels of social impact?; how does social impact differ among subgroups? This allowed very general hypotheses to be developed. The hypotheses corresponding to the four objectives are listed below.

1. Objective: to develop and evaluate a survey instrument.
   It was hypothesized that an instrument could be developed which was reliable and valid. Furthermore, it was hypothesized that the survey instrument would detect more effectively group variations in social impact compared with an existing survey instrument.

2. Objective: To determine the frequency and extent of social impact.
   It was hypothesized that the survey instrument would reveal high

levels of discomfort and dysfunction coupled with relatively lower levels of disability and handicap – a pattern consistent with current concepts of oral health.

3. Objective: To assess variations in social impact.
   This was an exploratory assessment, and it was hypothesized that there would be variations in the social impact among groups defined by:
   - Epidemiological indicators - including basic oral status (edentulism and denture use) and oral epidemiological measures of tooth loss, caries experience, periodontal destruction, and occlusal wear.
   - Non-epidemiological characteristics - including demographic characteristics, socio-economic factors and patterns of dental care.

   Furthermore, it was hypothesized that the relationships between social impact and epidemiological indicators would differ among some groups defined by non-epidemiological factors, as indicated by the existence of interactions in multivariate models.

4. Objective: To examine relationships among dimensions of social impact.
   It was hypothesized that disability would be related primarily to levels of dysfunction and discomfort. However there would be modifying effects of edentulism and oral status on that primary relationship.

3.3 Rationale

The first three objectives follow the orientation of epidemiological investigations and intended to develop a method for measuring social

impact, examine the distribution of social impact, and to assess its determinants. The first objective was necessary after the preceding review of existing research had indicated a need for a survey instrument which reflected current theoretical concepts of oral health and which was sufficiently valid and reliable. The need to develop an instrument was confirmed after gaining experience with a pilot survey (reported in Chapter 4). The second and third objectives sought to extend previous research, both through the use of the new measure of social impact, and by relating social impact to a full range of sociodemographic and oral epidemiological indicators.

The "epidemiological orientation" in this research was adopted primarily to address social impact from a public health perspective. Some key initial questions in public health ask "what is the burden of illness" and "what are the causes of illness" (Tugwell et al, 1985). This research views social impact as a basic component of the burden of illness and one which should be considered, in addition to the traditional biological or clinical measures of disease, when planning intervention strategies for prevention or health care. Consequently, the basic rationale for the research relates to pragmatic questions about assessment and subsequent intervention to control the burden of oral disease.

This orientation follows logically from previous research into social impact of oral disease, reviewed in Chapter 3. That research draws attention to generic indicators of the impact of oral disease (such as work-loss) within large groups and national populations. It is appropriate, therefore, to extend that research with a focus on more diverse and specific forms of impact within smaller groups. It follows that there is a need to assess relationships between social impact and specific oral diseases and oral conditions. An understanding of those relationships should provide

additional justification and capacity to advocate for the prevention and treatment of such conditions. The identification of conditions which are associated with the greatest levels of social impact should also allow clinical practitioners and health planners to identify subgroups most likely to benefit from interventions. However, the aims of this research did not extend to assessment of the effectiveness or efficacy of any interventions in reducing social impact.

This research examined social impact within a population of older adults. While symptoms and social impact potentially can affect anyone with oral disease, older adults represent one population subgroup of special importance from a public dental health perspective. In part, this is due to the projected growth in number of persons and number of natural teeth within the population aged 65 years or more (Australian Bureau of Statistics, 1990a; National Health Strategy, 1992). It also relates to the frequency of accumulated tooth loss and other oral conditions which potentially can lead to a substantial impact on everyday life. In this sense, older adults represent a group within which levels of social impact are expected to show considerable variation. This is useful methodologically, particularly in relation to the first objective (to evaluate an instrument measuring social impact).

The general orientation of this research differed from other methodologies which may be concerned, for example, with the phenomenological experience of social impact, the effects of social impact on other internal feeling states (and vice versa), or the relative effects of oral conditions on quality of life in comparison with other diseases or disorders. Those other orientations no doubt would add to knowledge about social impact. However they have not been pursued in this research.

The fourth objective examines the extent to which dimensions of social impact (for example, dysfunction and disability) may be related. For example, chewing dysfunction can be expected to relate directly to the more disruptive impact of eating disability (such as avoidance of foods). However, a range of mediating effects, such as dentate status, could influence the relationship. Those effects predominantly are of theoretical interest, since a high level of disability can be regarded as a burden of illness, regardless of the underlying levels of dysfunction or discomfort. However the theoretical investigation was pursued in order to assess the WHO model of impairment, disability and handicap (WHO, 1980) within the context of oral health.

CHAPTER 4. PILOT SURVEY

In 1988, a pilot survey was conducted to prepare for a multidisciplinary longitudinal study of ageing and health (Centre for Ageing Studies, 1990). The pilot survey was undertaken in collaboration with other researchers investigating the health and social circumstances of older adults. Oral health findings from the survey provided preliminary information about social impact. The pilot survey allowed procedures to be tested for a planned larger study. However, the findings from the pilot survey also led to the recognition of a need to undertake further methodological work (described in Chapter 5). Findings concerning oral health status and treatment needs from the pilot survey have been published elsewhere (Slade et al, 1993).

4.1 Methods

The pilot survey was a cross-sectional epidemiological survey and included questions about oral health obtained during face-to-face interviews, along with clinical findings from oral epidemiological examinations. The fieldwork took place between March and May, 1988.

4.1.1 Source of subjects

A random sample of 250 persons was drawn from residents in the Adelaide Statistical Division using the Health Insurance Commission Masterfile for the sampling frame. The Commission administers the universal Medicare health system, and the masterfile is a compulsory register for Australian residents. Information on the sampling frame included the age and residential address of each person. The sample was stratified to achieve 25 men and 25 women in each of five age groups: 60-

64, 65-69, 70-74, 75-79 and 80+ years. The numbers were selected to conform with the purpose of pilot survey, which was to assess the feasibility and adequacy of methods, rather than to formally test any specific hypotheses.

4.1.2 Data collection methods

Sampled persons were visited at their residential address, and each person was invited to participate in a face-to-face interview conducted by trained interviewers from the Australian Bureau of Statistics. There was no substitution of subjects in instances where the sampled person could not or would not participate. Interviews were conducted in English, although a friend or relative was used as a translator or proxy in some instances. In addition to details concerning general health status, demographic and social characteristics, the interview sought information concerning oral health status, denture wearing, use of dental services and the social impact of oral disease. A copy of the oral health items from the questionnaire is contained in Appendix 1.

4.1.2.1 Assessment of social impact

Social impact was assessed during the face-to-face interviews using questions modified from previous research of Cushing et al (1986). Participants were asked to indicate "How much of a problem has (the item) been for you recently?" A Likert-type response indicated if the item had been a problem "very much", "quite a bit", "not much" or "not at all", and answers were coded as 4, 3, 2, and 1 respectively. The items were categorized into three dimensions of impact, and the phrasing for each item is indicated in Table 1.

TABLE 1 SOCIAL IMPACT ITEMS USED IN THE PILOT SURVEY*

Dimension of impact	Item
Oral pain/discomfort	Toothache or pain
	Sensitivity to food
	Food packing
	Denture discomfort
Eating disability	Difficulty or restriction with chewing
	Difficulty or restriction with biting hard
	Difficulty or restriction with taking a big bite
	Having to change types of food eaten
Social disability	Difficulty or restriction with talking
	Difficulty or restriction with smiling
	Difficulty or restriction with laughing
	Difficulty or restriction with kissing

From: Cushing et al, 1986.

Subscale scores were computed by summing the numerical code for the Likert response for the four questions in each dimension of impact. This created a possible range from 4, indicating no impact, to 16, indicating maximum impact. The subscales were summed to provide a total impact score which could range from 12 (no impact) to 48 (maximum impact). As well, prevalence rates were assessed as the percentage of persons reporting "quite a bit" or "very much" impact for individual items.

The internal reliability of subscales was assessed using Cronbach's alpha co-efficient applied to each separate subscale and the total social impact score. The findings are presented in Table 2. The reliability of the

oral pain/discomfort subscale was only poor to moderate, while reliability for the other subscales and the total social impact score was good. Only small improvements in reliability of 0.02 to 0.07 could be achieved by deletion of any single items. Consequently, the complete subscales were retained for analysis.

TABLE 2 INTERNAL RELIABILITY OF SOCIAL IMPACT SUB-SCALES USED IN THE PILOT SURVEY

Subscale	Cronbach's alpha co-efficient
Pain/discomfort	0.467
Eating disability	0.726
Social disability	0.762
Total social impact	0.733

4.1.2.2 Oral epidemiological assessment

Participants in the interviews were invited to take part in clinical examinations which included oral epidemiological examinations conducted by three dentists who underwent prior training and calibration. However, no replicate examinations were conducted. Examinations were conducted at a single clinic using portable equipment and fibre-optic illumination. Sharp sickle probes and "Williams O" periodontal probes were used. The protocol for the oral examinations was based on the World Health Organization (WHO, 1987). Caries experience was measured for crowns using the DMFT index and separately for roots using a count of decayed and filled roots. A

modification was made to the recording of filled teeth to provide a category for teeth which were filled and non-carious, but with some defect requiring the replacement of the restoration.

Dentures were assessed using the criteria of Rise (1977). The assessment of denture treatment needs was a subjective assessment made after the examination of any existing denture and discussion with the subject, and hence it represents a negotiated decision between examiner and subject.

The Community Periodontal Index of Treatment Needs (CPITN) of individual teeth was assigned by examiners after assessing gingival bleeding, calculus and pocket depth of individual teeth (WHO, 1978).

4.1.3 Analysis

The analysis began with the computation of univariate statistics describing the percentage of persons reporting social impact and the distribution of subscale scores. Sociodemographic and oral epidemiological characteristics also were computed. Differences in mean social impact subscale scores were evaluated among groups categorized by sociodemographic characteristics.

Associations between social impact and epidemiological variables were assessed by comparing mean epidemiological indices among groups reporting no impact (that is, a response of "not at all" to all four items within a subscale category) and some impact (that is, a response of "not much" or greater on one or more items). The clinical indices included the number of functioning teeth, computed as the sum of sound and filled teeth (Cushing et al, 1986). The social disability subscale was excluded from this analysis

due to the small number of persons reporting one or more items. Nonetheless the total social impact category included any reports of social disability items.

Differences in percentage rates were evaluated using the Chi-square statistic with continuity adjustment. Differences in mean subscale scores were evaluated using the non-parametric Kruskal-Wallis test.

In computing statistics for the analysis, the data were weighted to be representative of the Adelaide population of persons aged 60+ years. This was necessary because of the stratified sampling scheme which selected equivalent numbers of persons in the five age groups and two sexes, as described above. Weights were computed by the Australian Bureau of Statistics, and used the formula:

$$WEIGHT_i = ERP_i \,/\, Sum[ERP_i] \;\times\; Sum[n_i] \,/\, n_i$$

Where: i = Stratum (10 strata defined by 5 ages and 2 sexes)

ERP_i = Estimated Resident Population of stratum i, obtained from the 1986 Population census (Australian Bureau of Statistics, 1986)

n_i = Number of survey participants in stratum i

The weights therefore adjusted for the probability of selection in the sampling scheme, with the consequence that estimates were representative of the Adelaide population aged 60+ years. At the same time, the weights retained the original number of cases within the sample.

4.1.4 Rationale

The pilot survey served two purposes: to obtain preliminary information about social impact, and to test survey procedures. While the first purpose may have been achieved with a smaller and non-representative sample, it was important to adopt the more rigourous approach of selecting and surveying a population sample in order to satisfy the second purpose. For that reason, methods which would be used in the subsequent larger survey needed to be thoroughly tested, including: selection and recruitment of a random sample of persons aged 60+ years; face-to-face interviews; survey instruments; and clinical examinations. A survey among a random sample of persons also provided more confidence about likely prevalence estimates, means and standard deviations, all of which were useful in planning subsequent surveys.

4.1.5 Ethical review

The pilot survey was reviewed and approved by the Committee on the Ethics of Human Experimentation at The University of Adelaide.

4.2 Results

4.2.1 Participation

Of the 250 persons selected from the sampling frame, 27 were no longer resident at the listed address. The household interview was completed by 178 persons, representing 79.8 per cent of those eligible. Refusal to take part in the survey was the main reason for non-participation, although there were nine persons who had illness,

bereavement or language barriers. One hundred and six persons took part in oral examinations comprising 54 dentate and 52 edentulous.

The weighted age and sex composition of the sample of interviewed persons is displayed in Table 3 along with the percentage of interviewed persons who received an oral examination. There was a tendency (although not statistically significant - p = 0.109) for older persons to have a lower participation rate in the examinations.

TABLE 3 COMPOSITION OF THE PILOT SURVEY SAMPLE AND PARTICIPATION IN EXAMINATIONS

Age group (years)	Weighted number of persons interviewed			per cent of persons examined*
	males	females	persons	
60-64	25	27	52	69.0
65-74	34	43	77	58.9
75+	17	32	49	52.2
All ages	76	102	178	60.0

* Differences in participation among age groups were not statistically significant (Kruskal-Wallis, p=0.109).

4.2.2 Characteristics of participants

Characteristics of the 178 participants in the pilot survey are displayed in Table 4. Due to the weighting scheme, the age and sex distribution was similar to the Adelaide population. Most people were born in Australia or in European countries and just over one half were dentate. Nonetheless, dentures were frequent, and comprised full dentures worn by

nearly one half of the sample (that is, virtually all edentulous persons), as well as dentures worn by a majority of dentate persons.

TABLE 4 CHARACTERISTICS OF 178 INTERVIEWED PARTICIPANTS IN THE PILOT SURVEY

Age	% of persons	Oral status	% of persons
60-64 years	29.1	Dentate	52.7
65-74 years	43.2	Edentulous	47.3
75+ years	27.7		
		Dentures	
Sex		None	16.2
Male	42.6	Edentulous (F/, /F or F/F)	46.2
Female	57.4	Dentate (F/ or P/)	22.3
		Dentate, other combination	15.2
Country of birth			
Australia	75.2		
UK/Eire	14.0		
Other	10.9		

Oral epidemiological data were collected from 54 dentate persons who took part in clinical examinations. There were high levels of missing teeth (Table 5). Equivalent numbers of retained teeth were sound (mean=7.7) or had coronal fillings (mean=7.7). Untreated decay was less frequent, averaging less than one tooth with coronal decay and less than one root with root decay per person.

TABLE 5 ORAL EPIDEMIOLOGICAL FINDINGS FROM 54 EXAMINED, DENTATE PERSONS IN THE PILOT SURVEY

Parameter	Mean	StdDev	Min	Max
Missing teeth	16.12	7.48	1	30
Coronal sound	7.72	4.11	0	19
Coronal decay	0.44	1.02	0	4
Coronal filled	7.72	5.59	0	20
DMFT	24.28	4.21	13	31
Root decay	0.64	1.31	0	6
Root filled	2.33	3.55	0	14

4.2.3 Social impact

Levels of social impact are reported in Table 6 from the interviewed sample of 178 persons. The most frequent individual social impact item was biting hard, reported "very much" or "quite a bit" by 12.5 per cent of persons. A number of individual items were reported to this extent by fewer than five per cent of persons including all four disability questions. Also presented in Table 6 are the combined frequencies for the groups of impact items. At least one pain/discomfort item was reported "very much" or "quite a bit" by nearly one fifth of persons. A similar frequency was observed for the chewing disability items while a much lower frequency (2.3 per cent) was observed for social disability. Social impact from at least one of the 12 items was reported "very much" or "quite a bit" by 29.5 per cent of persons, and a further 30.2 per cent reported "not much" social impact.

TABLE 6 SOCIAL IMPACT ITEMS REPORTED AMONG 178 PARTICIPANTS IN THE PILOT SURVEY

	% of persons reporting item:					
	Very much/	Not	Not	Subscale scores		
Impact item	quite a bit	much	at all	Max	Mean	StdDev
Toothache	4.1	7.3	88.6			
Sensitivity	3.2	9.3	87.5			
Food packing	7.6	17.8	74.6			
Denture discomfort	10.1	10.0	79.8			
Any pain/discomfort	19.3	26.7	54.0	11	4.95	1.44
Chewing	3.2	13.5	83.3			
Biting hard	12.5	14.7	72.8			
Taking a big bite	12.4	13.9	73.7			
Change food	0.0	5.8	94.2			
Any eating disability	17.6	20.5	61.9	12	5.19	1.97
Talking	1.1	4.1	94.8			
Smiling	1.2	0.8	98.0			
Laughing	0.0	1.6	98.4			
Kissing	0.0	1.1	98.9			
Any social disability	2.3	3.4	94.3	9	4.13	0.62
Any social impact	29.5	30.2	40.3	26	14.3	3.02

The mean subscale scores were highest for pain/discomfort and eating disability. However, all mean values for the subscales were close to the minimum possible value of 4, which corresponds to an individual

responding with "not at all" to each question in the subscale. Indeed, the observed maximum subscale scores indicate that no individuals obtained the highest possible subscale score of 16.

Sociodemographic group differences in social impact are presented in Table 7. Differences generally were small and were statistically significant only for eating disability with respect to edentulism and denture wearing. Edentulous persons reported higher levels of eating disability than dentate, although when denture wearing was considered, dentate persons who had "other denture combinations" also reported high levels of eating disability. Despite the observed differences in subscales, none of the groups in Table 7 had significantly different total impact scores. Partly this was related to different effects among the component subscales. In the case of dentition status, for example, edentulous persons had slightly lower levels of pain/discomfort, higher levels of eating disability and virtually identical levels of social disability, resulting in total impact values which differed by less than one unit.

TABLE 7 VARIATIONS IN SOCIAL IMPACT AMONG SOCIODEMOGRAPHIC GROUPS FROM THE PILOT SURVEY*

		Mean subscale scores			
Group		Pain/ discomfort	Eating disability	Social disability	Total impact
Age	60-64 years	5.2	4.6	4.1	13.8
	65-74 years	5.0	5.3	4.2	14.5
	75+ years	4.8	5.5	4.1	14.4
Sex	Male	4.8	5.1	4.1	14.0
	Female	5.1	5.3	4.1	14.5
Dentition	Dentate	5.1	4.7†	4.1	13.8
	Edentulous	4.8	5.7	4.2	14.7
Denture(s)	None	4.9	5.0†	4.1	14.0
	Edentulous/ Full dentures	4.8	5.6	4.2	14.6
	Dentate/ upper denture	4.8	4.3	4.1	13.2
	Dentate/ other denture	5.4	5.6	4.2	14.9

* n=178 interviewed persons.
† Differences among groups significant, $p<0.05$ Kruskal-Wallis test.

The comparisons of oral epidemiological indices among groups reporting no impact and some impact are presented in Table 8. The data relate to examined persons. There were significantly greater numbers of missing teeth among persons reporting eating disability. Other differences were not statistically significant, although most were in the expected directions. For example, persons reporting impact tended to have more decayed teeth and fewer functioning teeth. The DMFT index did not differ significantly among impact groups, and the small differences varied in direction. Pain/discomfort and total impact were associated with lower

mean DMFT values while eating disability was associated with a higher DMFT value.

TABLE 8 VARIATION IN ORAL HEALTH STATUS INDICES AMONG GROUPS REPORTING SOCIAL IMPACT IN THE PILOT SURVEY

		Mean no. of	Mean no. of teeth†			
	Amount	missing	Coronal	Root		Functioning
Dimension	of impact	teeth*	decay	decay	DMFT	teeth
Pain/discomfort	None	24.9	0.23	0.64	25.1	15.0
	Some	23.0	0.59	0.69	24.0	13.6
Eating disability	None	22.4‡	0.38	0.56	24.3	14.9
	Some	26.5	0.60	0.93	24.9	12.8
Total social	None	24.2	0.26	0.63	25.3	14.4
impact	Some	23.8	0.54	0.96	24.0	14.3

* n=106 examined persons.
† n=54 examined dentate persons.
‡ Differences among impact groups significant, $p<0.05$ Kruskal-Wallis test.

4.3 Discussion

Findings from the baseline pilot survey provided an indication of the likely levels of social impact which would be reported by older adults in Adelaide. Some 29.5 per cent of persons reported at least one impact item "very much" or "quite a bit" and a similar percentage reported "not much" impact from at least one of the 12 items. As expected, pain/discomfort and eating disability were more frequent than social disability. Another encouraging finding was the general tendency for social impact to be more frequent among groups with specific oral conditions. Eating disability was

more frequent among edentulous persons and denture wearers. Persons reporting impact tended to have more missing teeth, more decayed teeth and fewer functioning teeth, although most of those differences were not statistically significant.

The general lack of statistical significance in social impact among subgroups was not particularly surprising in view of the modest sample size. However, it also appeared to be related to the properties of the impact subscales. For example, mean subscale scores for social disability were close to the minimum possible value, with the consequence that distributions were highly skewed.

Despite the clear demographic differences between this pilot survey sample and the group of workers in the United Kingdom studied by Cushing et al (1986), there were some consistencies in the prevalence of social impact. Cushing et al (1986) reported discomfort among 50 per cent, eating disability among 20 per cent and social disability among 15 per cent of persons. In the pilot survey, the figures were 46 per cent, 38 per cent and six per cent respectively, using a definition of "very much", "quite a bit" or "not much". In both samples, associations between clinical indices and social impact were observed, and the associations followed expected directions. In addition, the general lack of association observed in the pilot survey between the DMFT index and social impact was consistent with the general findings of Cushing et al (1986).

The findings from the pilot survey demonstrated the value of including a Likert-type response scale which provided information about prevalence and severity. This can allow different components of the frequency of impact to be described. For example, eating disability had a lower prevalence than oral pain or discomfort (17.6 versus 19.3 per cent reporting "quite a bit" or

"very much"). However eating disability had a higher mean subscale value (5.19 compared with 4.95 for pain/discomfort). This probably suggests that pain is common, although rarely severe, whereas eating disability is slightly less common and, when it occurs, it tends to be more severe. The Likert response scale, which was not used by Cushing et al (1986), appears to offer additional valuable insight into social impact.

Despite the general value of the findings from the baseline pilot survey, there were a number of equivocal results which suggested a need for additional research. First, the internal reliability of the pain/discomfort subscale was only moderate, and social disability was reported at a very low frequency. This suggested a need to reconsider the groupings of items, and possibly the need for examining requirements for other questions about pain and social disability.

A second difficulty concerned the nature of the response categories and coding scheme for the social impact measure. When individuals were categorized as experiencing impact only if they had problems "very much" or "quite a bit", the prevalence estimates of social impact were approximately halved, compared with the estimates when the "not much" category was included. Clearly there was a substantial amount of reporting at this low frequency category of "not much" and this caused subscale scores to be close to the minimum. It suggested a need to create an additional category between "never" and "quite a bit" which might help to capture some variation in the less frequent forms of impact.

A further consideration was the actual wording of the "not much" response. Although it represents a useful way to distinguish between no impact and very low levels of impact, it seemed ambiguous to combine this negatively phrased category of frequency with the positively phrased

categories of "quite a bit" and "very much" for the purpose of creating a cut-off point when computing prevalence. For example, the statement that "11.4 per cent of persons report toothache very much, quite a bit or not much" creates some uncertainty. Should "not much" impact be regarded as a problem, or as an indication that individuals believe their oral problems are at an acceptable level? This could be particularly problematic in the Australian vernacular, where the phrase "not bad" can be used to convey a positive feeling of well-being as in the following type of exchange: "How are you today?", "Not bad thanks."

These impressions led to the conclusion that it would be desirable from a statistical perspective to include an additional response category which could detect low-level impact, and that, for the purpose of clearer interpretation, an additional category should be worded affirmatively.

Another pressing requirement was a method for combining individual items within a subscale. For example, toothache appears to be a much more substantial impact than food packing, although each had equal weight when subscales were computed in the pilot survey. However, there was no existing indication of the relative severity of those two conditions, and therefore no clear justification for attaching weights to the individual questions.

A final general problem identified in the pilot survey was the very low frequency, at least of some forms of impact. As mentioned above, this resulted in skewed distributions of subscale scores and may have contributed to an inability to detect statistically significant differences among groups. While it is clear that some forms of social impact will be rare (social disability for example), it would appear desirable to have a sufficient

range of questions, as well as more sensitive response categories so that any differences in those forms of impact could be evaluated.

In addition to the findings about social impact, it should be noted that the baseline pilot survey provided useful experience with survey design, implementation and management. This experience was particularly valuable to provide indications of likely participation rates and requirements for resources in the larger South Australian Dental Longitudinal Study which was to follow.

4.4 Conclusions

The findings from the pilot survey confirmed that social impact is an important component of the burden of oral disease. Levels of pain and eating disability, reported by approximately one in five persons, are not adequately reflected in clinical epidemiological indices and indeed were not correlated with measures such as DMFT. Many types of social impact assessed in the pilot survey were frequent and readily measurable. However the findings revealed a need to improve some technical features of the measurement of social impact. Specifically there was a need to: reconsider and add to the social impact items; examine different groups of questions in order to improve reliability; add to and modify the phrasing of response categories; and provide a way of combining items with differing severity into a single subscale score.

CHAPTER 5. DEVELOPMENT AND EVALUATION OF THE ORAL HEALTH IMPACT PROFILE

After obtaining preliminary information about social impact from the pilot survey, it was recognized that further work would be necessary to develop an instrument to measure social impact in a more comprehensive manner. Work on the development of the Oral Health Impact Profile (OHIP) took place between March 1989 and June 1990. Some findings from that work have been reported elsewhere (Slade and Spencer, in press). This Chapter presents the methodologies and results from the research which led to the development of the OHIP.

5.1 Materials and methods

The methods used in development of the OHIP follow the approaches used for other questionnaires and indices of general health status (Gilson et al, 1975; Hunt et al, 1986). The approach involved identifying a conceptual model, then acquiring a broad range of questions and associated numerical weights which could be combined to create index scores. There were five specific steps: specification of the conceptual model; obtaining statements about social impact; obtaining judgements about the importance of statements; assessment of reliability; and assessment of validity of the OHIP. A conceptual model was derived from the work of Locker (1988b), reviewed previously in Chapter 3. The operational definitions within the model are defined in the results section of this Chapter. The methods used for the other four steps are described below.

5.1.1 Obtaining statements about social impact

A set of statements about social impact was collected during interviews with a group of 64 dental patients. Open ended questions were asked about individuals' experiences of dental disorders and the responses were recorded in longhand. The set of statements was reduced to a smaller, representative collection each containing a description of a single event associated with dental disorders. The reduction procedure involved an analysis of the form and content of individual statements, their grouping into common dimensions, and the abstraction of statements about a single aspect of social impact according to the descriptions contained in the conceptual model (Locker, 1988b). For example, a series of statements concerning a single symptom (such as hypersensitivity of teeth to thermal and chemical stimuli) was summarized into a single statement, and categorized into the physical pain dimension according to the operational definitions contained in the conceptual model.

The 64 participants in this part of the research are referred to here as the "patient group", and they were drawn from private dental offices, a dental hospital primary care clinic and a dental hospital prosthodontic clinic in Adelaide, South Australia. The patient group was not a random sample, but was selected because of the likely range of oral diseases and consequent social impact which was expected to be more frequent in this group than a random sample of the population.

5.1.2 Judgments about the importance of statements

The set of 49 statements obtained from the patient group was weighted using Thurstone's method of paired comparisons (Edwards, 1957) to reflect the relative importance of each statement. The statements within

each conceptual dimension were weighted. For example, physical pain items were judged in relation to other physical pain items to provide separate weights for each item in that dimension. This step was undertaken to account for variations in the impact of different events; for example toothache presumably needed to be given more weight than thermal sensitivity of teeth. The same technique has been used to compare toothache with general medical conditions (Verhey and Hoogstraten, 1986), and was found to provide identical rankings to the alternative method of direct ranking.

The weights were computed using the views of 328 persons drawn from community groups, dental practitioners and students. They are described below as the "judging panel". Individuals from the judging panel were presented with all possible pairs of statements within conceptual dimensions and asked to indicate the statement in each pair which was thought to be the most unpleasant. The total number of paired judgements was ${}^{9}C_{2} = 36$ for each of the three dimensions with nine statements, ${}^{6}C_{2} = 15$ for each of the two dimensions with six statements, and ${}^{5}C_{2} = 10$ for each of the two dimensions with five statements. Because the total of 158 paired comparisons was judged too burdensome for a single respondent, separate questionnaires were designed, one containing 82 pairs and the other containing 76 pairs of statements. Individuals were asked to complete only one of the questionnaires. Copies of the two self-complete questionnaires used to obtain the paired judgements are included in Appendix 2.

A respondent's judgements about pairs of items was used if one and only one item from all possible pairs was marked. Paired judgements were converted to numerical weights using methods described by McKenna et al (1981). There were five computational steps.

1) The number of persons rating one statement as more unpleasant than the other was laid out onto a n x n matrix (where n=number of items in the subscale).

2) The numbers were converted to proportions of all persons completing the questionnaire, and a proportion of 0.5 was imputed for the diagonal.

3) Unit normal deviates (that is, z-scores) for the proportions were calculated.

4) The mean value of the unit normal deviates in each column of the matrix was calculated.

5) A constant of 1.645 (selected because it corresponded to the upper 90 per cent of the z-distribution) was added so that the mean figures were all greater than zero, and the product was multiplied by a second constant so that the sum of weights for the subscale equalled 10. This last step was undertaken since all impacts were conceptualized as unfavourable, and so it was necessary to create a positive value for all questions (McKenna et al, 1981). As well, it was desirable that a response to all questions in the subscale should have the same maximum possible value, regardless of the number of questions in the subscale.

A worked example is presented in Table 9, using hypothetical judgements from 10 individuals about five statements. Statement E is judged to be more unpleasant than most other statements: nine times compared with statement A; eight times compared with statement D; seven times compared with statement B. However it is judged as equivalent (five persons rating it as more unpleasant) compared with statement C. Since

proportions greater than 0.5 correspond with positive values on the z-distribution, the unit normal deviates for statement E are all positive or zero. Consequently, statement E has the largest weight (2.64) of the five statements.

TABLE 9 CALCULATIONS FOR THURSTONE'S METHOD OF PAIRED COMPARISONS

Number of persons judging column statement to be more unpleasant than row statement (from a hypothetical group of 10 judges)

Row Statement	Column statement A	B	C	D	E
A	-	2	7	5	9
B	8	-	6	4	7
C	3	4	-	3	5
D	5	6	7	-	8
E	1	3	5	2	-

Proportions

Row Statement	Column statement A	B	C	D	E
A	0.50	0.20	0.70	0.50	0.90
B	0.80	0.50	0.60	0.40	0.70
C	0.30	0.40	0.50	0.30	0.50
D	0.50	0.60	0.70	0.50	0.80
E	0.10	0.30	0.50	0.20	0.50

Unit normal deviates

Row Statement	Column statement A	B	C	D	E
A	0.00	-0.84	0.52	0.00	1.28
B	0.84	0.00	0.25	-0.25	0.52
C	-0.52	-0.25	0.00	-0.52	0.00
D	0.00	0.25	0.52	0.00	0.84
E	-1.28	-0.52	0.00	-0.84	0.00
Mean	-0.19	-0.27	0.26	-0.32	0.53
Mean+1.645 (=Wo)	1.46	1.38	1.91	1.33	2.18
Statement weight (10*Wo/Sum(Wo)	1.76	1.67	2.31	1.61	2.64

Consensus among judges was assessed using Kendall's *u* statistic which reflects the level of agreement for Thurstone's paired comparisons (David, 1963). The statistic is calculated using the formula:

$$u = \sum_{i<j} \alpha^2_{ij} \quad n \sum_{i<j} \alpha_{ij} + {}^{n}C_2.{}^{t}C_2$$

Where:

α_{ij} = the number of judges rating statement i in preference to statement j (that is, the elements of the top matrix in the example from Table 9).

n = the number of judges (10 in the example from Table 9).

t = the number of items judged (five in the example from Table 9).

The resulting expression can range from small negative values of -1/n (that is, –0.1 in the example from Table 9) indicating no agreement, through zero to a maximum positive value of 1.0. Increasing values of the *u* statistic indicate higher levels of agreement, and the statistic can have a maximum possible value of +1 when all judges have identical preferences. The *u* statistic can be evaluated against the null hypothesis of no agreement using a statistic which is distributed according to the Chi-square distribution (David, 1963).

5.1.3 Reliability

5.1.3.1 Structure of the OHIP questionnaire

Each statement was re-phrased as a question to create a battery of 49 items which was administered either by interviewer or as a self-complete questionnaire. Respondents were asked to indicate if they had experienced each item during the previous year "because of problems with your teeth mouth or dentures". They were asked to indicate their response on a five

point Likert-type scale: never, hardly ever, occasionally, fairly often or very often. Those responses were coded from zero to four respectively. The categories were used to give a range from never, through equivocal to the three more affirmative statements of occasionally, fairly often or very often. This was intended to provide greater sensitivity at the lower end of the response categories, while allowing the reports to be dichotomised to encompass the three affirmative responses.

The response categories aimed to overcome the shortcomings of the four-item response used earlier in the pilot survey (discussed in Chapter 4). The greater number of response categories and the inclusion of a "don't know" was also motivated by findings from methodological research (National Center for Health Services Research, 1984) supporting those techniques.

Subscale scores were obtained by multiplying the weight for each question by the coded Likert-type response (between zero and four) for that question. The products were summed within each conceptual dimension to compute subscale scores. Where any OHIP questionnaire had 10 or more "don't know" or missing responses, the case was excluded from analysis. When there were between one and nine missing or "don't know" responses, the mean Likert response for the specific question was used as an imputed value before computing each individual's subscale score.

Questionnaires (Appendix 3) containing the OHIP items were administered using different methods to members of the same cohort of persons aged 60+ enrolled in the 1988 pilot survey (described in Chapter 4). The questionnaires were administered initially in 1989/90, some 20 months after the 1988 pilot survey. The OHIP questions were split into two halves. The first 18 questions covered the dimensions of functional limitation and physical pain and were asked of all persons. Those who indicated some

impact (that is, "hardly ever", "occasionally", "fairly often", or "very often") to at least one of the first 18 items were asked to complete the remaining 31 OHIP items in the second part of the questionnaire. Persons who indicated "never" to the first 18 questions skipped the remaining questions and zero values were imputed for the additional unanswered questions in the second part. This procedure was adopted in an attempt to reduce interviewer and respondent burden which co-investigators at the Centre for Ageing Studies thought may be severe, especially when an individual had experienced no functional limitation or physical pain. It was argued that persons who reported no functional limitation or physical pain could not experience other forms of impact such as psychological discomfort, disability or handicap.

5.1.3.2 Design of the test-retest trial

The test-retest trial involved members of the seniors' cohort, recruited originally during the pilot survey conducted during 1988 (see Chapter 4), and involved individuals completing the OHIP questionnaire on two occasions using a crossover design to examine the effect of the method of its administration. Of the 178 members of the seniors' cohort originally interviewed in the pilot survey, 132 of them (74.2 per cent) could be traced and agreed to participate in the test of the OHIP during 1989/90. However, 10 persons were interviewed using a proxy questionnaire which excluded the OHIP questions. Of the 122 persons who took part in this initial OHIP questionnaire, five gave incomplete information about social impact leaving 117 who provided usable responses. For the initial questionnaire, the OHIP was administered in two ways to randomly selected subgroups of the cohort: self-complete mail questionnaire; or personal interview (either face-to-face or telephone interview). Two separate questionnaires therefore were used (Appendix 3), both containing a core of 49 identical social impact items. The two subgroups were assigned after stratifying for dentition status (dentate or edentulous) and the baseline levels of impact reported in the 1988 pilot

survey. Hence, the subgroups were expected to report similar levels of impact using the OHIP.

Internal consistency of the OHIP is one aspect of reliability and was assessed using Cronbach's reliability coefficient α from the responses of all persons to this initial administration of the OHIP. Test-retest reliability was assessed during a second administration of the OHIP conducted in 1990, three months after its initial administration. All 117 persons who provided usable OHIP responses in the initial test were asked to take part. A randomly selected sub-sample of 78 respondents was asked to do the retest using the same method of administration used during the initial test (either personal interview or self-complete). Sixty two of them (79.5 per cent) provided usable responses to this retest questionnaire. For the remaining 39 members of the seniors' cohort, a different method of administration was adopted during the retest, and 29 of them (74.3 per cent) took part. The layout of the test-retest design is displayed in Table 10.

TABLE 10 PARTICIPANTS IN THE TEST-RETEST TRIAL OF THE OHIP

		Number of persons 1991 Retest Method*	
		PI	MQ
1990/91 Test Method	PI	48	13
	MQ	16	14

* PI=Personal interview (telephone or face-to-face);
MQ=Mail questionnaire (self-complete).

5.1.3.3 Computation of OHIP scores

OHIP responses from the groups having the same method of administration on both occasions (48 persons in the PI–PI cell and 14 persons in the MQ–MQ cell in Table 10) were used and the intra-class correlation co-efficient (Bartko, 1966) was computed to evaluate test-retest reliability.

A third aspect of reliability concerned the effects of questionnaire administration method. Changes in OHIP values were assessed separately among groups which underwent the retest using the same methods (that is, the 62 persons just described) and different methods of administration (that is, the remaining 29 persons from Table 10. A single standardized OHIP score was calculated for each person. It was obtained by firstly standardizing each subscale score to a mean of zero and standard deviation of one. Then each individual's seven standardized subscale scores were summed. This was achieved in SAS using "proc standardize", which is equivalent to subtracting the group mean from each individual's subscale value, and dividing by the standard deviation for that subscale. The group mean and standard deviation was obtained from the distribution of OHIP responses at the initial test and subsequent retest of the OHIP. The average amount of change in standardized OHIP values for each individual (retest minus test) therefore had an expected value of zero if there had been no net change in levels of social impact. An increase in reported impact would be represented by a positive value, while a decrease would be represented by a negative value.

Net changes in social impact were evaluated using the single summary statistic of change in standardized OHIP scores. Initial OHIP scores were used as a covariate in analysis of covariance to test the four

types of test-retest groups defined from the crossover design described in Table 10.

5.1.4 Validity

Validity was assessed using the notion of "convergent validity" (Kaplan et al, 1976). Comparisons of social impact were made between groups defined according to perceived treatment needs. The comparisons were made using both the 1988 pilot survey findings, where social impact was measured using the items developed by Cushing et al (1986), and the 1989/90 initial administration of the OHIP. As noted previously, there were 117 persons from the seniors' cohort who took part in both the 1988 and 1989 survey and who provided usable OHIP questionnaires. Analysis of variance was used to evaluate the capacity of the OHIP to detect relationships, initially observed in the 1988 pilot survey, between social impact and perceived need for care.

5.1.5 Source of subjects

Three separate study groups were used for the methods described above, and their characteristics are summarized in Table 11. Both the patient group and judging panel were non-random samples and each had a majority of females. In addition, efforts were made to obtain sufficient numbers of edentulous persons and denture wearers in each of those groups, and the prevalence of these parameters exceeded estimates from the general population (Australian Institute of Health and Welfare, 1992). The seniors' cohort was more representative of the population aged 60 years or more because it was a random sample although the stratification provided approximately equivalent numbers of men and women.

TABLE 11 GROUPS USED FOR DEVELOPMENT AND EVALUATION OF THE OHIP

	Patient group	Judging panel	Seniors' cohort
Stage	Obtaining statements	Judging statements	Reliability/ validity
Sampling	Convenience	Convenience	Random
Number of persons	64	328	122*
Age range (years)	18-78	18-75+	60-92
Female (%)	67.2	64.9	51.6
Edentulous (%)	18.8	31.1	44.3
Wearing dentures (%)	54.7	57.0	85.2

* 132 persons participated in interviews both in the pilot survey in 1988 (Chapter 4) and 20 months later in 1989, although only 122 received OHIP questionnaires and 117 provided complete social impact data; 91 members of the cohort took part in the 23 month retest of the OHIP during 1990.

One feature of the seniors' cohort not shown in Table 11 was the completeness of follow–up between the pilot survey (Chapter 4) and the initial administration of the OHIP. One hundred and thirty two of the original 178 participants could be contacted again at follow–up, representing an attrition rate of 31.5 per cent, although only 117 of them provided OHIP responses. Attrition rates were analyzed according to baseline characteristics of the 178 participants, and higher rates of attrition were observed among older persons (60–64 years = 17.5 per cent, 65–74 years = 17.8 per cent, and 75+ years = 40.0 per cent, Chi-square=10.7, $p<0.05$) and those who did not have an oral examination at baseline (non–examined = 41.7 per cent, examined = 15.1 per cent, Chi-square=15.8, $p<0.05$).

5.1.6 Ethical review

The surveys for interviews with dental patients, judgements about social impact statements and the seniors' cohort study were reviewed and approved by the Committee on the Ethics of Human Experimentation at The University of Adelaide.

5.2 Results

5.2.1 Conceptual model

The conceptual model of Locker (1988b) has been reviewed previously in Chapter 3. Seven distinct dimensions of social impact were identified from the model, and operational categories based on Locker's description were developed using the definitions which follow.

1) Functional limitation was defined as loss of function of body parts or systems. Functions of the teeth and mouth were taken to include mastication, speech and maintenance of facial form. Statements which referred to the efficiency of individual's own oral function or the perceived adequacy of facial form were included in this dimension. The functional requirements of dentures concerned their fit.

2) Physical pain was defined as the subjective perception of physical discomfort and pain. Statements which referred to typical oral symptoms of discomfort and pain were included in this dimension.

3) Psychological discomfort was defined as the subjective perception of distress or discomfort associated with cognitive or mental states.

Statements which referred to internal cognitive processes (such as self-consciousness or tension) were included in this category.

4) Physical disability was defined as any limitation in or lack of ability to perform physical activities of daily living. Statements which indicated a deficit in specific tasks were included in this dimension. It represented an extension of functional limitation to indicate a behavioural impact on daily physical activities which healthy individuals should be able to perform. While functional limitation would be perceived as reduced performance (for example, difficulty chewing), physical disability would represent a practical behavioural consequence (such as avoiding foods). The main physical activities related to consumption of food, communication and smiling.

5) Psychological disability was defined as any limitation in or lack of ability to perform psychological activities involved in daily living. This represents an extension of psychological discomfort (referring to an effect on cognitive processes) to create a change in psychological activities such as mood or concentration. The major psychological activities concerned relaxation, sleep concentration and mood.

6) Social disability was defined as any limitation in or lack of ability to perform social activities involved in daily living. Whereas the other dimensions of disability refer predominantly to an individual's own performance, social disability considers effects on interactions with others. The major social activities were viewed as interactions with family and friends.

7) Handicap was defined as disadvantage experienced by individuals because of any disease, dysfunction, discomfort or disability. This

category of impact aimed to capture any statements which referred broadly to diminished life circumstances or quality of life.

5.2.2 Obtaining statements about social impact

People in the patient group were interviewed and asked to describe, using their own words, the consequences of oral disorders. A total of 535 statements was obtained and sorted into the seven dimensions drawn from Locker's model. The percentage of statements in each dimension and examples of the statements are listed in Table 12. (The full list of original statements appears in Appendix 4.) Nearly one third (30 per cent) of statements related to physical disability while statements about functional limitation, physical discomfort and psychological disability were common (Table 12). The complete series of 535 statements was then reduced to 46 unique statements selected to be representative of the complete series. Since statements about handicap were rare, three statements from an existing inventory (Hunt et al, 1986) were added in an attempt to adequately reflect the definition provided in the theoretical model.

TABLE 12 DISTRIBUTION AND EXAMPLES OF STATEMENTS REPORTED BY PATIENT GROUP

Dimension	% of statements*	Example of statements
Functional limitation	16	"I've had trouble pronouncing some words."
Physical discomfort	16	"My dentures have been uncomfortable."
Psychological discomfort	11	"I've been a bit irritable because of dental troubles."
Physical disability	30	"My speech has been unclear."
Psychological disability	16	"My concentration has been affected."
Social disability	10	"I've been less tolerant of my spouse."
Handicap	1	"I've been limited in my work."

* n = 535 statements.

5.2.3 Judging the importance of statements

Subsets of the 49 statements were presented to persons in the judging panel who selected the statement judged to be the most unpleasant from each pair of statements within a dimension. The matrix summarizing the distribution of judgements for functional limitation is presented in Table 13. By looking down the columns it can be seen that the seventh item (dentures not fitting) was regarded by a majority of the 106 judges to be worse than any other item. On the other hand, "noticed a tooth which doesn't look right" (item 2) was judged to be worse than any other items by no more than 49 persons. Consequently, the weights for functional limitation ranged from 0.747 ("tooth doesn't look right") to 1.472 ("dentures not fitting") among the nine functional limitation items.

TABLE 13 DISTRIBUTION OF JUDGEMENTS ABOUT FUNCTIONAL LIMITATION STATEMENTS

Number of persons judging column statement as more unpleasant than row statement (n=106 persons).

Statement (OHIP number)*	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[1] digestion worsened (Q8)		25	38	63	42	56	79	51	29
[2] noticed tooth (Q3)	81		74	82	65	86	86	83	57
[3] appearance affected (Q4)	68	32		60	38	58	79	66	58
[4] breath stale (Q5)	43	24	46		38	54	75	68	37
[5] taste worsened (Q6)	64	41	68	68		74	81	80	52
[6] food catching (Q7)	50	20	48	52	32		74	62	49
[7] dentures not fitting (Q17)	27	20	27	31	25	32		31	28
[8] difficulty chewing (Q1)	55	23	40	38	26	44	75		53
[9] trouble pronouncing (Q2)	77	49	48	69	54	57	78	53	
Weights	1.168	0.747	1.059	1.154	0.931	1.181	1.472	1.253	1.036

* Complete wording of the question is included in the OHIP questionnaire (Appendix 5) - question numbers included in parentheses.

A similar layout is used in Table 14 to compare the physical pain items. There were 128 judges, and in this instance, toothache was consistently judged by a majority to be the most unpleasant impact. Painful aching was frequently judged as unpleasant, and the item weight reflects this tendency. However there was less unanimity in the judgements about physical pain. For example, the least unpleasant item (a sore jaw) was nevertheless regarded by some 68 persons (little more than one half) as more unpleasant than discomfort while eating. The weights have a narrower range than was the case for functional limitation which indicates the greater

degree of uncertainty concerning physical pain. Items weights ranged from 0.931 (sore jaw) to 1.361 (toothache).

TABLE 14 DISTRIBUTION OF JUDGEMENTS ABOUT PHYSICAL PAIN STATEMENTS

	Number of persons judging column statement as more unpleasant than row statement (n=128 persons).								
Statement (OHIP number)*	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[1] Painful aching (Q9)		35	52	53	75	48	51	44	64
[2] Sore jaw (Q10)	93		78	61	92	69	85	60	91
[3] Headaches (Q11)	76	50		63	85	50	65	57	68
[4] Teeth sensitive (Q12)	75	67	65		90	64	59	48	81
[5] Toothache (Q13)	53	36	43	38		38	43	43	43
[6] Dentures (Q18)	80	59	78	64	90		69	76	80
[7] Gums painful (Q14)	77	43	63	69	85	59		44	93
[8] Uncomfortable eat (Q15)	84	68	71	80	85	52	84		98
[9] Sore spots (Q16)	64	37	60	47	85	48	35	30	
Weights	1.213	1.084	1.361	1.088	1.264				
	0.937	1.053	1.002	0.998					

* Complete wording of the question is included in OHIP questionnaire (Appendix 5) - question numbers included in parentheses.

Table 15 presents weights for the psychological discomfort statements. The range again was relatively narrow, especially among four of the items which obtained a weight of 2.025 or less. The lack of unanimity is confirmed when the individual judgements for those four items (questions 19, 20, 22 and 23) are examined: only small majorities judged any individual item within a pair to be more unpleasant.

TABLE 15 DISTRIBUTION OF JUDGEMENTS ABOUT PSYCHOLOGICAL DISCOMFORT STATEMENTS

	Number of persons judging column statement as more unpleasant than row statement (n=149 persons).				
Statement (OHIP number)*	[1]	[2]	[3]	[4]	[5]
[1] Been miserable (Q21)		56	57	57	64
[2] Been worried (Q19)	93		68	63	70
[3] Self-conscious (Q20)	92	81		70	82
[4] Uncomfortable (Q22)	92	86	79		90
[5] Feeling tense (Q23)	85	79	67	59	
Weights	2.252	2.006	1.902	1.815	2.025

* Complete wording of the question is included in OHIP questionnaire (Appendix 5) - question numbers included in parentheses.

Judgements about physical disability are presented in Table 16. The resultant weights ranged from 0.952 (interrupting meals) to 1.351 (unable to eat with dentures). Again there was no clear majority for a number of items resulting in weights grouped around 1.0.

TABLE 16 DISTRIBUTION OF JUDGEMENTS ABOUT PHYSICAL DISABILITY STATEMENTS

	Number of persons judging column statement as more unpleasant than row statement (n=132 persons).								
Statement (OHIP number)*	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[1] Speech unclear (Q24)		72	59	60	68	62	91	50	52
[2] Misunderstood (Q25)	60		54	71	74	59	82	64	46
[3] Less flavour (Q26)	73	78		68	83	62	79	74	69
[4] Unable to brush (Q27)	72	61	64		81	60	88	62	58
[5] Avoid foods (Q28)	64	58	49	51		42	85	56	38
[6] Diet (Q29)	70	73	70	72	90		85	69	64
[7] Unable to eat (Q30)	41	50	53	44	47	47		45	32
[8] Avoided smiling (Q31)	82	68	58	70	76	63	87		48
[9] Interrupt meals (Q32)	80	86	63	74	94	68	100	84	
Weights	1.109	1.111	1.051	1.068	1.266	1.022	1.351	1.070	0.952

* Complete wording of the question is included in OHIP questionnaire (Appendix 5) - question numbers included in parentheses.

Table 17 presents judgements for psychological disability statements, for which computed weights ranged from 1.393 (been upset) to 1.950 (sleep disturbed). There was a relatively evenly spaced range in intermediate weights.

TABLE 17 DISTRIBUTION OF JUDGEMENTS ABOUT PSYCHOLOGICAL DISABILITY STATEMENTS

	Number of persons judging column statement as more unpleasant than row statement (n=124 persons).					
Statement (OHIP number)*	[1]	[2]	[3]	[4]	[5]	[6]
[1] Sleep interrupted (Q33)		39	49	60	41	38
[2] Been upset (Q34)	85		66	89	69	72
[3] Difficult to relax (Q35)	75	58		83	55	53
[4] Feeling depressed (Q36)	64	35	41		54	34
[5] Concentration (Q37)	83	55	69	70		42
[6] Been embarrassed (Q38)	86	52	71	90	82	
Weights	1.950	1.393	1.646	1.936	1.638	1.437

* Complete wording of the question is included in OHIP questionnaire (Appendix 5) - question numbers included in parentheses.

There was a similar pattern in the distribution of judgements about social disability, presented in Table 18. Being less tolerant of another person was judged to be more unpleasant than any other individual item, while avoiding going out was judged as the least unpleasant.

TABLE 18 DISTRIBUTION OF JUDGEMENTS ABOUT SOCIAL DISABILITY STATEMENTS

	Number of persons judging column statement as more unpleasant than row statement (n=117 persons).				
Statement (OHIP number)*	[1]	[2]	[3]	[4]	[5]
[1] Avoided going out (Q39)		91	72	79	75
[2] Less tolerant (Q40)	26		31	40	27
[3] Trouble getting on (Q41)	45	86		82	52
[4] Been irritable (Q42)	38	77	35		45
[5] Difficulty doing jobs (Q43)	42	90	65	72	
Weights	1.572	2.555	1.832	2.236	1.805

* Complete wording of the question is included in OHIP questionnaire (Appendix 5) - question numbers included in parentheses.

The final group of judgements concerned the six handicap questions, presented in Table 19. A perception of worsened general health was judged as the most unpleasant impact, while financial disadvantage was judged as the least unpleasant.

TABLE 19 DISTRIBUTION OF JUDGEMENTS ABOUT HANDICAP STATEMENTS

	Number of persons judging column statement as more unpleasant than row statement (n=115 persons).					
Statement (OHIP number)*	[1]	[2]	[3]	[4]	[5]	[6]
[1] Health worsened (Q44)		30	27	30	30	54
[2] Financial disadvantage (Q45)	85		64	55	60	82
[3] Enjoy company less (Q46)	88	51		58	56	71
[4] Life less satisfying (Q47)	85	60	57		47	73
[5] Unable to work (Q48)	85	55	59	68		70
[6] Unable to function (Q49)	61	33	44	42	45	
Weights	2.112	1.420	1.545	1.567	1.476	1.879

* Complete wording of the question is included in OHIP questionnaire (Appendix 5) - question numbers included in parentheses.

Visual analyses of the paired comparisons in the preceding tables provide a general impression of small to moderate majorities in judgements. For example, the largest majority was represented by the paired comparison of "less tolerant of spouse or family", rated by 90 of the 117 persons (76.9 per cent) as more unpleasant than "difficulty doing jobs" (Table 18). Among most other subscales, the largest majorities were between 70 and 75 per cent, although in the case of psychological discomfort, the largest majority was only 62.4 per cent of persons who rated "feeling miserable" worse than "being worried". When other paired comparisons within subscales were compared, the majorities were smaller or there was evenly divided opinion. For example, within the functional limitation subscale, 53 persons regarded "difficulty chewing" as more unpleasant than "trouble pronouncing words",

while the opposite view was held by the remaining 53 who regarded "trouble pronouncing words" as more unpleasant then "difficulty chewing" (Table 13).

Table 20 presents the Kendall *u* statistics, and they confirm the descriptive interpretation obtained from the discussion so far. The *u* statistic ranged from 0.022 for psychological discomfort to 0.132 for social disability. Although they were statistically significant against the null hypothesis of no agreement, the magnitude of the statistics indicated that the agreement was only small to moderate.

TABLE 20 OBSERVED VALUES AND POSSIBLE RANGE FOR KENDALL'S *U* STATISTIC* IN PAIRED COMPARISONS OF IMPACT STATEMENTS

Subscale	Kendall's *u*	p
Functional limitation	0.120	<0.01
Physical pain	0.067	<0.01
Psychological discomfort	0.022	<0.01
Physical disability	0.041	<0.01
Psychological disability	0.069	<0.01
Social disability	0.132	<0.01
Handicap	0.084	<0.01

* Possible range of *u* statistic is -0.01 to +1.0.

The level of agreement was investigated further among subgroups of individuals. The procedures and tables presented already for the entire group of judges were recalculated for groups defined by age, sex, and denture-wearing groups. The summary statistics of agreement are presented in Table 21. Levels of agreement tended to improve when specific subgroups were defined by denture wearing. For example, the *u* statistic for functional limitation increased to 0.194 among persons wearing two

dentures. On the other hand, the largest level of agreement for the handicap items was observed for persons with no dentures. For all of the subscales, values of the *u* statistic increased by no more than a factor of three compared with the values for the entire group (presented previously in Table 20). The highest single level of agreement was 0.219 for handicap observed among non-wearers of dentures (Table 21).

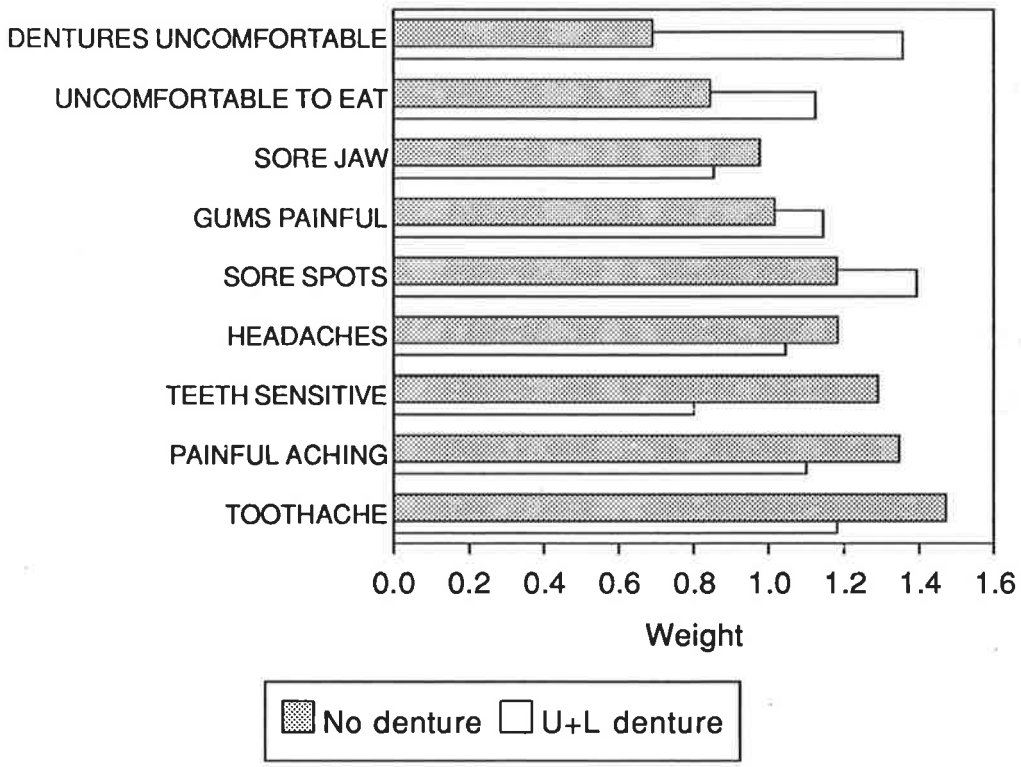
TABLE 21 VARIATIONS IN KENDALL'S *U* STATISTIC AMONG DEMOGRAPHIC AND DENTURE WEARING GROUPS

Subgroup	Func Limit	Phys Pain	Psych Disc	Phys Disab	Psych Disab	Social Disab	Handi-cap
Age							
15-54	0.098	0.102	0.029	0.025	0.080	0.158	0.201
55-64	0.147	0.098	0.017	0.056	0.060	0.143	0.060
65+	0.139	0.068	0.029	0.057	0.072	0.124	0.029
Sex							
Male	0.092	0.095	0.013	0.019	0.136	0.190	0.115
Female	0.134	0.051	0.019	0.058	0.039	0.114	0.075
Dentures							
None	0.087	0.142	0.044	0.025	0.101	0.210	0.219
One	0.153	0.193	0.012	0.045	0.029	0.212	0.040
Two	0.194	0.094	0.055	0.090	0.042	0.047	0.012

The greater levels of agreement among subgroups raises the question about the relative ranking of items by those subgroups. One example is provided in Figure 4, where the statement weights have been computed separately for two subgroups - non-wearers of dentures and wearers of two dentures. The range for the weights was greater for the non-wearers of

dentures, ranging from 0.69 for "dentures uncomfortable" to 1.47 for "toothache". In contrast, the upper and lower denture group ranked "teeth sensitive" as the least unpleasant (weight=0.80) and sore spots as the most unpleasant (weight=1.39). Not only was the range in statements weights smaller for the denture group, there were clear differences in the ranking of statements.

FIGURE 4 PHYSICAL PAIN STATEMENT WEIGHTS FROM DENTURE WEARING GROUPS



5.2.4 Reliability of the Oral Health Impact Profile

Values of Cronbach's α are presented in Table 22. Values for six subscales ranged from 0.70 to 0.83, indicating good reliability of those subscales, although the handicap subscale had only moderate reliability (α=0.37). Intra-class correlations are presented for the 62 subjects from the seniors' cohort who participated both in the test and retest of the OHIP and

who had the same method of administration at both occasions. The coefficients ranged from 0.42 to 0.77 in six subscales demonstrating good or very good reliability, except in the case of the social disability subscale where the coefficient was only 0.08 (Table 22).

TABLE 22 RELIABILITY OF THE ORAL HEALTH IMPACT PROFILE SUBSCALES IN THE SENIORS' COHORT

Subscale	Cronbach's alpha*	Intra-class correlation coefficient†
Functional limitation	0.70	0.77
Physical pain	0.76	0.42
Psychological discomfort	0.77	0.76
Physical disability	0.82	0.72
Psychological disability	0.83	0.74
Social disability	0.73	0.08
Handicap	0.37	0.48

* Responses from 117 persons in the seniors' cohort at the initial testing of the OHIP during 1989/90.
† Responses from 62 persons who took part in the retest of the OHIP during 1990.

Additional findings from the test-retest trial are presented in Table 23. Among all four groups considered in this crossover design, there was a net increase in reported social impact, with the difference (retest minus test) equal to 0.66 using the standardized OHIP scores. (Recall that the expected value was zero if there had been no net change.) There was an indication among subgroups of differing amounts of change in OHIP scores, ranging from an increase of 3.2 (PI-MQ) to a decrease of –2.4 (MQ-MQ). However, there was also an indication of different initial (test) scores among the subgroups. Initial OHIP scores tended to be lower for those groups showing

greater increases at retest and higher for those groups showing greater decreases at retest. This was an indication of possible regression towards the mean, and therefore statistical significance of these effects was evaluated using analysis of covariance with the initial (test) value used as the covariate.

TABLE 23 STANDARDIZED OHIP SCORES FROM THE TEST-RETEST TRIAL OF THE OHIP

Group			Test Score		Difference (Retest-Test)	
Test	Retest	n	Mean	StdDev	Mean	StdDev
All groups		**91**	**-0.33**	**5.0**	**0.66**	**5.1**
PI	PI	48	-1.6	4.2	1.7	3.9
PI	MQ	13	-0.6	4.8	3.2	7.8
MQ	PI	16	0.9	5.4	-1.8	4.4
MQ	MQ	14	2.7	6.1	-2.4	4.5

* PI=Personal interview (telephone or face-to-face).
MQ=Mail questionnaire (self-complete).

The findings from the analysis of covariance in this test-retest trial are presented in Table 24. All terms were statistically significant, indicating variations according to the test-retest group and the occurrence of regression towards the mean. Least squares means obtained from the model are also displayed in Table 24. The least squares (or adjusted) means represent the magnitude of change for each group with the covariate set to the sample average. They indicate the amount of change in summed standardized OHIP scores after controlling for variations in test scores. The Wald's test evaluates the null hypothesis that the mean change is equal to zero.

TABLE 24 ANALYSIS OF COVARIANCE FOR OHIP TEST-RETEST GROUPS

Dependent variable: Difference (Retest-Test) in summed standardized OHIP values

Source	df	F	p
Test score (covariate)	1	9.0	0.004
Group	3	4.7	0.004
Interaction			
Group * Test score	3	7.2	<0.001

Group*		Least squares means of change in standardized OHIP values		
Test	Retest	mean	(StdDev)	p†
PI	PI	2.0	(0.6)	0.002
PI	MQ	3.2	(1.2)	0.009
MQ	PI	-0.96	(1.1)	0.39
MQ	MQ	-0.44	(1.3)	0.75

* PI=Personal interview (face-to-face or telephone
MQ=Mail questionnaire (self-complete)
† Wald's test for least squares means obtained from analysis of covariance model. H_0: Mean=0

For the two groups in Table 24 which initially had personal interviews (PI), there was a statistically significant increase in OHIP values. The increase was greatest for the PI–MQ group (least squares mean = 3.2). In contrast, for the two groups which initially had mail questionnaires, there were small decreases which were not statistically significant. The best overall result, with a mean change closest to zero, was the group which

received repeated mail questionnaires (MQ–MQ – least squares mean = –0.44).

5.2.5 Validity of the Oral Health Impact Profile

Table 25 presents descriptive findings from the initial test administration of the OHIP among the seniors' cohort. Functional limitation was the most frequent form of impact among edentulous persons, affecting 69 per cent of edentulous persons while physical pain was the most frequent among dentate, affecting 71 per cent. Most impacts were reported by a similar percentage among dentate and edentulous persons, although there were differences in the mean subscale values between the two groups. For example, edentulous persons had a higher mean subscale value for functional limitation (6.15 edentulous compared with 4.52 dentate), despite the fact that the two were reported by a similar percentage.

TABLE 25 DISTRIBUTION OF OHIP SUBSCALES IN THE SENIORS' COHORT TEST ADMINISTRATION

Subscale	No. of questions	% of persons* Dentate (n=68)	% of persons* Edentulous (n=48)	Mean (StdDev) subscale score† Dentate (n=68)	Mean (StdDev) subscale score† Edentulous (n=48)
Func. limitation	9	69	69	4.52 (5.00)	6.15 (6.45)
Physical pain	9	71	53	4.12 (4.59)	4.80 (6.38)
Psych. discomfort	5	30	30	3.16 (6.56)	3.52 (6.93)
Physical disability	9	41	47	1.96 (3.78)	3.38 (5.94)
Psych. disability	6	21	21	1.11 (3.64)	2.13 (5.16)
Social disability	5	3	11	0.08 (0.24)	0.83 (2.55)
Handicap	6	9	13	0.71 (2.22)	0.41 (1.21)

* Per cent of persons reporting at least one item occasionally, fairly often or very often.
† The minimum possible value in each subscale was zero indicating no social impact and the maximum possible was 40.

Although not shown in Table 25, most people reported multiple forms of impact - a mean of 5.7 impact items was "occasionally", "fairly often" or "very often", where the maximum possible number was 49. This number did not differ significantly among dentate and edentulous persons. However there was an association with age: a mean of 7.1 items was reported by persons aged 60-64, 5.4 items by those aged 65-74 and 4.8 items by those aged 75+.

The decision to split the questionnaire into two halves created some difficulties during analysis. Some individuals who responded affirmatively to one or some of the first 18 questions misinterpreted the instructions and skipped the remaining part of the questionnaire. This occurred both for the

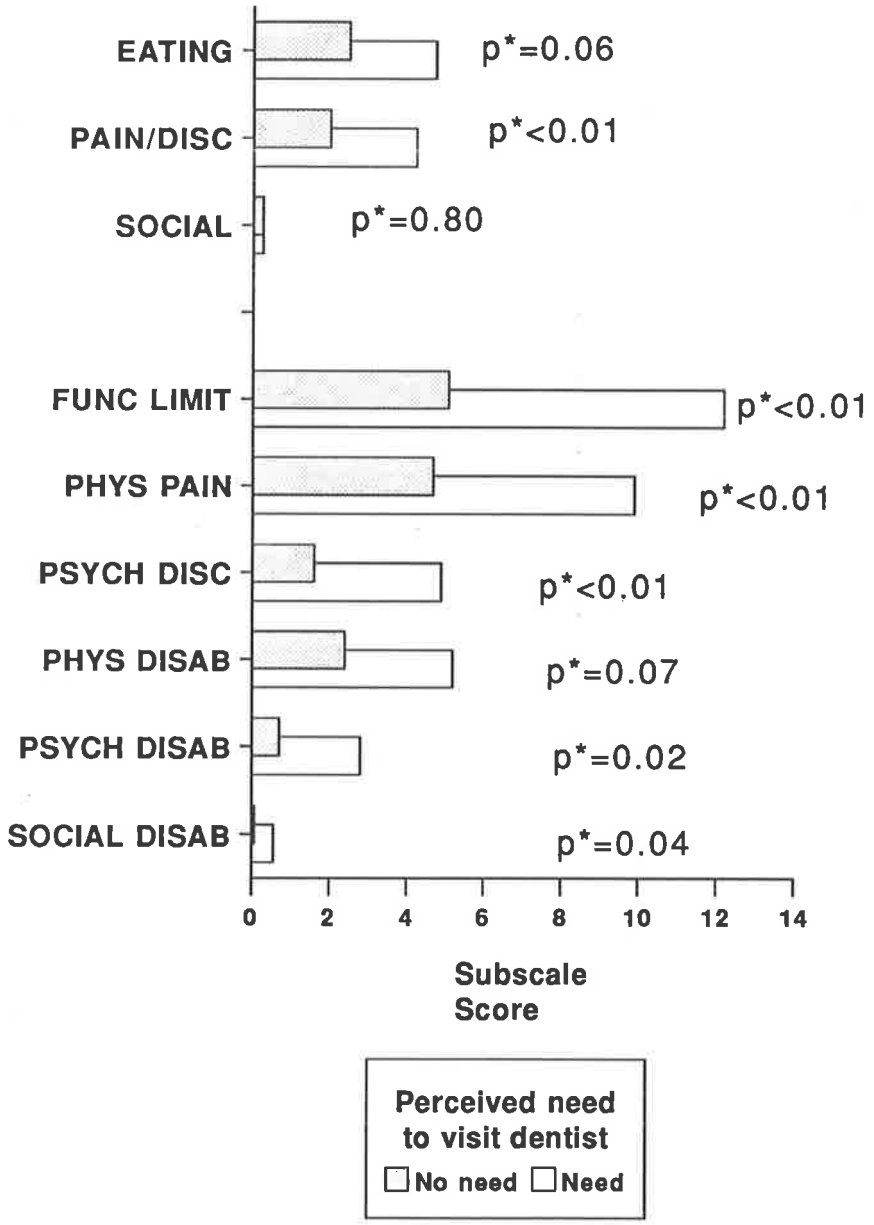
self-complete and personal interview versions. In two other cases, persons who reported no impact in the first half of the questionnaire went on to complete the second half and recorded some affirmative responses. However, the original approach (described in the methods) was used of imputing zero values to the second half of the questionnaire.

An assessment of validity was the final step in testing the OHIP, and is an important requirement to demonstrate the extent to which the underlying event of social impact is actually captured by the questionnaire. Although the empirical derivation of the OHIP contributes to its content validity, evidence of its construct validity also was sought (Kaplan et al, 1976). This was made possible by drawing on the baseline findings from the pilot survey of the seniors' cohort when preliminary information on social impact was obtained in responses to the 12 questions based on the work of Cushing et al (1986). The top section of the bar chart in Figure 5 indicates that persons who, in the pilot survey, reported a need to visit a dentist, tended to have higher social impact scores on the scale of Cushing et al (1986) than those who did not perceive a need to visit. This general trend is expected, since the experience of social impact should act as a cue to visit a dentist. However, the trend was not observed for the social disability subscale of that questionnaire.

During the 1989/90 follow-up of the seniors' cohort, the OHIP questionnaire was administered and scores were also compared between those who did and did not perceive a need to visit a dentist at that time. Those responses are also shown in Figure 5, where the subscale scores of persons who said they needed to visit a dentist were approximately twice as high as the OHIP subscale scores of persons who did not. As well, the differences in mean OHIP subscale scores were more likely than the baseline scores to be statistically significant as assessed using analysis of variance ($p<0.05$ in five OHIP subscales). This indicates that the OHIP was able to

detect a previously observed association between social impact and perceived need to visit a dentist, that the association persisted across a broader range of subscales and was more sensitive to statistical tests.

FIGURE 5 OHIP SUBSCALES AND PILOT SURVEY SUBSCALES OF SOCIAL IMPACT AMONG TREATMENT NEED GROUPS



* F-test, H_0: No need = need.

5.3 Discussion

This phase of the research was prompted by the need for an improved measure of social impact. The results indicated that the OHIP could quantify social impact across a number of conceptually distinct dimensions and that it was a reliable and valid survey instrument.

The first step of the OHIP's development specifically recognized the potential for diversity in the social impact of oral disease by assigning operational definitions to seven conceptual dimensions of impact. For example, chewing was defined as a function of the mouth, while eating was defined as an activity of daily living. Similarly, a feeling of tension was regarded as psychological discomfort, while difficulty relaxing was defined as a psychological disability on the grounds that a requirement to relax can be seen as an activity of daily living. These subtle distinctions are necessary to capture the underlying framework of the WHO (1980) model.

One of the revealing findings from the collection of statements about social impact was that individuals readily reported consequences of oral conditions which encompassed six of those dimensions. As noted, this process adds to the construct validity of the instrument. The fact that the interviews with 64 dental patients revealed such a diverse range of statements about social impact itself provides support for the view that oral disease is pervasive and can cause a substantial impact. Indeed, some of the statements appear to extend beyond the collection of normative impacts envisaged in previous research. For example, statements such as "unable to brush teeth properly" and "concentration affected" have not been included in the main comparable indices reviewed in Chapter 3.

The observed diversity of impacts across the range of dimensions draws attention to one of the distinctive features of the OHIP in contrast to other indices. Unlike other indices, the OHIP assigns each specific impact to a point on the hierarchy between functional limitation, disability and handicap. The hierarchy, proposed originally in the WHO model (WHO, 1980) differs from other the classification scheme used by Cushing et al (1986), who grouped impacts according to their effects on specific tasks. For example, "biting hard" and "changing foods" were both included in the eating dimension of Cushing et al (1986). This makes sense using a task orientation because both impacts relate to the task of eating. Furthermore, Cushing et al (1986) regard "difficulty or restriction" as equivalent. In contrast, the OHIP has a different orientation which aims to distinguish between the extent to which disorders affect social well-being. Disruptions which are limited in their extent to reduced performance of a function would be classified as functional limitation, while those which extended to reduced performance of an activity of daily living would be regarded as disability. In this respect, difficulty biting hard would be equivalent to a functional limitation, while changing foods would conform more closely with disability.

Other indices such as the GOHAI (Atchison and Dolan, 1990) make no distinction among individual items of social impact, and instead sum the number of items to provide an overall indicator of impact. It has been argued above that such an approach ignores what, on face value, are quite different forms of impact such as toothache and sensitivity. One underlying assumption of the GOHAI therefore appears to be that separate events are significant while the amount of impact associated with any single event in relation to another event effectively can be disregarded.

The third step in the development of the OHIP emphasized some of its distinctive features. In this step, weights were formulated by asking individuals to judge all possible pairs of statements within a conceptual

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dimension, and to identify the statement which was most unpleasant within each pair. The findings demonstrated generally small to moderate majorities in judgements. The most uniform judgement concerned the statement "less tolerant of spouse or family" judged by 76.9 per cent as more unpleasant than "difficulty doing jobs" (Table 18). Within the physical pain dimension, "toothache" was judged by 70.3 per cent to be more unpleasant than "sensitivity of teeth". Most other judgements had smaller majorities, with the result that item weights within conceptual dimensions varied by no more than a factor of two.

It should be noted that larger comparative differences in item weights could be obtained by using different assumptions in the Thurstone's weighting procedure. One approach could be the use of a homogeneous group of judges known to have more consistent patterns of agreement. For example, the overall level of agreement (Kendall's *u* statistic) concerning physical pain could be doubled by using the judgements of persons without dentures (Table 21). In other OHIP dimensions, agreement was greater among denture wearers or, in the case of psychological disability, among males. Presumably the improved level of agreement comes about, in part, because of more common experiences of subgroups. For example, persons without dentures probably have never experienced denture-related pain, and they may tend to disregard the impact caused by it. This probably accounts for the marked differences in weights in Figure 4, where persons without dentures ranked "uncomfortable dentures" as least unpleasant, while wearers of upper and lower dentures ranked it the second most unpleasant.

However the use of subgroup specific weights would create additional problems of interpretation. It is not certain which specific group should be used if the weights were to be applied to all other subgroups. For example, should the views of persons without dentures be regarded as more valid

than the views of denture wearers? On the other hand, if different weights obtained from subgroups were used for scoring the responses of the specific subgroups, it would be create additional difficulties in interpreting the findings. For example, should subscale values then be compared among the subgroups when different weights were used to compute the values? Since each person could be defined according to a number of subgroups (such as age, sex and denture wearing), which subgroup-specific weight should be used?

Another potential way to compute different statement weights would be to use a different constant (other than 1.645) during the computation process. It will be recalled from Table 9 (page 70) that the mean of the unit normal deviates was always distributed around zero, and that it is necessary to add a positive integer since all statements are conceptualized as having an adverse impact. (If that concept was disregarded, and reports of impact could range from negative to positive scores, the score for persons reporting no impact would require an arbitrary negative constant, effectively creating an identical problem.) The constant of 1.645 was selected, since it corresponds to two standard deviations on the z-distribution. In theory (and in practice) no single z-score (taken from the mean of the columns in Table 9) is expected to be more than two standard deviations below the symmetrical point of zero.

However, much smaller constants could have been selected for each group of statements. In the example in Table 9, for example, any constant greater than 0.32 would have satisfied the criterion of forcing all weights to a positive value. For the observed data in Tables 13 to 19, a constant of 0.54 would have been sufficient to yield positive values for all weights. If the constant of 0.54 was used, one consequence would be to attach relatively greater weight to those statements judged to be most unpleasant and near-zero weights to those which were judged to be least unpleasant. In the pain

subscale, for example, the use of a constant of 0.54 would result in weights ranging from 0.58 ("sore jaw") to 1.86 - over a three-fold difference. The actual weights, developed using a constant of 1.645, ranged from 0.94 and 1.36 - a difference of only 45 per cent.

The decision to use the judgements of all persons and the constant of 1.645 was based on a wish to remain consistent with the theory underlying the Thurstone's pairs procedure. The generally small majorities in judgements apparently reflect legitimate diversity of opinion among individuals. The findings from Figure 4 suggest that those opinions reflect, in part, the current oral status of individuals. No doubt some individuals would have difficulty imagining specific forms of impact. However, the purpose of obtaining judgements is to obtain the candid judgements of individuals. Even if there is diversity or uncertainty in those judgements, it is appropriate to weight the statements accordingly.

The outcome of these decisions is the creation of subscales which pay some cognizance to relative severity of items, but which are influenced more by the Likert scale of scores applied to the reported frequency of impact: "very often", scored as four, through to "never" scored as zero. Within the physical pain subscale, for example, a report of sensitivity "very often" would add 4 x 1.053 to the subscale, while a report of toothache "fairly often" (3 x 1.361) would add a similar amount. While this represents a typical approach to coding Likert-type response there is no particular justification for the use of the integers zero to four in preference to any other group (such as a logarithmic scale). Bradburn and Miles (1979) found that the quantitative value which should be attached to descriptors of frequency varies according to the reported event. They found, in reporting the sensation of "excitement" during the previous month, the gap between "not too often" and "pretty often" was 6.30 times per month, and between "pretty

often" and "very often" it was 3.67 times per month. In contrast, the gaps for boredom were 9.57 and 3.67 respectively.

While it is not certain that the existing coding scheme for the Likert-type response in the OHIP is the most appropriate, there is also no strong theoretical reason or practical evidence to support the use of another scheme. In a practical sense, the findings concerning the reliability and validity of the OHIP encourage the retention of the existing coding scheme. However, there has been no explicit testing of the reliability or validity associated with alternative weighting schemes.

Another issue in coding the Likert-type scale is the use of a uni-directional response scale: all impacts were conceptualized as negative effects on well-being, and all questions used the same uni-directional response. It would be possible to re-conceptualize some impacts as having a positive effect on health. For example a feeling of discomfort about appearance (Q22) could be rephrazed to refer to sense of attractiveness. Alternatively, individuals may regard their capacity to chew as better than "the average person" or simply as a function in which they performed well. Such an approach has been used for the DIP (Strauss and Hunt, 1993). However, others have noted a lack of English vocabulary describing positive dimensions of health which itself is taken as evidence of a very limited lay perception of wellness compared with a broad acknowledgement of illness (Hunt et al, 1986).

The choice to adopt a uni-directional view of adverse impact within the OHIP in part reflects a deliberate conceptual orientation and one which is proposed within the WHO framework (WHO, 1980). Indeed, Twaddle (1980) argues that wellness and illness frequently are assessed by individuals using quite separate concepts. As noted in the literature review, findings

from surveys which have assessed positive and negative aspects of oral health provide some support for that view. The uni-directional construction of social impact in the OHIP is consistent also with the general epidemiological orientation of this research which intends to add additional dimensions to the assessment of the burden of illness within populations.

There are other practical difficulties in any attempts to use positive dimensions within the OHIP. For example, toothache cannot sensibly be regarded as a positive health outcome. Of course, it may be possible to ask individuals if they regard their experience with toothache to be better, average or worse, in which case an explicit comparison would be required with peers or with some earlier time period. However the comparison then adds a second source of judgement which raises additional measurement problems. Do people have any sense of "average" levels of toothache? Can everyone be expected to assess equally the "average" level, and will they make similar comparative judgements?

Aside from this question of any positive aspects of OHIP questions, there is a separate question about the consistent layout of the Likert-type response categories for each of the 49 items. A common recommendation for attitudinal scales is to vary at random the direction of response codes. This is done in an effort to discourage a "response set", whereby individuals become accustomed to and even influenced by the attitudes underlying a consistent series of questions. While that phenomenon has been reported for personal opinions (for example, political preferences), it is less certain how influential a response set might be within a battery of questions such as the OHIP which intends to capture factual reports relating to oral symptoms and their impact.

One specific difficulty within the OHIP would be the practical issue of reversing the Likert-type scale. The existing response asks "how often" the problem has been experienced. To ask "how infrequently" problems were experienced demands consideration of a double negative: "not very infrequently" presumably would be similar to "fairly often". This also appears to create an unnecessary respondent burden. Furthermore there appears to be no equivalent to the existing "never" response - even "very, very infrequently" could reflect some level of impact.

A simpler approach would be to presume that the existing Likert-type scale actually contains positive and negative dimensions of frequency, and to vary the responses symmetrically about the middle "occasionally" category. This would be a simple issue of layout in the existing questionnaire, effectively to reverse the response codes for about half of the questions. In the event, this was not done because of concerns about confusing or even annoying respondents.

The evidence of reliability, obtained during the test and retest of the OHIP, includes both "internal reliability", as indicated by Crobach's alpha coefficient, and "stability" as indicated by the intra-class correlation coefficient. In both respects, the majority of OHIP subscales were adequate, although the less frequent subscales of social disability and handicap featured equivocal results. Moreover, in the case of the test-retest reliability of social disability, fluctuations can be anticipated during the three month interval and would influence the test-retest findings.

The findings from the repeated administration of the OHIP using the crossover design provide support for the consistent use of a self-complete form of the instrument. In the test-retest trial, an overall increase in social impact was observed during the three month period, with a net increase of

0.66 in the standardized OHIP. One possible explanation for the net increase in reported social impact was an instrument effect: after completing the OHIP in late 1990, respondents may have become more aware of oral symptoms and social impact, and therefore more sensitized to the repeated administration of the instrument three months later. Furthermore, there was evidence of regression towards the mean across the two time periods, that is, individuals who reported high levels of impact late in 1990 tended to report less three months later.

The analysis of covariance model, presented in Table 24, allowed least squares means to be calculated, controlling for regression to the mean. Individuals who initially had a personal interview and later a self-complete questionnaire showed the largest increase, while those who had a self-complete questionnaire followed by an interview had the largest decrease. The findings indicated firstly that the crossover of method created the greatest amount of discrepancy between administrations of the OHIP; either an increase or decrease. This may be expected, and highlights some of the different dynamics which most likely operate during data collection by these basically different approaches.

However the order of administration was also important. Initial personal interview followed by self-complete questionnaire created a larger increase compared with the decrease accompanying the reverse method. The average time recorded for the personal interview was 12 minutes, or less than 15 seconds per OHIP item. It is plausible that initial personal interviews received relatively prompt responses, but that subjects subsequently had time to contemplate aspects of social impact. Another influence would be a more candid divulgence of social impact items. For example, questions about embarrassment and interactions with spouse or

family may be answered more honestly in an anonymous response to a mailed questionnaire compared with face-to-face or telephone interview.

In most other respects, the OHIP questionnaire performed satisfactorily. There were adequate response rates, even within the small cohort of seniors who received follow-up without prior warning on two occasions. Levels of missing data were acceptable. However one obvious source of problems was imposed by the decision to split the OHIP questionnaire into two halves, and the direction to skip the second half if there were no affirmative responses to the first half. This resulted in some incomplete responses as participants (and interviewers) misinterpreted the instructions. For this reason, it was decided to avoid the artificial distinction between two parts of the questionnaire during future use of the OHIP and instead to use the instrument as a single battery of 49 items.

The validity of the OHIP was evaluated indirectly, and was found to be favourable. For questionnaires such as the OHIP, for which there is no single criterion or "gold standard", validity must necessarily be evaluated by observing consistent and expected effects (Kaplan et al, 1975). One expected effect is that higher levels of social impact would occur among persons who also perceive a need for treatment, since a perception of treatment is likely to be prompted by the experience of symptoms and social impact. In this instance there was an opportunity to compare the OHIP results with earlier findings obtained using the responses to the battery of items adapted from Cushing et al (1986). The findings demonstrated higher levels of social impact among those with a perceived need for treatment. Furthermore, the OHIP scores for those with perceived treatment needs were higher by a factor of approximately two in the six subscales, whereas the variations were less pronounced (and less likely to be statistically significant) using the pilot survey results. This indicated that the OHIP was

sensitive across the range of subscales, and that it was able to detect differences in a statistically efficient manner.

Like many other indices, there will be a continuing need to re-assess the validity of the OHIP and to evaluate it in other settings. Concurrent validity and predictive validity need to be further examined in longitudinal studies which obtain parallel information on oral health status and dental behaviours. Evaluation before and after different types of dental treatment would be another good method to examine validity.

In addition, it is important to acknowledge disadvantages associated with the specific approach and assumptions used in developing the OHIP. The 49 items constitute a lengthy questionnaire, and its complexity and length may be inappropriate for some individuals (for example, children or persons with reduced language or cognitive skills) and in some settings where detailed data collection is not possible.

It is also apparent that the distinctions between subscales, and particularly between specific items, are reasonably subtle. It has been argued already that this constitutes one of the features of the OHIP distinguishing it from other instruments such as the GOHAI (Atchison and Dolan, 1990). In many instances, the distinctions are important: for example, some treatments (such as some forms of prosthodontics) may primarily aim to reduce physical disability, while having little effect on pain. In other instances, it is valuable to categorize individuals into disabled and non-disabled groups, in which case cut-off points within the disability subscales would be more valuable than a simple cut-off point for overall impact. As well, it has been argued already that there is a need to develop a sufficiently precise picture of social impact, to complement the detailed

epidemiological picture which is created using various indices of caries experience, periodontal destruction and denture assessments.

One assumption about the operational definitions for dimensions within the OHIP is that they were adequately encompassed in the statements obtained from the clinic sample. However there was an indication that the adequacy varied among dimensions. For example, there was a small number of statements about handicap, and additional items were added from the NHP (Hunt et al, 1986).

There are other potential ways to assess the comprehensiveness of items within subscales. One would be to use other individuals to assign the original 535 statements, or the smaller group of 49 statements, to the seven conceptual dimensions. It may be appropriate to draw on other dental researchers or lay persons to perform such an exercise. Another approach would be to empirically regroup the existing items, based on the distribution of responses. Factor analysis is the favoured technique for exploring alternative groupings, but has not been conducted here because of the relatively small number of respondents (122 persons) and large number of items (49) in this phase of the research.

There are other questions about the very appropriateness of constructing separate dimensions of social impact. While theoretical distinctions between dimensions may be appropriate for many types of research or policy development, there will be occasions where a simplified "single score" is necessary. In those instances, the OHIP subscales can be standardized (each to a common mean and standard deviation) and summed. This accords equal importance to subscales after considering the distribution (rather than absolute values) of the subscales. For example, an individual who scored one standard deviation above the mean on a single

subscale would receive the same value as an individual who scored half a standard deviation above the mean on two subscales. An absolute score within a subscales featuring a narrow distribution and small standard deviation (such as handicap) would add relatively more to the standardized OHIP score than an equivalent absolute score from a subscale with a larger standard deviation (such as functional limitation).

A simpler summary statistic can be obtained from a count of the number of OHIP items reported occasionally, fairly often or very often. In this instance, a single handicap item and a single functional limitation item would add equivalent value to the summary statistic. Both the count of items and the standardized OHIP provide an overall ranking of individuals according to their social impact. However, in order to interpret specific differences in impact it is useful to examine the individual subscale scores and to construct a profile of social impact. For example, a group with high levels of functional limitation alone could have similar summary statistics compared with another group having moderately high levels of functional limitation and disability. However, the two groups could be expected to have differences in underlying oral conditions, and there may be different types of interventions which would be appropriate to address the burden of illness.

Finally, it should be recognized that additional research could be undertaken to provide alternative methods of combining subscales. Ranking methods could be used to obtain judgements about the relative importance of the conceptual dimensions. Factor analysis based on subscale scores could also help to explore new combinations of social impact.

5.4 Conclusions

The method of developing the OHIP and the results concerning its reliability and validity overcame the major inadequacies of the earlier pilot survey questionnaire. The derivation of statements about social impact from a group of dental patients add credence to the view that oral conditions cause a diversity of impacts. The dimensions of social impact included impairment, disability and handicap as proposed by the WHO (1980).

The use of community groups to judge the relative importance of statements yielded small to moderate majorities in judgements, and suggested the existence of a diversity of opinion. A consequence was that the range of arithmetic weights was narrow. However, this appeared to be appropriate in view of legitimate differences in opinions observed among subgroups of judges.

When the OHIP was evaluated in a test-retest trial with a crossover design, there was good evidence of reliability and validity. Self-complete questionnaires produced the most consistent results, and would appear to be the method of administration least prone to instrument effects. Furthermore, it avoids unintended effects on response which appeared to be associated with telephone or face-to-face administration.

The distinctive feature of the OHIP in relation to other indices is the intended partitioning of impacts according to a hierarchy of impairment, disability and handicap. This creates a relatively complex and lengthy survey instrument, although one which appears to operate well as a self-complete questionnaire within a non-institutionalized population of older adults. The level of detail should have substantial benefits in the practical application of the instrument. For example, it may be desirable to

concentrate on disability rather than overall impact when assessing specific groups or interventions. When necessary, OHIP subscales can be combined to create a single standardized score or a simplified count of the 49 items can be computed.

CHAPTER 6. THE SOUTH AUSTRALIAN DENTAL LONGITUDINAL STUDY – BASELINE FINDINGS

Baseline findings from the South Australian Dental Longitudinal Study (SADLS) provided data to address the second, third and fourth objectives of this thesis concerning the distribution and correlates of social impact and relationships among dimensions of social impact. This exploratory phase of research therefore had an applied focus seeking to advance existing knowledge about the occurrence of social impact among older adults. It differs from the two previous sections, which focussed on the methods used for measuring social impact.

This section begins with a description of the survey methods and is followed by results concerning descriptive findings from the OHIP, factors associated with social impact, and relationships between dimensions of social impact.

6.1 Materials and methods

The procedures used in the SADLS were adopted specifically to address the second, third and fourth objectives of this thesis. However, the procedures also reflect two additional features of the Study:

1. The Study had additional objectives concerning, longitudinal patterns of change in oral disease and social impact, which influenced the sample size requirements for the baseline data collection; and

2. The Study was planned to take advantage of the opportunity to compare dental caries prevalence and incidence in the non-fluoridated city of Adelaide and the fluoridated city of Mt Gambier. Although the

findings concerning fluoride are not reported in this thesis, the requirements for that comparison influenced the design of the study, primarily by including only dentate persons from Mt Gambier.

6.1.1 Design

The baseline component of the SADLS was a cross-sectional epidemiological survey of non-institutionalized persons aged 60+ years. Data were collected by means of face-to-face interview, self-complete questionnaire and clinical examination. The data collection took place between May 1991 and February 1992.

6.1.1.1 Sampling procedures

A representative sample of two South Australian cities (Adelaide and Mt. Gambier) was selected using a two-stage stratified sampling design. In 1991 Adelaide, the capital city of the state of South Australia, had a population of 1.06 million persons, and the estimated resident population of persons aged 60+ years was 188,686. In contrast, Mt Gambier is a regional centre for logging and rural industry situated some 450 km to the south east of Adelaide. In 1991 the City and District Council had a population of 27,301 with 4,042 persons aged 60+ years (Australian Bureau of Statistics, 1993).

The sampling design was selected to obtain sufficient numbers of dentate persons in age- and sex-strata, while promoting optimum participation and minimizing costs associated with data collection. The sampling frame for the survey was the electoral database maintained by the South Australian State Electoral Department. Registration on the database is a legal requirement for Australian citizens aged 18+ years living in non-

institutional care unless they have exemption due to illness. Included on the database were the age and sex of each registered voter, their residential address, and a geographic locality code, referred to as the "walk code". The walk code was used by the Department to manage fieldwork at times when the database was updated. The most recent update of the database occurred in late 1990 in preparation for a State election.

Sampling from the frame was conducted with the assistance of Mr Graeme Tucker from the Australian Bureau of Statistics Adelaide Office. He developed computer programs in SAS containing procedures for stratification and systematic random sampling. The entire electoral database was supplied on magnetic tape, and records of persons aged 60 years or more who were resident in Adelaide or Mt Gambier were copied onto a VAX mainframe computer to create the sampling frame. This sampling frame consisted of 181,263 records representing all electors aged 60+ years in the two cities. A separate file, listing the census collector's district (CD) code for each electoral walk was merged with the sampling frame.

In the first step of sampling, 24 strata were created. Eighteen of the strata occurred in Adelaide and were defined by distance, age and sex. Distance referred to the geographic distance from the centroid of each CD to one of 33 dental clinics used for oral examinations. Each record on the sampling frame therefore was categorized as being near (within 1.95 km), middle (between 1.95 and 2.73 km) or far (greater than 2.73 km) from a dental clinic.

Age-strata were defined as: 60-64 years, 65-74 years, and 85+ years. The two sex-strata identified males and females. The three distances, three ages and two sexes therefore resulted in a total of 18 strata within Adelaide. In Mt Gambier, six strata were defined according to the same three age-

groups and the two sexes. Distance was not used as a separate stratum due to the relatively small size of the city.

Sampling within the 24 strata (18 in Adelaide and six in Mt Gambier) then proceeded with a random start, systematic random sampling process. The skip intervals in Adelaide were selected to result in the selection of approximately equivalent numbers of persons in each age- and sex-grouping but with greatest numbers of persons who were geographically near, smaller numbers who were middle and the lowest numbers of persons who were far from a dental clinic. Skip intervals in Mt Gambier were selected to yield equivalent numbers of age- and sex-groups.

This first stage of sampling resulted in the selection of 4,857 records. A second stage of sampling allowed for the exclusion of a percentage of edentulous persons within each of the 24 strata. Within Adelaide, 50 per cent of edentulous persons aged 75+ years were excluded, 20 per cent of edentulous persons aged 65 to 74 years were excluded, while none of the edentulous persons aged 60-64 were excluded. In Mt Gambier, all edentulous persons were excluded. Edentulism status was not contained on the sampling frame. Instead, edentulous persons were excluded at the time of an initial approach to each sampled household by the survey interviewers.

6.1.1.2 Sample size requirements for testing hypotheses

The Study sought information about a representative sample of the population of adults aged 60+ years in Adelaide and Mt Gambier. The numbers of subjects and the approach to sampling reflected the requirements for the second, and third aims described for this thesis. The fourth objective (a comparison of relationships among dimensions of social

impact) would be analyzed primarily as correlation co-efficients, and no formal sample size requirements were calculated.

The process of determining the size of the sample for the baseline study involved: the specification of important hypotheses; listing assumptions for the sample size formulae; analysis of requirements for each inference; and estimates of participation rates under the planned sampling strategy. The hypotheses have been described in Chapter 2.

For the hypotheses relating to the second objective, it was necessary to obtain sufficient subjects to allow for precise estimates of prevalence of individual social impact items. Based on findings from the development and evaluation of the OHIP (Chapter 5), it was expected that percentage prevalence rates of individual OHIP items would range from 5 to over 50 per cent. It was desired that 95 per cent confidence intervals for those percentages should be no greater than plus or minus five percent and that they should exclude zero. It was expected that mean OHIP subscale scores would range from 0.5 (StdDev=1.5) to 10.0 (StdDev=8.0).

For the third objective, it was desired to assess group differences in OHIP subscale scores which appeared to be meaningful. Findings from the development and evaluation of the OHIP provided some guidelines for anticipated effects (Table 25, page 96). It was deemed that group differences of 2.0 units in the functional limitation, physical pain and physical disability subscales would be worth detecting, while differences of 1.0 units in the remaining subscales would be worth detecting. In practical terms, these conform with differences in reporting of around two and one OHIP items, respectively, per subscale, varying according to the item weight within the subscale. In assessing the third objective, it was recognized that comparison groups would not necessarily have equivalent numbers, and

allowance was made for group sizes which differed by as much as a factor of four.

Standard formulae (Meinert and Tonascia, 1986) were used to calculate the sample size requirements for hypothesis tests of rates (expressed as percentages) and means. In the case of outcomes which were small proportions (less than 0.2), the inverse sine transformation approximation was used. In all cases a two-tailed Type I error of 0.05 was specified and a Type II error of 0.2 was used. Adjustments to the standard sample size were made to reflect the sampling design described above. Stratification according to distance from dental clinics introduced an element of clustering within the design. Clustering has a general effect of increasing variances of estimates, while stratification by the other variables generally helps to provide more precision (and hence less variance). For most population surveys, an adjustment factor for design effect of 1.1 is regarded by the Australian Bureau of Statistics as most appropriate, with larger design effects (up to 1.2) being reserved for surveys with unusual geographic distributions and complex multi-stage selections. Consequently, an increase in sample size requirements of 10 per cent was made to allow for the "design effect".

The sample size requirements for the baseline of the SADLS are shown in Table 26. For most inferences, an adjusted sample size of approximately one thousand or less would be sufficient. An exception occurred for social disability, where a very low mean value (taken from the pilot survey, Chapter 4) resulted in a large sample size requirement in order to achieve a 10 per cent relative standard error. As noted elsewhere, the mean level of social disability in the pilot survey (0.39) was substantially lower than expected. There was also a large sample size requirement (1639 persons) for comparing psychological discomfort among groups of unequal size.

TABLE 26 SAMPLE SIZE REQUIREMENTS FOR THE SADLS – BASELINE COMPONENT

Objective	Inference/hypothesis		No of persons (simple random sample)	No of persons (adjusted for design)
Prevalence of social impact	Proportion and 95% CI of 0.50 +/- 0.05 (eg % reporting oral pain)		384	423
	Proportion and 95% CI of 0.05 +/- 0.025 (eg % reporting avoiding going out)		292	321
	10% Relative standard error for subscales:			
	Functional limitation (Mean=7.76, StdDev=8.44)		118	130
	Physical pain (Mean=4.42, StdDev=5.46)		153	168
	Psych. discomfort (Mean=3.32, StdDev=6.70)		407	448
	Physical disability (Mean=2.59, StdDev=4.89)		357	393
	Psych. disability (Mean=1.56, StdDev=4.40)		791	870
	Social disability (Mean=0.39, StdDev=1.73)		1953	2148
	Handicap (Mean=0.58, StdDev=1.85)		1036	1140
Variations in social impact	Functional limitation:	difference=2.0	558	614
		n_1/n_2=4*		961
	Physical pain:	difference=2.0	512	564
		n_1/n_2=4		881
	Psych. discomfort	difference=1.0	954	1048
		n_1/n_2=4		1639
	Physical disability	difference=2.0	410	452
		n_1/n_2=4		706
	Psych. disability	difference=1.0	590	650
		n_1/n_2=4		1014
	Social disability	difference=1.0	64	70
		n_1/n_2=4		109
	Handicap	difference=1.0	104	114
		n_1/n_2=4		180

* Ratio n_1/n_2 refers to the difference in sample size of subgroups.

Most requirements for testing hypotheses in the baseline study therefore could be achieved with a sample size of 1140. As noted previously, there were other considerations for the longitudinal design of the study which indicated a need for 581 examined, dentate subjects after two years and 246 examined, dentate subjects after five years.

6.1.1.3 Expected recruitment and participation rates

Expectations about recruitment and participation rates were developed after experience in the baseline pilot survey. Since the SADLS was planned to involve longitudinal follow-up data collections, the baseline sample size also needed to consider effects of attrition. This section provides details of the calculations which were performed to ensure that sufficient subjects were recruited at baseline to satisfy sample size requirements throughout the longitudinal study. The procedures involved:

1) estimation of baseline participation rates;

2) estimation of two-year attrition rates; and

3) estimation of five-year attrition rates.

The likely baseline recruitment and participation rates were considered first, and the likely losses during the longitudinal follow-up were then examined. The estimated rates of each form of attrition were then brought together on an electronic spreadsheet which applied each rate at each step of the study to provide a calculation of the number of persons available for interview and examination at each stage. The baseline sample was then adjusted until each of the examination and interview sub-samples was sufficient to meet the sample size requirements described previously.

The sampling frame used in the pilot survey was the Health Insurance Commission's Medicare Masterfile which in most respects is similar to the State Electoral Database. Some 89 per cent of subjects sampled from the Medicare Masterfile were located and found to be alive when the interviewers approached the addresses for the pilot survey, and the same percentage was assumed for persons aged 60-74 in the SADLS. However, a more conservative estimate of 85 per cent was assumed for the oldest age stratum age 85+ years.

Of those subjects who were located and alive in the pilot survey, 80 per cent agreed to participate in face-to-face interviews in their homes. There were reasons to expect a similar or better rate for the SADLS, since the SADLS interview schedule was considerably shorter than the average 2 hours 12 minutes required for the multi-disciplinary pilot survey. However, experience gained elsewhere (Locker et al, 1990) indicated that participation in dental studies is lower than in other general health surveys. In addition, it was expected that there could be less willingness to participate in a longitudinal study, where subjects may not wish to over-commit themselves. Hence more conservative estimates of the interview participation rate were used for the two older age-groups, with an overall 74 per cent participation rate in baseline interviews.

The final consideration for the SADLS was participation in dental examinations. Again a more conservative estimate than the one obtained in the pilot survey was used, despite the fact that the pilot survey's general health examination was more arduous involving a three-hour battery of physical and psychological tests preceded by overnight fasting. In addition, clinical examinations for the pilot survey occurred at only one clinic in Adelaide, whereas the SADLS sampling strategy was based on the use of 33 clinics throughout the Adelaide metropolitan area. Despite these

considerations, the clinical participation in the SADLS was expected to average 64 per cent among dentate persons and 56 per cent among edentulous persons.

Table 27 contains the estimated recruitment rates and numbers of persons required for Adelaide.

TABLE 27 ADELAIDE RECRUITMENT REQUIREMENTS FOR THE SADLS

	Age group (yrs)			
	60-64	65-74	75+	Total
Number of subjects sampled from frame	470	790	1400	2660
% live, located	90%	90%	85%	
% (of live/located) willing to participate	80%	75%	70%	
Number willing to participate	338	533	833	
% dentate	65%	50%	35%	
Number of dentate subjects	219	266	291	776
% participating in clinic	70%	65%	60%	
Number of dentate examined	153	172	174	499
Number of edentulous subjects	118	266	541	
% of edentulous selected	100%	80%	50%	
Number of edentulous interviewed	118	212	270	600
% participating in clinic	65%	60%	50%	
Number of edentulous examined	76	127	135	338

Notes:	SADLS Predicted	Pilot survey Observed
Percentage of subjects live and located	88%	89%
Percentage of live/located subjects interviewed	74%	80%
Percentage of dentate interviewees examined	64%	70%
Percentage of edentulous interviewees examined	56%	

The Mt Gambier baseline sample is presented in Table 28 and demonstrates that the number of subjects required from the sampling frame

is almost as high as Adelaide (some 2310 subjects). In fact, the number would ideally be slightly higher than the Adelaide sample to provide equal numbers of dentate subjects at both places, however the oldest Mt Gambier sample was limited by the population size of 1,050 (South Australian Department of Environment and Planning, 1989). Hence the subsample aged 75+ years represented a full enumeration of the oldest Mt Gambier age group.

TABLE 28 MT GAMBIER RECRUITMENT REQUIREMENTS FOR THE SADLS

	Age group			
	60-64	65-74	75+	Total
Number of subjects sampled from frame	470	790	1050	2310
% live, located	90%	90%	85%	
% (of live/located) willing to participate	80%	75%	70%	
Number willing to participate	338	533	624	
% dentate	60%	45%	30%	
Number of dentate subjects	202	239	187	628
% participating in clinic	70%	65%	60%	
Number of dentate examined	141	155	112	408

Notes:	SADLS Predicted	Pilot survey Observed
Percentage of subjects live and located	88%	89%
Percentage of live/located subjects interviewed	74%	80%
Percentage of interviewees examined	65%	70%

Two independent events were considered to determine the extent of attrition in the interviewed and examined sub-samples. Firstly, losses due to death and movement out of the State were considered using information concerning mortality and migration rates (Australian Bureau of Statistics 1988, 1990a). The expected rate of loss was taken to be 50 per cent greater than the age-specific population mortality rates to account for additional causes of attrition, in particular institutionalization and illness. The rate of loss was independently applied to each of the groups for whom baseline information was obtained to allow calculation of the number of persons for whom a continuous longitudinal data series would be available. Using these calculations, and compounding annual losses over two years, age-specific losses of between 6 and 26 per cent were calculated as displayed in Table 29. These percentages were then applied independently to the baseline numbers of interviewees and examinees to derive the potentially available number of second-year interviewees and examinees respectively.

A second rate of loss was applied to the attrited sample to account for non-participation. The extent of non-participation in interviews was expected to be considerably less among the subjects who previously had participated in baseline interviews and hence 90 per cent participation in the interviews was anticipated at two years. However participation rates in the second round of examinations were expected to be less than 90 per cent. Age-specific examination rates which were ten per cent higher than the baseline rate therefore were used.

When the two effects of loss to follow-up and non-participation were combined at two years the average total longitudinal loss of interviewees was 24 per cent and of examinees was 39 per cent (calculated from data in Table 29 compared with combined requirements from Tables 27 and 28).

TABLE 29 PARTICIPATION IN THE TWO YEAR FOLLOW-UP OF THE SADLS

	Age group 60-64	65-74	75+	Total
Adelaide dentate sub-sample				
% loss from baseline	6%	10%	26%	
Number available for re-interview	205	239	215	659
% participating in interview	90%	90%	90%	
Number of subjects interviewed	184	215	193	592
Number available for re-examination	143	154	128	
% participating in examination	80%	75%	70%	
Number of subjects examined	114	115	89	318
Adelaide edentulous sub-sample				
% loss from baseline	6%	10%	26%	
Number available for re-interview	110	190	199	
% participating in interview	90%	90%	90%	
Number of subjects interviewed	99	171	179	449
Number available for re-examination	71	114	99	
% participating in examination	70%	65%	55%	
Number of subjects examined	49	74	54	177
Mt. Gambier sub-sample				
% loss from baseline	6%	10%	26%	
Number available for re-interview	189	215	138	
% participating in interview	90%	90%	90%	
Number of subjects interviewed	170	193	124	487
Number available for re-examination	132	139	82	
% participating in examination	80%	75%	70%	
Number of subjects examined	105	104	57	
Entire 2nd-year sample				
Number interviewed	453	579	496	1528
Number examined (all subjects)	268	293	200	761
Number examined (dentate subjects)	219	219	146	584

Similar procedures were used to calculate the loss of subjects at five years. New levels of attrition were calculated using as the base the number of participants in the two-year interviews and examinations. During the three years between the second and third examination phases, losses due to mortality and migration ranging from 8 to 37 per cent were used (Table 30). The rates of participation in interviews and examinations used at the first follow-up were applied to this stage, although this represents an even more

conservative estimate since these subjects will have demonstrated their willingness to participate at two successive stages.

TABLE 30 PARTICIPATION IN THE FIVE YEAR FOLLOW UP OF THE SADLS

	Age group 60-64	65-74	75+	Total
Adelaide dentate sub-sample				
% loss from 2nd year	8%	15%	37%	
Number available for re-interview	169	182	121	472
% participating in interview	90%	90%	90%	
Number of subjects interviewed	152	163	108	423
Number available for re-examination	104	97	56	257
% participating in examination	80%	75%	70%	
Number of subjects examined	83	72	39	194
Adelaide edentulous sub-sample				
% loss from 2nd year	8%	15%	37%	
Number available for re-interview	91	145	112	348
% participating in interview	90%	90%	90%	
Number of subjects interviewed	81	130	100	311
Number available for re-examination	45	62	34	
% participating in examination	70%	65%	55%	
Number of subjects examined	31	40	18	89
Mt. Gambier sub-sample				
% loss from 2nd year	8%	15%	37%	
Number available for re-interview	156	164	78	398
% participating in interview	90%	90%	90%	
Number of subjects interviewed	140	147	70	357
Number available for re-examination	96	88	35	
% participating in examination	80%	75%	70%	
Number of subjects examined	76	66	24	166
Entire 5th-year sample				
Number interviewed	373	440	278	1091
Number examined (all subjects)	190	178	81	449
Number examined (dentate subjects)	159	138	63	360

The total sample of completed baseline interviews and examinations exceeds the requirements for the aims described previously, and was in excess of the 1140 persons required to assess most of the hypotheses for this thesis. However the baseline "oversample" was necessary when the attrition of the cohort was considered. The total number of subjects for whom longitudinal interview information would be available at two years was expected to be 1528 compared with the 2004 at baseline, representing an interview loss of 24 per cent. In the case of examinations, the attrition was 39 per cent. When the number of subjects retained at that stage is compared with the sample size requirements, the yield of 584 examined dentate subjects was just sufficient to allow testing of the previously specified differences in incidence rates of social impact and disease among dentate persons. Hence the baseline sample was sufficiently large to allow testing of baseline hypotheses, while the attrited five-year sample was sufficient large to allow testing of the longer-term hypotheses.

6.1.2 Data collection methods

The baseline SADLS fieldwork was conducted over a period of ten months, and involved: recruitment and interview; self-complete OHIP questionnaires; and oral examinations. The ten–month period reflected the rate at which oral examinations could be arranged and conducted. The other aspects of fieldwork were arranged around the timetable for examinations.

6.1.2.1 Recruitment and interviews

Primary approach letters (Appendix 6) were posted to each person in the sample approximately one week prior to an approach by interviewers.

The letters were specific for the Adelaide and Mt Gambier sites. They explained the purpose of the study and encouraged participation.

Thirty-three interviewers were trained in the survey procedures before beginning fieldwork. A training manual (Appendix 7) described the purpose of the study, the procedures for enumerating households and selecting a subject, the procedures for obtaining consent and administrative details. During two-hour training sessions with small groups of up to six interviewers, the questionnaire schedule was reviewed. Adelaide interviewers had previous training and experience with population surveys for the Australian Bureau of Statistics. In Mt Gambier, interviewers were selected, trained and provided with field supervision through a contracted firm, South East Survey Services.

Household enumeration and subject selection took place during the initial approach the listed address of each sampled person. In order to preserve confidentiality, interviewers were not provided with the name of the "target person" sampled from the Electoral Database. Indeed, the names of individuals were not recorded on the data file supplied by the State Electoral Commission. Consequently, it was necessary for interviewers to go through an enumeration and selection process during the initial approach to households. The enumeration and selection process was recorded onto a "Household Contact" card (Appendix 8). Up to six visits were made to each household, and non-contacted addresses were re-visited some two months later. Approaches were made predominantly during daylight hours. Where it became difficult to find someone at home, interviewers spoke with neighbours or left calling cards with a contact telephone number.

A responsible adult at the household was asked firstly to list the name, age and sex of each persons aged 60 years or more. Interviewers

then consulted a pre-printed label for that household which listed the target age-range (60-64 years, 65-74 years or 75+ years) and sex of a person registered as a voter at the address. In the majority of cases, only one individual at any address satisfied the age- and sex-criteria, and consequently that person was selected to be the target person. However, if more than one person satisfied the criteria (for example, two sisters of similar age), then the person with the most recent birthday was selected as the target person. This situation arose most frequently in collective living centres such as hostels.

In some instances, more than one person at a single address was sampled. This was most frequent in Mt Gambier where a substantially larger proportion of the population was approached. In those instances, two Household Enumeration Cards were created, each with separate details on the pre-printed labels. For example, where both a husband and wife were sampled, one Household Enumeration Card contained the age-range and sex for the husband, and another Household Enumeration Card contained the age-range and sex for the wife.

On other occasions, there were no enumerated persons who satisfied the selection criteria. This occurred, for example, where the sampled voter had died or moved. It also could occur when a target person recently had a birthday which moved them out of the age-range criterion. For example, a 64-year-old at the time of sampling (March 1992) could turn 65 before the initial household contact, and therefore at the time of enumeration would not be within the age-range criterion (60-64 years) which would be printed on the Household Enumeration Card. In those circumstances, the household was listed as "out of scope" and contact was terminated.

After identification of a target person, a final selection procedure was completed to sample an appropriate proportion of edentulous persons. The interviewer asked a responsible adult if the person matching the age- and sex-criteria had any natural teeth. If the person was dentate, they were always selected for interview. If the person was edentulous, the interviewer consulted the pre-printed label which instructed whether to select or exclude the person. That instruction was printed on a random sample of an appropriate percentage of labels according the sampling stratum. For example, in Mt Gambier, all edentulous persons were excluded. In Adelaide, the percentage of edentulous persons excluded ranged from 50 per cent (75+ year olds) to zero per cent (60-64 year olds). Persons excluded in this way were issued with a pre-printed letter to thank them.

There were other possible outcomes from the household enumeration process. They included: refusal to participate in the enumeration process; death or illness which precluded the enumeration process; language barriers which precluded the enumeration process; inability to find anyone at home; and non-residential addresses (including addresses which were nursing homes, businesses or demolished houses).

Immediately following their selection, target persons were asked to take part in a 25-minute face-to-face interview. The interview contained 72 questions about dental health status, use of dental services, preventive practices, medical conditions, residential history, and sociodemographic characteristics (Appendix 9). In instances where there were communication barriers, another responsible adult could act as proxy and answer on behalf of the target person.

6.1.2.2 The Oral Health Impact Profile

Following completion of the interview, an OHIP questionnaire (Appendix 5) and reply-paid envelope was left with each participant other than those whose interview was by proxy. The OHIP questionnaire contained instructions asking participants to complete the questionnaire in their own time and to return it either by reply-paid post or at a subsequent dental examination. First reminder notices were posted to non-respondents approximately four weeks later, and a second reminder letter along with a new OHIP questionnaire was posted to persistent non-respondents approximately four weeks after that.

6.1.2.3 Examinations

At the time of interview, participants were asked to provide their telephone number so that a dental examination subsequently could be scheduled. Examination schedules were then arranged by contacting each participant from the central office. Participants without telephones were advised about the wish to conduct an examination, and an appointment subsequently was posted by mail. However examinations were not conducted with participants who declined to provide their telephone number or did not wish to take part.

Examinations were conducted by one of four dentists who had undergone prior calibration. Training and calibration took place over six sessions, two of them under the supervision of Dr Ron Hunt who had previously trained examiners for the Iowa (Hunt et al, 1985) and Piedmont (Drake and Strauss, 1990) surveys. Training and calibration involved slides and discussions (two sessions) where criteria were reviewed, as well as clinical examinations (four sessions) where dentists examined the same

subject and subsequently compared findings. Differences among examiners were identified and resolved by joint re-examination of the subject, and through subsequent reviews of criteria. Some 18 dentate and nine edentulous subjects took part in the training and calibration exercises.

Examinations for the Survey itself were conducted at dental clinics or in participants' homes. Standard dental lights or intra-oral fibre-optic lights were used for illumination. Plane mouth mirrors, sharp sickle probes and US National Institute of Dental Research (NIDR) periodontal probes were used, however radiographs were not used.

Four groups of oral health characteristics and corresponding treatment needs were examined: dentition and denture status; dental caries experience; calculus accumulation and gingival bleeding; and periodontal destruction. The basic components of the protocol are drawn from the NIDR diagnostic criteria (NIDR, 1987). The principal adaptations to the NIDR protocol were: inclusion of an additional category for surfaces which were restored, non-carious but defective; recording of periodontal destruction for all teeth; the selection of three sites for periodontal assessment on each tooth; exclusion of the separate category for teeth extracted due to orthodontic care; the inclusion of Tooth Loss and Prosthetic Treatment Typology (TLPT – Meskin et al, 1988). The examination manual used in the field is included in Appendix 10 and a summary follows.

Dentition status

The wearing of prosthetic appliances was recorded separately for upper and lower jaws. This included fixed or removable, partial or full appliances worn at the time of examination. In addition, a classification scheme for coding the TLPT was used using the "tooth status" coding described later.

Condition of dentures

Six indicators were assessed separately for upper and lower removable dentures using definitions described by Rise (1977). Retention was registered as unsatisfactory if the denture was unseated during moderate opening of the mouth. Stability was assessed as unsatisfactory if vertical or rotation pressure from the examiner's fingers resulted in movement of 3 mm or more. Occlusion was unsatisfactory if there was a lack of three-point contact (left, right and anterior) when the teeth were closed in centric relation. If two dentures were present, the occlusion score was recorded only for the upper denture. However, if only one jaw had a denture and the other was edentulous, occlusion was registered as satisfactory. Denture material was registered as unsatisfactory if one or more of the following conditions were found: crazing or porosities covering more than 1/3 of the base material; temporary or deficient relining; and extensive staining and/or calculus deposits. Defects of the dentures were divided into small, large or multiple defects caused by breakage or inadequate design. The condition of the soft tissues related to the denture was examined in each jaw and assessed as unsatisfactory if there was ulceration or hyperplasia related to the denture, denture stomatitis or angular cheilitis.

Need for prosthetic treatment

Unsatisfactory condition of the denture was a subjective assessment made after the examination of the existing denture and discussion with the subject. The condition of the denture was a negotiated process between examiner and subject and was made on the grounds of the best interest of the subject's oral health and the likely success of any treatment. It was not simply a judgement about the technical adequacy of the denture.

Oral mucosal lesions

A screening examination of the oral mucosa was made for every subject.

The clinical procedure adopted for the (US) National Health and Nutrition Examination Survey III (NHANES III) was used to classify lesions and they were coded using the NHANES III categories, although the site of the lesion was not recorded.

Tooth status

Each tooth or equivalent dental unit was coded as: present (sound, carious or restored); root fragment only; missing and unreplaced; missing and replaced with a removable prosthetic unit; missing and replaced with a fixed prosthetic unit; or missing with insufficient space for replacement of the unit (for example, due to drifting of adjacent teeth). No decision was made about presumed reasons for extraction or absence of missing teeth.

Coronal caries experience

Tooth surfaces were coded as: sound; primary caries; secondary caries; filled with a satisfactory restoration; or filled with an unsatisfactory (although non-carious) restoration. The last category comprised restorations which, in the opinion of the examiner, had deficiencies requiring some treatment. They included deficient margins, an overhang causing local pathology or a fracture causing looseness or leakage into dentine. For incisors and canines, four separate surfaces were coded, while for premolars and molars, five surfaces were coded. Contiguous lesions or restorations covering two non-occlusal surface had to satisfy the "one-third rule" to be coded for both surfaces. That is, the lesion/restoration had to extend at least one third of the circumference of the tooth onto the adjacent surface.

Root caries

Root surfaces were scored separately from coronal surfaces according to an identical coding scheme. However the tactile diagnosis for caries differed, in that root caries required softening and resistance to removal of a probe.

Contiguous lesions or restoration covering both coronal and root surfaces were coded only for a single surface using the "half rule", so that only the surface containing the larger proportion of the lesion/restoration was deemed to be involved. An exception occurred where the lesion/restoration was divided equally on root and coronal surfaces, in which case both coronal and root surfaces were coded.

Caries treatment requirements of individual teeth

Caries treatment needs for individual teeth were assessed on the basis of the examiner's clinical judgements, and there was no attempt to calibrate those judgements. Four restoration codes were used to identify teeth requiring one, two, three, or more than three surfaces restored. However crowns were coded separately. The need for extraction was coded according to the predominant condition, either caries, periodontal disease or denture-construction. There was also capacity to code a requirement for preventive treatment of individual teeth.

Periodontal assessment

Prior to periodontal assessment, dentate individuals were questioned about heart disease, prosthetic joints or heart valves, and blood clotting disorders. Individuals with any of those contra-indications were excluded from the assessment.

The assessment of periodontal destruction followed the NIDR (1987) protocol. Periodontal destruction comprised separate measurements of pocket depth (free gingival margin to bottom of sulcus/pocket) and recession (cemento-enamel junction to free gingival margin). In addition to the mid-buccal and mesio-buccal sites specified in the NIDR protocol, additional measurements were made at the disto-lingual. This was done in order to reduce the level of under-estimation of treatment needs when partial

recordings are used (Douglass, 1989). Millimetre measurements were recorded following the NIDR convention of "rounding down" to the nearest integer. For example, measurements between 2.0 and 2.9 millimetres (inclusive) were all coded as 2 millimetres. Measurements were excluded if they could not reliably be detected, for example because of an inability to visualize the cemento-enamel junction or because calculus precluded entry of the probe into the periodontal sulcus/pocket.

Calculus and gingivitis

Supra or subgingival calculus detected either by visual or tactile sense was recorded for each of the three sites (mid-buccal, mesio-buccal and disto-lingual). Gingivitis was recorded once only for the tooth if any of the pockets exhibited gingival bleeding immediately after the probe was removed from the periodontal pocket.

Copies of the optical mark-sense forms, on which examination findings were recorded, are included in Appendix 11.

6.1.2.4 Examiner reliability

Inter-examiner reliability was assessed from thirty pairs of replicate examinations conducted among the four examiners. At each replication, two examiners conducted the full caries and periodontal examination with a single participant from the survey, although the replicate examinations may have been separated by a period of up to one week. The intention was to obtain five pairs of replicate examinations for all six possible pairs of examiners. However one pair of examiners conducted only three pairs of replicate examinations, while two pairs of examiners conducted six replicate examinations. Intraclass correlation coefficients (Fleiss, 1979) were

computed for all continuous epidemiological variables computed from the replicate examinations and the findings are presented in Table 31.

TABLE 31 INTER-EXAMINER RELIABILITY ASSESSED FROM 30 PAIRS OF REPLICATE EXAMINATIONS

TOOTH LOSS		CARIES EXPERIENCE/ ATTRITION		PERIODONTAL ATTACHMENT	
Variable*	Intra-class correlation coefficient	Variable*	Intra-class correlation coefficient	Variable*	Intra-class correlation coefficient
MT1	0.98	CROWNDS	0.87	AVGREC	0.92
MT2	1.00	ROOTDS	0.56	AVGPOC	0.46
SPACE1	0.83	CROWNFS	0.98	AVGLOA	0.84
SPACE2	0.90	ROOTFS	0.68	NRECGE4	0.77
FUNIT1	0.91	CROWNDFS	0.98	NPOCGE4	0.42
FUNIT2	0.93	ROOTDFS	0.70	NLOAGE4	0.70
RROOTS	0.91	TOOTHDFS	0.98	MAXREC	0.75
		ATTRITE	0.04	MAXPOC	0.21
		ATTRITD	0.37	MAXLOA	0.81
		ATTRITS	0.50	NGING	0.31
				NCALC	0.42

* Variable names and definitions appear in Table 49, page 197.

The highest levels of inter-examiner reliability were observed for measures concerning tooth loss (MT1, MT2) and replacement (FUNIT1, FUNIT2) while the lowest level was observed for enamel attrition (ATTRITE). For all measures of caries experience and most measures of periodontal attachment loss, intra-class correlations exceeded 0.5. However, periodontal pockets, particularly the maximum pocket depth (MAXPOC),

and the number of teeth with gingival bleeding (NGING) had weaker reliability.

6.1.3 Analysis

Data from the SADLS were weighted for analysis. The weighting procedure recognized the different probability of selection of persons from different sampling strata and allowed findings to be computed which were representative of older adults in the sampled population. A plan for analysis was adopted to provide, firstly, univariate statistics describing levels of social impact and, secondly, bivariate and multivariate relationships between epidemiological factors, non-epidemiological factors and social impact. This section describes the weighting procedures, the approach to analysis and the rationale for the approach to analysis.

6.1.3.1 Weighting

Two individual weights were computed, one to represent the interviewed sample of 1,650 persons, and the other to represent the examined sample of 1,224 persons. The purpose in constructing weights for the survey was to ensure that prevalence calculations correctly reflected the sampling scheme and provided estimates which were appropriate for the populations of Adelaide and Mt Gambier. In addition, it was intended to make inferences about associations as they would occur within the target population of older adults, rather than inferences which were confined to the specific (and special) sample which was selected for the SADLS. For both reasons, it was necessary to compute unit record weights and use them during descriptive and inferential analysis.

The general approach was to create weights which were a function of the total population size ($N_{i,i,k}$) divided by the sample size for each

individual sampling stratum. The number of persons on the original sampling frame are presented in Table 32, along with the estimated percentage of edentulous persons. The latter was obtained from the initial household contact when interviewers enquired about the oral status of all sampled persons.

TABLE 32 NUMBER OF PERSONS AND PERCENTAGE DENTATE IN 24 SAMPLING STRATA

Stratum	Stratum characteristics i=Age	j=Sex	k=Distance	No of persons on frame ($N_{i,i,k}$)	% of persons dentate
1	60-64	Male	Near	11848	77.36
2	60-64	Male	Middle	5433	81.25
3	60-64	Male	Far	5160	41.67
4	60-64	Female	Near	12509	65.49
5	60-64	Female	Middle	5770	68.75
6	60-64	Female	Far	5516	66.67
7	65-74	Male	Near	18891	60.00
8	65-74	Male	Middle	8552	63.77
9	65-74	Male	Far	8194	72.00
10	65-74	Female	Near	22677	45.55
11	65-74	Female	Middle	10884	48.44
12	65-74	Female	Far	9835	63.64
13	75+	Male	Near	9853	42.51
14	75+	Male	Middle	5025	43.14
15	75+	Male	Far	4165	40.00
16	75+	Female	Near	16383	29.94
17	75+	Female	Middle	9622	27.00
18	75+	Female	Far	7096	10.00
19	60-64	Male	Mt Gambier	556	61.76
20	60-64	Female	Mt Gambier	549	47.40
21	65-74	Male	Mt Gambier	776	54.85
22	65-74	Female	Mt Gambier	952	35.61
23	75+	Male	Mt Gambier	380	33.96
24	75+	Female	Mt Gambier	637	18.43

The estimated number of persons in each age, sex, distance and dentate stratum ($N_{i,i,k,l}$) could then be calculated by multiplying $N_{i,i,k}$ by the percentage of dentate persons. For example, the estimated number of

persons in the dentate sub-stratum of the first stratum in Table 32 was 11848 x 77.36 per cent = 9165.43, and the number of persons in the edentulous sub-stratum was 11848 x (100-77.36) per cent = 2682.57. The dentate and edentulous sub-strata were calculated only within Adelaide. In Mt Gambier, only dentate persons were selected during initial household contacts, and so the total sampling frame population was used as numerator ($N_{i,i,k}$) within the six Mt Gambier age- and sex-strata. The Adelaide sub-stratum population sizes and Mt Gambier stratum population sizes are presented in Table 33, along with the number of interviewed and examined persons in each group. The two right-hand columns provide the unit record weights, calculated using the formulas:

Interview $(WtI_{i,i,k,l}) = [N_{i,i,k,l}/I_{i,i,k,l}] \; / \; [Sum(N_{i,i,k,l})/Sum(I_{i,i,k,l})]$

and

Examination $(WtE_{i,i,k,l}) = [N_{i,i,k,l}/E_{i,i,k,l}] \; / \; [Sum(N_{i,i,k,l})/Sum(E_{i,i,k,l})]$

where:

$N_{i,i,k,l}$ = number of persons from sampling frame

$I_{i,i,k,l}$ = number of persons interviewed

$E_{i,i,k,l}$ = number of persons examined.

Unit records weights were applied during analysis. For example, the 66 unit records from interviews within the first dentate stratum each received a weight of 1.36689 when interview data were analyzed. When examination data were involved in analyses, the smaller number of 49 unit records within that same stratum each received weights of 1.26308.

TABLE 33 UNIT RECORD WEIGHTS USED IN THE SADLS

Stratum & substratum		No of persons in frame ($N_{i,i,k,l}$)	No of persons in sample Intv ($I_{i,i,k,l}$)	No of persons in sample Exam ($E_{i,i,k,l}$)	Unit record weight Intv WtI	Unit record weight Exam WtE
1	Dentate	9165.43	61	49	1.36689	1.26308
1	Edentulous	2682.57	19	18	1.28442	1.00635
2	Dentate	4414.31	24	18	1.67326	1.65601
2	Edentulous	1018.69	4	2	2.31682	3.43940
3	Dentate	2150.00	4	4	4.88979	3.62953
3	Edentulous	3010.00	4	3	6.84570	6.77513
4	Dentate	8191.73	55	42	1.35495	1.31704
4	Edentulous	4317.27	31	23	1.26695	1.26752
5	Dentate	3966.88	19	16	1.89936	1.67417
5	Edentulous	1803.13	9	7	1.82261	1.73940
6	Dentate	3677.33	11	9	3.04125	2.75907
6	Edentulous	1838.67	5	4	3.34537	3.10395
7	Dentate	11334.60	94	80	1.09696	0.95673
7	Edentulous	7556.40	45	40	1.52762	1.27564
8	Dentate	5453.45	36	26	1.37810	1.41635
8	Edentulous	3098.55	12	8	2.34903	2.61542
9	Dentate	5899.68	18	17	2.98172	2.34343
9	Edentulous	2294.32	6	4	3.47868	3.87317
10	Dentate	10329.31	74	62	1.26985	1.12500
10	Edentulous	12347.69	69	48	1.62798	1.73707
11	Dentate	5271.94	26	23	1.84463	1.54780
11	Edentulous	5612.06	20	15	2.55272	2.52641
12	Dentate	6258.64	17	13	3.34921	3.25094
12	Edentulous	3576.36	10	3	3.25352	8.04994
13	Dentate	4188.28	123	98	0.30977	0.28859
13	Edentulous	5664.72	62	41	0.83119	0.93297
14	Dentate	2167.65	40	29	0.49299	0.50473
14	Edentulous	2857.35	20	14	1.29971	1.37819
15	Dentate	1666.00	15	13	1.01040	0.86537
15	Edentulous	2499.00	10	7	2.27341	2.41069
16	Dentate	4904.46	76	47	0.58707	0.70464
16	Edentulous	11478.54	86	59	1.21423	1.31373
17	Dentate	2597.94	20	11	1.18171	1.59481
17	Edentulous	7024.06	20	11	3.19499	4.31189
18	Dentate	709.60	2	1	3.22771	4.79166
18	Edentulous	6386.40	12	6	4.84157	7.18749
19	Mt Gambier	556.00	72	54	0.07025	0.06953
20	Mt Gambier	549.00	61	44	0.08188	0.08425
21	Mt Gambier	776.00	119	91	0.05932	0.05758
22	Mt Gambier	952.00	89	61	0.09731	0.10539
23	Mt Gambier	380.00	80	58	0.04321	0.04424
24	Mt Gambier	637.00	69	45	0.08399	0.09559
Sum		181263.00	1649	1224		

Inspection of the numbers of respondents and the unit record weights reveals the groups in which the sample is concentrated. The largest population size of 12347.69 is observed for stratum 10 (edentulous, Adelaide, aged 65-74 years, female, middle distance). There were 69 persons interviewed from that stratum, and each interviewed case was weighted by 1.62798. The product of the two numbers (69 x 1.62798 = 112.3) represents the largest weighted group within the sample. In contrast, the smallest population size was observed for stratum 23 (Mt Gambier, aged 85+ males) and 80 interviewed persons received a weight of 0.04321. The product of those two numbers yielded a weighted number of only 3.5 persons in the sample.

The weighting scheme highlights the generally greater weights given to Adelaide (because it is a much larger city) and to edentulous persons (who were selected as a small proportion). If data were unweighted, however, the prevalence estimates and measures of association would be biassed by the relatively large numbers of dentate Mt Gambier persons in the sample. While unweighted estimates would be valid within the sample, it would be difficult to generalize the findings to a "real world" population of older South Australians.

6.1.3.2 Plan for analysis

The analyses addressed the second, third and fourth aims of this thesis. The second aim, concerned with the frequency of social impact, entailed computation of univariate statistics. Four different approaches were used:

1) The percentage of persons reporting the 49 individual OHIP items;

2) The mean subscale values from the OHIP, along with single summary statistics;

3) Combinations of items from OHIP dimensions; and

4) The percentage of persons reporting groups of OHIP items.

In the first approach, the frequency of individual OHIP items was expressed as the percentage of persons reporting impact "occasionally", "fairly often" or "very often". The same percentage is used elsewhere when comparing responses to individual items among subgroups. For completeness, the percentage of persons responding to each category within the Likert-type scale was also calculated.

The second approach to analyzing the OHIP followed the methods presented in the previous Chapter. To summarize: OHIP subscale scores were computed from answers to each question coded as zero (for "never" or "not applicable"), or one through to four for "hardly ever", "occasionally", "fairly often" and "very often" respectively. "Don't know" or unanswered questions were assigned the sample mean for the relevant question. However, questionnaires with 10 or more unanswered questions or "Don't know" responses were eliminated from the analysis. Coded responses to each question were multiplied by the severity weight for the question, and the products were summed within each of the seven conceptual dimensions to derive seven subscale scores.

Two summary statistics were computed by counting the number of questions to which a "sometimes", "fairly often" or "very often" response was made and by standardizing and summing together the seven subscale scores. The latter, referred to as the standardized OHIP score, was achieved

by standardizing each subscale to a mean of one and a standard deviation of one using the SAS PROC STANDARDIZE. This was equivalent to subtracting the sample mean for the subscale from each individual's subscale value and dividing by the sample standard deviation for the subscale. All seven standardized values were added to create the standardized OHIP score for each individual. In interpreting the statistic, a value of two could indicate that an individual was two standard deviations above the sample mean on one individual subscale or one standard deviation above the sample mean on two separate subscales, or some other arithmetic combination.

The third approach combined items from conceptual dimensions, initially to display the percentage of persons reporting one or more and two or more items within each dimension. In addition, individuals were categorized according to the most disruptive or severe dimension within a hierarchy. Dimensions were ranked in the following order: functional limitation, physical pain, physical disability, psychological discomfort, psychological disability, social disability, and handicap.

The ranking aimed to represent a progressive broadening of impact from simple physical impacts through to more complex effects on psychological and social disability or handicap. Each individual was categorized according to reported impact "occasionally", "fairly often" or "very often" within the highest ranked dimension. For example, a person who reported functional limitation (ranked 1) and physical disability (ranked 3) would be categorized into the third rank (physical disability). Hence, the categorisations were mutually exclusive. A variation of this method was used to simply list the observed combinations of dimensions: for example, functional limitation alone; functional limitation with physical pain, and so on. There exists a potential of $2^7 = 128$ combinations of dimensions,

although a relatively small number encompassed most of the observed combinations.

In the fourth approach to describing social impact, eight of the functional limitation items were grouped relating to eating (Q1 and Q8 of the OHIP), fit of dentures (Q17), speech (Q2), appearance (Q3, Q4) and breath/taste (Q5, Q6). The groups represent an alternative arrangement of OHIP items, and are similar to some of the groups defined by Cushing et al (1986). Individuals were categorized according to whether they reported some social impact ("occasionally", "fairly often" or "very often") in a single group or any combination of groups.

The third aim of this research was to assess variations in social impact. Variations among sociodemographic groups and among groups with different oral conditions provided insight into the conditions associated with or (by inference) causing social impact. The plan for analysis involved examinations of bivariate associations between explanatory factors (both epidemiological factors obtained during dental examinations, and non-epidemiological factors obtained by interview) and outcome measures of social impact. The outcome measures included OHIP subscale scores and the standardized OHIP score.

The first step was the presentation of univariate statistics describing the explanatory variables. They included items from the face-to-face questionnaire about: oral status and denture use; use of dental services; self-reported medical conditions; and sociodemographic characteristics. Variables from epidemiological examinations included: assessment of dentures; retention and prosthodontic replacement of teeth; caries experience of crowns and roots; occlusal wear; periodontal recession; and periodontal pocket depth.

The initial bivariate analysis began by assessing variations in social impact among dentate and edentulous persons, and among groups defined by denture wearing. These represent the most basic indicators of oral status, and differences were assessed in terms of the percentage of individual OHIP items and mean OHIP subscale values. Percentages were used again (as they were for the univariate findings) in an effort to convey intuitive meaning to any differences which existed in mean subscale values. As well, this part of the analysis considered the roles of clinical disorders associated with dentures and the frequency of denture wearing.

There were larger numbers of epidemiological explanatory variables to assess, particularly from the examined dentate participants in the SADLS. This presented a problem for parsimonious presentation. Consequently, the approach was to examine correlation coefficients between OHIP scores and the oral epidemiological factors which were continuous variables. The latter included measures such as: the number of denture-related disorders; the number of decayed, missing and filled teeth; the number of teeth with recession or pockets; and average amounts of recession and pocket depth. The correlation coefficients were displayed for all measures without regard to statistical significance, simply to give an indication of general trends and relative strengths of association. However, there was no emphasis attached to any particular "cut off" point to indicate if a correlation was important in absolute terms.

Another approach to investigate bivariate associations with epidemiological factors was the construction of "case definitions" of oral conditions. Dentate individuals were arranged into eight mutually exclusive categories according to: the number of missing teeth; the presence of root decay; and the average amount of periodontal recession. Mean OHIP values

were compared for the eight categories, although statistical significance was not assessed.

The larger number of sociodemographic variables, obtained from the questionnaire, were categorical or ordinal in nature. In order to provide an overview of the direction and strength of association between those variables and social impact, differences in the seven standardized subscale values were examined. Standardized subscale values were computed by subtracting from an individual's subscale value the sample mean for that value, then dividing by the sample standard deviation. This effectively allowed group variations (such as age groups or dental visit groups) in social impact to be readily contrasted across the subscales, all of which had quite different ranges. For example, a value of positive one indicated that a subgroup's level of (say) functional limitation was one standard deviation above the sample mean. That same subgroup could also have a psychological disability value one standard deviation above the sample mean, even though the absolute value on the psychological disability subscale would be quite different from the absolute value of the functional limitation subscale.

The next phase of analysis sought to identify the independent and statistically significant epidemiological factors associated with social impact. All 33 of the dental epidemiological measures examined previously were considered for inclusion in multivariate models. Before including the independent variables in the regression models, multicollinearity among them was assessed according to three criteria (Kleinbaum et al, 1988). First, those with individual bivariate correlations exceeding 0.7 were identified. Second, the matrix of condition indices (also referred to as eigenvalues of the beta estimates) of the independent variables was examined, and any variables with a condition number (computed as the

maximum eigenvalue divided by the minimum eigenvalue for that variable) greater than 30 were identified. Third, groups of two or more variables which had high (greater than 0.5) variance inflation factors were identified for any condition number exceeding 30. (Findings from the multicollinearity analysis are presented within the results of this section.)

This process resulted in the exclusion of fourteen variables, which effectively represented composites of other variables. They were: total number of missing teeth (sum of anterior and posterior missing teeth); total number of unreplaced spaces (sum of anterior and posterior spaces); number of anterior, posterior and total functional units (which are a function of missing teeth and unreplaced spaces); the sum of decayed root and coronal surfaces; the sum of filled root and coronal surfaces; crown, tooth and root DFS measures (related to respective decayed and filled measures); three attachment loss measures (average, number of sites and maximum, all related to respective pocket and recession measures); and dentinal attrition. The composite measures (eg loss of attachment) were eliminated rather than the component measures (eg pockets and recession) in order to isolate any distinctive effects within the regression models. It is conceivable, for example, that recession could be associated with impact, while pockets may not. It would be desirable, therefore, to isolate the specific origins of social impact rather than interpret a mixed effect of two variables.

In the approach to the multivariate analysis, epidemiological factors were viewed as "etiological factors" which would have a direct (causal) effect on social impact. For example, tooth loss was regarded as an etiological factor in functional limitation. This was in distinction to the non-epidemiological factors, which were regarded as indirect and/or modifying factors. For example, age was hypothesized to influence social impact

indirectly, either because it was associated with etiological factors (such as tooth loss) or it acted as a separate influence on the more direct relationship between tooth loss and social impact. For example, the latter could indicate a secondary effect of reduced muscle strength on masticatory performance in the presence of diminished occlusal support. It should be noted that aspects of dental care, such as use of dental services or barriers to care, were also regarded as non-etiological factors. For example, reduced access to treatment could be expected to worsen the impact of direct etiological factors such as dental caries.

This distinction between etiological and modifying factors was adopted at a theoretical level to provide a systematic approach to the multivariate data analysis. It should be emphasized that cross-sectional survey data do not allow "causal" and "non-causal" factors to be identified separately. Consequently, findings of associations with epidemiological factors cannot be taken as evidence of causation. However, within this approach to modelling, they have been considered first on theoretical grounds. If epidemiological factors were significant, they were purposefully retained in subsequent multivariate analysis.

Eight separate multivariate models were constructed using the seven OHIP subscales and the standardized OHIP as dependent variables. The 20 oral epidemiological variables with acceptable low multicollinearity were used as explanatory variables, along with a binary indicator (coded 0 or 1) to indicate the presence of dentures. The analysis sought to establish the explanatory variables which were independently associated with each OHIP score. Stepwise backwards regression was performed using SAS PROC REGRESSION, with the criterion for elimination at each iteration set to $p>0.05$ using the F-test.

Separate ordinary least squares models were constructed to analyze sociodemographic and dental visit characteristics which were associated with OHIP scores. Independent variables included those which were categorical (such as age group) with more than two categories, and in those instances dummy variables were created automatically by the SAS procedure PROC GLM procedure. The procedure retains as a block all dummy variables relating to a particular construct, and evaluates the significance of them collectively using the F–test. For example, there were two dummy variables created for the three age groups, and the significance of age was assessed with both dummy variables considered together using the F–statistic based on 2 numerator degrees of freedom. Other independent variables were continuous, (such as number of medical conditions) and which are often used in "linear regression" models. The SAS PROC GLM procedure allows both types of variables as well as interactions between them, to be analyzed in a single model (Freund et al, 1986). Two of the variables which were collected as categorical responses represented constructs which were continuous in nature: the age at leaving school and household income. Consequently, two new imputed values were used by assigning the numeric mid-point from each category of response. The imputed variables were used in place of the original categorical variables. On the other hand, age was retained as a categorical variable with three levels (entailing two dummy variables): 60-69 years, 70-79 years and 80+ years. The period since last extraction was collected as a continuous variable and was analyzed as such.

All potential variables other than period since last extraction were included initially in the linear models for non-epidemiological factors, and those with non-significant effects (as indicated by the F–statistic, $p>0.05$) were eliminated. In the SAS PROC GLM procedure, the Type III sum of squares was selected for calculation of the F–statistic. It represents the sum

of squares associated with the variable after considering all other variables, and therefore is equivalent to a standard sum of squares for that variable as though it were the last one added (Freund et al, 1986). Effectively it allows the significance of all terms to be assessed, regardless of the order in which terms are specified in the model. The SAS PROC GLM has no automatic stepwise facility, so the full model was run, non-significant variables were removed, and the model re-run in an iterative process.

The period since last extraction featured a high proportion of missing values due to non-response. Consequently it was treated differently, by considering both the effects of a smaller number of respondents and the variable itself. After obtaining a parsimonious model from the larger set of non-epidemiological variables, the model was recalculated among the smaller number of respondents who also answered the question about period since last extraction (although without including that variable). If the terms in the model remained significant, the next step was to include the variable concerning period since last extraction, and assessing its independent contribution to social impact.

In the next stage of analysis, all of the epidemiological factors (identified as significant in the first multivariate analyses) were retained and the significant non-epidemiological factors were added. The significance of non-epidemiological factors was re-evaluate and any which did not have significant effects, as indicated by the F–statistic based on the Type III sum of squares, were eliminated.

The final part of the multivariate analysis examined interactions between epidemiological and non-epidemiological factors. The purpose of this stage of the analysis was to clarify whether non-epidemiological factors simply had an additional effect on social impact, or whether they modified

the relationships between epidemiological factors and social impact. To continue with the previous example, greater age might effectively modify the relationship between tooth loss and social impact. For example, younger persons may experience a 50 per cent increase in social impact in association with the loss of 8 teeth. On the other hand, older persons may experience a 100 per cent increase in social impact for an identical amount of tooth loss. In that instance, a statistical interaction would exist, and would convey additional information about the process of social impact.

Interactions were assessed using the standardized OHIP as the dependent variable. There were 27 potential two-way interactions between epidemiological and non-epidemiological variables and all of them were considered. The non-epidemiological variables were categorical, so the least squares model could also be described as an analysis of covariance model (Kleinbaum et al, 1988). However the SAS PROC GLM makes no such distinction in terminology, since it is a generalized linear model able to incorporate continuous variables, categorical variables and interactions between any class of explanatory variable. The statistical significance of interactions was assessed using the F–statistic computed using the Type III sum of squares. In this instance, hierarchical modelling principles were used (Kleinbaum et al, 1988), so that any first order terms which were also involved in an interaction were forcibly retained in the model. The standard probability of $p<0.05$ (based on the F–test) was adopted when assessing statistical significance of interactions.

The SAS PROC GLM also has a capacity to produce estimates and standard errors from the linear model after specifying (or controlling for) any number of other variables (either continuous variables or factors) in the model (Freund et al, 1986). The estimates are referred to as "adjusted

means" in some texts. The resulting least squares means were obtained to provide visual scatterplots of a number of effects within the linear models.

The fourth aim was addressed firstly by examining correlations among subscale values, and repeating the analysis for dentate and edentulous subgroups. The three disability subscales (physical, psychological and social) were then evaluated separately among four groups categorized according to whether they reported combinations of high and low levels of functional limitation and physical pain. Within those groups, differences between dentate and edentulous persons were examined. In order to more completely control for variations in functional limitation and physical pain level, matched pairs were created of dentate and edentulous persons, matched according to their levels of physical pain and functional limitation. Paired t-tests were used to ascertain if edentulism had an independent effect on disability after controlling for functional limitation and pain.

6.1.4 Rationale

The sampling strategy reflected a desire to obtain a valid sample with optimum numbers of subjects in age- sex- and city-strata. Equivalent numbers of age- and sex-groups and subsequent weighting of the sample was appropriate for this study of social impact to ensure that findings could be generalized to the population while still ensuring that hypotheses could be tested while maintaining adequate numbers of persons among age groups. For example, a simple random sample would have resulted in relatively small numbers of men aged 85+ years, and may have limited the generalizability of associations between, say, social impact and clinical conditions to the predominantly younger age groups. The three "distance" strata were constructed to provide a degree of clustering which helped to limit fieldwork costs and, hopefully, to maximize clinic participation.

The initial selection of a proportionately larger number of dentate persons was done in order to allow the research to efficiently focus on the third objective - examining relationships between oral disease and social impact. There was a much larger number of oral epidemiological variables among dentate persons which were relevant to the third objective. Dentate persons from Mt Gambier were added to the sample primarily to examine water fluoridation and dental caries - objectives not related to this thesis.

Weighting of the data during analysis was undertaken deliberately so that the findings, including measures of association, would relate to the distribution of social impact within the target populations of Adelaide and Mt Gambier. The use of weights is a common procedure when computing prevalence estimates from stratified samples. However, it is not always used when measures of association are assessed in bivariate or multivariate analyses. The decision to weight data during bivariate and multivariate analysis was taken in order to ensure external validity of the findings. The intention was to explore patterns of association with social impact as they would occur within the populations of Adelaide and Mt Gambier. Because of the stratified sampling scheme, some groups were over-represented within the sample (such as the oldest Mt Gambier group, which virtually was fully enumerated), and it could be misleading to presume that unweighted associations (such as correlations and mean differences) within the sample would be replicated in the wider population. Hence, external validity would not necessarily be retained using unweighted analyses. For example, a higher level of social impact within a subgroup of the population at large (such as persons who visit dental technicians) may not be properly estimated if the subgroup differs from the rest of the population on any of the stratification criteria. In this example, users of dental technicians are more likely edentulous (a stratum which is sampled at a lower rate), and therefore the subgroup within an unweighted sample would be under-

representative of edentulous persons. If dentate persons have, on average, lower levels of social impact, then the unweighted frequency within the sample of social impact among users of dental technicians would represent an under-estimate of the true population frequency. The consequences can be magnified when multivariate effects are considered. This is particularly true for interactions. For example, during analysis of covariance, the statistical significance of an interaction is dependent not only on the differences in strength of association among groups, but also on the numbers of persons within the groups.

In general, there are limits in generalizing the findings from an unweighted analysis to the broader population, particularly when the sampling scheme stratifies on key factors such as age and edentulism. This would appear to be important during an exploratory analysis such as this, when the initial research questions ask about the patterns of social impact within the population.

The survey methods followed current procedures recommended for social and oral epidemiological surveys and they were adopted to ensure that high quality data were obtained. As well, the NIDR protocol has been used in the other major North American studies of oral health among older adults, and therefore provides for direct comparison among the studies.

The approach to analysis and modelling follows a standard pattern of univariate, bivariate and multivariate analysis. Univariate descriptions of the percentage of individual OHIP items and the distributions of OHIP subscales provide basic information about the outcome variables used most consistently in this research. Furthermore, the subscale values and the standardized OHIP provide the most practical and parsimonious method to assess bivariate and multivariate relationships. Despite the methodological

advantages of describing social impact using mean OHIP subscale values, there is no prior "practical" meaning which can be attached to such values. Consequently, the various alternative approaches to describing social impact were adopted to provide a more practical indication of the levels and distribution of social impact.

Another alternative approach was to describe groups of functional limitation items. In this approach, functional limitation groups were formed relating to eating (Q1, Q7 and Q8 of the OHIP), fit of dentures (Q17), speech (Q2), appearance (Q3, Q4) and breath/taste (Q5, Q6). Because functional problems were thought to be most immediately related to clinical conditions or disease patterns, these groupings can be interpreted readily with reference to known epidemiological or clinical parameters within the population of older adults. For example, while high levels of eating dysfunction could be anticipated in view of the high levels of tooth loss among persons aged 60 years or more, the frequency of functional problems with appearance or speech are not well understood. Furthermore, functional limitation is viewed within Locker's conceptual model as an experience which frequently precedes other more disruptive forms of impact such as disability. Consequently, the grouping of functional limitation items intends to give an indication of the types of underlying conditions within the sample: for example, are more functional problems related to speech than appearance?

The plan for analysis of variations in social impact began by identifying and distinguishing between "etiological" and non-etiological factors. The importance of the distinction was relevant for the plan of the multivariate analyses addressing the third aim. Since oral epidemiological factors were seen as the most direct "causes" of social impact, regression analyses began by assessing only the independent effects of those factors in

relation to the seven OHIP subscales and the standardized OHIP. Subsequent multivariate modelling added to those effects by including the non-etiological factors, such as use of dental services, medical conditions and sociodemographic characteristics.

The approach to multivariate modelling created distinctions between oral epidemiological and non–epidemiological variables. In models which combined both sets of variables, the significant epidemiological variables were preferentially retained. This aimed to avoid some situations where, for example, age may be retained in a multivariate model in preference to the mean number of missing teeth (when both age and missing teeth had significant bivariate associations). If an indiscriminate approach was adopted in this example, age could be retained in preference to missing teeth, even if the principal effect of age was as an indirect or "proxy" indicator of tooth loss. In contrast, in the approach which was adopted, age would be retained only if it had some additional explanatory effect beyond missing teeth. For example, additional effects could include physical performance, capacity to cope with oral conditions, or expectations about oral function. Such an interpretation would be more informative than an interpretation from the "indiscriminate" approach which would leave unanswered the question as to whether age had an effect indirectly (through tooth loss) or indirectly through another mechanism such as coping or expectations.

Although the approach to modelling is based on the preconception that oral epidemiological variables are more immediately related to social impact than non–epidemiological variables, it should be emphasized that the cross–sectional nature of the survey limits the capacity to demonstrate any causal effects. In the case of tooth loss, for example, it would be necessary to have longitudinal data on social impact from groups which did and did

not experience tooth loss in order to make strong inferences about causation. Hence, the relationships examined in this research can only be regarded as associations.

All oral epidemiological variables and virtually all the variables collected by interview were considered as explanatory factors. The latter encompassed interview questions about: oral status and denture use; use of dental services (including length of period since the last dental extraction); self-reported medical conditions; and sociodemographic characteristics. These variables were hypothesized to have an indirect influence on social impact, either by modifying the direct impact of clinical conditions (themselves reflected in the oral epidemiological variables) or by acting as "proxy indicators" of other causal factors not included in the survey. Other potential causal factors could include: attitudes to oral health; satisfaction with dental care; other life stressors; aspects of personality; and coping capacity, although they were not assessed. However, some items within the questionnaire, such as preventive practices, tobacco and alcohol use were not considered because they were regarded only as antecedents to oral disease rather than modifiers of oral epidemiological factors.

The inclusion of the full range of available factors was consistent with the original aims formulated for this thesis which were exploratory in nature. Since there had been limited previous research examining factors associated with social impact, it was appropriate to adopt an exploratory approach. However it was important to adopt a plan for multivariate analysis which recognized the distinction between the etiological (epidemiological) and other non-etiological factors.

Relationships were analyzed firstly through an assessment of bivariate relationships. This aimed to give an indication of the direction and relative strengths of association between epidemiological factors and social impact. Subsequently, all epidemiological factors were considered for the multivariate analysis, regardless of whether the factors had statistically significant bivariate effects. Statistical significance was evaluated only during multivariate analysis, and not for the bivariate analysis. This was done for two reasons:

1) A lack of a statistically significant bivariate effect is not a sufficient indication that an explanatory factor has no effect on a dependent variable in the presence of other explanatory variables (Kleinbaum et al, 1982); and

2) There would be a large number of bivariate tests involving eight outcome variables, each reflecting "social impact". This would create legitimate concerns about multiple significance testing.

The strategy for analysis was also confined to an examination of the predictive capacity of oral epidemiological and non-epidemiological variables, rather than an attempt to explain fully the variation in social impact. If a search was undertaken for the factors explaining variation in social impact the strategy would involve the collection of a larger number of potentially relevant characteristics of individuals, such as their attitudes to oral health, satisfaction with dental care and psychological orientation to disease. As well the analyses would concentrate on the total amount of variation (measured using the R^2 statistic), rather than the magnitude and direction of effects (as indicated by parameter estimates in the linear models). In this research, there was relatively little attention paid to R^2 statistics.

6.1.5 Ethical review

The SADLS was reviewed and approved by the Committee on the Ethics of Human Experimentation at The University of Adelaide and the Australian Institute of Health and Welfare's human ethics committee. The South Australian Government's Privacy Committee separately reviewed and approved the use of the State Electoral Roll for the study.

6.2 Participation

Responses from the 4,857 persons sampled from the electoral register are displayed in Table 34. Some 2,106 persons were excluded, predominantly because they were edentulous persons within a stratum which excluded edentulous persons, or because there was no-one at the household within scope. The latter can be regarded partly as a failure of the sampling frame: for example when individuals change address and do not notify the electoral commission, new residents can move into the household which subsequently becomes included in the sample. Also, it partly represents the "anonymous" process of subject identification. Because sampled persons were identified only by address, age and sex it is likely that a number of them would have had a birthday which moved them out of the sampling age-range. For example, some people sampled within a 60-64 year stratum turned 65 prior to the interview. Some sampled addresses were not approached because the sampling frame had insufficient detail to identify a house. This occurred primarily in Mt Gambier where some addresses consisted only of a road name.

Within the remaining group of 2,751 persons, an interview response rate of 60.0 per cent was observed (57 per cent for a full interview, 3 per cent for a part interview, when some questions were not answered). The

most common reason for non-participation was refusal (24.6 per cent) and death or illness (10.6 per cent) – Table 34.

TABLE 34 PARTICIPATION IN THE SADLS INTERVIEW

Response	No of persons	% of total	% of sub-total
i) Excluded			
Non-residence	103	2.1	4.9
Out of scope	458	9.4	21.7
Excluded/edentulous	1302	26.8	61.8
Not approached	243	5.0	11.5
Sub-total - excluded	2106	43.3	100.0
ii) In scope			
Full interview	1567	32.3	57.0
Part interview	83	1.7	3.0
Refusal	676	13.9	24.6
Declined-death/illness	292	6.0	10.6
Non-contact	58	1.2	2.1
Declined-language	75	1.5	2.7
Sub-total - in scope	2751	56.6	100.0
iii) All persons	4857		100.0

Table 35 displays response rates among the 2,751 persons "in-scope" according to the characteristics of those persons recorded on the electoral database. Also presented are variations according to socioeconomic indicators for geographic areas (SEIFA – Australian Bureau of Statistics, 1990b). Age groups varied in response by nearly 10 per cent, while Adelaide

had a response rate nearly seven per cent higher than Mt Gambier. The slightly higher response rate among males, although nearly significant statistically, appears not to be of any practical importance. There were significantly higher rates of participation in geographic areas which had higher socioeconomic status, as indicated by a higher SEIFA index of economic resources. Differences in participation by the SEIFA index of education and occupation were in a similar direction, but were not statistically significant.

TABLE 35 VARIATIONS IN INTERVIEW RESPONSE AMONG 2,751 PERSONS IN SCOPE

Group		% of persons interviewed	p*
Age	60-69 years	64.5	
	70-79 years	60.1	<0.01
	80+ years	49.0	
Sex	Male	61.8	0.055
	Female	58.1	
City	Adelaide	62.2	<0.01
	Mt Gambier	55.3	
Index of	Lowest quartile	59.0	
Economic	Low-middle	58.5	<0.01
Resources†	High-middle	61.6	
	Highest quartile	69.4	
Index of	Lowest quartile	61.6	
Education/	Low-middle	58.9	0.09
occupation†	High-middle	61.5	
	Highest quartile	66.6	

* Chi-square test with continuity adjustment.
† Measure of economic resources within the sampled person's Census Collector's district, obtained from the SEIFA database (Australian Bureau of Statistics, 1990b).

The pool of examined persons and responses to the OHIP questionnaire were obtained only from the 1,650 persons who took part in face-to-face interviews (full interview or part interview in Table 34). Variations in the examination and OHIP response rates are presented in Table 36. There were lower response rates among persons who were: aged 75+ years; female (other than OHIP response); and edentulous. Undoubtedly those three variables are intercorrelated, and it is not possible from this bivariate analysis to determine, for example, if age effects persist after controlling for edentulism. Other significantly lower rates for all three responses were observed for: persons who lived alone; who rented accommodation; who had lower household income; and who reported less recent dental visits. Lower OHIP and combined OHIP/EXAM responses were observed for persons who: had lower educational attainment; were health card holders; who visited for dental problems; and who had no dental insurance. Lower OHIP responses alone were observed for: persons born outside Australia, UK or Eire and persons who had more difficulty paying a $100 dental fee. Lower EXAM responses alone were observed for persons who last visited a private dental practice and who perceived no need for dental treatment.

TABLE 36 VARIATIONS IN EXAMINATION AND OHIP QUESTIONNAIRE RESPONSES AMONG 1,650 INTERVIEWED PERSONS

Group		% of persons participating in EXAM	OHIP	EXAM and OHIP
All		74.2	73.8	61.6
Age (years)	60-69	78.4	78.0	68.2
	70-79	71.7	73.3	58.7
	80+	67.3	61.8	48.6
	p*	<0.01	<0.01	<0.01
Sex	Male	77.6	74.4	64.0
	Female	70.4	73.0	58.9
	p	<0.01	0.53	0.04
Oral Status	Dentate	75.6	75.1	64.1
	Edentulous	70.3	70.1	55.8
	p	0.03	0.05	<0.01
City	Adelaide	75.1	74.0	62.8
	Mt Gambier	72.0	73.1	58.6
	p	0.22	0.72	0.12
Living arrangements	Alone	67.2	66.3	52.2
	With others	77.0	76.6	65.3
	p	<0.01	<0.01	<0.01
Own/rent dwelling	Own	75.4	76.0	63.7
	Rent	70.0	64.7	46.6
	p	0.05	<0.01	<0.01
Age left school	<14 yrs	74.8	67.4	58.3
	14 yrs	71.8	70.6	57.8
	15 yrs	75.1	77.4	63.6
	16 yrs	75.4	76.2	66.1
	17+ yrs	78.7	81.9	66.7
	p	0.29	<0.01	0.01
County of birth	Australia	73.9	74.7	62.1
	UK/Eire	75.7	76.0	63.5
	Other	75.0	67.3	58.1
	p	0.82	0.05	0.35
Annual household income	<$8,000	68.8	64.6	50.8
	$8-$12,000	71.5	69.0	55.2
	$12-$16,000	77.9	76.3	66.8
	$16-$20,000	80.1	76.2	68.0
	$20-$30,000	77.6	80.8	69.2
	>$30,000	76.4	81.9	66.9
	p	0.04	<0.01	<0.01

continued...

* Chi-square test with continuity adjustment. Response rates unweighted.

TABLE 36 (CONTINUED)

Group		% of persons participating in EXAM	OHIP	EXAM and OHIP
Health benefit card holder	Yes	74.1	70.9	59.6
	No	75.3	77.2	65.0
	p	0.65	<0.01	0.03
Period since last dental visit	<1 yr	77.2	79.3	66.2
	1-2 yrs	72.8	67.9	60.6
	>2-5 yrs	75.1	70.5	59.7
	>5-10 yrs	77.4	68.5	58.2
	>10 yrs	63.7	68.2	52.5
	p	<0.01	<0.01	<0.01
Reason for usual visit	Regular/check	77.4	81.1	69.3
	Problems	73.6	70.9	58.9
	p	0.10	<0.01	<0.01
Site of last visit	Private	72.9	74.3	60.8
	Public	80.6	72.9	65.8
	p	<0.01	0.66	0.11
Perceived dental treatment need	Yes	82.0	71.3	64.0
	No	70.9	74.7	60.6
	p	<0.01	0.18	0.23
Private dental insurance	Yes	75.0	79.0	65.6
	No	74.1	70.6	59.4
	p	0.74	<0.01	0.01
Difficulty paying $100 dental fee	None	73.5	76.0	63.0
	Hardly any	75.2	79.6	67.5
	A little	75.2	72.0	60.3
	A lot	78.1	66.0	57.8
	p	0.51	<0.01	0.20
Reported medical conditions	None	71.3	75.1	63.0
	One	73.2	74.3	60.4
	Two	77.8	74.9	64.8
	Three	71.6	68.0	55.0
	Four or more	76.5	76.0	65.0
	p	0.19	0.21	0.07

* Chi-square test with continuity adjustment. Response rates unweighted.

A general impression was obtained of lower participation among older, edentulous females with lower socio-economic background. OHIP responses appeared to be lower specifically among persons with lower educational

attainment and who were not of Anglo-Saxon origin. Examination responses appeared to be lower specifically among those who visited private dentists and who had no perceived treatment needs.

Another aspect of response bias was assessed among persons who returned OHIP questionnaires in different waves. The mean number of items reported "occasionally", "fairly often" or "very often" was compared among initial respondents and those who responded only after one or two reminder notices. The means were 7.39, 6.84, and 7.06 items respectively and the difference was not statistically significant (Kruskal-Wallis test, $p=0.27$). Hence, there was not a consistent increase or decrease in mean number of items according to the delay in response. This suggests that the "harder to reach" groups did not necessarily have higher or lower levels of social impact.

While these variations give some general indication of potential response biases in the survey, they do not necessarily indicate the degree of bias which might persist after controlling for age, sex and edentulism - the three characteristics which are accounted for in the weighting scheme. Consequently logistic regression analyses were undertaken using the three forms of response as outcome variables. Age, sex and dentate status were entered as the first explanatory variables, and the remaining variables from Table 36 were added. The findings are displayed in Table 37.

TABLE 37 LOGISTIC REGRESSION MODELS RELATING SOCIODEMOGRAPHIC CHARACTERISTICS TO RESPONSE RATES IN THE SADLS

Dependent Variable	Independent variables*	Chi-square	df	p
Exam participation	Age	8.76	2	0.01
	Sex	4.86	1	0.03
	Dentate	0.04	1	0.84
	Visit for problem	3.92	1	0.05
	Perceived treatment need	10.88	1	<0.01
OHIP participation	Age	21.02	2	<0.01
	Sex	0.01	1	0.99
	Dentate	0.13	1	0.72
	Period since last visit	11.19	4	0.02
	Live alone	4.61	1	0.03
	Country of birth	6.30	2	0.04
	Education	21.42	4	<0.01
EXAM& OHIP	Age	28.05	2	<0.01
	Sex	0.48	1	0.49
	Dentate	1.25	1	0.26
	Visit for problem	4.18	1	0.04
	Education	13.06	4	0.01

* Age, sex and dentate variables were entered first and retained in each model. Other variables considered: last dental visit, reason for visit, site of visit, perceived treatment needs, health benefit card ownership, dental insurance, financial hardship, living alone, ownership of dwelling, country of birth, educational attainment and annual household income.

After controlling for age, sex and edentulism, examinations were less likely among persons who usually visited for problems and persons who

perceived no need for treatment. After controlling for the same three factors, OHIP responses were less likely among persons with less recent dental visits, who lived alone, who were born outside Australia and UK/Eire, or who had lower levels of education. In the case of the combined examination and OHIP response, after controlling for age, sex and edentulism there was a lower participation rate among persons who visited for problems and who had lower levels of education.

To obtain some indication of the influence of these factors on estimates of social impact, the rates of social impact were computed among the subgroups of the OHIP sample, with subgroups defined according to the factors significantly associated with response rates in Table 37. The rates of social impact were expressed as: percentages of persons reporting difficulty chewing; percentages of persons reporting toothache; and the mean standardized OHIP scores. All percentages were weighted using the unit record weights described previously and which are used in subsequent sections of this Chapter which present the results. Subgroup-specific rates of social impact were then applied to the larger sample of interviewed persons, and adjusted rates were computed. This is equivalent to direct rate standardization in epidemiological studies (Mausner and Kramer, 1985), and provides estimates of social impact within the entire interviewed sample, adjusting for OHIP non-response bias. The method has been described previously for the assessment of non-response bias in oral health surveys (Locker et al, 1990). The results are laid out in a spreadsheet format in Table 38.

The influence of response bias on reported chewing difficulty (Q1 of the OHIP) is indicated at columns three and four of Table 38. Among OHIP respondents who had made a dental visit within the previous year, 33.9 per cent reported difficulty chewing (column 3). That percentage was multiplied by the number of interviewed persons with a visit in the previous year

(column 2) to give the product shown in column 4 (p_1 x n). The process was repeated for the other four dental visit periods. The sum of the products in column 4 then represented the imputed number of persons who would have reported chewing difficulty had they all completed OHIP questionnaires (637.5 persons). The sum in column 4 was then divided by the total number of interviewees (1625.2, column 2) to give the adjusted estimate of 39.2 per cent, shown in bold. This compares to the observed rate of 38.9 per cent, shown in the box above columns 3 and 4.

TABLE 38 ADJUSTED ESTIMATES OF SOCIAL IMPACT WITHIN THE INTERVIEWED SAMPLE

		Difficulty chewing (Q1=38.9%)		Toothache (Q13=17.6%)		Standardized OHIP (Mean=7.03)	
Column	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	Weighted no. of persons interviewed* (n)	% of persons reporting Q1 (p_1)	(p_1 x n)	% of persons reporting Q13 p_2	(p_2 x n)	Mean Stnd OHIP (x_3)	(x_3 x n)
Period since visit							
<1 year	706.8	33.9	239.6	26.6	188.0	7.23	5110.2
1-2 years	214.7	46.9	100.7	18.6	39.9	7.33	1573.8
>2-5 year	276.8	40.0	110.7	8.6	23.8	7.51	2078.8
>5-10 year	177.8	45.5	80.9	5.9	10.5	5.86	1041.9
>10 years	249.1	42.4	105.6	5.8	14.4	6.40	1594.2
Sum	1625.2		637.5		276.7		11398.8
Adjusted Estimate		**39.2**		**17.0**		**7.01**	
Live alone							
Yes	463.0	41.9	194.0	11.5	53.2	7.36	3407.7
No	1183.5	38.1	450.9	19.6	232.0	6.92	8189.8
Sum	1646.5		644.9		285.2		11597.5
Adjusted Estimate		**39.2**		**17.3**		**7.04**	
Country of birth							
Australia	1062.8	37.2	395.4	14.9	158.4	6.70	7120.8
UK/Eire	321.3	41.5	133.3	18.9	60.7	7.35	2361.6
Other	265.5	42.5	112.8	27.5	73.0	8.00	2124.0
Sum	1649.6		641.5		292.1		11606.3
Adjusted Estimate		**38.9**		**17.7**		**7.04**	
Age left school							
<14 years	217.9	38.6	84.1	24	52.3	7.87	1714.9
14 years	658.1	44.4	292.2	15.5	102.0	7.40	4869.9
15 years	288.1	32.7	94.2	17.2	49.6	6.61	1904.3
16 years	228.6	40.6	92.8	19	43.4	6.44	1472.2
17+ years	249.2	32.9	82.0	17.7	44.1	6.62	1649.7
Sum	1641.9		645.3		291.4		11611.0
Adjusted Estimate		**39.3**		**17.7**		**7.07**	

* Weighted according to sampling strata of age, sex, distance from dental clinics and edentulism. Totals vary for different sociodemographic groups because of non-response or "don't know" answers to specific questions in the interview.

The relatively small influence of adjustment for period since last dental visit comes about because the greatest difference in response rate for that characteristic was observed among persons who attended 10 years ago or more - Table 35). However, the percentage of those persons reporting chewing disability was only slightly higher (42.4 per cent - Table 38, column 3) than the overall OHIP sample. Other rate adjustments revealed similarly small influences on the estimate of prevalence for chewing disability.

Effects of rate adjustment on the prevalence estimate for toothache are represented in columns five and six of Table 38. The estimate adjusted for period since last dental visit was slightly lower (17.0 per cent) compared with observed 17.6 per cent within the OHIP sample. This reflected a lower prevalence of toothache among the group visiting 10 years ago or more which also had the lowest participation rate. Other differences between the observed rate of 17.6 per cent and the adjusted rates were also small. A similar impression of generally small effects was obtained from the examination of adjusted mean values for the standardized OHIP (Table 38, columns 7 and 8). The mean value of 7.03 within the OHIP sample changed by no more than 0.04 after adjustment for non-response.

While the previous findings provide an indication of effects on descriptive statistics, additional analysis was necessary to examine the effects of non-response on multivariate models. While it was not possible to examine multivariate relationships with OHIP scores among persons who did not complete the OHIP, the face-to-face questionnaire (Question A–7) contained a separate series of six questions concerning chewing capacity, themselves based on the work of Leake (1990). A variable was constructed from a count of the total number of foods which could not be chewed. The variable therefore ranged from a value of zero, reported by 60.2 per cent of

the 1,650 interviewed persons, through to six foods, reported by 1.1 per cent. A greater number of problem foods was consistent with higher levels of chewing incapacity, and in many respects can be regarded as an alternative indicator of social impact.

The effects of non–response were assessed by examining multivariate relationships with chewing capacity separately among two groups. One was comprised of persons with non-missing data who participated in the face-to-face interview, examination and OHIP – a weighted number of 950 persons, classified here as "participants". The other group consisted of all interviewed persons, and therefore included persons who did not complete the examination and OHIP. They represented a weighted number of 1,508 persons with non-missing data, classified here as the "full sample". Data used as explanatory variables in the multivariate models were: edentulism, perceived need for treatment (Question B–6 in the face-to-face questionnaire, Appendix 9), the site of last dental visit (Question B–4), the usual reason for visits (Question B–3) and financial hardship (Question B–10). The five characteristics were selected because they were significantly associated with OHIP scores in findings presented later in Section 6.3. The intention in the analysis was to ascertain the extent of variation in multivariate models between participants and the full sample.

The analysis of variance models, using Leake's (1990) index of chewing capacity as the dependent variable, are presented in Table 39. The principal interest was on differences between parameter estimates between participants and the full sample, rather than the statistical significant of terms in specific models. For participants, the negative parameter estimates indicated that there were lower levels of chewing incapacity among dentate persons, those who attended a private dental clinic, those who perceived no treatment needs and those reporting "hardly any" or "a little" difficulty paying a $100 dental fee. Chewing incapacity was higher among persons

whose usual dental visits were for problems, as indicated by the positive parameter estimates. For three of the characteristics (oral status, site of last visit and treatment needs) the effects were statistically significant.

TABLE 39 ANALYSIS OF VARIANCE MODELS RELATING CHEWING INCAPACITY TO SOCIODEMOGRAPHIC CHARACTERISTICS AMONG PARTICIPANTS AND THE FULL SAMPLE

Independent variable	df	F	p	Parameter(s)	Estimate	StdErr†
PARTICIPANTS* (weighted n=950)						
Oral status	1	73.9	<0.01	Dentate	-0.66	0.08
				Edentulous	0.00	
Usual visit	1	3.2	0.07	Problem	0.14	0.08
				Check-up	0.00	
Site of last visit	1	17.5	<0.01	Private	-0.32	0.08
				Public	0.00	
Treatment need	1	46.9	<0.01	Yes	0.00	
				No	-0.49	0.07
Financial hardship	3	2.2	0.09	None	0.10	0.09
				Hardly any	-0.08	0.12
				A little	-0.07	0.10
				A lot	0.00	
FULL SAMPLE* (weighted n=1,508)						
Oral status	1	139.8	<0.01	Dentate	-0.73	0.12
				Edentulous	0.00	
Usual visit	1	1.9	0.18	Problem	0.10	0.07
				Check-up	0.00	
Site of last visit	1	15.0	<0.01	Private	-0.25	0.06
				Public	0.00	
Treatment need	1	105.0	<0.01	Yes	0.00	
				No	-0.61	0.06
Financial hardship	3	1.0	0.42	None	0.03	0.07
				Hardly any	-0.09	0.11
				A little	-0.06	0.08
				A lot	0.00	

* Participants were persons who completed the face-to-face questionnaire, the examination and the OHIP, and who had non-missing data for all variables in the model. The full sample consisted of all who completed the face-to-face questionnaire with non-missing data.

† Parameter estimates for reference groups implicitly valued as zero, and no standard error is available.

There were close similarities in the parameter estimates obtained from the full sample. Indeed, estimates for all variables were in the same direction, and differed by no more than 0.12. Compared with the full sample, parameter estimates for the participants were slightly smaller (in absolute value) for oral status and perceived treatment needs. This indicates that the multivariate effects of oral status and perceived treatment were marginally weaker among interviewed persons. In contrast, the absolute values of parameter estimates among participants were slightly greater for: the usual reason for visits; the site of visits; and financial hardship (for two of the three dummy variables). This indicates that those multivariate effects were somewhat stronger among participants.

The two multivariate models therefore indicated effects which generally were consistent for all explanatory variables. Variations in parameter estimates were small and suggested that there were no systematic biases in the multivariate associations observable among participants. While the same interpretation can be applied only by analogy to the relationships with OHIP scores, the findings from Table 39 suggest that findings from examined persons who completed OHIP questionnaires could be generalized, with considerable confidence, to the larger group of participants in the face-to-face interview.

6.3 Results

6.3.1 Descriptive findings from the OHIP

This section addresses the second aim of the research by examining the extent of social impact within the SADLS sample. Extent is used as a general term to describe the prevalence of OHIP items as well as mean scores obtained from subscales and summary statistics. Additional methods are used to combine OHIP items thus providing alternative expressions of the extent of social impact.

6.3.1.1 Percentage of persons reporting OHIP items

For the purpose of convenient description, individual OHIP items can be expressed as a prevalence rate equivalent to the percentage of persons reporting each item "occasionally", "fairly often" or "very often" during the previous 12-month period. Table 40 presents the prevalence rates from the complete SADLS sample. Thirteen OHIP items were reported "occasionally", "fairly often" or "very often" by 20 per cent or more of individuals. Seven of those items were categorized as physical pain. However the most frequently reported single item was food catching (71.6 per cent of persons), categorized as functional limitation. In addition there were three items of physical disability in this most prevalent group. Only two items from other dimensions (being worried and avoiding eating some foods, categorized as psychological discomfort and physical disability respectively) appeared in this most prevalent group of thirteen items.

TABLE 40 PERCENTAGE OF PERSONS REPORTING OHIP ITEMS "OCCASIONALLY", "FAIRLY OFTEN" OR "VERY OFTEN"

Rank Order	Dimension	OHIP item* No.	Description	% of persons
1	Func Limit	Q07	Food catching	71.6
2	Phys Pain	Q16	Sore spots	50.8
3	Phys Pain	Q15	Uncomfortable to eat foods	39.9
4	Func Limit	Q01	Difficulty chewing	38.9
5	Phys Pain	Q14	Painful gums	34.8
6	Phys Disabil	Q28	Avoid eating some foods	33.3
7	Func Limit	Q17	Dentures not fitting	32.9
8	Phys Pain	Q12	Sensitive teeth	27.7
9	Phys Pain	Q09	Painful aching	25.0
10	Phys Pain	Q18	Uncomfortable dentures	24.9
11	Psyc Discom	Q19	Worried	24.9
12	Func Limit	Q05	Breath stale	23.1
13	Phys Pain	Q10	Sore jaw	20.2
14	Phys Disabil	Q32	Interrupt meals	19.2
15	Func Limit	Q04	Appearance affected	19.0
16	Psyc Discom	Q20	Self-conscious	18.0
17	Phys Pain	Q13	Toothache	17.6
18	Psyc Discom	Q22	Uncomfortable appearance	16.6
19	Func Limit	Q03	Noticed tooth	16.3
20	Psyc Discom	Q21	Miserable	15.6
21	Phys Disabil	Q30	Unable to eat with dentures	15.0
22	Psyc Discom	Q23	Tense	13.8
23	Psyc Disabil	Q38	Embarrassed	13.5
24	Psyc Disabil	Q34	Upset	13.3
25	Phys Disabil	Q24	Speech unclear	13.2
26	Func Limit	Q02	Trouble pronouncing words	12.8
27	Func Limit	Q08	Digestion worse	12.8
28	Func Limit	Q06	Taste worse	12.7
29	Phys Disabil	Q25	Words misunderstood	11.7
30	Phys Disabil	Q26	Less flavour in food	11.2
31	Phys Disabil	Q31	Avoid smiling	9.1
32	Psyc Disabil	Q36	Depressed	8.6
33	Psyc Disabil	Q35	Difficult to relax	8.6
34	Psyc Disabil	Q33	Sleep interrupted	8.1
35	Handicap	Q47	Life less satisfying	7.8
36	Phys Disabil	Q27	Unable to brush	6.9
37	Handicap	Q45	Financial loss	6.7
38	Handicap	Q44	General health worsened	5.8
39	Social Disabil	Q42	Irritable	5.5
40	Phys Disabil	Q29	Diet unsatisfactory	5.4
41	Handicap	Q46	Unable to enjoy company	5.0
42	Phys Pain	Q11	Headaches	4.9
43	Social Disabil	Q40	Less tolerant	4.5
44	Social Disabil	Q39	Avoid going out	4.1
45	Psyc Disabil	Q37	Concentration affected	4.0
46	Social Disabil	Q43	Difficulty doing jobs	2.3
47	Social Disabil	Q41	Trouble getting on	1.9
48	Handicap	Q48	Unable to function	1.8
49	Handicap	Q49	Unable to work	1.6

* OHIP item numbers correspond with question numbers in the questionnaire (Appendix 5) which also contains the complete description of each item.

The least prevalent group in Table 40 consisted of 19 items, each reported by fewer than 10 per cent of the SADLS participants. All 11 items categorized into social disability or handicap dimensions appeared in this least prevalent group, along with four of the six items categorized as psychological disability.

Between these extremes of prevalence was the group of 17 items reported by 10 to 20 per cent of persons. The major categories of items in this middle group consisted of four (from the total of five) in the psychological discomfort dimension, four physical disability items, and five functional limitation items.

Consequently there was a reasonably discrete split of social impact items from five of the conceptual dimensions according to their prevalence: almost all physical pain items appeared in the high prevalence group; almost all psychological discomfort items appeared in the middle prevalence group; and the majority of psychological disability items appeared in the low prevalence group along with all of the handicap and social disability items. The exceptions to this scheme of description apply for two of the larger dimensions (functional limitation and physical disability) which appear predominantly in the middle and high prevalence groupings.

Despite the general grouping of items, there was variation within dimensions in Table 40. There was a nine-fold variation in prevalence of physical pain/discomfort items, from 5.4 per cent (headaches) to 45 per cent (sore spots). There was a seven-fold variation in functional limitation items from 11 per cent (taste worsened) to 74 per cent (food catching).

Table 41 presents the distribution of response categories for individual OHIP items using the complete Likert-type response codes. The questions are ranked in the same order of frequency as Table 40. Consequently, those

with the greatest prevalence of impact "occasionally", "fairly often" or "very often" are at the top of the table. In most cases, the items near the top were the ones most likely to be reported "fairly often" or "very often". However there were some exceptions. For example, Question 18 (uncomfortable dentures) was ranked 10th but was reported "fairly often" by 4.4 per cent and "very often" by 5.9 per cent of persons. These percentages were greater than the "fairly often" or "very often" categories of many of the higher ranked questions. For the first 30 ranked questions, the most common of the affirmative responses (that is, excluding "never") was "occasionally", while for the remaining 19 items the "hardly ever" response tended to be the most common.

Most levels of non-response (either a blank response or "don't know") were below two per cent. However question 3 (noticed a tooth which doesn't look right), 11 (headaches) and 25 (misunderstood words) had combined non–responses of 10 per cent each.

TABLE 41 DISTRIBUTION OF RESPONSE CATEGORIES FOR INDIVIDUAL OHIP ITEMS

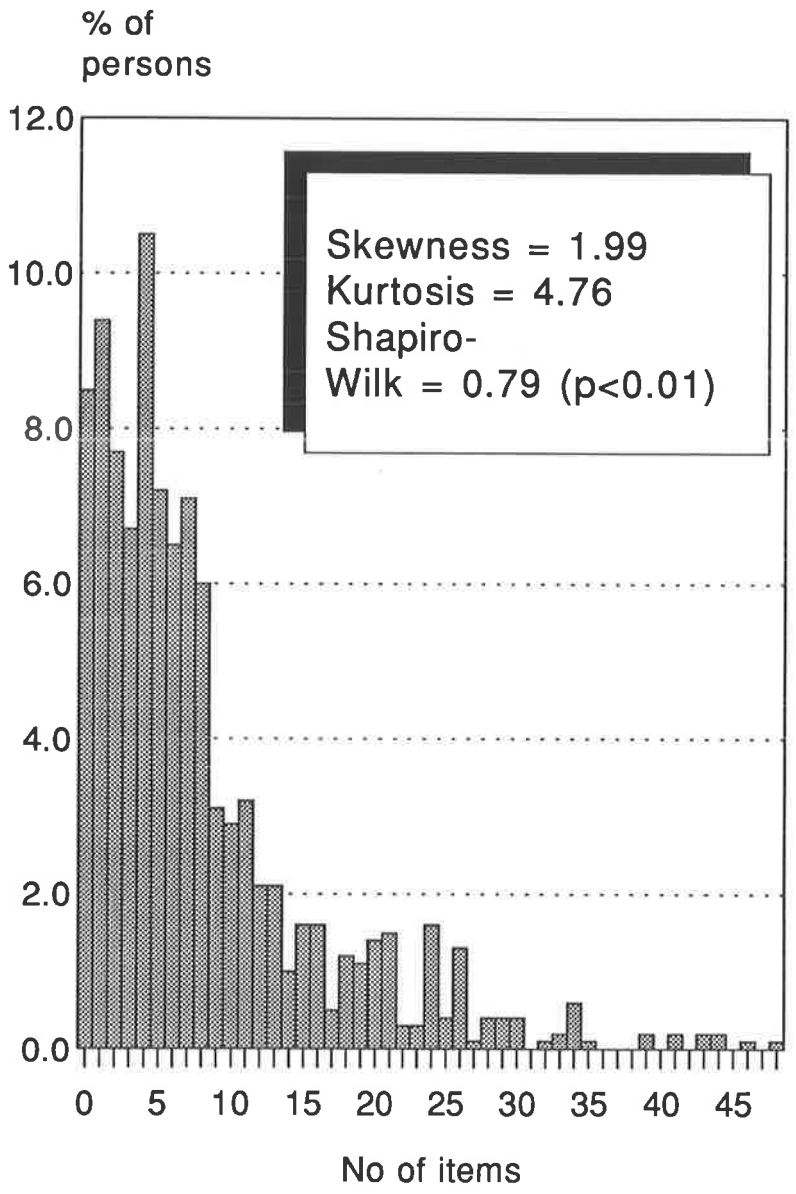
OHIP item* Rank	No.	Blank	Don't know	% of persons reporting: Never	Hardly ever	Occas-ionally	Fairly often	Very often
1	Q07	0.5	0.1	14.3	13.9	46.9	14.3	10.0
2	Q16	0.3	0.1	29.6	19.4	41.6	5.6	3.4
3	Q15	1.5	0.0	40.4	18.9	29.3	6.3	3.7
4	Q01	1.3	0.0	36.4	24.0	28.7	5.2	4.6
5	Q14	3.2	0.3	43.8	19.1	27.3	4.0	2.3
6	Q28	0.5	0.3	49.5	16.7	25.0	4.3	3.7
7	Q17	1.7	1.4	52.8	12.3	18.4	6.5	6.9
8	Q12	2.7	0.1	57.4	12.8	21.9	3.4	1.7
9	Q09	0.2	0.1	55.5	19.2	20.3	2.0	2.7
10	Q18	1.9	0.2	59.3	14.2	14.1	4.4	5.9
11	Q19	1.6	0.7	51.2	22.2	17.8	3.3	3.3
12	Q05	0.4	5.8	52.4	19.9	17.1	2.6	2.0
13	Q10	0.6	1.0	66.2	12.4	16.8	1.3	1.7
14	Q32	0.2	0.0	64.4	16.2	16.0	1.7	1.5
15	Q04	1.5	3.2	68.4	8.7	10.4	2.9	4.9
16	Q20	0.4	1.1	69.9	11.0	10.8	2.8	4.1
17	Q13	4.0	0.3	61.5	17.4	15.7	0.4	0.7
18	Q22	0.5	0.4	73.7	8.8	11.0	2.8	2.8
19	Q03	3.6	5.5	69.6	6.4	8.4	2.3	4.1
20	Q21	1.2	0.6	70.5	12.4	10.7	1.7	3.0
21	Q30	1.7	0.0	69.3	14.3	9.2	1.9	3.6
22	Q23	0.2	0.9	74.0	11.2	9.4	1.2	3.0
23	Q38	0.1	0.9	72.0	13.7	10.0	1.6	1.8
24	Q34	0.2	0.4	73.8	12.4	9.5	1.3	2.5
25	Q24	0.9	2.6	73.0	10.8	9.5	1.5	1.7
26	Q02	0.2	1.4	73.3	12.4	10.1	1.1	1.4
27	Q08	1.2	4.3	72.5	10.0	8.1	1.5	2.5
28	Q06	0.1	2.5	75.2	9.8	8.9	1.1	2.4
29	Q25	0.8	9.0	71.9	7.7	8.2	1.0	1.3
30	Q26	0.8	3.2	76.3	8.9	7.1	1.9	1.7
31	Q31	1.0	0.3	82.2	7.5	6.4	1.4	1.2
32	Q36	0.3	0.3	82.2	8.7	5.8	1.2	1.6
33	Q35	0.0	0.5	76.8	14.2	6.1	1.1	1.4
34	Q33	0.4	1.1	79.5	11.1	6.5	0.4	1.0
35	Q47	0.1	1.7	81.5	9.0	5.3	1.3	1.1
36	Q27	2.5	0.1	83.2	7.4	4.6	1.5	0.6
37	Q45	1.1	2.1	86.2	4.2	5.0	0.7	0.8
38	Q44	0.4	4.8	82.6	6.7	3.5	0.8	1.1
39	Q42	0.2	0.9	85.5	8.0	4.6	0.4	0.5
40	Q29	0.3	0.7	83.5	10.1	2.9	1.6	0.8
41	Q46	0.2	0.5	86.9	7.4	3.9	0.5	0.6
42	Q11	0.3	9.2	80.9	5.2	3.0	0.6	0.9
43	Q40	0.5	1.8	88.3	5.0	3.0	0.8	0.6
44	Q39	0.1	0.0	92.1	3.7	3.4	0.3	0.3
45	Q37	0.5	2.9	82.5	10.2	3.1	0.5	0.3
46	Q43	0.4	1.3	91.2	4.9	1.9	0.0	0.3
47	Q41	0.0	1.6	91.8	4.7	1.3	0.1	0.4
48	Q48	0.0	0.3	94.6	3.3	1.3	0.2	0.3
49	Q49	0.7	0.8	89.4	7.5	0.8	0.5	0.3

* Items are ranked in the order of prevalence from Table 40. Appendix 5 contains complete descriptions and question numbers corresponding with item numbers.

6.3.1.2 Distribution of OHIP subscales and summary statistics

A simplified statistic which summarizes the extent of social impact for each individual can be computed by counting the number of OHIP items reported "occasionally", "fairly often" or "very often". The mean number of items reported was 7.85 per person and 91.5 per cent of persons reported one or more items, with the distribution being skewed as shown in Figure 6.

FIGURE 6 DISTRIBUTION OF OHIP ITEMS REPORTED PER PERSON*



* Number of items reported "occasionally", "fairly often" or "very often".

While the most common (modal) report was four items, 10 per cent of persons reported 18 or more items and the maximum number was 48 items. The distribution reinforces the notion that a complete absence of social impact was uncommon among these older adults. Indeed, one half of persons reported five or more items.

There are several shortcomings which have been emphasized previously about this summary statistic of social impact: it uses an arbitrary cut–off point of "occasional" frequency, and it does not consider severity of problems within subscales. The use of subscales overcomes those limitations, and Table 42 presents univariate statistics describing the distribution of OHIP subscales and the standardized OHIP. It will be recalled that the standardized OHIP is obtained after standardizing each subscale score to a mean of one, and standard deviation of one, and then summing the results. It follows that the mean value was 7.0 (Table 42).

Within the separate subscales, means were greatest for functional limitation and physical pain, and were lower for disability, particularly the psychosocial disability and handicap. There was a large range in the observed subscale scores, with the maximum possible score of 40 occurring in four of the subscales. However the distributions clearly were skewed with the mean and median values much closer to the minimum than the maximum.

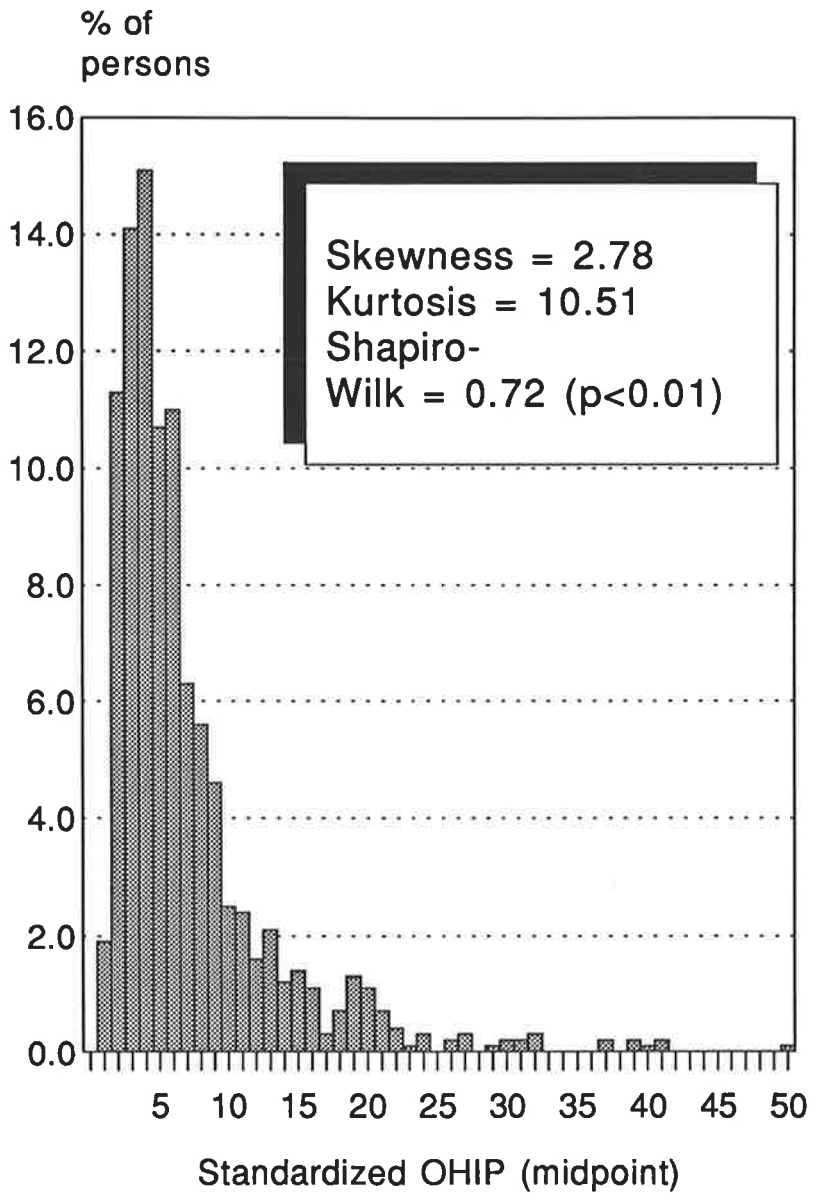
TABLE 42 UNIVARIATE STATISTICS FOR OHIP SUBSCALE SCORES*

Subscale	Mean	StdDev	Min-imum	Median	Max-imum
Functional limitation	8.38	6.48	0.0	6.34	40.0
Physical pain	7.91	5.90	0.0	6.47	40.0
Psychological discomfort	5.77	7.94	0.0	2.01	40.0
Physical disability	4.57	5.74	0.0	2.14	35.7
Psychological disability	3.37	5.94	0.0	0.00	40.0
Social disability	1.44	3.91	0.0	0.00	37.8
Handicap	1.81	4.13	0.0	0.00	36.9
Standardized OHIP	7.00	6.00	1.48	4.75	50.2

* The possible range for each subscale was from a minimum of zero indicating no impact, to a maximum of 40 indicating impact "very often" on all items within the subscale.

The standardized OHIP also featured a median and mean which was near to the minimum value of zero. The histogram depicting the distribution of the standardized OHIP is presented in Figure 7. The distribution was skewed (skewness = 2.78 and kurtosis = 10.5) and the data were not normally distributed (Shapiro–Wilk = 0.718, $p<0.01$ for the null hypothesis that the distribution was normal). However, in comparison with Figure 6, the distribution of standardized OHIP scores in Figure 7 appeared smoother, although it was spread over a roughly similar range.

FIGURE 7 DISTRIBUTION OF STANDARDIZED OHIP SCORES



6.3.1.3 Combinations of OHIP items

While the preceding tables and figures help to describe the extent of social impact, it is valuable to consider other groups of persons according to alternative combinations of OHIP items. A simple approach is to combine items according to the groups which comprise the dimensions underlying

the OHIP subscales. Table 43 presents, in the first column of figures, the percentage of persons reporting one or more items within individual dimensions of social impact. Because individuals can experience more than one form of impact (say functional limitation and physical pain), the percentages add to more than 100.

Items from functional limitation and physical pain were the most frequently reported, followed by physical disability. Psychological impacts and social disability or handicapping conditions were reported by fewer than forty per cent of persons. The overall ranking of frequency did not change when two or more items were used to categorize respondents (listed in the right-hand column of Table 43).

TABLE 43 PERCENTAGE OF PERSONS REPORTING 1+ AND 2+ ITEMS WITHIN DIMENSIONS OF SOCIAL IMPACT

	% of persons reporting*	
Dimension	1+ items	2+ items
Functional limitation	85.0	60.5
Physical pain	77.4	60.0
Psychological discomfort	39.6	22.8
Physical disability	49.8	30.7
Psychological disability	24.5	13.8
Social disability	10.0	4.2
Handicap	17.1	5.5

* Items reported "occasionally", "fairly often" or "very often". Columns sum to more than 100 because individuals may report impact in more than one dimension.

The very high prevalence of functional limitation in Table 43 was reduced substantially from 85.0 per cent to 60.5 per cent when the cut–off from 1+ items to 2+ items was used. This appeared to reflect the isolated

effect of the most frequent item, food catching (Question 7, reported by 71.6 per cent of persons – Table 40) which produced a much higher percentage of persons reporting one or more items compared with two or more items. For the other dimensions, the reduction in prevalence from a cut–off of 1+ items to 2+ items was smaller (roughly 10 to 20 per cent in magnitude). In general the difference between the cut–off points for those dimensions naturally reflect the skewed distribution of items within the dimensions.

An alternative mutually exclusive categorization of persons can be made according to a normative ranking of the dimensions of social impact (Table 44). In this instance, each individual was categorized according to reports of items within the highest ranked dimension. For example, a person who reported functional limitation (ranked 1) and physical disability (ranked 3) would be categorized into the highest of the two rankings (physical disability). Consequently, each column of percentages sums to 100 per cent. There were higher percentages of persons ranked into physical pain or physical disability than either of the psychological dimensions, and they in turn were more common than social disability. This suggests that many people cope with or tolerate physical impacts, that some experience additional psychological impact, and that a minority experience impacts in their social activities. However handicap, which had the highest ranking in this scheme, was more frequent than social disability. Furthermore, relatively few individuals appeared to report functional limitation alone. This suggests that they were likely to experience physical pain or disability in addition to functional limitation.

When two or more items were used to categorize individuals the relatively high percentage with handicap reduced to 5.5 per cent (Table 44, right-hand column). This indicates that relatively high proportions of individuals report only a single handicap item. The percentage reporting

physical pain increased while the most dramatic increase was observed for the "no impact" group.

TABLE 44 PERCENTAGE OF PERSONS REPORTING IMPACT RANKED BY PHYSICAL, PSYCHOLOGICAL AND SOCIAL DIMENSIONS

Rank	Dimension	Percentage of persons reporting items* in highest ranked dimension: 1+ items	2+ items
0	No impact	8.5	25.1
1	Functional limitation	8.1	9.4
2	Physical pain	19.4	27.4
3	Physical disability	17.9	12.8
4	Psychological discomfort	15.7	10.8
5	Psychological disability	10.2	7.2
6	Social disability	3.1	1.7
7	Handicap	17.1	5.5

* Items reported "occasionally", "fairly often" or "very often".

A more complete description of the combined patterns of impact is contained in Table 45, where persons were simply categorized according to the combination of dimensions in which one or more items were reported "occasionally", "fairly often" or "very often". This catgorization makes no normative assessments (which were implicit in the previous ranking in Table 44) about the possible "hierarchy" of impacts among the conceptual dimensions. Because there is a large potential number of combinations (2^7 = 128 altogether), only the 15 combinations reported by more than per cent of individuals are reported in Table 45. Together they cover 88 per cent of all observed combinations.

TABLE 45 FIFTEEN COMBINATIONS OF DIMENSIONS IN WHICH ONE OR MORE OHIP ITEMS WERE REPORTED*

Combination	Dimension: Func Limit	Phys Pain	Phys Disab	Psyc Discom	Psyc Disab	Social Disab	Handicap	% of persons†	Cumulative %
(a)	1	1						17.3	17.3
(b)	1	1	1					16.4	33.8
(c)	1							8.8	42.6
(d)	1	1	1	1	1			7.4	50.1
(e)	1	1	1	1	1	1	1	7.2	57.2
(f)	1	1		1				7.0	64.3
(g)	1	1	1	1				7.0	71.2
(h)	1	1	1	1	1		1	3.9	75.2
(i)		1						3.9	79.1
(j)	1	1	1	1	1	1		2.1	81.2
(k)	1		1					1.7	82.9
(l)	1	1	1				1	1.6	84.6
(m)	1			1				1.3	85.9
(n)	1	1			1			1.1	87.0
(o)	1	1	1	1			1	1.0	88.1

* 1 denotes one or more items reported "occasionally", "fairly often" or "very often" within the corresponding dimension.
† Weighted n = 1,110 persons reporting some impact.

The most likely combination was functional limitation and physical pain followed by those two combined with physical disability. In this respect, the combinations conform with the previously described ranking scheme. That is, physical disability was unlikely in the absence of functional limitation and physical pain. Indeed, the same is true for the majority of combinations in Table 45. However exceptions were observed, for example in combination (h) where handicap was reported in the absence

of social disability, and (i) where physical disability was reported without functional limitation. Most single dimensions were not as common as all seven in combination reported by 7.2 per cent (combination (e)).

Another approach to combining OHIP items was confined to the functional limitation dimension. Eight of the items from the functional limitation dimension were divided into five groups relating to eating (Q1, Q8), fit of dentures (Q17), speech (Q2), appearance (Q3, Q4) and breath/taste (Q5, Q6). Question 7 (food catching) was excluded because of its very high frequency and the consequent tendency for that item to be included in almost all of the five groups just described.

Within these groupings of functional limitation, items confined to eating were the most common event, reported by 12.1 per cent of persons with functional limitation (Table 46). Eating featured in many other combinations, accounting for a total of 61.3 per cent of all combinations. The second most common was ill fitting dentures, which featured in 47.9 per cent of combinations.

TABLE 46 COMBINATIONS OF FIVE GROUPS OF EIGHT FUNCTIONAL LIMITATION ITEMS*

Groups of functional limitation items						
Eating (Q1, Q8)	Speech (Q2)	Appear-ance (Q3, Q4)	Breath/ taste (Q5, Q6)	Dentures (Q17)	% of persons†	Cumulative %
1					12.1	12.1
1				1	9.0	21.1
		1			8.8	29.8
				1	8.7	38.6
			1		8.2	46.7
1			1		6.4	53.1
1	1	1	1	1	5.4	58.5
1			1	1	4.8	63.3
1		1			4.4	67.7
1		1		1	3.9	71.6
		1	1		3.5	75.1
1		1	1	1	3.2	78.3
1		1	1		3.0	81.4
1	1			1	2.9	84.2
		1		1	2.5	86.7
1	1		1	1	2.1	88.8
			1	1	1.9	90.7
	1				1.7	92.4
1	1	1	1		1.2	93.6
1	1	1		1	1.0	94.6
	1		1	1	0.9	95.5
1	1		1		0.9	96.3
		1	1	1	0.8	97.1
	1		1		0.6	97.7
1	1	1			0.6	98.3
	1	1	1		0.4	98.8
1	1				0.4	99.1
	1	1	1	1	0.3	99.4
	1	1		1	0.3	99.7
	1			1	0.2	99.9
	1	1			0.1	100.0

* 1 denotes item(s) within the group reported "occasionally", "fairly often" or "very often".

† Weighted n = 809 persons reporting one or more of the eight functional limitation items.

The most frequent pairs of grouped items were eating and dentures (9.0 per cent) and eating and breath/taste (6.4 per cent). However, the combination of all five groups (reported by 5.4 per cent) was more frequent than each of the combinations of three or four groups, and more frequent than most combinations of two groups. While this group of seven reported by 5.4 per cent constitutes a significant minority of all persons, it represents

widespread impact across all possible elements of functional limitation. The affected individuals necessarily were denture wearers, since one of the groups in Table 46 contains denture-related disorders. However denture wearers represent the majority of persons (77.2 per cent) in the SADLS sample. In a qualitative sense these individuals could be considered to be experiencing "multiple morbidity" associated with oral disorders.

6.3.2 Oral epidemiological variables associated with social impact

As described previously, oral epidemiological factors were the ones regarded as most directly related to social impact. Descriptive statistics for the oral epidemiological measures are presented first in this section. Relationships are then examined between edentulism and denture-related factors on one hand and social impact on the other. This includes relationships with specific items from the OHIP as well as the subscale scores and standardized OHIP. The larger group of oral epidemiological measures obtained from examinations of dentate persons are assessed with regard to the quantitative subscale measures.

6.3.2.1 Descriptive oral epidemiological statistics

Denture wearing status was assessed for dentate and edentulous persons who participated in oral examinations, and the prevalence of denture wearing is presented in Table 47. Virtually all edentulous persons wore upper and lower dentures, and just over one half of dentate persons wore a denture. Approximately equivalent percentages of dentate persons wore a full upper denture, a partial upper denture or a lower partial denture. However full lower dentures among dentate persons were rare.

TABLE 47 PERCENTAGE OF EXAMINED PERSONS WEARING DENTURES

	% of persons*	
	Dentate	Edentulous
Type of denture	(n=569)	(n=448)
Upper partial	24.4	-
Upper full	27.7	98.2
Lower partial	20.8	-
Lower full	0.5	93.6
Any upper denture	52.1	98.2
Any lower denture	21.3	93.6
Any denture	54.6	98.3

* Weighted n = 1,017 examined persons.

The frequency of examiner-assessed denture-associated disorders is presented in Table 48. The disorders were defined according to the criteria of Rise (1977), and includes oral mucosal conditions as well defects in extension, materials and fit of dentures. Stability and retention disorders were more frequent among the lower dentures. Stomatitis and occlusion disorders were more frequent for upper dentures. However it should be noted that for persons wearing full upper and lower dentures, inadequate occlusion was recorded for only the upper denture.

TABLE 48 PERCENTAGE OF PERSONS WITH EXAMINER-ASSESSED DENTURE-ASSOCIATED DISORDERS

	% of persons:	
	Upper denture wearers	Lower denture wearers
Disorder	(n=737)	(n=541)
Hyperplasia	3.2	1.0
Stomatitis	23.8	3.7
Cheilitis	4.4	0.8
Ulceration	5.5	7.1
Other mucosal lesion	0.4	0.2
Material defect	3.4	4.2
Extension defect	7.7	6.7
Retention	5.5	23.4
Stability	11.7	25.7
Occlusion	10.8	3.7

A larger group of oral epidemiological variables, all of them continuous variables, were assessed including tooth retention, caries experience, periodontal measures and attrition. Univariate statistics are presented in Table 50 for dentate persons who had no contra-indications to periodontal probing. Variable names and definitions are presented in Table 49.

TABLE 49 VARIABLE NAMES AND DEFINITIONS FOR ORAL EPIDEMIOLOGICAL MEASURES.

MT1	Number of anterior* missing teeth with or without replacement. (Reasons for missing teeth were not assessed and includes non-eruption and agenesis.)
MT2	Number of posterior* missing teeth.
MTEETH	All missing teeth (sum of MT1 and MT2).
SPACE1	Number of anterior spaces = missing tooth with no prosthodontic replacement resulting in a gap of at least half of the mesio-distal dimension of the missing tooth.
SPACE2	Number of posterior spaces.
SPACES	All spaces (sum of SPACE1 and SPACE2).
FUNIT1	Number of anterior functional units = natural tooth with at least one quarter of crown or prosthodontic replacement unit (fixed or removable).
FUNIT2	Number of posterior functional units.
FUNITS	All functional units (sum of FUNIT1 and FUNIT2).
CROWNDS	Number of coronal surfaces decayed (in teeth with at least one quarter of coronal tissue).
ROOTDS	Number of root surfaces decayed (in teeth with at least one quarter of coronal tissue).
TOOTHDS	All decayed surfaces (sum of CROWNDS and ROOTDS).
RROOTS	Number of retained roots (either decayed or non-decayed) comprising less than one quarter of coronal tissue.
CROWNFS	Number of coronal surfaces filled.
ROOTFS	Number of root surfaces filled.
TOOTHFS	All filled surfaces (sum of CROWNFS and ROOTFS).
CROWNDFS	Number of coronal surfaces filled or decayed (sum of CROWNDS and CROWNFS).
ROOTDFS	Number of root surfaces filled or decayed (sum of ROOTDS and ROOTFS).
TOOTHDFS	Number of tooth surfaces filled or decayed (sum of CROWNDFS and ROOTDFS).
ATTRITE	Number of teeth with enamel attrition (in teeth with at least one quarter of coronal tissue).
ATTRITD	Number of teeth with dentine attrition.
ATTRITS	Number of teeth with severe attrition.
AVGREC†	Average periodontal recession (mm) across all sites for the individual.
NRECGE4	Number of sites with periodontal recession 4+ mm.
MAXREC	Maximum periodontal recession among all sites.
AVGPOC	Average pocket depth (mm) across all sites for the individual.
NPOCGE4	Number of sites with pockets 4+mm.
MAXPOC	Maximum pocket depth among all sites.
AVGLOA	Average loss of attachment (mm) across all sites for the individual.
NLOAGE4	Number of sites with loss of attachment 4+mm.
MAXLOA	Maximum amount of attachment loss among all sites.
NGING	Number of sites with gingival bleeding.
NCALC	Number of sites with calculus.

* Anterior refers to canines and incisors; Posterior refers to molars and premolars.

† All periodontal measurements were confined to teeth with at least one quarter of coronal tissue.

Nearly one half of all the natural teeth were missing (MTEETH, mean = 14.88) although many had been replaced, as indicated by the FUNITS variable which refers to the total number of artificial or natural teeth. As would be anticipated, virtually all 12 anterior teeth were either present or replaced (FUNIT1, mean = 11.69). The average number of decayed surfaces was less than one (TOOTHDS, mean = 0.82), and was approximately equivalent between coronal surfaces (CROWNDS) and root surfaces (ROOTDS). However there were much larger numbers of filled surfaces. Attrition was recorded for relatively small numbers of teeth, and predominantly it was enamel attrition. The sample mean for each individual's average amount of recession (AVGREC) was slightly less than one millimetre, and individuals averaged only two sites with recession of 4+mm (NRECGE4). This represents only a small proportion of all sites, in part because three sites per tooth were measured. Average pocket depth (AVGPOC) was near two millimetres, while the mean number of sites with pockets of 4+mm (NPOCGE4) was 2.93. Gingival bleeding (NGING) and calculus (NCALC) also were recorded for a minority of sites.

TABLE 50 UNIVARIATE STATISTICS FOR ORAL EPIDEMIOLOGICAL VARIABLES*

Variable	Name†	Mean	StdDev	Min	Median	Max
Missing teeth, ant.	MT1	2.94	2.60	0	2	12
Missing teeth, post.	MT2	11.93	4.38	0	13	20
Missing teeth, all	MTEETH	14.88	6.52	0	15	31
Unreplaced spaces, ant.	SPACE1	0.20	0.63	0	0	7
Unreplaced spaces, post.	SPACE2	5.77	3.44	0	6	20
Unreplaced spaces, all	SPACES	5.96	3.72	0	6	26
Functional units, ant.	FUNIT1	11.68	0.78	3	12	12
Functional units, post.	FUNIT2	13.41	3.48	0	13	20
Functional units, all	FUNITS	25.10	3.79	5	25	32
Decayed coronal surfaces	CROWNDS	0.42	0.90	0	0	16
Decayed root surfaces	ROOTDS	0.40	0.81	0	0	11
All decayed surfaces	TOOTHDS	0.82	1.31	0	0	17
Retained roots	RROOTS	0.14	0.54	0	0	11
Filled Coronal surfaces	CROWNFS	22.04	15.68	0	14	90
Filled root surfaces	ROOTFS	2.67	3.00	0	1	24
All filled surfaces	TOOTHFS	24.71	16.69	0	18	93
DFS coronal	CROWNDFS	22.46	15.65	0	15	90
DFS root	ROOTDFS	3.07	3.08	0	2	27
DFS all	TOOTHDFS	25.53	16.55	0	19	94
DFS/total surfaces (%)	DFSRISK	16.72	8.57	0	15	83
Enamel attrition	ATTRITE	4.12	3.37	0	3	24
Dentinal attrition	ATTRITD	1.61	2.38	0	0	16
Severe attrition	ATTRITS	0.04	0.29	0	0	9
Average recession (mm)	AVGREC	0.93	0.72	0	1	7
Sites of recession 4+mm	NRECGE4	2.11	3.19	0	1	30
Maximum recession (mm)	MAXREC	3.60	1.37	0	4	10
Average pocket (mm)	AVGPOC	1.79	0.45	1	2	5
No. of pockets 4+mm	NPOCGE4	2.93	4.26	0	1	40
Maximum pocket (mm)	MAXPOC	3.97	1.29	1	4	12
Average LOA (mm)	AVGLOA	2.66	0.95	1	3	11
No. of LOA 4+mm	NLOAGE4	4.57	5.55	0	2	43
Maximum LOA (mm)	MAXLOA	5.72	1.80	2	5	17
Gingival bleeding (sites)	NGING	2.26	2.67	0	1	21
Calculus (sites)	NCALC	5.59	6.75	0	3	58

* Weighted n = 569 dentate persons with periodontal examinations.
† Variable names and definitions are described in Table 49, page 197.

6.3.2.2 Edentulism

The prevalence of individual OHIP items reported "occasionally", "fairly often" or "very often" by dentate and edentulous persons is presented in Table 51. The items have been listed with those more frequently reported

among edentulous at the top of the table and those more frequent among dentate at the bottom.

For a majority of OHIP items, there were higher percentages of edentulous persons reporting impact (Table 51). Edentulous persons reported levels of impact in the first 10 items which were at least 10 percentage points greater than dentate. However three of those items (dentures not fitting, uncomfortable dentures and uncomfortable to eat with dentures) were confined to denture wearers. In contrast, dentate persons reported levels of impact which were at least 10 percentage points higher than edentulous in only the last five items. Three of those items were not asked of edentulous persons.

TABLE 51 PERCENTAGE OF DENTATE AND EDENTULOUS REPORTING OHIP ITEMS

Item* Number	Description	% of persons reporting item† Dentate	Edentulous	p‡
Q28	Avoid eating some foods	20.9	49.1	<0.01
Q17	Dentures not fitting	21.2	47.5	<0.01
Q15	Uncomfortable to eat foods	28.9	54.0	<0.01
Q01	Difficulty chewing	28.9	51.7	<0.01
Q16	Sore spots	41.7	62.3	<0.01
Q14	Painful gums	26.5	45.8	<0.01
Q18	Uncomfortable dentures	16.4	35.5	<0.01
Q32	Interrupt meals	10.8	29.8	<0.01
Q10	Sore jaw	14.5	27.4	<0.01
Q30	Unable to eat with dentures	10.0	21.2	<0.01
Q26	Less flavour in food	7.0	16.8	<0.01
Q08	Digestion worse	8.5	18.2	<0.01
Q06	Taste worse	9.8	16.5	<0.01
Q02	Trouble pronouncing words	10.6	15.7	0.01
Q29	Diet unsatisfactory	3.3	8.0	<0.01
Q46	Unable to enjoy company	3.3	7.3	<0.01
Q21	Miserable	13.9	17.8	0.07
Q25	Words misunderstood	10.1	13.8	0.08
Q35	Difficult to relax	7.0	10.5	0.04
Q24	Speech unclear	11.7	15.1	0.10
Q42	Irritable	4.0	7.3	0.02
Q39	Avoid going out	2.7	5.9	0.01
Q34	Upset	11.9	15.1	0.10
Q47	Life less satisfying	6.6	9.3	0.10
Q23	Tense	12.7	15.1	0.26
Q40	Less tolerant	3.7	5.6	0.14
Q36	Depressed	7.9	9.5	0.37
Q11	Headaches	4.3	5.7	0.35
Q41	Trouble getting on	1.3	2.7	0.15
Q44	General health worsened	5.3	6.4	0.53
Q38	Embarrasssed	13.1	14.0	0.72
Q48	Unable to function	1.5	2.2	0.50
Q49	Unable to work	1.4	1.9	0.67
Q37	Concentration affected	3.8	4.3	0.79
Q33	Sleep interrupted	7.9	8.3	0.88
Q22	Uncomfortable appearance	16.6	16.7	0.99
Q43	Difficulty doing jobs	2.6	1.9	0.49
Q09	Painful aching	25.7	24.2	0.58
Q31	Avoid smiling	10.4	7.4	0.09
Q05	Breath stale	24.8	20.8	0.12
Q45	Financial loss	8.6	4.3	0.01
Q04	Appearance affected	21.2	16.2	0.04
Q20	Self-conscious	21.0	14.2	<0.01
Q19	Worried	28.1	20.9	<0.01
Q27	Unable to brush	11.6	na	
Q07	Food catching	80.6	60.1	<0.01
Q03	Noticed tooth	26.4	3.0	<0.01
Q13	Toothache	29.8	na	
Q12	Sensitive teeth	46.7	na	

* Item numbers correspond with question numbers in the OHIP (Appendix5).

† Items reported "occasionally", "fairly often" or "very often". na = question not asked of edentulous persons.

‡ Pearson's Chi-square statistic (with continuity adjustment) for H_0: dentate = edentulous.

Items from functional limitation, physical disability and physical pain dimensions differed most substantially in Table 51 – generally by 10 per cent or more. Worry and self-consciousness (reported more frequently by dentate persons) were the two psychosocial items which featured the largest discrepancy between the two groups. For most of the remaining psychosocial items, the differences were five percentage points or less.

Variations in subscale scores and the standardized OHIP between dentate and edentulous persons are presented in Table 52. The largest differences were observed within the the physical disability subscale, which differed by 1.98, and the functional limitation subscale, where the mean differed by 0.76. Other subscales featured smaller and statistically non-significant differences. This is consistent in most respects with the variation in individual items (Table 51), which differed most in the functional and physical impacts. The standardized OHIP scores differed by 0.58 – a difference which was not statistically significant (Table 52, $p = 0.08$).

TABLE 52 MEAN OHIP SCORES AMONG DENTATE AND EDENTULOUS GROUPS*

	DENTATE			EDENTULOUS			
Subscale	Mean	StdDev	Max	Mean	StdDev	Max	p†
Func Limit	7.91	5.15	37.0	8.67	9.33	40.0	0.04
Phys Pain	7.84	4.96	40.0	7.85	7.87	33.0	0.98
Psych Disc	5.94	6.38	40.0	5.36	11.30	40.0	0.20
Phys Disab	3.60	4.33	35.7	5.58	8.26	34.3	<0.01
Psych Disab	3.14	4.79	40.0	3.44	8.24	38.3	0.38
Social Disab	1.23	3.03	37.7	1.59	5.50	31.4	0.09
Handicap	1.67	3.31	35.7	1.87	5.69	36.9	0.38
Standardized OHIP	6.64	4.72	50.2	7.22	8.48	41.4	0.08

* All OHIP respondents (n = 1,214 persons).
† F–test for H_0: dentate = edentulous.

Comparisons of the differences in individual items between dentate and edentulous groups in Table 51 help to give meaning to otherwise dimensionless subscale scores presented in Table 52. For example, the prevalence of several OHIP items differed by 10 per cent or more between dentate and edentulous (Table 51). If there were 10 per cent of persons whose response to an item shifted from from "hardly ever" to "occasionally", there would be an associated mean change for the subscale of around 0.10 (varying, depending on the item severity weight). Therefore, even if all items within a nine-item subscale were reported in this way by an extra 10 per cent of edentulous persons, it follows that the magnitude of difference within the subscale could be as small as approximately 0.9.

However the situation can vary from this simple scenario, due to larger shifts across the Likert-type scale, or because of greater severity

weights assigned to specific items. Therefore, an important distinction arises between the interpretations of individual items (Table 51) and subscale scores (Table 52) because of the inclusion of the full range of responses and items within mean subscale scores. For example, there were five physical pain items reported more frequently by edentulous persons (with a difference of at least 10 percentage points – Table 51), compared with only two physical pain items reported more frequently to this extent by dentate persons. As a consequence, it might be expected that edentulous persons would have higher subscale scores for physical pain, even allowing for the fact that two pain items were not asked of edentulous persons. However the subscale scores for physical pain were virtually identical between dentate and edentulous. This indicates that dentate persons have either more frequent or more severely weighted forms of oral pain, despite their overall lower likelihood of experiencing the nine different forms of physical pain.

Another interpretation from the preceding two tables is that not all individual items within a subscale will vary in the same direction as the mean values. For example, "avoid smiling" was more frequent among dentate persons (Table 51) despite their lower mean score on the corresponding subscale of physical disability (Table 52). Furthermore, it is apparent that similar mean scores can conceal a number of differences among individual items, such as the previous example of physical pain.

6.3.2.3 Denture-related factors

Table 53 presents mean OHIP scores among groups defined according to denture-wearing and dentition status (dentate or edentulous). Unlike Table 52, which referred to all OHIP respondents, Table 53 refers to the smaller number of examined persons. When standardized OHIP scores were examined among dentate persons, wearers of one full denture had the

highest level of impact and non-denture wearers had the lowest. The same trend among dentate persons was observed for most individual subscale scores. The overall advantage (that is, lower levels of impact) for dentate persons with no dentures was most noticeable within the functional limitation and physical disability dimensions (Table 53). Dentate persons with one full denture had similar functional limitation and physical pain scores compared with the other dentate denture wearing groups.

TABLE 53 MEAN OHIP SCORES AMONG ORAL HEALTH STATUS AND DENTURE WEARING GROUPS – ALL EXAMINED PERSONS

	Weighted	Mean score							
Group	no. of persons	Func limit	Phys pain	Psych disc	Phys disab	Psych disab	Soc disab	Handi-cap	Stnd OHIP
Dentate									
No denture	258	6.55	7.21	5.24	2.47	2.56	0.79	1.29	5.74
Partial(s)	64	9.05	8.55	6.78	4.33	3.47	1.39	1.80	7.30
1 Full	96	9.26	8.56	6.51	5.17	4.55	2.39	2.52	8.06
Full&Partial	151	9.31	8.39	5.39	4.60	2.56	0.79	1.28	6.75
ALL	569	7.98	7.93	5.88	3.66	3.14	1.22	1.63	6.66
Edentulous									
No denture	8	10.92	10.52	6.66	9.56	7.40	4.00	3.91	10.65
1 Full	21	15.75	12.16	15.15	13.78	8.93	7.51	8.13	15.65
2 Full	419	9.01	8.19	5.56	5.69	3.53	1.54	1.94	7.39
ALL	448	9.35	8.41	6.02	6.13	3.85	1.85	2.26	7.83
All									
No denture	266	6.68	7.31	5.28	2.68	2.70	0.89	1.37	5.89
Full&Partial	151	9.31	8.39	5.39	4.60	2.56	0.79	1.28	6.75
Partial(s)	64	9.05	8.55	6.78	4.33	3.47	1.39	1.80	7.30
1 Full	117	10.41	9.20	8.03	6.69	5.32	3.30	3.51	9.40
2 Full	419	9.01	8.19	5.56	5.69	3.53	1.54	1.94	7.39
ALL	1017	8.58	8.14	5.94	4.75	3.45	1.50	1.91	7.17

Differences among edentulous persons require cautious interpretation because of the small numbers who wore either a single denture (weighted number of 21 persons) or no dentures (eight persons – Table 53). Edentulous persons who wore a single denture had substantially higher levels of impact across all subscales and in the standardized OHIP. Indeed,

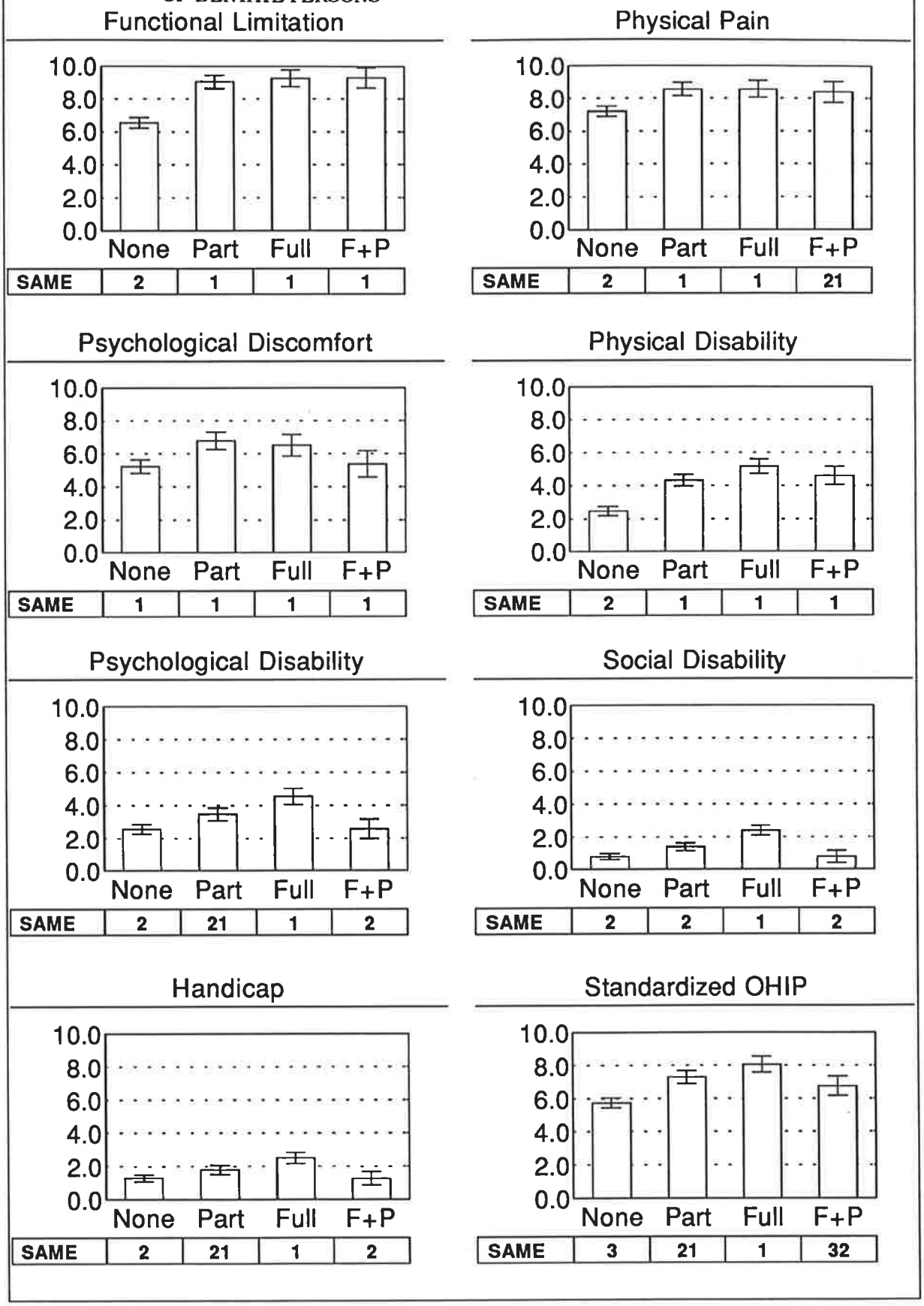
this subgroup reported the highest levels of impact among any of the subgroups in Table 53.

For most subscales and for the standardized OHIP, mean scores for dentate persons with one full denture were similar to or greater than the scores for edentulous persons with two full dentures. In general, the differences observed in mean subscale scores within the four dentate subgroups were of a greater magnitude than the differences observed between all dentate and all edentulous persons (also presented in Table 53). For example, differences between dentate persons without dentures and dentate persons with one full denture ranged from 2.71 (functional limitation) through to 1.23 (handicap). The corresponding differences between all dentate and all edentulous persons in Table 53 were 1.37 and 0.63.

Statistical analysis of the data in Table 53 was undertaken separately for dentate and edentulous persons using analysis of variance. Means for the seven subscales and the standardized OHIP were compared among the four subgroups of dentate persons: non-wearers of dentures; those wearing partial denture(s) only; those wearing a single full denture; and those wearing a full and partial denture. Differences among subgroups were evaluated using the post-hoc Duncan-Waller test. The findings are presented in Figure 8, which contains eight bar charts – one for each dependent variable. Each vertical bar represents the mean subscale score for a subgroup, and the error bars are equal to plus one and minus one standard error. Within each bar chart, subgroups with statistically non-significant differences share the same digit within the "SAME" box below the horizontal axis. In the case of functional limitation, for example, non-denture wearers had significantly lower levels of impact than the other three groups which themselves had no significant differences. Indeed the same

trend of lowest subscale scores among non-denture wearers was observed for all subscales other than psychological discomfort.

FIGURE 8 VARIATIONS IN OHIP SCORES AMONG DENTURE SUBGROUPS OF DENTATE PERSONS*

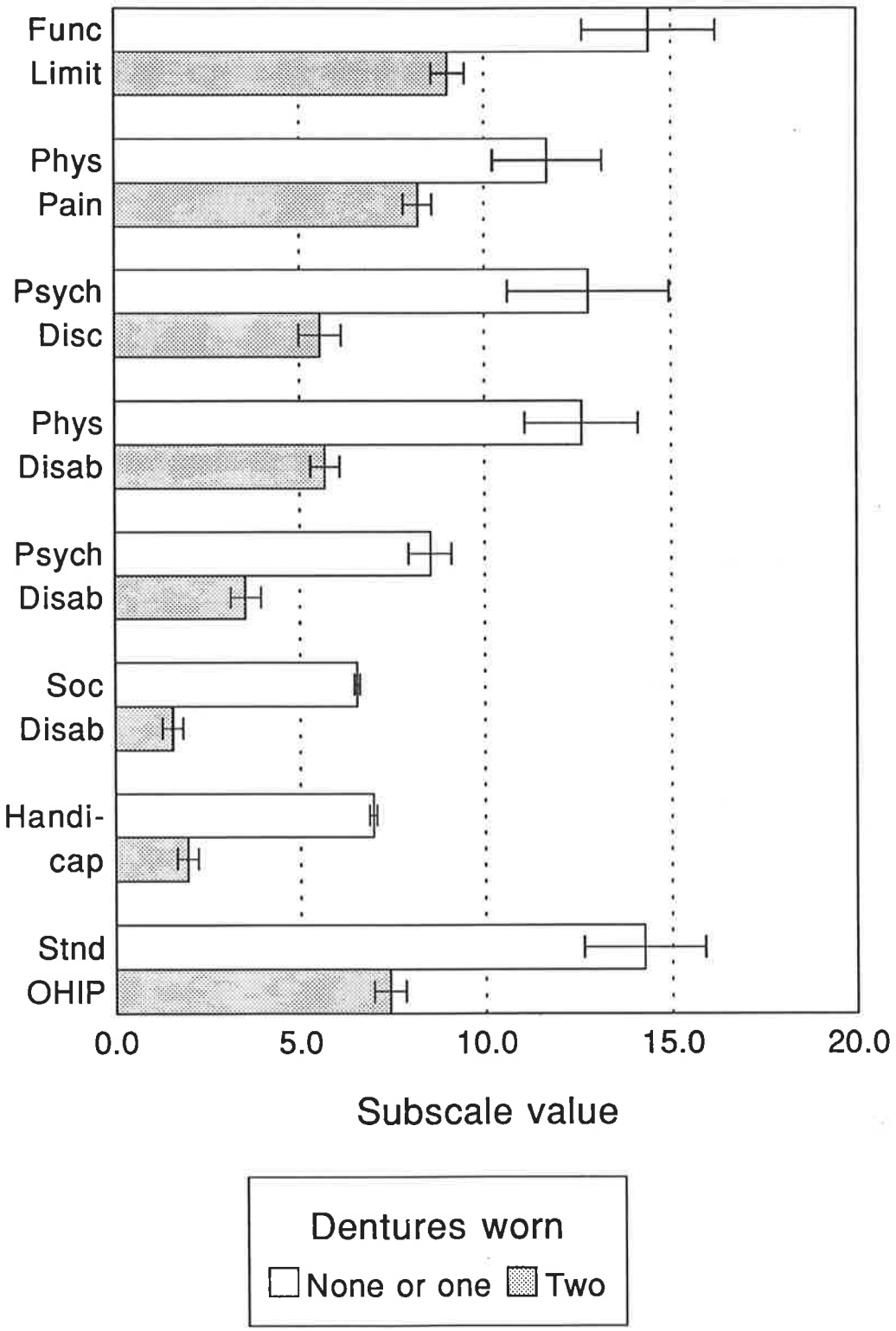


* Error bars represent +/- one standard error. Subgroups with the same digit in the "SAME" box were not significantly different – Duncan-Waller test, $p>0.05$.

In the case of the standardized OHIP, the lowest impact occurred for non-denture wearers and full/partial denture wearers which themselves did not differ significantly, as indicated by the shared digit "3" for those subgroups (Table 53). However partial denture wearers and full denture wearers had significantly higher standardized OHIP scores than the non-denture wearers.

The analysis for edentulous persons was confined to two subgroups: wearers of two dentures compared with wearers of one or no dentures. This was achieved by combining the two smallest groups from Table 53, a step which was necessary to achieve a sufficiently large comparison group. The findings are presented in Figure 9. In this instance, the two-group comparison was evaluated using the F–test, and the differences between the denture subgroups were statistically significant for all eight dependent variables. It will be observed that the scale for the standardized OHIP in Figure 9 (horizontal axis) is larger than the previous bar charts for dentate persons (Figure 8, vertical axes), reflecting the very high levels of impact reported by edentulous persons who wore no dentures or only one denture.

FIGURE 9 VARIATIONS IN OHIP SCORES AMONG DENTURE SUBGROUPS OF EDENTULOUS PERSONS*



* Error bars represent +/- one standard error. All differences between denture subgroups were statistically significant (F-test, $p<0.05$).

In view of the generally high levels of social impact among persons with dentures, it could be anticipated that there would be reasonably strong variations according to the clinical disorders associated with those dentures. However bivariate correlations between the total number of denture-related disorders (from a maximum possible of 20 if two dentures were worn) and social impact were only weak. Table 54 presents Pearson's correlation coefficients between the number of examiner-assessed denture disorders and OHIP scores. The table refers only to denture wearers. Correlations for the total number of denture disorders among all denture wearers were 0.07 or less, and were greatest for functional limitation among dentate persons. Interestingly the correlations among edentulous persons were negative (although weak) ranging to –0.08 for the coefficient between total denture disorders and handicap. Although not shown in Table 54, there were no clear variations on these patterns when only upper or lower dentures were considered.

TABLE 54 CORRELATIONS BETWEEN NUMBER OF DENTURE DISORDERS AND OHIP SCORES AMONG DENTURE WEARERS

Pearson's correlation coefficients between number of denture disorders* and OHIP scores

	Subscale							
Group	Func limit	Phys pain	Psych disc	Phys disab	Psych disab	Soc disab	Handi-cap	Stnd OHIP
Upper denture disorders								
Dentate	0.09	0.02	0.05	0.04	0.07	0.01	0.05	0.05
Edentulous	0.00	-0.06	-0.05	-0.06	-0.04	-0.05	-0.09	-0.06
ALL	0.04	-0.03	-0.01	-0.02	0.01	-0.03	-0.03	-0.01
Lower denture disorders								
Dentate	0.05	0.05	0.03	0.03	0.07	0.02	0.03	0.05
Edentulous	0.00	-0.07	-0.09	-0.04	-0.05	-0.04	-0.11	-0.06
ALL	0.01	-0.05	-0.07	-0.02	-0.03	-0.02	-0.08	-0.04
Total denture disorders								
Dentate	0.12	0.04	0.08	0.07	0.08	0.01	0.06	0.08
Edentulous	0.05	-0.03	-0.04	-0.02	-0.04	-0.04	-0.08	-0.03
All	0.07	-0.01	-0.01	0.04	0.00	-0.01	-0.03	0.01

* Upper denture disorders and lower denture disorders do not relate to mutually exclusive groups of persons, and therefore "all denture disorders" do not represent the combined correlations for upper and lower denture disorders.

On the face of it, this observation suggests that there was nothing about the clinical adequacy of dentures to account for higher levels of social impact. However there were a range of individual clinical assessments which contribute to the total number of denture disorders, and it is appropriate to examine relationships between those separate assessments and social impact scores. Table 55 presents variations in standardized OHIP scores among denture wearers according to the presence or absence of

the ten separate conditions. Upper and lower denture disorders were combined, although the data are reported separately for dentate and edentulous persons in view of the opposing associations noted in Table 54.

In the case of hyperplasia, stomatitis, cheilitis and design defects, there were generally small differences in the standardized OHIP (Table 55). Differences were most apparent in the edentulous group where standardized OHIP scores were lower among persons with those three denture-related conditions. For example, edentulous persons with stomatitis had a mean standardized score of 6.77 compared with 7.81 for those without stomatitis. The one condition which was associated with noticeably higher levels of impact in both dentate and edentulous persons was denture stability. However in the dentate group, the difference in standardized OHIP scores associated with presence and absence of ulceration, retention, stability or occlusion was greater than 1.0 – a difference which, based on the findings from previous tables, would be associated with quite large percentage differences across a number of individual OHIP items.

TABLE 55 MEAN STANDARDIZED OHIP SCORES BY DENTURE-RELATED CONDITIONS AMONG DENTURE WEARERS

		Standardized OHIP					
		DENTATE			EDENTULOUS		
Condition		Weighted no. of persons	Mean	StdDev	Weighted no. of persons	Mean	StdDev
Hyperplasia	Absent	300	7.49	5.42	426	7.81	8.95
	Present	11	5.58	1.57	13	6.87	3.07
Stomatitis	Absent	244	7.36	5.40	330	8.12	9.38
	Present	67	7.65	5.00	110	6.77	7.02
Cheilitis	Absent	300	7.44	5.33	417	7.82	8.98
	Present	12	6.98	4.87	23	6.99	6.80
Ulceration	Absent	306	7.38	5.30	401	7.79	8.88
	Present	5	9.74	6.22	39	7.69	8.55
Material defect	Absent	298	7.55	5.40	416	7.81	8.81
	Present	13	4.32	1.55	24	7.29	9.39
Design defect	Absent	282	7.44	5.45	396	7.79	8.90
	Present	29	7.27	3.82	44	7.74	8.49
Retention	Absent	283	7.30	5.14	313	7.72	9.14
	Present	28	8.58	7.31	127	7.93	8.26
Stability	Absent	267	7.14	5.07	289	7.56	9.02
	Present	44	9.12	6.27	151	8.20	8.56
Occlusion	Absent	285	7.26	5.35	370	7.90	9.19
	Present	26	9.17	4.90	70	7.12	7.05

The findings in Table 55 suggest that only specific denture conditions (particularly retention and stability) were associated with higher levels of impact, and that other conditions were associated with lower levels of impact. This helps to explain why correlations (using a total count of

conditions) were low or even negative. However it raises the question as to why some clinical conditions are associated with reduced impact.

One explanation could be that the standardized scores are somehow dominated by forms of impact other than those which are associated specifically with denture conditions. Any such tendency could "hide" substantial effects of denture conditions. This issue was addressed by examining associations between the ten examiner-assessed denture disorders and the three OHIP items which asked specifically about dentures: dentures not fitting (Q17), uncomfortable dentures (Q18) and being unable to eat with dentures (Q30). The findings are presented in Table 56 relating to examined denture wearers. Hyperplasia again was noticeable, with a lower percentage of affected persons reporting uncomfortable dentures or inability to eat with dentures. However retention was associated with higher percentages reporting impact for all three OHIP items.

TABLE 56 PERCENTAGE OF PERSONS WITH DENTURE-SPECIFIC OHIP ITEMS BY DENTURE-RELATED DISORDERS*

Condition		% of persons reporting*: Dentures not fitting	Uncomf-ortable dentures	Unable to eat with dentures
Hyperplasia	Absent	44.0	33.1	21.6
	Present	41.5	16.8	12.6
Stomatitis	Absent	43.9	33.4	22.6
	Present	43.7	29.7	17.2
Cheilitis	Absent	43.3	32.7	21.4
	Present	56.1	29.7	19.5
Ulceration	Absent	43.6	31.9	21.4
	Present	49.3	43.0	20.2
Material defect	Absent	44.4	32.8	21.4
	Present	34.4	27.3	18.2
Design defect	Absent	42.9	32.3	21.3
	Present	52.7	34.6	21.4
Retention	Absent	39.3	29.2	18.8
	Present	61.3	45.3	30.7
Stability	Absent	41.4	30.7	21.2
	Present	51.2	37.8	21.5
Occlusion	Absent	42.6	31.6	21.4
	Present	52.8	39.1	20.8

* Data for 751 examined persons with dentures. OHIP items reported "occasionally", "fairly often" or "very often".

The general interpretation obtained from the three preceding tables about the effects of dentures is complex. Clearly there were a range of clinical denture-related conditions, only some of which were associated with higher levels of social impact. Indeed, some were associated with less impact. Dentate persons generally appeared to be affected more adversely by the clinical conditions. Where clinical conditions were associated with higher levels of impact, they predominantly affected functional limitation. In

contrast, the clinical conditions were associated with lower levels of handicap, particularly among edentulous persons.

A final denture-related factor concerned the usual periods when dentures were worn. Questions in the face-to-face interview provided information about the usual periods during which upper and lower dentures were worn: during sleep, when with other people, and while eating (Appendix 9, Questions A-3A and A-6A).

Table 57 presents mean OHIP scores for examined persons according to their reported periods of denture wearing. A majority of upper denture wearers and approximately one half of lower denture wearers said that they wore those dentures on all three of the nominated occasions: when sleeping, when with others and when eating. Persons who wore dentures on all three occasions had the lowest scores for all subscales and for the standardized OHIP. The differences in scores tended to be greater with regard to lower dentures. For example, the mean standardized OHIP differed by 2.51 between persons wearing lower dentures on all occasions compared with one or two occasions, and by 1.77 for persons wearing upper dentures on all occasions compared with one or two occasions. The differences appeared substantial and were larger than most of the previously observed differences according to clinical conditions.

TABLE 57 MEAN STANDARDIZED OHIP SCORES BY OCCASIONS OF DENTURE WEARING

	Upper denture worn				Lower denture worn			
	All* occasions (n=453)		One or two occasions (n=284)		All* occasions (n=270)		One or two occasions (n=255)	
Subscale	Mean	StdDev	Mean	StdDev	Mean	StdDev	Mean	StdDev
Func Limitation	8.63	6.78	10.29	7.66	7.78	7.16	10.33	8.72
Phys Pain	7.72	6.07	9.55	6.71	6.74	6.00	9.88	7.43
Psych Discomfort	5.71	8.51	6.82	8.88	4.54	8.60	6.80	10.04
Phys Disability	4.86	5.40	6.70	7.33	4.50	5.76	6.52	7.25
Psych Disability	3.37	6.06	4.39	7.36	2.51	6.00	4.27	7.96
Social Disability	1.34	3.93	2.42	5.00	0.85	3.36	2.07	5.26
Handicap	1.69	3.61	2.89	5.94	1.17	3.21	2.59	5.72
Standardized OHIP	6.99	6.08	8.76	7.65	6.09	5.84	8.60	8.11

* All occasions = eating, sleeping and when with others.

The previous descriptive findings regarding denture disorders were evaluated statistically using analysis of variance with the OHIP subscales and the standardized OHIP as dependent variables. Separate models were constructed for upper dentures and lower dentures. The independent factors considered for each model were categorical variables: dentition status (dentate or edentulous); the type of denture (full or partial); the duration of denture wearing (all three nominated occasions or fewer than three); and examiner-assessed disorders. The selection of disorders was constrained by the frequency distributions. For the upper jaw, there were fewer than 20 cases of ulceration or "other" soft tissue lesions, and those factors were not considered in the analysis of upper dentures. For the lower jaw, there were fewer than 20 cases of hyperplasia, stomatitis, angular

cheilitis, material deficiencies, design defects or inadequate occlusion. (Some of those conditions, such as cheilitis and occlusion, were recorded only for the upper denture for persons with full upper and lower dentures.)

The significant relationships between social impact and upper dentures are presented in Table 58. The table includes the statistics from the analysis of variance as well as least squares (adjusted) means and standard errors for each level of each significant factor. The least squares means provide an indication of the magnitude and direction of effects, although in the case of the single factor models (such as the last four models in Table 58) the least squares means are identical to the observed means presented previously in Table 57).

The number of occasions on which dentures were worn was the factor most consistently associated with social impact for upper dentures (Table 58). Instability of upper dentures represented the only significant clinical factor and it was associated with functional limitation and physical disability. The largest number of explanatory factors was observed for the model in which physical disability was the dependent variable. In addition to the occasions of denture wearing and clinical stability, there was an independent effect of edentulism on physical disability. Psychological discomfort was not associated with any of the factors considered in the analysis.

TABLE 58 MULTIVARIATE MODELS* RELATING OHIP SCORES TO DENTURE-RELATED FACTORS – UPPER DENTURES

Dependent variable	Independent variable(s)	df	F	p	Group	Least squares Mean	StdErr
Funct limit	Occasions worn	1	11.2	<0.01	<3 occasions	11.4	0.53
					3 occasions	9.6	0.46
	Clinical stablity	1	9.4	<0.01	Present	11.7	0.77
					Absent	9.2	0.29
Phys Pain	Occasions worn	1	15.8	<0.01	<3 occasions	9.6	0.38
					3 occasions	7.7	0.30
Psych Disc	NO SIGNIFICANT FACTORS						
Phys Disab	Occasions worn	1	17.8	<0.01	<3 occasions	7.3	0.45
					3 occasions	5.4	0.40
	Dentition status	1	10.9	<0.01	Edentulous	7.1	0.41
					Dentate	5.6	0.44
	Clinical stability	1	7.5	<0.01	Present	7.3	0.66
					Absent	5.4	0.25
Psych Disab	Occasions worn	1	4.0	0.04	<3 occasions	4.4	0.39
					3 occasions	3.4	0.31
Social Disab	Occasions worn	1	9.6	<0.01	<3 occasions	2.4	0.26
					3 occasions	1.3	0.20
Handi-cap	Occasions worn	1	10.4	<0.01	<3 occasions	2.8	2.76
					3 occasions	1.7	0.22
Stnd OHIP	Occasions worn	1	12.1	<0.01	<3 occasions	8.8	0.40
					3 occasions	7.0	0.32

* Multivariate analysis of variance, n = 737 examined persons with upper dentures.

The findings concerning lower dentures are presented in Table 59 which has a similar layout to the previous table. Occasions of denture wearing was significant in all models for lower dentures. As was the case with upper dentures, stability was the only statistically significant clinical

variable and was confined to the models for functional limitation and psychological discomfort.

TABLE 59 MULTIVARIATE MODELS* RELATING OHIP SCORES TO DENTURE-RELATED FACTORS – LOWER DENTURES

Dependent variable	Independent variable(s)	df	F	p	Group	Least squares Mean	StdErr
Func Limit	Occasions worn	1	17.5	<0.01	<3 occasions	11.0	0.82
					3 occasions	8.2	0.50
	Clinical stability	1	5.50	0.02	Present	10.5	0.67
					Absent	8.7	0.39
Phys Pain	Occasions worn	1	31.5	<0.01	<3 occasions	10.0	0.40
					3 occasions	6.7	0.40
Psych Disc	Occasions worn	1	8.8	<0.01	<3 occasions	7.3	0.61
					3 occasions	4.9	0.59
	Clinical stability	1	3.7	0.05	Present	7.0	0.78
					Absent	5.2	0.46
Phys Disab	Occasions worn	1	13.0	<0.01	<3 occasions	6.5	0.39
					3 occasions	4.5	0.39
Psych Disab	Occasions worn	1	8.4	<0.01	<3 occasions	4.2	0.42
					3 occasions	2.5	0.42
Soc Disab	Occasions worn	1	10.2	<0.01	<3 occasions	2.2	0.28
					3 occasions	0.9	0.29
Handi-cap	Occasions worn	1	12.0	<0.01	<3 occasions	2.5	0.28
					3 occasions	1.2	0.28
Stnd OHIP	Occasions worn	1	17.7	<0.01	<3 occasions	8.6	0.42
					3 occasions	6.1	0.42

* Multivariate analysis of variance, n = 541 examined persons with lower dentures.

While these findings concerning denture-related factors suggest a limited influence of clinical parameters on social impact, it must be recognized that only relatively coarse indicators have been used to describe

dentures themselves. Within the dentate group more specific measures exist of the number and location of prosthetic replacement teeth. It is conceivable that these more specific characteristics of prosthodontic status could feature stronger associations with social impact. They are considered, along with other oral epidemiological factors, within the next section.

6.3.2.4 Tooth retention, caries experience, periodontal destruction and occlusal wear

A much larger group of oral epidemiological variables was available from the examined dentate participants in the SADLS, including measures of tooth retention, caries experience, periodontal attachment loss and occlusal wear. This section follows the planned approach for analysis, considering bivariate relationships first and multivariate relationships second.

In order to create a parsimonious presentation of bivariate relationships, correlation coefficients were computed for all of the epidemiological measures without regard to statistical significance, simply to give an indication of general trends. (Statistical significance is assessed later in the multivariate analyses.) The bivariate correlations are presented in Table 60. The main features of these findings are summarized below.

1) Correlation coefficients ranged from –0.21 to 0.33 – values which can be regarded as low or moderate.

2) Functional limitation and physical disability were the subscales which featured the strongest positive correlations – other subscales frequently had correlations which were only half the magnitude.

3) However, correlations with decayed root surfaces were high across all subscales; in the case of psychological disability and handicap the correlations were greater for this variable than any other oral epidemiological measure.

4) Missing teeth, decayed root surfaces, average periodontal recession and average loss of attachment were the epidemiological measures having the strongest positive correlations with social impact.

5) Most negative correlations were plausible: a greater number of functional units (natural or artificial teeth) should help to reduce social impact; a larger number of filled surfaces presumably represents fewer missing and fewer filled teeth (both positively correlated); and the composite measures of DFS surfaces appeared to be dominated by this effect of filled surfaces.

6) Calculus and pockets of 4+mm had negative correlations ranging to –0.12, and they appear to go against expectations.

7) While decayed coronal and root surfaces represent apparently related disease processes, they had markedly different patterns of correlation with social impact.

8) Among the periodontal variables, the three measures computed as averages across all sites (recession, pocket depth and attachment loss) were more positively associated with social impact than other periodontal variables representing a count or maximum. Indeed, average pocket depth featured positive correlations, while the number of sites with pockets 4+mm and maximum pocket depth had several negative correlations.

8) Unreplaced anterior spaces had stronger positive correlations than unreplaced posterior spaces, while functional units (the converse, approximately, of unreplaced spaces) had stronger negative correlations for the anterior teeth.

9) The three attrition measures appeared to behave as a spectrum from health through to disease: correlations for enamel attrition were negative, for dentinal attrition they were near zero, and for severe attrition they were positive.

TABLE 60 CORRELATIONS BETWEEN ORAL EPIDEMIOLOGICAL MEASURES AND SOCIAL IMPACT SCORES AMONG EXAMINED DENTATE PERSONS

	Pearson's correlation coefficient							
Epidemiological measure*	Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Social Disab	Handi-cap	Stnd OHIP
MT1	0.32	0.17	0.15	0.31	0.16	0.15	0.13	0.23
MT2	0.30	0.14	0.13	0.27	0.13	0.10	0.13	0.20
MT	0.33	0.16	0.14	0.31	0.15	0.13	0.14	0.22
SPACE1	0.19	0.08	0.13	0.21	0.10	0.06	0.07	0.14
SPACE2	0.08	0.03	0.13	0.06	0.08	0.05	0.09	0.08
SPACES	0.11	0.04	0.14	0.09	0.09	0.06	0.10	0.10
FUNIT1	-0.21	-0.07	-0.13	-0.21	-0.09	-0.02	-0.07	-0.13
FUNIT2	-0.05	-0.01	-0.12	-0.03	-0.06	-0.03	-0.07	-0.06
FUNITS	-0.09	-0.02	-0.14	-0.08	-0.08	-0.03	-0.07	-0.08
CROWNDS	-0.03	-0.01	-0.01	-0.01	0.01	0.04	0.03	0.00
ROOTDS	0.19	0.16	0.15	0.23	0.20	0.14	0.21	0.21
TOOTHDS	0.10	0.09	0.09	0.14	0.13	0.11	0.15	0.13
RROOTS	0.17	0.04	0.11	0.14	0.06	-0.00	0.03	0.09
CROWNFS	-0.18	-0.09	-0.07	-0.20	-0.09	-0.09	-0.05	-0.13
ROOTFS	-0.12	-0.04	-0.06	-0.08	-0.04	-0.05	-0.04	-0.07
TOOTHFS	-0.19	-0.09	-0.08	-0.20	-0.09	-0.10	-0.06	-0.13
CROWNDFS	-0.18	-0.09	-0.07	-0.20	-0.09	-0.09	-0.05	-0.13
ROOTDFS	-0.07	0.00	-0.02	-0.01	0.01	-0.02	0.01	-0.02
TOOTHDFS	-0.18	-0.08	-0.07	-0.19	-0.08	-0.09	-0.04	-0.12
DFSRISK	-0.00	0.01	0.00	-0.03	-0.01	-0.05	0.04	-0.00
ATTRITE	-0.15	-0.10	-0.11	-0.17	-0.10	-0.11	-0.09	-0.14
ATTRITD	0.05	0.00	0.00	0.01	0.01	0.03	-0.05	0.01
ATTRITS	0.09	0.07	0.06	0.06	0.06	0.04	0.08	0.08
AVGREC	0.19	0.10	0.11	0.17	0.05	-0.01	0.03	0.11
NRECGE4	0.09	0.08	0.08	0.06	-0.00	-0.04	-0.02	0.04
MAXREC	0.06	0.04	0.09	0.04	0.00	-0.05	-0.04	0.02
AVGPOC	0.03	0.06	0.06	0.07	0.04	0.02	0.07	0.06
NPOCGE4	-0.07	-0.01	0.03	-0.03	-0.01	-0.02	0.02	-0.01
MAXPOC	-0.06	-0.02	0.02	-0.01	-0.01	-0.03	0.00	-0.02
AVGLOA	0.16	0.10	0.10	0.17	0.05	0.00	0.05	0.10
NLOAGE4	0.05	0.08	0.08	0.05	0.00	-0.02	0.01	0.04
MAXLOA	0.07	0.06	0.10	0.06	0.01	-0.03	-0.00	0.04
NGING	-0.06	-0.05	0.03	-0.07	0.06	0.05	0.01	-0.00
NCALC	-0.12	-0.06	-0.02	-0.10	-0.02	0.03	-0.04	-0.06

* Abbreviated epidemiological measures are described fully in Table 49, page 197. n = 569 examined dentate persons.

The general impression that correlations were weak or moderate is not surprising given the different purposes and orientations of epidemiological measures compared with the OHIP. On theoretical grounds, there is no reason to expect strong correlations (say, 0.7 or more) between clinical disease parameters and social impact given that a number of intervening factors affect the pathways between the two. For example, early cavitation in a molar tooth may be asymptomatic and go unnoticed by those with the condition. However, the correlation coefficients clearly serve the purpose of demonstrating that the associations of some epidemiological measures with social impact are stronger than others. Missing teeth and decayed root surfaces had the strongest positive correlations while functional units and filled surfaces had the strongest negative correlations.

The strength of association must also be attributed in part to differential effects of tooth retention and tooth survival within this sample of older adults. For example, more extensive levels of periodontal attachment loss (measured as the number of sites with 4+mm of loss – NLOAGE4 in Table 60) are more likely to be observed among individuals with more natural teeth. Consequently, in these bivariate analyses, correlations with the extent of attachment loss would reflect higher levels of impact caused by dysfunctional or uncomfortable attachment loss and lower levels of impact associated with a more complete dentition.

For this reason it is valuable to have measures of severity (highest measure), extent (number of sites affected) and "attack" rate (average measure) for the three periodontal measures. Some of the apparently anomalous correlations among the three measures of a single parameter (for example, MAXPOC, NPOCGE4 and AVGPOC in Table 60) become more readily understood when the statistical features of each measure are considered.

Additional comment should be made about the differing effects of anterior and posterior teeth in Table 60. In the case of missing teeth (MT1 and MT2 – each representing a count of teeth missing for any reasons, whether or not they have been replaced) the patterns of correlation with each subscale were very similar. However, for anterior spaces (SPACE1 – missing teeth with unreplaced gaps) stronger positive correlations were observed with functional limitation, physical pain and physical disability than was the case for posterior spaces (SPACE2). Correlations for the remaining subscales were similar between SPACE1 and SPACE2. This probably goes against a clinical expectation that outcomes such as self-consciousness (in the psychological discomfort subscale), being upset or embarrassed (psychological disability) or avoidance of going out (social disability) would be more likely in association with anterior spaces than posterior spaces. However, the impacts with which anterior spaces (in contrast with posterior spaces) had a noticeably stronger positive correlation were: functional limitation, physical pain and physical disability. These effects of anterior versus posterior spaces were also observed with respect to functional units, although correlations for functional units were negative.

A simple way in which to describe some of the combined effects of epidemiological measures was to define "case definitions" according to four dichotomised oral epidemiological variables. Table 61 presents mean OHIP scores for individuals categorized into one of eight groups according to three dichotomies: whether or not they had fewer than 16 missing teeth; whether or not they had any decayed root surfaces; and whether or not they had average recession measurements less than one millimetre. The cut–off points corresponded to the median of the respective distributions of the independent variables, although cell sizes inevitably differed because the distributions were not normal and because the independent variables themselves would be correlated.

TABLE 61 MEAN OHIP SCORES FOR DICHOTOMISED COMBINATIONS OF ORAL EPIDEMIOLOGICAL VARIABLES

Oral status				Mean score							
Miss-ing	Root DS	Avg Rec	n	Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Soc Disab	Hand-icap	Stnd OHIP
0-15	0	<1mm	220	5.91	6.80	4.26	2.12	2.03	0.77	0.85	5.19
		1+mm	61	7.78	7.84	5.17	2.83	2.72	0.71	1.09	6.05
	1+	<1mm	44	7.03	7.84	6.85	2.41	3.06	1.17	1.62	6.37
		1+mm	23	8.73	8.72	10.50	4.16	5.09	1.28	2.43	8.11
16+	0	<1mm	110	8.92	7.85	6.53	3.59	2.96	1.11	1.69	6.82
		1+mm	113	9.97	7.99	6.64	5.27	3.55	1.86	2.05	7.68
	1+	<1mm	45	12.39	12.02	9.67	8.85	7.81	4.43	6.07	12.09
		1+mm	60	11.01	10.57	7.32	6.41	4.31	0.73	1.69	8.32

Mean levels of social impact tended to increase with each additional condition in Table 61. Among those with fewer than 16 teeth, standardized OHIP scores increased for groups with root decay, average recession of 1+mm and again for the combination of root decay and recession. The same was observed for all subscales except social disability (where persons with no root decay but recession had the lowest mean value).

The group with 16+ missing teeth (but neither root decay nor recession) had a lower mean standardized OHIP score than the group which had 0–15 missing teeth, root decay and recession. However, mean scores again tended to increase with combinations of recession and decay among the group with 16+ missing teeth. It is noteworthy that the group with 16+ missing teeth, root decay and recession less than one millimetre had the

highest mean standardized score. Recession appeared to have a reverse effect (that is, it was associated with reduced impact) for this group with 16+ missing teeth and root decay. Individual subscale variations among the groups with 16+ missing teeth generally followed the same trend as the standardized score. Two exceptions within individual subscales existed. The first was for psychological discomfort, where groups with 16+ missing teeth, decay and recession had lower mean scores than the group with fewer than 16 missing teeth. The other exceptions were the very low handicap and social disability subscale scores for the group with 16+ missing teeth, decay and recession.

A feature of Table 61 is the magnitude of variation in mean scores, which differ by more than a factor of two among the eight groups. The differences were substantially greater, for example, than those observed previously between dentate and edentulous. By way of comparison, the range is similar to the difference observed between dentate persons without dentures and the small group of edentulous persons who wore only one or no dentures (Table 53).

It should not be surprising that there are large variations among the groups of dentate persons in Table 61 since the variables used to create the eight groups were deliberately selected as those featuring the strongest bivariate correlations with social impact. On the other hand, the specific oral conditions were not rare, which demonstrates that groups of common oral conditions can be associated with apparently marked variation in social impact – variations which appeared not as strong when assessed simply with correlation coefficients.

6.3.2.5 Multivariate relationships

Multivariate analysis represents a more thorough and traditional method of examining the separate effects of the various epidemiological indices considered so far. It is also parsimonious, since it incorporates hypothesis tests which have not been conducted so far. The results presented here follow the plan of analysis. An assessment of multi-collinearity was conducted first. All variables with acceptably low collinearity were considered in stepwise regression analyses, even though some featured negligible correlations with OHIP scores in Table 61. Non-significant terms were eliminated in the regression analyses. A binary variable to code dentures as present (with a value of 1) or absent (with a value of 0) was also incorporated.

The matrix of correlation coefficients for the oral epidemiological variables considered so far are displayed in Table 62. The highest correlations existed between composite measures and their components. For example, MTEETH with MT1 and MT2; CROWNDFS with TOOTHDFS; and MAXLOA with MAXREC. There were some other correlations of 0.7 or more among variables which were not derived as arithmetic functions of each other. For example, TOOTHFS had a moderately strong negative correlation with MTEETH.

TABLE 62 MATRIX OF PEARSON'S CORRELATION COEFFICIENTS AMONG ORAL EPIDEMIOLOGICAL VARIABLES FOR REGRESSION DIAGNOSTICS

Variable number and abbreviation*		Variable number											
		1	2	3	4	5	6	7	8	9	10	11	12
1	MT1												
2	MT2	0.7											
3	MTEETH	0.9	1.0										
4	SPACE1	0.2	0.2	0.2									
5	SPACE2	-0.2	0.2	0.1	0.4								
6	SPACES	-0.1	0.2	0.1	0.6	1.0							
7	FUNIT1	-0.2	-0.2	-0.2	-0.9	-0.4	-0.5						
8	FUNIT2	0.2	-0.1	0.0	-0.4	-1.0	-0.9	0.4					
9	FUNITS	0.2	-0.1	-0.0	-0.6	-0.9	-1.0	0.6	1.0				
10	CROWNDS	-0.0	-0.0	-0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1			
11	ROOTDS	0.2	0.2	0.2	0.1	-0.0	-0.0	-0.1	0.0	-0.0	0.2		
12	TOOTHDS	0.1	0.1	0.1	0.1	-0.0	0.0	-0.1	-0.0	-0.1	0.8	0.8	
13	RROOTS	0.1	0.1	0.1	0.2	0.1	0.1	-0.5	-0.2	-0.3	0.3	0.2	0.3
14	CROWNFS	-0.6	-0.7	-0.7	-0.2	-0.1	-0.2	0.2	0.0	0.1	-0.1	-0.2	-0.2
15	ROOTFS	-0.3	-0.2	-0.3	-0.1	-0.0	-0.0	0.1	0.0	0.0	-0.1	-0.0	-0.1
16	TOOTHFS	-0.6	-0.7	-0.7	-0.2	-0.1	-0.2	0.2	0.0	0.1	-0.1	-0.2	-0.2
17	CROWNDFS	-0.6	-0.7	-0.7	-0.2	-0.1	-0.2	0.2	0.0	0.1	-0.0	-0.2	-0.1
18	ROOTDFS	-0.2	-0.1	-0.2	-0.1	-0.0	-0.0	0.1	0.0	0.0	-0.0	0.3	0.2
19	TOOTHDFS	-0.6	-0.6	-0.7	-0.2	-0.1	-0.2	0.2	0.0	0.1	-0.0	-0.1	-0.1
20	DFSRISK	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	0.1	0.1	0.1	-0.0	0.1	0.1
21	ATTRITE	-0.3	-0.3	-0.3	-0.1	0.0	0.0	0.1	-0.0	0.0	0.0	-0.1	-0.1
22	ATTRITD	-0.1	0.0	-0.0	0.0	0.1	0.1	-0.0	-0.1	-0.1	0.1	0.1	0.1
23	ATTRITS	0.0	0.0	0.0	0.1	0.1	0.1	-0.2	-0.1	-0.1	0.0	0.1	0.1
24	AVGREC	0.5	0.4	0.4	0.2	0.0	0.0	-0.1	0.0	0.0	-0.0	0.2	0.1
25	NRECGE4	0.1	0.1	0.1	0.1	0.0	0.1	-0.1	-0.0	-0.0	-0.0	0.1	0.0
26	MAXREC	0.2	0.1	0.2	0.1	0.1	0.1	-0.1	-0.1	-0.1	-0.0	0.1	0.1
27	AVGPOC	0.1	-0.1	-0.0	0.1	-0.1	-0.1	-0.1	0.1	0.0	0.1	0.1	0.1
28	NPOCGE4	-0.2	-0.3	-0.3	0.0	-0.1	-0.1	-0.0	0.1	0.1	0.0	0.0	0.0
29	MAXPOC	-0.1	-0.3	-0.2	0.1	-0.0	-0.0	-0.1	0.0	-0.0	0.0	0.0	0.0
30	AVGLOA	0.4	0.3	0.4	0.2	-0.0	0.0	-0.1	0.1	0.0	0.0	0.2	0.1
31	NLOAGE4	0.0	-0.0	-0.0	0.1	0.1	0.1	-0.1	-0.0	-0.0	0.0	0.1	0.0
32	MAXLOA	0.1	0.1	0.1	0.1	0.0	0.1	-0.1	-0.0	-0.0	-0.0	0.1	0.1
33	NGING	-0.2	-0.2	-0.2	-0.0	-0.0	-0.0	0.0	-0.0	0.0	0.2	-0.0	0.1
34	NCALC	-0.2	-0.2	-0.2	0.0	0.1	0.1	-0.0	-0.1	-0.1	0.2	-0.0	0.1

continued...

* Variable names and definitions are described in Table 49, page 197.

TABLE 62 (CONTINUED)

Variable number and abbreviation*		Variable number											
		13	14	15	16	17	18	19	20	21	22	23	24
14	CROWNFS	-0.1											
15	ROOTFS	-0.1	0.3										
16	TOOTHFS	-0.1	1.0	0.4									
17	CROWNDFS	-0.1	1.0	0.3	1.0								
18	ROOTDFS	-0.0	0.2	0.9	0.3	0.2							
19	TOOTHDFS	-0.1	1.0	0.4	1.0	1.0	0.4						
20	DFSRISK	-0.0	0.7	0.4	0.7	0.7	0.4	0.7					
21	ATTRITE	-0.1	0.1	0.1	0.1	0.1	0.0	0.1	-0.1				
22	ATTRITD	0.0	-0.1	0.0	-0.1	-0.1	0.0	-0.1	-0.1	-0.1			
23	ATTRITS	0.1	-0.1	-0.0	-0.1	-0.1	0.0	-0.0	-0.0	-0.0	0.1		
24	AVGREC	0.0	-0.4	0.1	-0.3	-0.4	0.2	-0.3	-0.1	-0.1	0.0	0.0	
25	NRECGE4	0.0	-0.2	0.3	-0.1	-0.2	0.3	-0.1	-0.1	0.0	0.0	0.1	0.7
26	MAXREC	0.0	-0.2	0.2	-0.1	-0.2	0.3	-0.1	-0.0	-0.1	0.0	0.1	0.8
27	AVGPOC	0.1	-0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.0	0.2
28	NPOCGE4	0.0	0.1	0.1	0.1	0.1	0.1	0.1	-0.0	0.0	-0.1	0.0	0.0
29	MAXPOC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-0.0	0.0	-0.1	0.0	0.1
30	AVGLOA	0.0	-0.3	0.1	-0.3	-0.3	0.2	-0.3	-0.1	-0.1	-0.0	0.0	0.9
31	NLOAGE4	0.0	-0.1	0.3	-0.1	-0.1	0.3	-0.1	-0.1	0.1	0.0	0.1	0.6
32	MAXLOA	0.1	-0.1	0.2	-0.1	-0.1	0.2	-0.1	-0.0	-0.1	0.0	0.1	0.7
33	NGING	-0.0	0.1	-0.0	0.1	0.1	-0.0	0.1	0.0	0.1	0.1	-0.0	-0.1
34	NCALC	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	0.2	0.1	-0.0	0.0

		25	26	27	28	29	30	31	32	33
26	MAXREC	0.7								
27	AVGPOC	0.2	0.2							
28	NPOCGE4	0.1	0.1	0.8						
29	MAXPOC	0.2	0.2	0.7	0.7					
30	AVGLOA	0.7	0.7	0.6	0.3	0.4				
31	NLOAGE4	0.8	0.6	0.5	0.5	0.5	0.7			
32	MAXLOA	0.7	0.8	0.6	0.4	0.6	0.8	0.8		
33	NGING	-0.0	-0.1	0.3	0.3	0.2	0.0	0.1	0.0	
34	NCALC	0.1	0.1	0.3	0.3	0.2	0.1	0.2	0.2	0.4

* Variable names and definitions are described in Table 49, page 197.

All composite variables and variables which were arithmetic functions of others were eliminated. Multi-collinearity was then assessed by examining eigenvalues of the linear predictors obtained from unweighted regression of the remaining 20 independent variables against functional limitation. The largest condition index (the condition number) was 6.5, well below the threshold of 30, and no two independent variables had variance inflation factors exceeding 0.5 for any of the eigenvalues. The results are

presented in Table 63. Hence 20 independent variables with accpetably low multi-collinearity were retained for analysis. They were: MT1, MT2, SPACE1, SPACE2, CROWNDS, ROOTDS, RROOTS, CROWNFS, ROOTFS, DFSRISK, ATTRITE, ATTRITS, AVGREC, NRECGE4, MAXREC, AVGPOC, NPOCGE4, MAXPOC, NGING, NCALC. A binary indicator variable for prosthodontic status (0 = no denture, 1 = 1+ dentures) was also considered.

TABLE 63 EIGENVALUES AND VARIANCE INFLATION FACTORS FOR ORAL EPIDEMIOLOGICAL VARIABLES

Eigenvalue No.	Eigenvalue value	Condition number	Variance inflation factors for variable* MT1	MT2	SPACE1	SPACE2	CROWNDS
1	3.54	1.00	0.01	0.01	0.01	0.00	0.00
2	3.16	1.06	0.00	0.00	0.00	0.00	0.00
3	2.20	1.27	0.00	0.00	0.01	0.01	0.02
4	1.60	1.48	0.02	0.00	0.01	0.06	0.00
5	1.50	1.54	0.00	0.00	0.04	0.02	0.09
6	1.30	1.65	0.00	0.00	0.09	0.06	0.13
7	1.00	1.88	0.00	0.01	0.04	0.08	0.00
8	0.87	2.01	0.00	0.01	0.00	0.02	0.03
9	0.83	2.06	0.00	0.00	0.01	0.00	0.01
10	0.68	2.29	0.04	0.03	0.00	0.00	0.00
11	0.66	2.31	0.01	0.01	0.18	0.05	0.05
12	0.54	2.56	0.00	0.03	0.33	0.21	0.01
13	0.51	2.62	0.00	0.00	0.06	0.00	0.55
14	0.50	2.67	0.01	0.00	0.03	0.00	0.04
15	0.30	3.46	0.00	0.00	0.01	0.00	0.01
16	0.27	3.62	0.00	0.01	0.01	0.00	0.00
17	0.18	4.42	0.03	0.01	0.00	0.00	0.01
18	0.16	4.73	0.25	0.37	0.14	0.33	0.01
19	0.13	5.19	0.49	0.21	0.04	0.16	0.00
20	0.08	6.51	0.13	0.29	0.00	0.00	0.04

continued...

* Variable names and definitions are described in Table 49, page 197.

TABLE 63 (CONTINUED)

Variance inflation factors for variable*:

No.	ROOTDS	RROOTS	CROWNFS	ROOTFS	DFSRISK	ATTRITE	ATTRITS
1	0.01	0.00	0.01	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.01	0.01	0.05	0.02	0.00	0.00
4	0.02	0.01	0.00	0.01	0.01	0.09	0.01
5	0.05	0.15	0.00	0.01	0.02	0.01	0.05
6	0.03	0.00	0.00	0.00	0.00	0.03	0.03
7	0.01	0.02	0.00	0.01	0.01	0.06	0.45
8	0.37	0.23	0.00	0.00	0.01	0.00	0.12
9	0.24	0.02	0.00	0.02	0.00	0.30	0.22
10	0.12	0.01	0.00	0.17	0.02	0.25	0.06
11	0.00	0.00	0.02	0.28	0.01	0.14	0.00
12	0.01	0.01	0.00	0.21	0.01	0.08	0.00
13	0.03	0.45	0.00	0.00	0.01	0.03	0.02
14	0.01	0.05	0.01	0.01	0.04	0.00	0.01
15	0.00	0.00	0.00	0.00	0.01	0.00	0.00
16	0.00	0.01	0.00	0.00	0.00	0.00	0.00
17	0.00	0.01	0.00	0.02	0.02	0.01	0.02
18	0.01	0.00	0.01	0.01	0.02	0.00	0.00
19	0.02	0.03	0.01	0.00	0.01	0.00	0.00
20	0.08	0.00	0.92	0.20	0.78	0.01	0.00

Variance inflation factors for variable*:

No.	AVGREC	NRECGE4	MAXREC	AVGPOC	NPOCGE4	MAXPOC	NGING	NCALC
1	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2	0.00	0.01	0.01	0.02	0.02	0.02	0.01	0.01
3	0.01	0.01	0.01	0.00	0.00	0.00	0.02	0.03
4	0.00	0.01	0.01	0.02	0.01	0.01	0.00	0.02
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.04
7	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.02
9	0.00	0.00	0.00	0.00	0.00	0.01	0.11	0.01
10	0.00	0.01	0.02	0.01	0.00	0.00	0.11	0.00
11	0.01	0.00	0.01	0.00	0.01	0.00	0.04	0.00
12	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.10
13	0.00	0.00	0.00	0.01	0.00	0.01	0.21	0.01
14	0.00	0.01	0.00	0.00	0.00	0.01	0.34	0.63
15	0.00	0.04	0.07	0.02	0.38	0.63	0.01	0.06
16	0.00	0.50	0.56	0.00	0.09	0.06	0.00	0.00
17	0.03	0.00	0.06	0.83	0.46	0.17	0.00	0.00
18	0.35	0.09	0.16	0.03	0.01	0.01	0.00	0.02
19	0.56	0.28	0.07	0.05	0.01	0.04	0.00	0.01
20	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.03

* Variable names and definitions are described in Table 49, page 197.

Table 64 presents findings from stepwise regression analyses which used the 20 oral epidemiological measures as independent variables within separate models for each subscale and the standardized OHIP. The main features of the models are:

1) Missing anterior teeth (MT1) was significantly associated with all OHIP subscales. Parameter estimates varied from 0.57 (functional limitation) to 0.20 (handicap) and therefore were approximately proportionate to the means for those scales (see Table 42), indicating a similar strength of effect of missing teeth on each subscale.

2) Decayed root surfaces (ROOTDS) were significantly associated with all OHIP subscales, although parameter estimates were approximately 1.0 for each. This indicates a relatively greater effect within the psychosocial subscales which had smaller mean scores.

3) For all except two subscales, SPACE2 was a significant term. However for physical pain and physical disability, neither SPACE2 nor MT2 were significant, indicating no independent effects of posterior tooth loss.

4) Periodontal variables appeared in four models, although the variables and the direction of their effects were quite inconsistent. For example, calculus was associated with less functional limitation, gingivitis with more psychological disability, recession with less social disability and handicap, and pocket depth with more handicap.

7) The amount of variance explained by the regression models was no greater than fifteen per cent (for functional limitation and physical disability) and was as low as four per cent for physical pain. This is

not surprising, for two reasons. First, the epidemiological measures are not intended necessarily to detect symptoms (such as pain) or the non-clinical consequences of disease. Second, social surveys which use individuals as the unit of analysis in general can be expected to provide only limited explanatory power of variation among those individuals. Consequently, the focus of interpretations from these models has been on the magnitude and sign of parameter estimates rather than R^2.

TABLE 64 MULTIVARIATE* MODELS RELATING ORAL EPIDEMIOLOGICAL MEASURES TO OHIP SCORES

No.	Dependent variable	Independent variable†	Parameter estimate	StdErr	F	p	Model R^2
i)	Functional limitation	MT1	0.57	0.08	56.8	<0.01	0.150
		SPACE2	0.19	0.05	11.5	<0.01	
		ROOTD	0.77	0.24	10.7	<0.01	
		RROOTS	1.01	0.35	8.4	<0.01	
		NCALC	-0.06	0.03	4.3	0.04	
ii)	Physical pain	MT1	0.28	0.07	13.8	<0.01	0.044
		ROOTD	0.83	0.24	11.8	<0.01	
iii)	Psychological discomfort	MT1	0.36	0.10	14.0	<0.01	0.059
		SPACE2	0.29	0.07	16.1	<0.01	
		ROOTD	0.99	0.31	10.5	<0.01	
iv)	Physical disability	MT1	0.44	0.06	48.8	<0.01	0.150
		SPACE1	1.03	0.26	15.6	<0.01	
		ROOTD	0.93	0.20	20.9	<0.01	
v)	Psychological disability	MT1	0.29	0.07	15.4	<0.01	0.071
		SPACE2	0.15	0.05	7.4	<0.01	
		ROOTD	1.07	0.23	21.4	<0.01	
		NGING	0.16	0.07	5.0	0.02	
vi)	Social disability	MT1	0.22	0.05	19.5	<0.01	0.052
		SPACE2	0.07	0.03	4.7	0.03	
		ROOTD	0.49	0.15	11.2	<0.01	
		AVGREC	-0.51	0.18	7.8	0.01	
vii)	Handicap	MT1	0.24	0.06	13.0	<0.01	0.076
		SPACE2	0.15	0.04	11.3	<0.01	
		ROOTD	0.86	0.16	26.3	<0.01	
		MAXREC	-0.25	0.10	6.6	0.01	
		AVGPOC	0.63	0.30	4.5	0.03	
viii)	Standardized OHIP	MT1	0.40	0.07	31.9	<0.01	0.096
		SPACE2	0.17	0.05	10.4	<0.01	
		ROOTD	1.06	0.23	22.1	<0.01	

* Multivariate analysis using least squares regression (weighted n = 569 dentate persons) with stepwise backward elimination. Independent variables considered in each model: MT1, MT2, SPACE1, SPACE2, CROWNDS, ROOTDS, RROOTS, CROWNFS, ROOTFS, DFSRISK, ATTRITE, ATTRITS, AVGREC, NRECGE4, MAXREC, AVGPOC, NPOCGE4, MAXPOC, NGING, NCALC. A binary indicator variable for prosthodontic status (0 = no denture, 1 = 1+ dentures) was also considered.

† Variable names and definitions are described in Table 49, page 197.

Table 64 emphasizes the effects of the individual components of epidemiological indices. Composite measures (such as DFS) were excluded because of multi-collinearity and because it was assumed that those measures may mask any independent associations between social impact and the separate component measures (such as decayed surfaces and filled surfaces). However indices such as DFS are used so widely that it is appropriate to examine their relationships with social impact. When separate regression models were constructed using only missing teeth, and the composite measures of coronal DFS, root DFS and average loss of attachment, none of the composite measures were significant. The total number of missing teeth was the only significant term in the models for the seven subscales and the standardized OHIP.

While tooth loss was strongly associated with all forms of impact the association was far from simple. There was a distinction between missing teeth and unreplaced spaces which was reasonably consistent for all models in Table 64. Missing anterior teeth appeared to be associated with higher levels of impact, regardless of whether those teeth were replaced. This is indicated by the presence within the regression models of the MT1 variable, which was retained in preference to the SPACE1 variable. It indicates the importance of tooth loss as such, rather than "untreated" tooth loss. It may suggest, for example, that there are basic limitations in the capacity of anterior prosthodontic units to restore functional and psychosocial well-being. On the other hand, posterior tooth loss contributed independently to social impact if there were unreplaced spaces, as indicated by the SPACE2 variable. This could be taken to indicate that the mechanism by which posterior tooth loss causes impact is principally through chewing, and that prosthodontic replacement works well to restore chewing function. It could have fundamental implications: for example, it may be taken to indicate

that extraction of posterior teeth would have little social impact, provided those teeth can be replaced.

As a first step in the further assessment of tooth loss, standardized OHIP values were examined among groups with specific combinations of missing teeth and unreplaced spaces. Figure 10 presents the observed mean standardized OHIP scores among eight groups, dichotomised according to the presence or absence of: three or more missing anterior teeth; seven or more posterior spaces; and one or more decayed root surfaces. (Decayed root surfaces were included in these categories in order to control for the other consistent term in the regression model from Table 64.) The effect of posterior spaces can be observed by comparing the white and shaded pairs of bars. The effect was strongest for persons with few missing anterior teeth, and virtually absent for persons with 3+ missing anterior teeth.

Figure 11 follows a similar format, using the presence or absence of 13 or more missing posterior teeth (contrasted in white and grey bars) instead of seven or more posterior spaces. Again, the effect of missing posterior teeth appeared to be substantial if there were few missing anterior teeth (Figure 11). However, there appeared to be a large inverse effect of missing posterior teeth among persons with root decay and three or more missing anterior teeth.

FIGURE 10 OBSERVED MEAN STANDARDIZED OHIP SCORES FOR TOOTH LOSS GROUPS – POSTERIOR SPACES

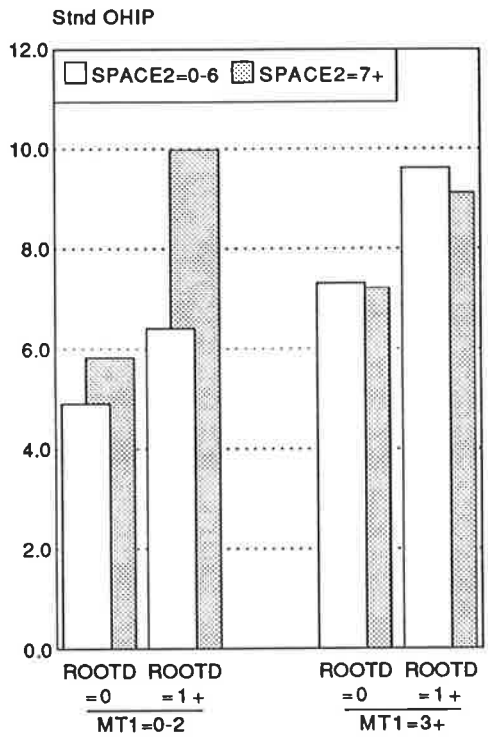
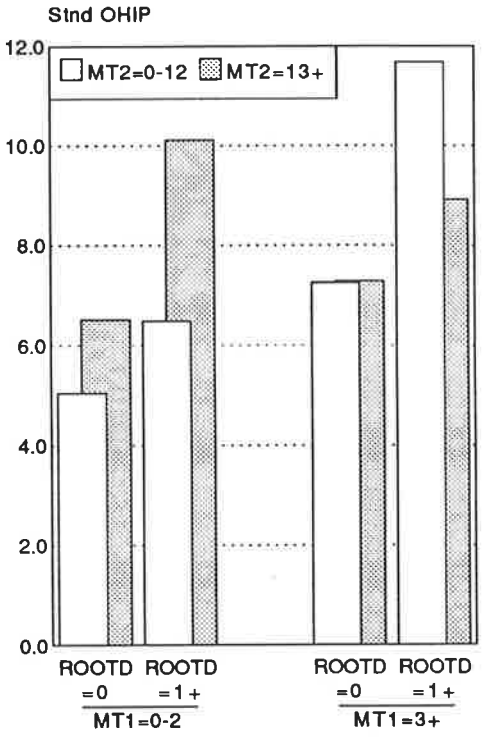


FIGURE 11 OBSERVED MEAN STANDARDIZED OHIP SCORES FOR TOOTH LOSS GROUPS – POSTERIOR MISSING TEETH



While the effects of posterior spaces (Figure 10) appear to differ compared with the effects of posterior missing teeth (Figure 11), the categorizations were relatively crude dichotomies. Consequently, the relationships were analyzed using linear regression to capture variations and to statistically evaluate the effects. Four different models were constructed, all using the standardized OHIP as dependent variable. The first model used missing anterior teeth, posterior spaces and decayed root surfaces as independent variables, and therefore was identical to the model in Table 64, (model (viii)). The second model used missing posterior teeth instead of posterior spaces. Each model was then analyzed for second order interactions to create Models 3 and 4 in Table 65.

TABLE 65 MULTIVARIATE RELATIONSHIPS* BETWEEN POSTERIOR TOOTH LOSS AND STANDARDIZED OHIP SCORES

MODEL 1†				MODEL 2			
Term	F	p	Esti-mate	Term	F	p	Esti-mate
MT1	31.9	<0.01	0.40	MT1	39.6	<0.01	0.32
SPACE2	10.4	<0.01	0.17	MT2	1.4	0.24	0.04
ROOTD	22.1	<0.01	1.06	ROOTD	21.5	<0.01	1.06

MODEL 3				MODEL 4			
Term	F	p	Esti-mate	Term	F	p	Esti-mate
MT1	19.7	<0.01	0.51	MT1	12.4	<0.01	1.05
SPACE2	9.7	<0.01	0.23	MT2	3.8	0.05	0.13
ROOTD	22.2	<0.01	1.06	ROOTD	22.7	<0.01	1.09
MT1*SPACE2	1.3	0.24	-0.02	MT1*MT2	6.7	<0.01	-0.05

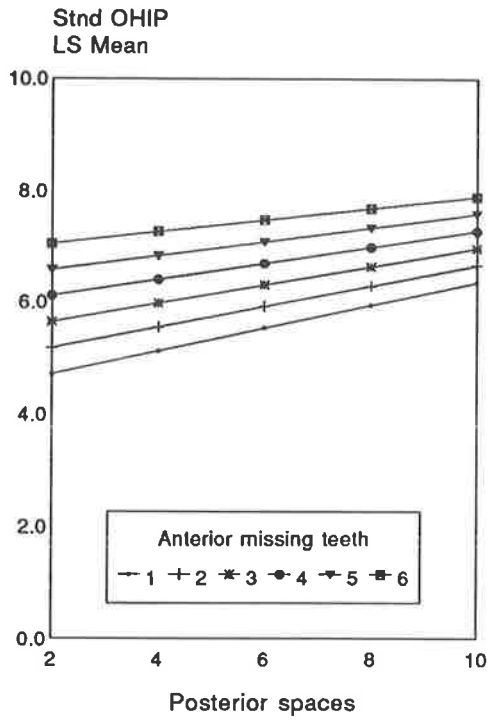
* Multivariate analysis using least squares regression.
† Model 1 previously presented in Table 64, model (viii).

Missing posterior teeth in Model 2 did not have an independent effect on the standardized OHIP, after controlling for anterior missing teeth and decayed root surfaces. As noted previously, unreplaced posterior spaces did have an independent effect (Model 1). When the interaction between anterior missing teeth and posterior unreplaced spaces was added to Model 1, it was not statistically significant (Model 3, $p = 0.24$). As well, the parameter estimate for the interaction term was near zero and substantially smaller in absolute value than the estimate for posterior spaces. In contrast, the interaction between anterior missing teeth and posterior missing teeth was statistically significant (Model 4, $p<0.01$). As anticipated from the bar chart presented previously (Figure 10) the sign of the

parameter estimate for the interaction term in Model 4 was negative, and was closer to the absolute value of the estimate for posterior missing teeth. In other words, there was an indication that missing posterior teeth would be associated with less social impact among groups with larger numbers of missing anterior teeth.

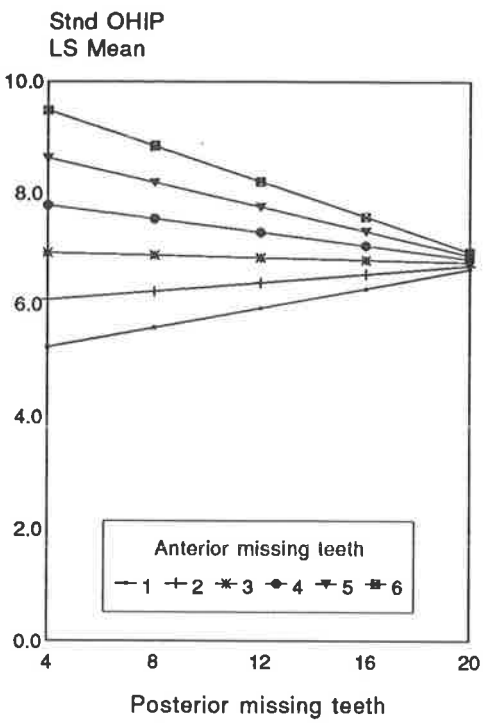
The effects can be observed graphically using the least squares (or adjusted) means from the regression models. Least squares means were obtained for Models 3 and 4 with the SAS PROC GLM using the "ESTIMATE" option. Values for the independent variables were nominated to range above and below the means for the various tooth loss parameters by approximately one standard deviation. The findings are presented in Figures 12 and 13, which correspond to Models 3 and 4 respectively from Table 65. Note that the horizontal axes vary between the two graphs. In Figure 12, least squares means for the standardized OHIP increased quite consistently as the number of posterior spaces increased, regardless of the number of missing anterior teeth. This is demonstrated by the near parallel nature of the regression lines. (Note that the interaction term from Model 3, Table 65 has been retained for the calculation of least squares means in Figure 12, despite the lack of statistical significance of the interaction.) In Figure 13, standardized OHIP scores increased with increasing numbers of missing posterior teeth only among groups with less than three missing anterior teeth. As suggested previously, groups with larger numbers of missing anterior teeth showed an inverse relationship between missing posterior teeth and social impact.

FIGURE 12 LEAST SQUARES MEANS* FOR TOOTH LOSS GROUPS – POSTERIOR SPACES



* Least squares means from Model 3, Table 65

FIGURE 13 LEAST SQUARES MEANS* FOR TOOTH LOSS GROUPS – POSTERIOR MISSING TEETH



* Least squares means from Model 4, Table 65

At first appearance, the findings from Figures 12 and 13 might appear to be anomalous. However, the inverse relationships in Figure 13 probably are related to a greater tendency by persons with more than three missing anterior teeth to wear full upper dentures. For example, the group with six missing anterior teeth (the top regression line in each graph) would include a large proportion with full upper dentures (who therefore would have at least 10 missing posterior teeth, and possibly as many as 20). They would be likely to report less social impact than a group with six missing anterior teeth and correspondingly smaller numbers of posterior spaces (say, less than 10), since this second group would probably be reliant on partial dentures with complex designs to replace quite large numbers of anterior and posterior teeth. As well, this second group would be likely to have some posterior spaces (unreplaced teeth) while the full denture wearers would

have no spaces in the upper jaw. Consequently, the partial denture wearers would contribute to the positive slope of the regression line in Figure 12. Another likely contributing factor is that persons with both anterior and posterior missing teeth would be more resigned to their levels of impairment, and have managed to cope with it.

The findings help to clarify the effects of tooth loss within the earlier regression models (Table 64) which used only first order terms with no interactions. These more detailed analyses suggest that it is the typical patterns of tooth loss and (apparently) the configurations of tooth replacement within the population which have modified the effects of tooth loss. The findings should dispel any misinterpretation that the extraction of posterior teeth is unimportant.

6.3.3 Non-epidemiological characteristics associated with social impact

Non-epidemiological characteristics include sociodemographic characteristics, reported medical conditions and aspects of dental services utilization. Data concerning those characteristics were obtained from the face-to-face interviews conducted at participants' households. This section begins with descriptive statistics and then examines bivariate and multivariate relationships between the non-epidemiological characteristics and OHIP subscales.

6.3.3.1 Descriptive statistics

The percentages of persons with key sociodemographic characteristics are presented in Table 66. The percentages are reported for the full sample of persons who completed the face-to-face interview and the OHIP. In addition, dentate and edentulous subgroups are reported. These represent larger numbers of persons than the examined groups considered so far,

since some 26 per cent of interviewed persons did not complete an oral examination.

Due to the weighting scheme, the age and sex characteristics of the sample in Table 66 is representative of the Adelaide and Mt Gambier populations. As expected, the edentulous subgroup had a higher percentage of persons aged 80+ years, and a larger percentage of females. The majority of interviewed persons were born in Australia or the UK/Eire. Dental visit characteristics are reported also in Table 66. Approximately one half of dentate persons had made a dental visit in the previous year, although only one quarter visited regularly. Edentulous persons were less likely to have visited during the previous year and virtually none had regular check-ups. Within both subgroups approximately three-quarters of visits were to a private dentist. There were marked variations in dental insurance and perceived needs for dental care, both of which were more frequent among dentate persons. Approximately two thirds of dentate persons reported an extraction within the previous 20–year period, compared with only one quarter of edentulous persons.

TABLE 66 DISTRIBUTION OF SOCIODEMOGRAPHIC AND DENTAL VISIT CHARACTERISTICS AMONG INTERVIEWED PERSONS

Variable*	Group	% of persons All (n=1213)	Dentate (n=677)	Edentulous (n=537)
Age	60-69 yrs	52.8	62.2	41.0
	70-79 yrs	37.2	31.3	44.7
	80+ yrs	10.0	6.5	14.3
Sex	Male	45.8	50.4	39.9
	Female	54.2	49.6	60.1
County of birth (F2)	Australia	64.6	64.6	64.7
	UK/Eire	20.4	18.2	23.2
	Other	15.0	17.3	12.1
Dental visits				
Period since last visit (B1)	<1 year	46.8	68.0	19.8
	1-2 years	12.1	12.3	11.7
	>2-5 years	16.5	11.6	22.9
	>5-10 years	10.6	4.6	18.3
	10+ years	14.0	3.6	27.3
Usual reason for visit (B3)	Regular check-up	27.9	48.6	1.2
	Discomfort/fixed	72.1	51.4	98.8
Site of last visit (B4)	Private	77.7	74.3	81.9
	Public	22.3	25.7	18.1
Dental insurance (B7)	Yes	42.8	50.4	33.1
	No	57.2	49.6	66.9
Perceived need for care (B6)	Yes	25.9	32.2	18.2
	No	74.1	67.8	81.8
Period since last extraction (B5)	0-10 yrs	27.7	47.2	5.1
	11-20 yrs	20.7	21.9	19.2
	21-30 yrs	12.7	14.4	10.8
	31-40 yrs	17.0	8.3	27.0
	41+ yrs	21.9	8.2	37.9

continued...

* Question numbers in parentheses refer to the face-to-face questionnaire (Appendix 9).

TABLE 66 (CONTINUED)

Variable*	Group	% of persons: All (n=1213)	Dentate (n=677)	Edentulous (n=537)
Health benefit card (B8)†	PHBC	58.8	50.4	68.7
	DVA	9.2	9.6	8.8
	None	32.3	40.0	22.5
Difficulty paying $100 dental bill (B10)	None	50.3	54.5	44.9
	Hardly any	11.3	10.5	12.3
	A little	20.7	20.4	21.1
	A lot	17.7	14.6	21.7
Live alone (E1)	Alone	24.6	20.0	30.5
	With others	75.4	80.0	69.5
Residential ownership (E2)	Own	81.5	88.4	72.9
	Rent	18.5	11.6	27.1
Education – age left school (F4)	None/<14 yrs	11.3	11.6	10.9
	14 yrs	38.1	30.2	48.2
	15 yrs	18.9	20.2	17.3
	16 yrs	14.1	16.7	10.9
	17+ yrs	17.6	21.3	12.9
Annual household income (F6) ('000s)	<$8	12.0	9.2	15.4
	$8-<$12	19.7	15.8	24.6
	$12-<$16	30.5	31.6	29.0
	$16-<$20	12.8	13.4	12.0
	$20-<$30	16.0	18.8	12.5
	$30+	9.1	11.1	6.5
Chronic medical conditions (D1)	None	15.2	18.9	10.6
	One	27.3	31.6	22.0
	Two	28.1	24.2	32.9
	Three	15.9	12.4	20.3
	Four+	13.6	13.0	14.3
Home care services (D2)	Yes	7.7	7.2	8.3
	No	92.3	92.8	91.7

* Question numbers in parentheses refer to the face-to-face questionnaire (Appendix 9).

† PHBC = Pensioner health benefit card (eligible for care at public clinics). DVA = Department of Veterans' Affairs card (not eligible for care at public clinics).

Differences between dentate and edentulous persons also were observed with regard to health benefit card entitlement, financial hardship, living arrangements and the socio-economic characteristics of educational

attainment and household income (Table 66). Edentulous persons tended to be more disadvantaged on each of those characteristics. In part, the variations observed between dentate and edentulous are likely to be attributable to the age and sex variations described first in Table 66.

6.3.3.2 Bivariate relationships

A single summary statistic was used to provide an indication of the direction and magnitude of bivariate relationships between social impact and the sociodemographic and dental visit characteristics. The summary statistic was the z-score for each subscale and the standardized OHIP. The z-score represents the number of standard deviations by which a particular subgroup's mean subscale or standardized OHIP score is above or below the sample mean. Hence a value of +0.10 would indicate a subgroup in which the subscale score exceeded the sample mean by one tenth of a standard deviation. The main benefit of the statistic is its consistency across subscales, since a difference of +0.10 standard deviations indicates the same direction and relative magnitude of variation even in subscales which have quite different means and distributions within the sample.

Table 67 presents the findings for all persons who completed the face-to-face questionnaire and OHIP. The first characteristic is edentulism, presented primarily to give an indication of the magnitude of variation which can be anticipated from the statistic. As described previously (Table 52), the standardized OHIP score differed by 0.58 in absolute value between dentate and edentulous persons. In Table 67 dentate persons had a standardized OHIP which was 0.06 standard deviations below the sample mean while edentulous persons were 0.07 standard deviations above the sample mean. The variation between dentate and edentulous in Table 67 was greatest (0.38 standard deviations) for physical disability.

TABLE 67 DEMOGRAPHIC GROUP VARIATIONS IN SOCIAL IMPACT

Group	Weighted no. of persons	Standard deviations of difference from sample mean for subscale: Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Social Disab	Handi-cap	Stnd OHIP
		ALL PERSONS (weighted n=1,214)							
Dentition									
Dentate	677	-0.07	-0.01	0.02	-0.17	-0.04	-0.05	-0.03	-0.06
Edentulous	537	0.08	0.01	-0.03	0.21	0.04	0.07	0.04	0.07
		DENTATE PERSONS (weighted n=677)							
Age									
60-69	421	-0.00	0.03	0.10	-0.15	0.01	-0.02	-0.02	-0.01
70-79	212	-0.14	-0.03	-0.09	-0.19	-0.09	-0.09	-0.05	-0.11
80+	44	-0.31	-0.27	-0.15	-0.21	-0.21	-0.14	-0.07	-0.23
Sex									
Male	341	0.02	0.06	0.00	-0.10	0.04	0.03	0.00	0.01
Female	335	-0.16	-0.08	0.04	-0.23	-0.11	-0.14	-0.07	-0.12
Country of Birth									
Aust	437	-0.11	-0.08	-0.05	-0.23	-0.09	-0.07	-0.08	-0.12
UK/Eire	123	-0.11	0.03	0.05	-0.16	-0.06	-0.18	-0.15	-0.10
Other	117	0.14	0.22	0.27	0.06	0.21	0.17	0.27	0.22
		EDENTULOUS PERSONS (weighted n=537)							
Age (yrs)									
60-69	220	0.10	0.11	-0.03	0.27	0.13	0.19	0.11	0.15
70-79	240	0.03	-0.10	-0.05	0.12	-0.06	-0.05	-0.08	-0.03
80+	77	0.19	0.08	0.02	0.33	0.12	0.07	0.20	0.17
Sex									
Male	214	0.21	0.13	-0.05	0.35	0.10	0.17	0.10	0.17
Female	323	0.00	-0.07	-0.02	0.12	0.01	-0.00	0.00	0.01
Country of birth									
Aust	347	0.06	-0.02	-0.05	0.15	0.03	0.01	0.01	0.03
UK/Eire	125	0.21	0.07	-0.04	0.44	0.13	0.20	0.15	0.19
Other	65	-0.01	0.04	0.11	0.10	-0.04	0.10	-0.00	0.05

Among dentate persons, standardized OHIP scores were higher for younger age-groups compared with older, for males compared with females, and for persons born in other countries beside Australia, UK and Eire. Age differences were most marked for psychological discomfort, sex differences were most marked for social disability, and country of birth differences were

most marked for handicap. Demographic variations among edentulous persons followed a different pattern. The oldest age group (80+ years) had the highest standardized OHIP, although this was not consistent across subscales – for example, the youngest group of edentulous persons had high levels of psychological disability. Men again had higher subscale and standardized OHIP scores compared with women, although the variation was greatest for functional limitation. Edentulous persons born in the UK or Eire had the highest standardized OHIP, although this was not observed throughout all subscales.

The trends observed in Table 67 varied in magnitude for different OHIP subscales and the standardized OHIP, although there appeared to be no single subscale which featured larger patterns of variation than any other subscale. This differs from the correlations between oral epidemiological measures and social impact measures observed earlier, where functional limitation and physical disability subscales frequently had stronger associations with clinical parameters than the psychosocial subscales.

Table 68 presents variations in OHIP values among groups defined by dental visit characteristics. Variations are expressed again as z-scores. The period since last dental visit had an inconsistent association with social impact for dentate and edentulous groups. The highest impact for dentate persons was observed for those who attended between one and two years ago, while for edentulous the highest impact was among those who attended in the last year. Those attending five or more years ago tended to have the lowest social impact values, both for dentate and edentulous. The rather complicated pattern no doubt reflects various motives and barriers to the receipt of care. For example, individuals who experience certain symptoms are more likely to seek care for dental problems, and therefore appear in the group which visited during the previous year. As well, edentulous persons who received a denture within the previous year probably went through a

period of discomfort and dysfunction as they adjusted to the dentures. On the other hand, those who have few or minimal dental problems may simply avoid dental care altogether, and appear in the groups who attended more than five years previously.

There were higher levels of impact reported by those who attend for problems compared with check-ups, those who last attended a public clinic compared with private, and non-insured persons compared with insured (Table 68). These effects tended to be consistent for dentate and edentulous groups. No doubt some of these factors also influence the previously noted relationships with the period since last visit. For example, waiting lists for routine check-up visits at public dental clinics typically exceeded one year while insured persons would be more likely to make a dental visit within the previous year.

TABLE 68 DENTAL UTILIZATION GROUP VARIATIONS IN SOCIAL IMPACT

Group	Weighted no. of persons*	Standard deviations of difference from sample mean for subscale: Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Social Disab	Handi-cap	Stnd OHIP
DENTATE PERSONS (weighted n=677)									
Last visit									
<1 yr	458	-0.10	0.00	-0.01	-0.23	-0.05	-0.07	-0.04	-0.08
1-2 yrs	83	0.24	0.20	0.20	0.24	0.20	0.21	0.17	0.24
>2-5 yrs	78	-0.11	-0.09	-0.02	-0.17	-0.09	-0.15	-0.03	-0.11
>5-10 yrs	31	-0.04	-0.15	0.10	-0.19	-0.25	-0.09	-0.30	-0.15
>10 yrs	24	-0.20	-0.37	0.14	-0.33	-0.11	-0.14	-0.15	-0.19
Usual reason†									
Regular	327	-0.22	-0.15	-0.11	-0.33	-0.16	-0.21	-0.17	-0.22
Problems	346	0.08	0.12	0.15	-0.02	0.09	0.10	0.10	0.10
Site of visit									
Private/tech	500	-0.19	-0.11	-0.08	-0.29	-0.14	-0.14	-0.12	-0.18
Public	173	0.29	0.28	0.33	0.18	0.28	0.21	0.23	0.30
Dental insurance									
Yes	339	-0.22	-0.08	-0.11	-0.33	-0.16	-0.16	-0.14	-0.20
No	334	0.08	0.07	0.15	-0.01	0.09	0.06	0.08	0.09
Perceived need									
Yes	208	0.37	0.44	0.51	0.16	0.31	0.17	0.17	0.36
No	439	-0.27	-0.21	-0.21	-0.33	-0.20	-0.18	-0.14	-0.26
Last extraction									
0-10 yrs	280	0.23	0.22	0.31	0.07	0.19	0.09	0.18	0.21
11-20 yrs	130	-0.20	-0.04	-0.13	-0.30	-0.17	-0.14	-0.11	-0.18
21-30 yrs	85	-0.29	-0.24	-0.15	-0.35	-0.16	-0.18	-0.27	-0.28
31-40 yrs	49	-0.28	-0.29	-0.22	-0.34	-0.33	-0.11	-0.28	-0.31
41+ yrs	48	-0.46	-0.31	-0.34	-0.54	-0.26	-0.18	-0.23	-0.39
EDENTULOUS PERSONS (weighted n=537)									
Last visit									
<1 yr	105	0.52	0.60	0.38	0.73	0.47	0.39	0.35	0.57
1-2 yrs	62	-0.24	-0.18	-0.35	-0.04	-0.27	-0.12	-0.15	-0.23
>2-5 yrs	121	0.22	0.05	0.16	0.32	0.11	0.21	0.09	0.19
>5-10 yrs	97	-0.21	-0.30	-0.32	-0.05	-0.10	-0.16	-0.08	-0.20
>10 yrs	144	-0.02	-0.15	-0.13	0.04	-0.11	-0.07	-0.07	-0.09
Site of visit									
Private/tech	436	-0.07	-0.13	-0.16	0.10	-0.08	-0.02	-0.06	-0.07
Public	96	0.76	0.64	0.55	0.69	0.59	0.47	0.49	0.70
Dental insurance									
Yes	176	0.01	-0.05	-0.16	0.07	0.05	-0.01	-0.01	-0.02
No	356	0.12	0.03	0.03	0.29	0.05	0.11	0.07	0.12
Perceived need									
Yes	94	0.72	0.63	0.67	0.77	0.69	0.60	0.58	0.77
No	424	-0.06	-0.12	-0.19	0.09	-0.12	-0.06	-0.09	-0.09
Last extraction									
0-10 yrs	26	1.01	0.51	0.65	1.27	0.88	1.45	1.41	1.20
11-20 yrs	99	0.12	0.00	-0.15	0.37	0.01	0.07	-0.07	0.06
21-30 yrs	56	0.14	0.15	0.12	0.26	0.19	0.04	-0.04	0.14
31-40 yrs	138	-0.07	-0.10	-0.10	-0.01	-0.13	-0.12	-0.06	-0.10
41+ yrs	194	0.08	0.04	0.00	0.18	0.07	0.02	0.03	0.07

* "Don't know" or non-responses excluded.

† Usual reason for edentulous persons excluded due to insufficient persons visiting regularly.

Dentate and edentulous persons who had perceived needs for dental care, or who had received an extraction within the last 10 years reported very high levels of social impact (Table 68). For dentate persons, there was a difference of 0.60 standard deviations in the standardized OHIP between the subgroups reporting extractions 0-10 years ago and 41+ years ago. For edentulous persons, the difference was 1.13 standard deviations. It should also be noted that there were significantly fewer cases available for assessment of period since last extraction: 592 dentate persons compared with 674 for most other questions, and 513 edentulous persons compared with 532 for most other questions (Table 68).

Other non-epidemiological factors are investigated in Table 69. Again, the variation in OHIP values (expressed in standard deviations) is presented for dentate and edentulous persons. The general interpretation is that higher levels of social impact were reported by those who are disadvantaged. The effects were most noticeable with regard to household income and difficulty paying a $100 dental bill. For example, among dentate persons there was variation of 0.61 standard deviations between a lot and no difficulty paying a $100 bill. For edentulous, the difference was 0.66 standard deviations. Although less marked, there were greater levels of impact reported by those who lived alone, those who rented their accommodation, and those who left school at an earlier age (although the latter effect was less consistent among edentulous). Among dentate persons there were comparatively small differences according to medical conditions and receipt of home help such as nursing or meals. However, for edentulous persons these effects were more pronounced. As noted for Tables 67 and 68 the variations among groups seemed to be fairly consistent for individual subscales.

TABLE 69 SOCIOECONOMIC GROUP VARIATIONS IN SOCIAL IMPACT

Group	Weighted no. of persons*	Standard deviations of difference from sample mean for subscale: Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Social Disab	Handi-cap	Stnd OHIP
		DENTATE PERSONS (weighted n=677)							
Health benefit card									
PHBC	340	0.02	0.04	0.14	-0.04	0.06	0.02	0.06	0.05
Repat Card	64	-0.06	-0.12	-0.10	-0.19	-0.20	-0.12	-0.16	-0.16
None	270	-0.18	-0.05	-0.10	-0.33	-0.12	-0.13	-0.12	-0.17
Trouble paying $100									
None	363	-0.16	-0.10	-0.06	-0.24	-0.09	-0.09	-0.14	-0.15
Hardly any	70	-0.15	-0.07	-0.03	-0.23	-0.19	-0.18	-0.15	-0.17
Little	136	-0.08	0.02	-0.02	-0.18	-0.14	-0.23	-0.05	-0.11
Lot	98	0.38	0.33	0.45	0.22	0.48	0.43	0.50	0.46
Live alone									
Alone	135	-0.14	-0.05	0.01	-0.20	-0.03	-0.13	-0.02	-0.09
With others	541	-0.05	0.00	0.03	-0.16	-0.04	-0.03	-0.04	-0.05
Own/rent dwelling									
Own	594	-0.11	-0.03	0.00	-0.20	-0.05	-0.06	-0.05	-0.08
Rent/other	78	0.26	0.12	0.20	0.06	0.09	-0.01	0.09	0.14
Age left school									
Never/<14	79	0.10	0.10	0.18	0.01	0.13	0.01	-0.09	0.07
14 yrs	205	0.07	0.13	0.22	0.02	0.12	0.04	0.08	0.11
15 yrs	136	-0.11	0.00	-0.06	-0.25	-0.09	-0.12	0.02	-0.10
16 yrs	113	-0.20	-0.15	-0.13	-0.34	-0.19	-0.14	-0.19	-0.22
17+ yrs	144	-0.20	-0.17	-0.13	-0.33	-0.18	-0.08	-0.09	-0.20
Household income									
<$8K	60	-0.19	-0.04	0.08	-0.11	0.01	-0.01	0.12	-0.03
$8-12K	104	-0.01	-0.03	0.07	-0.14	0.02	-0.02	-0.02	-0.02
$12-16K	208	0.03	0.06	0.11	-0.11	0.01	0.04	0.00	0.02
$16-20K	88	-0.02	0.04	-0.01	-0.18	-0.11	-0.20	-0.05	-0.09
$20-30K	124	-0.10	-0.03	0.01	-0.13	0.06	-0.01	-0.03	-0.04
>30K	73	-0.19	-0.09	-0.22	-0.46	-0.29	-0.27	-0.21	-0.28
Medical conditions									
None	128	-0.07	-0.05	0.07	-0.21	0.03	-0.06	-0.01	-0.05
One	214	-0.10	-0.17	-0.07	-0.23	-0.19	-0.16	-0.13	-0.17
Two	164	-0.13	-0.04	-0.06	-0.25	-0.07	-0.14	-0.12	-0.14
Three	84	0.13	0.19	0.25	0.05	0.18	0.13	0.06	0.16
Four or more	88	-0.03	0.31	0.13	-0.02	0.12	0.22	0.25	0.16
Home help									
No	628	-0.05	0.00	0.03	-0.17	-0.04	-0.05	-0.05	-0.05
Yes	49	-0.24	-0.13	-0.07	-0.21	-0.00	-0.03	0.18	-0.08

continued...

* "Don't know" or non-responses excluded.

TABLE 69 (CONTINUED)

Group	Weighted no. of persons*	Standard deviations of difference from sample mean for subscale: Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Social Disab	Handi-cap	Stnd OHIP
		EDENTULOUS PERSONS (weighted n=537)							
Health benefit card									
PHBC	365	0.15	0.06	0.03	0.33	0.10	0.13	0.08	0.14
Repat Card	47	-0.20	-0.14	-0.44	-0.04	-0.36	-0.21	-0.34	-0.29
None	120	-0.00	-0.05	-0.08	-0.03	0.02	-0.03	0.06	-0.02
Trouble paying $100									
None	236	0.00	-0.08	-0.05	0.01	-0.07	-0.04	-0.03	-0.04
Hardly any	65	-0.10	-0.17	-0.39	-0.03	-0.28	-0.19	-0.22	-0.23
Little	111	-0.05	-0.13	-0.09	0.19	0.02	-0.05	-0.01	-0.02
Lot	114	0.53	0.50	0.32	0.83	0.54	0.58	0.42	0.62
Live alone									
Alone	163	0.19	0.07	0.11	0.31	0.21	0.15	0.20	0.21
With others	371	0.04	-0.01	-0.09	0.18	-0.03	0.03	-0.02	0.02
Own/rent dwelling									
Own	385	0.05	0.00	-0.06	0.14	0.04	0.09	-0.01	0.04
Rent/other	143	0.19	0.04	0.09	0.42	0.05	0.04	0.17	0.17
Age left school									
Never/<14	58	0.11	0.09	0.14	0.42	0.16	0.24	0.15	0.22
14 yrs	257	0.06	-0.05	-0.14	0.22	0.01	0.06	-0.02	0.02
15 yrs	92	-0.01	0.03	-0.15	0.05	-0.03	-0.09	0.06	-0.02
16 yrs	58	0.21	0.13	0.10	0.21	0.11	0.13	0.04	0.16
17+ yrs	69	0.21	0.09	0.32	0.25	0.15	0.10	0.16	0.21
Household income									
<$8K	80	0.25	0.14	0.22	0.41	0.12	0.01	0.06	0.20
$8-12K	128	0.06	-0.03	-0.08	0.23	0.07	0.10	0.10	0.07
$12-16K	151	0.18	0.13	-0.03	0.34	0.07	0.21	0.09	0.16
$16-20K	62	0.01	-0.08	0.01	0.07	-0.01	-0.04	-0.06	-0.02
$20-30K	65	0.15	0.05	-0.10	0.12	0.03	0.01	0.10	0.06
>30K	34	-0.25	-0.24	-0.21	-0.21	-0.02	-0.15	-0.24	-0.22
Medical conditions									
None	57	-0.09	-0.28	-0.42	0.02	-0.33	-0.19	-0.14	-0.24
One	118	-0.13	-0.27	-0.17	-0.02	-0.02	-0.11	-0.14	-0.14
Two	176	0.06	0.01	-0.05	0.20	0.07	0.13	0.01	0.07
Three	109	0.15	0.24	0.16	0.36	-0.05	0.08	0.18	0.19
Four or more	77	0.51	0.34	0.26	0.53	0.50	0.36	0.34	0.47
Home help									
No	492	0.08	0.00	-0.03	0.20	0.04	0.07	0.02	0.07
Yes	45	0.08	0.12	-0.00	0.30	0.07	0.01	0.25	0.14

* "Don't know" or non-responses excluded.

In order to convey a sense of the magnitude of subscale variation (rather than z-scores) and to provide some broad indication of joint effects of these sociodemographic characteristics, subscales were computed for combinations of three characteristics which were simple dichotomies. The three characteristics were: reason for visits (regular checks versus problems), financial hardship (none or hardly any difficulty paying a $100 dental bill versus a little or a lot of difficulty) and period since last dental extraction (0-20 years versus 20+ years). The analysis was confined to dentate persons because of the low percentage of edentulous persons who made "check-up" visits, and in order to maintain compatibility with the earlier oral epidemiological findings (presented in Table 61, page 229) which followed a similar format for epidemiological variables.

The findings from the eight combinations of sociodemographic characteristics are presented in Table 70. There was an approximate two-fold difference in subscale scores between the group with regular visits, no hardship and an extraction 21+ years ago compared with the group with problem visits, financial hardship and a more recent extraction. The magnitude of effect was similar across all subscales. However there was not a simple stepwise increase across the dichotomised groups. Indeed, the effect of problem visits appeared to be less for groups whose last extraction was 21+ years ago. This can be seen by comparing the first row (check, no hardship, 21+ years) with the fifth row (problem, no hardship, 21+ years), where the standardized OHIP varied by approximately one, and also the third row (check, hardship, 21+ years) with the seventh row (problem, hardship, 21+ years), where there was a small difference favouring the problem visit group.

TABLE 70 MEAN OHIP SCORES FOR DICHOTOMISED SOCIODEMOGRAPHIC CHARACTERISTICS AMONG DENTATE PERSONS

Characteristic*				Mean value							
Visit	Hard-ship	Last extract	n	Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Soc Disab	Hand-icap	Stnd OHIP
Check-up	No	21+	77	5.53	5.98	3.72	1.90	1.61	0.50	0.50	4.66
		0-20	120	7.31	7.25	5.06	2.80	2.49	0.82	1.32	5.90
	Yes	21+	19	6.86	7.86	4.51	3.32	2.13	0.21	0.67	5.58
		0-20	67	8.63	8.00	7.05	3.40	3.31	0.80	1.94	6.87
Prob-lem	No	21+	51	6.57	5.84	4.36	2.57	2.43	1.49	0.95	5.49
		0-20	123	9.54	9.40	7.92	5.00	3.88	1.66	1.95	7.95
	Yes	21+	35	7.01	6.74	4.01	2.23	2.12	0.88	0.92	5.39
		0-20	90	10.95	10.42	9.22	6.37	6.12	2.89	3.92	9.91

* Usual reason for dental visits (question B3) dichotomised as regular check versus problem or getting something fixed; financial hardship (question B10) dichotomised as none/hardly any difficulty paying a $100 dental bill versus a little/a lot of; last extraction (question B5) in years.

By way of comparison with dichotomous groupings of epidemiological variables in Table 61, the dichotomous groupings of sociodemographic characteristics in Table 70 revealed variations among the eight groups which were similar or slightly smaller in magnitude. For example, the largest differential in the standardized OHIP scores among the groups in Table 70 was 5.25 (the first line compared with the eighth line), and in Table 61 it was 6.90 (the first line compared with seventh line). This suggests that the overall strength of association may be similar for sociodemographic characteristics and oral epidemiological variables.

6.3.3.3 Multivariate relationships

The relationships between sociodemographic characteristics and social impact were analysed to ascertain independent effects and evaluate statistical significance. Separate linear models were constructed for dentate and edentulous persons, in part because the subsequent analyses of joint effects with oral health status draws on different groups of epidemiological variables for dentate and edentulous. Furthermore, the preceding analyses have revealed different gradients among dentate and edentulous, for example, with respect to age (Table 67) and medical conditions (Table 69). All previously considered non-epidemiological characteristics were included in multivariate models to assess their independent effects on social impact. Dummy variables indicating upper and lower denture wearing also were considered for the dentate subgroup. Terms which were not statistically significant (F–test, $p>0.05$) were excluded to create the most parsimonious model.

The non-epidemiological factors associated with the standardized OHIP are presented in Table 71. Among dentate persons most non-epidemiological variables were significant: age, upper denture wearing, period since last dental visit, usual reason for visits, site of last visit, perceived treatment needs, financial hardship, ownership of residential dwelling, country of birth, education and medical conditions. The parameter estimates revealed effects of those variables which conform closely to the bivariate analyses presented previously. People aged 60-69 years had higher levels of impact than those aged 70-79 years who implicitly were higher than the reference group of 80+ years. (In the SAS PROC GLM, reference groups always have parameter estimates of zero.) Persons with upper dentures had higher levels than the reference group without an upper denture. The effect of period since last dental visit was reasonably uniform: persons whose last visit was greater than 10 years ago had the lowest

impact as indicated by the negative parameter estimate. The reference group (5-10 years ago) implicitly had higher impact than the group visiting 2-5 years ago (which had a negative parameter estimate). However, the highest levels of impact occurred for the two groups with visits during the last two years. There were higher levels of impact among those who visited for dental problems. Persons who attended a private dental practice had lower levels of impact and those who perceived no treatment needs had lower levels of impact. People reporting "a lot" of difficulty paying a $100 dental bill had high levels of impact compared with the two middle categories ("a little" or "hardly any"). However the latter two groups reported less impact than the reference group ("no difficulty") as indicated by the negative parameter estimates. Persons who owned their residence reported less impact than the reference group who rented. Australian born persons reported lower levels of impact than the reference group (United Kingdom or Eire), who, in turn, had less impact than those born in other foreign countries. Two continuous variables were significant in the model for dentate persons. They were the age of leaving school, where greater age was associated with less impact, and medical conditions, where a greater number of conditions was associated with more impact.

TABLE 71 MULTIVARIATE MODELS* RELATING NON-EPIDEMIOLOGICAL FACTORS TO STANDARDIZED OHIP

Dentate persons† (n=622): Model R^2=0.240

Independent variable	df	F	p	Parameter(s)	Estimate	StdErr‡
Age group	2	4.5	0.01	60-69	2.13	0.78
				70-79	1.45	0.80
				80+	0.00	
Country of birth	2	5.1	<0.01	Aust	-0.16	0.48
				UK/Eire	0.00	
				Other	1.77	0.62
Own/rent dwelling	1	4.3	0.04	Own	-1.23	0.59
				Rent	0.00	
Age left school	1	5.1	0.02	(yrs)	-0.23	0.10
Medical conditions	1	16.7	<0.01	(number)	0.54	0.13
Upper denture	1	25.0	<0.01	Yes	0.00	
				No	-1.86	0.38
Period since visit	4	5.5	<0.01	<1 yr	1.86	1.00
				1-2 yrs	1.33	1.07
				>2-5 yrs	-0.18	1.06
				>5-10 yrs	0.00	
				>10 yrs	-2.29	1.35
Reason for visits	1	9.3	<0.01	Problem	1.39	0.46
				Check-up	0.00	
Site of last visit	1	5.7	0.02	Private/tech	-1.06	0.45
				Public	0.00	
Treatment needs	1	91.1	<0.01	Yes	0.00	
				No	-3.09	0.40
Trouble paying $100	3	6.7	<0.01	None	0.00	
				Hardly any	-0.82	0.62
				Little	-0.50	0.49
				Lot	1.95	0.57

continued...

* Variables considered for each model: Age; Sex; Country of birth; Period since last visit; Usual reason for visit; Site of last visits; Dental insurance; Perceived treatment need; Health benefit card; Financial hardship; Living alone; Own/rent dwelling; Education; Income; Medical conditions; Home help.

† Variable for upper denture and lower denture also considered for dentate persons.

‡ Parameter estimates for reference groups implicitly valued as zero, and no standard error is available.

TABLE 71 (CONTINUED)

Edentulous persons (n=496): Model R^2=0.326						
Independent variable	df	F	p	Parameter(s)	Esti-mate	StdErr‡
Sex	1	6.3	0.01	Male	0.00	
				Female	-1.72	0.68
Medical conditions	1	17.6	<0.01	(number)	1.05	0.26
Period since visit	4	5.7	<0.01	<1 yr	4.11	1.04
				1-2 yrs	1.16	1.22
				>2-5 yrs	3.52	1.02
				>5-10 yrs	0.00	
				>10 yrs	1.17	0.98
Site of last visit	1	10.9	<0.01	Private/tech	-2.98	0.88
				Public	0.00	
Treatment needs	1	31.2	<0.01	Yes	0.00	
				No	-5.79	0.84
Trouble paying $100	3	6.2	<0.01	None	0.00	
				Hardly any	-1.48	1.08
				Little	-0.15	0.85
				Lot	2.92	0.85

* Variables considered for each model: Age; Sex; Country of birth; Period since last visit; Usual reason for visit; Site of last visits; Dental insurance; Perceived treatment need; Health benefit card; Financial hardship; Living alone; Own/rent dwelling; Education; Income; Medical conditions; Home help.

† Variable for upper denture and lower denture also considered for dentate persons.

‡ Parameter estimates for reference groups implicitly valued as zero, and no standard error is available.

The model for edentulous persons in Table 71 contained fewer significant terms, although it explained a larger amount of variance (32.6 per cent) than was the case for dentate persons (24.0 per cent). The terms which were significant generally followed a similar pattern to dentate persons. Females, persons attending private clinics, and persons reporting no treatment needs reported less impact, while a greater number of medical conditions was associated with higher levels of impact. The relationship with period since last dental visit was less consistent than was the case for

dentate persons. In the edentulous group, those attending within the previous year or those attending between two and five years ago reported comparatively high levels of impact, while the reference group (attendance in the last 5 to 10 years) had the lowest levels of impact.

The models in Table 71 did not consider the period since last dental extraction because there was a high level of missing data for that item. This related to difficulty experienced by a number of individuals in recalling the timing of their last extraction. The model for dentate persons was recalculated among the smaller number who were able to report the timing of their last extraction (although without including that variable in the analysis) using the significant variables from Table 71. Three variables ceased to be significant: age group, site of last visit and education. When the period since last extraction itself was added to the model, it was statistically significant and indicated higher levels of impact among those reporting more recent extractions. Despite the theoretical appeal of such a model, it was judged unsuitable on the grounds of the high rate of missing data associated with that single question. The model presented in Table 71 relating to the larger set of respondents but excluding period since last extraction was retained.

In the case of the edentulous group, recalculation of the model using the smaller number of persons who were able to report the timing of their last extraction did not affect the significance of any terms listed in Table 71. However, the variable itself when added to the model did not have a significant independent effect. Hence, the variables listed in Table 71 were retained.

The process of model construction used in Table 71 for the standardized OHIP was repeated for the other subscales. The findings are

summarized in Table 72, which displays the statistically significant terms in models for dentate (D) and edentulous (E) groups.

TABLE 72 SUMMARY OF MULTIVARIATE* MODELS RELATING NON-EPIDEMIOLOGICAL FACTORS TO OHIP SCORES

Models for dentate (D) and edentulous (E) persons in which independent variables were significant ($p<0.05$)

	Dependent variable						
Independent variable	Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Soc Disab	Handi-cap
Age group	D		D				
Sex	DE	E		E	E	DE	E
Upper denture	D	D	D	D	D	D	D
Lower denture			D		D		
Last visit	DE	DE	E	DE	DE	DE	D
Reason for visit	D	D		D	DE	D	D
Site of visit	DE	E	DE	D	DE	D	DE
Perceived need	DE	DE	DE	DE	DE	DE	DE
Hardship	DE		DE	E	DE	DE	DE
Live alone	D				E		E
Dwelling ownership				D			
Country of birth		D	D	D	D	D	
Education		D	D	D	D		
Income							
Medical conditions	E	DE	DE	DE	DE	DE	DE
Model R^2							
Dentate	0.24	0.19	0.20	0.21	0.17	0.15	0.12
Edentulous	0.31	0.34	0.29	0.29	0.34	0.21	0.18

* Variables considered for each model: Age; Sex; Country of birth; Period since last visit; Usual reason for visit; Site of last visit; Dental insurance; Perceived treatment need; Health benefit card; Financial hardship; Living alone; Own/rent dwelling; Education; Income; Medical conditions; Home help. Upper and lower dentures also considered for dentate persons.

The most consistent effects among subscales for dentate persons in Table 72 were: upper denture wearing and perceived treatment needs (all subscales); three dental visit factors (period, reason and site – six subscales each); and medical conditions (six subscales). Psychological discomfort had the fewest significant independent variables, while social disability had the lowest R^2 value for dentate persons. Among edentulous persons R^2 values were higher, even though most models had only five or six significant independent variables – somewhat less than the models for dentate persons. The most consistent effects among edentulous persons in Table 72 were: medical conditions, perceived treatment needs (all subscales); sex, period since last visit, financial hardship and perceived treatment needs (six subscales).

Most models in Table 72 therefore revealed some broad similarities across the seven subscales, and between dentate and edentulous. The greatest dissimilarity between dentate and edentulous was observed for physical disability. Among dentate persons it was associated with period since last visit, perceived needs, medical conditions, upper dentures, reason for visit, site of visit, dwelling ownership, country of birth and education. Edentulous persons had in common only the first three of those factors. In general, impact among dentate persons was more likely to be associated with country of birth, education and upper dentures, and less likely to be associated with sex compared with edentulous persons.

Another feature of the models, both in Table 71 and Table 72, was the lack of significance of some terms. Household income and possession of a health benefit card did not appear in any of the models, although both may be accounted for in part by other variables such as financial hardship and site of visit (respectively). There was a strong effect of the site of last visit as indicated by the parameter estimate of –1.06 for private clinic (Table 71). While this could suggest that there are aspects of public dental care which

contribute to higher levels of impact, the interpretation is uncertain because access to those clinics is limited by possession of a health benefit card. Card holders differ in significant ways from non-holders, and the absence of health benefit card status from the multivariate models leaves open the question of any confounding effects this might have on the role of public dental clinics. In other words, is higher social impact among public clinic users related to the nature of care at those clinics or to the characteristics of health benefit card holders?

This question was investigated in further detail by examining unadjusted means for the standardized OHIP among groups defined by health card eligibility and site (public or private) of last visit. For practical purposes this produces only three groups, since non-health card holders who attended public clinics were represented in very small numbers. The groups were further subdivided according to the usual reason for visits and perceived treatment needs. The findings are presented in Table 73.

TABLE 73 VARIATIONS IN STANDARDIZED OHIP SCORES BY HEALTH CARD STATUS AND SITE OF LAST VISIT – DENTATE PERSONS

		Usual reason for visits: Regular			Usual reason for visits: Problem		
Site of last visit	Health benefit card*	Standardized OHIP n	Mean	StdDev	Standardized OHIP n	Mean	StdDev
Public	PHBC	54	6.12	4.19	90	10.9	9.68
Private	PHBC	67	5.31	3.56	109	6.39	4.24
Private	DVA/none	194	5.55	3.16	101	6.36	3.01

		Perceived treatment need: Yes			Perceived treatment need: No		
Site of last visit	Health benefit card	Standardized OHIP n	Mean	StdDev	Standardized OHIP n	Mean	StdDev
Public	PHBC	87	13.23	10.90	135	8.35	7.53
Private	PHBC	96	8.02	6.60	342	5.94	5.28
Private	DVA/none	98	8.78	4.50	344	5.13	2.80

* PHBC = Pensioner health benefit card (eligible for care at public clinics). DVA = Department of Veterans' Affairs card (not eligible for care at public clinics).

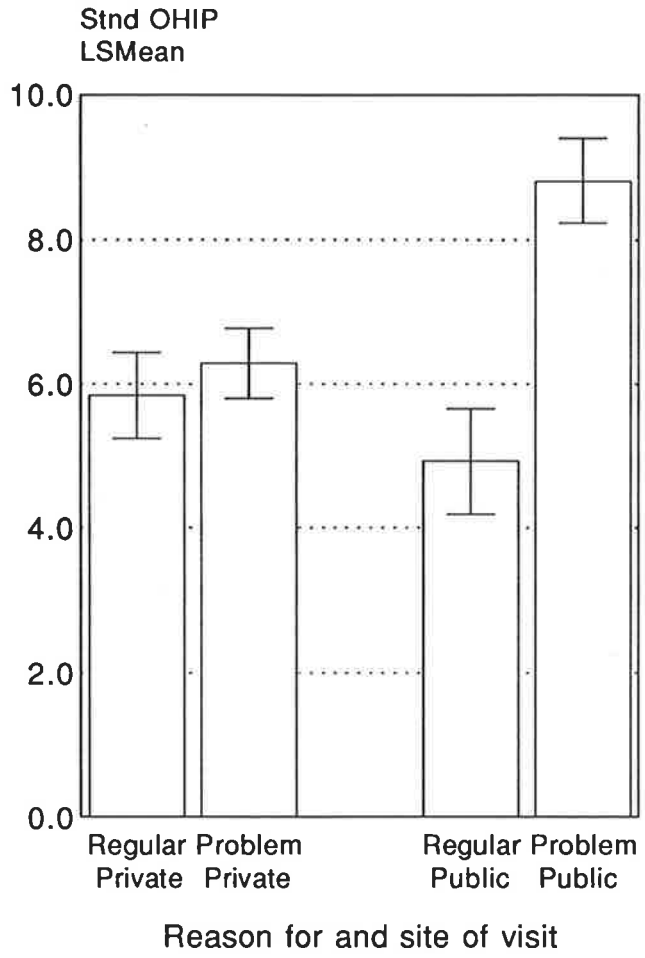
Public patients had higher levels of impact than private patients regardless of whether the private patients had a health benefit card. However, most of the effects appeared to exist for those who attended when they had dental problems, where there was nearly a two-fold difference in standardized OHIP scores for public patients (mean = 10.90) compared with private patients with PHBC cards (mean = 6.39) or private patients without PHBC cards (mean = 6.36). Variations among the three groups were

substantially less when the comparison was confined to persons who made regular visits. Perceived treatment needs did not appear to modify the effect in the same way. There was a large difference between public patients and private patients with PHBC cards both among persons with and without perceived treatment needs (Table 73).

On one hand, the findings suggest that PHBC card possession itself was not necessarily associated with higher levels of social impact – there appeared to be no effect of card possession among those who attended a private clinic. On the other hand, higher levels of social impact cannot be attributed solely to public clinics alone – those who visited regularly at public clinics had mean standardized OHIP scores which were similar to those who visited regularly at private clinics. Instead, the analysis suggests that there is an interaction between the site of visit and the usual reason for visit.

Because of the important practical implications of the findings in Table 73 concerning public clinics the effects were evaluated statistically by including an interaction within the model for dentate persons considered previously using the standardized OHIP as the dependent variable (Table 71). The interaction between site of last visit (public or private) and reason for visit (problem or check) proved to be statistically significant ($F_{1,603} = 17.2$, $p<0.01$). Least squares means for the combination are displayed in Figure 14. There were relatively small differences among the public patients who attended regularly and both groups of private patients. Indeed public patients who made regular visits had the lowest levels of impact. However, public patients who attended for problems had markedly higher levels of social impact.

FIGURE 14 STANDARDIZED OHIP LEAST SQUARES MEANS* BY SITE OF VISIT AND REASON FOR DENTAL VISITS – DENTATE PERSONS



* Least squares means from dentate model in Table 71 with additional site and reason interaction. Error bars represent +/- standard error.

6.3.4 Combined effects of oral epidemiological variables and non-epidemiological characteristics

Joint effects of the sociodemographic and dental visit characteristics (from Table 71) and the oral epidemiological variables (previously considered alone in Table 64, page 238) were evaluated among dentate persons. The initial interest was to assess the extent to which the two groups of explanatory variables may have independent effects. A further consideration

was any modifying effects which sociodemographic or visit characteristics might have on the epidemiological variables.

Table 74 summarizes findings from seven general linear models relating OHIP scores (as dependent variables) to the combined independent effects of oral epidemiological and non-epidemiological factors. The summary presents the parameter estimates for statistically significant independent variables in each model. Significance was assessed using the F–test. The epidemiological variables were entered first into the model and purposefully retained as the other characteristics were added. Consequently, the epidemiological variables appear in Table 74 as they did in Table 64, although the value of some parameter estimates differ.

TABLE 74 MULTIVARIATE MODELS RELATING EPIDEMIOLOGICAL VARIABLES, SOCIODEMOGRAPHIC AND VISIT CHARACTERISTICS TO OHIP SCORES – DENTATE PERSONS

Independent variable		Parameter estimates for seven OHIP subscales*						
		Func Limit	Phys Pain	Psyc Disc	Phys Disab	Psyc Disab	Social Disab	Handi cap
MT1	(teeth)	0.48	0.21	0.14	0.23	0.16	0.17	0.15
SPACE1	(teeth)				1.05			
SPACE2	(teeth)	0.20		0.29		0.04	0.03	0.09
ROOTD	(surfaces)	0.59	0.46	0.87	0.72	0.95	0.36	0.70
RROOTS	(teeth)	1.10						
NCALC	(sites)	-0.02						
NGING	(sites)					0.10		
AVGREC	(mm)						-0.41	-0.35
AVGPOC	(mm)							0.64
Age	60-69 yrs	4.31		4.35				
	70-79 yrs	3.11		2.82				
Sex	Female	-1.16						
Upper denture	None	-1.94		-1.80	-1.72	-1.36		
Lower denture	None					1.83		
Last visit	<1 yr	-0.18	3.38		0.39		0.81	2.00
	1-2 yrs	-0.31	2.95		1.29		0.41	1.41
	>2-5 yrs	-1.99	0.89		-0.63		-0.57	0.60
	>10 yrs	-4.22	-2.03		-2.25		-0.82	0.71
Reason for visit	Problem		1.65				0.97	1.00
Site of visit	Private				-1.01	-1.48	-0.71	-0.79
Perceived need	No need	-2.87	-3.31	-4.43	-1.73	-1.88	-0.61	
Financial hardship	Hardly any	-0.28		-0.38		-1.55	-1.00	-0.35
	Little	0.41		-0.75		-1.62	-0.67	0.13
	Lot	2.64		2.36		2.10	1.22	1.79
Country of birth	Australia		-0.75	-0.85	-0.41			
	Other		0.98	1.53	0.84			
Age left school	(years)		-0.42	-0.39	-0.28	-0.33		
Medical conditions	(number)		0.67		0.34		0.30	
Model R^2		0.301	0.195	0.222	0.248	0.179	0.136	0.132

* Variables considered for each model were the oral epidemiological variables from Table 64 and the sociodemographic and visit characteristics from Table 71. Blank cells in this table indicate non-significant effects.

Most non-epidemiological characteristics were retained in the general linear models in Table 74. For six of the models, only between two and four of the previously identified non-epidemiological characteristics from Table 72 were dropped. In the case of physical pain only one explanatory variable (upper denture wearing) was dropped. A consequence of this general tendency for retention of non-epidemiological variables was an increase in R^2 values compared with the original models containing only oral epidemiological variables (Table 64). In most instances, the model R^2 increased by a factor of two or more.

When individual explanatory variables were examined, three terms identified previously in the Table 72 were always retained in the respective models in Table 74. They were: age, significant in models for functional limitation and psychological discomfort in Table 72; financial hardship, significant in all models except for physical pain and physical disability in Table 72; and age left school, significant for physical pain, psychological discomfort, physical disability and psychological disability in Table 72. Each of those explanatory variables was retained in the respective models presented in Table 74. Period since last visit and perceived treatment needs were eliminated from only one of the models identified previously. The retention of these sociodemographic and visit variables indicates that they have consistently independent effects on social impact. This was not necessarily anticipated. For example, it might have been expected that age would act simply as a proxy indicator of the number of retained teeth. However the observed independent effect of age indicated that it had the reverse effect: persons in the youngest age groups have higher levels of functional limitation and psychological discomfort as indicated by the positive value of the parameter estimates for the group aged 60-69 years.

The non-epidemiological variables less frequently retained in Table 74 were: reason for visit (dropped from the initial models for functional

limitation, physical disability and psychological discomfort); country of birth (dropped from psychological disability and social disability); and medical conditions (dropped from psychological discomfort, physical disability and psychological discomfort).

The non-epidemiological characteristics generally had consistent effects when they were associated with more than one subscale, as indicated by similar signs and magnitudes of the parameter estimates. Younger age groups consistently had the highest levels of impact. Upper dentures were associated with less impact. Those visiting for problems had higher levels of impact. Those attending private dental practices had lower levels of impact. Those with no perceived needs had higher levels of impact. Persons reporting a lot of difficulty paying a $100 dental bill had higher levels of impact. Australian born persons reported the lowest levels of impact. Greater years of education was associated with lower levels of impact. A greater number of medical conditions is associated with higher levels of impact.

The one factor which appeared to have differing effects among subscales was the period since last dental visit. In the case of functional limitation, the reference group (visit from 5 to 10 years) had the highest level of impact, while for handicap that group had the lowest level of impact. Persons attending within a 12-month period had the highest levels of psychological discomfort, social disability and handicap, while those attending between one and two years previously had the highest levels of physical disability. To summarize in terms of the dimensions of social impact, recent visits were associated with higher levels of psychosocial impact, whereas visits between 5–10 years ago were associated with higher levels of dysfunction and physical disability. There is no simple explanation for these variable effects.

Parameter estimates for oral epidemiological variables, which were retained preferentially in the models contained in Table 74 and which therefore were always significant, did not differ substantially in magnitude from the earlier models developed with those variables alone (presented previously in Table 64, page 238). The small amounts of variation in the coefficients between the two sets of models suggests that the relationships between clinical conditions and social impact were not substantially confounded by non-epidemiological factors. This was a useful finding and suggested, within the constraints of cross-sectional comparisons, that the clinical parameters have a direct effect on social impact. In other words, the earlier associations observed between clinical conditions and social impact alone were not spurious effects mediated through differing non-epidemiological characteristics among oral health status groups.

The methodology employed previously for individual subscales was also applied to the standardized OHIP. Significant non-epidemiological effects (identified previously in Table 71) were added to significant oral epidemiological variables (identified previously in Table 64). Included with the non-epidemiological effects was the interaction between site of visit and usual reason for visit. Hierarchical modelling principles were adopted to purposefully retain the first order terms of that interaction. As was the case for individual subscales, the F–test used to assess significance and oral epidemiological variables were introduced first and retained preferentially. The findings are presented in Table 75.

TABLE 75 MULTIVARIATE MODEL* RELATING ORAL EPIDEMIOLOGICAL VARIABLES, SOCIODEMOGRAPHIC AND VISIT CHARACTERISTICS TO STANDARDIZED OHIP

Independent variable	df	F	p	Parameter(s)	Estimate	StdErr†
Missing anterior teeth	1	57.9	<0.01	(number)	0.27	0.09
Posterior spaces	1	15.3	<0.01	(number)	0.14	0.05
Decayed root surfaces	1	42.8	<0.01	(number)	0.93	0.18
Age group	2	12.1	<0.01	60-69	3.61	0.76
				70-79	2.74	0.78
				80+	0.00	
Upper denture	1	5.5	0.01	Yes	0.00	
				No	-1.02	0.49
Period since last visit	4	3.4	0.01	<1 yr	1.73	1.04
				1-2 yrs	0.88	1.11
				>2-5 yrs	-0.62	1.08
				>5-10 yrs	0.00	
				>10 yrs	-1.56	1.38
Treatment needs	1	51.7	<0.01	Yes	0.00	
				No	-2.31	0.41
Trouble paying $100	3	8.8	<0.01	None	0.00	
				Hardly any	-0.96	0.64
				Little	-0.55	0.49
				Lot	1.98	0.57
Age left school	1	5.5	0.02	(yrs)	-0.22	0.11
Medical conditions	1	11.0	<0.01	(number)	0.42	0.14
Reason for visits	1	4.4	0.03	Problem	3.18	0.80
				Check-up	0.00	
Site of last visit	1	4.1	0.04	Private	0.78	0.68
				Public	0.00	
Interaction				Problem/		
Site x Reason	1	12.2	<0.01	Private	-3.04	0.87

* n = 529 dentate persons with caries examination and complete questionnaire data. Model R^2=0.282.

† Parameter estimates for reference groups implicitly valued as zero, and no standard error is available.

The previous interpretations concerning individual subscales can also be made with regard to the model in Table 75 in which the standardized OHIP was the dependent variable. The majority of non-epidemiological factors observed previously in Table 71 appeared to have an independent effect on social impact. Only two of the previously identified non-epidemiological factors were dropped from the model – country of birth and dwelling ownership. Consequently, the R^2 value for this model (0.282) was approximately three times larger than the value of 0.096 for oral epidemiological variables alone. Nonetheless, the regression coefficients for

the oral epidemiological variables did not change markedly: for missing anterior teeth, the coefficient reduced from 0.40 (Table 64) to 0.27 (Table 75); for posterior spaces there was a reduction from 0.17 to 0.14; and for decayed root surfaces there was a reduction from 1.06 to 0.93. As Kleinbaum et al (1988) have described, changes to the magnitude or direction of parameter estimates within multivariate models is evidence of confounding. This has intuitive sense. For example, if decayed surfaces contributed to social impact because persons with decayed teeth were more likely to have chronic medical conditions, then the addition of chronic medical conditions to the model should reduce the magnitude of the parameter estimate for decayed surfaces. However the observed changes to parameter estimates for the oral epidemiological variables were small, and do not appear to constitute an important degree of confounding.

It is appropriate, therefore, to interpret the findings as suggestive of a substantial role played by aspects of the dental care system and other non-clinical parameters in the experience of social impact. Furthermore, such a role appears to independent of oral status as measured using conventional epidemiological indices.

The final part of this analysis was concerned with possible ways in which non-epidemiological factors may modify the relationship between epidemiological variables and social impact. For example, does the effect of missing anterior teeth vary across age groups, being stronger in one age group, and weaker in another?

Modifying effects were investigated using the standardized OHIP as the dependent variable. This was done in order to focus on the ways in which non-clinical parameters could affect overall social impact. While it is likely that some effect modifiers may be specific for certain subscales, it is parsimonious to confine exploratory investigation of interactions to the more

general effects observable with the standardized OHIP. The findings are presented in Table 76.

TABLE 76 MULTIVARIATE MODEL RELATING STANDARDIZED OHIP TO INDEPENDENT ORAL EPIDEMIOLOGICAL VARIABLES, SOCIODEMOGRAPHIC AND VISIT CHARACTERISTICS AND INTERACTIONS – DENTATE PERSONS*

Independent variable	df	F	p	Parameter(s)	Estimate	StdErr†
Missing anterior teeth	1	63.9	<0.01	(number)	0.45	0.15
Posterior spaces	1	16.9	<0.01	(number)	-0.12	0.07
Decayed roots surfaces	1	47.2	<0.01	(number)	1.21	0.60
Age group	2	13.3	0.01	60-69	3.12	0.81
				70-79	2.75	0.84
				80+	0.00	
Upper denture	1	6.0	0.01	Yes	0.00	
				No	-1.38	0.48
Period since last visit	4	3.8	0.01	<1 yr	2.39	1.02
				1-2 yrs	1.51	1.08
				>2-5 yrs	-0.28	1.05
				>5-10 yrs	0.00	
				>10 yrs	-0.72	1.35
Reason for visits	1	4.8	0.03	Problem	2.36	0.81
				Check-up	0.00	
Site of last visit	1	4.6	0.03	Private/tech	1.75	0.77
				Public	0.00	
Perceived needs	1	57.0	<0.01	Yes	0.00	
				No	-2.69	0.39
Trouble paying $100	3	9.6	<0.01	None	0.00	
				Hardly any	-0.63	0.82
				Little	-0.30	0.65
				Lot	-0.11	0.51
Age left school	1	6.0	0.01	(years)	-0.22	0.23
Medical conditions	1	9.7	<0.01	(number)	-0.45	0.24
Interactions:						
Visit Reason x Visit site	1	13.5	0.02	Problem/ Private	-1.59	0.90
Missing anterior teeth x Visit site	1	6.3	0.01	PrivatexMT1	-0.38	0.15
Missing anterior teeth x Trouble paying $100	3	5.4	<0.01	Hardly anyxMT1	0.03	0.20
				LittlexMT1	0.01	0.17
				A lotxMT1	0.59	0.18
Posterior spaces x Medical conditions	1	22.3	<0.01	(product)	0.14	0.03
Decayed root surfaces x Visit site	1	11.8	<0.01	PrivatexROOTD	-0.38	0.15
Decayed root surfaces x Age	2	11.6	<0.01	60-69xROOTD	1.73	0.49
				70-79xROOTD	-0.36	0.57

* n = 529 dentate persons. Model $R^2 = 0.356$.

† Parameter estimates for reference groups implicitly valued as zero, and no standard error is available.

There were six statistically significant interactions.

1) The interaction of reason for visit and site of visit has been investigated in previous analyses (Figure 14, page 269). The interaction terms in the current model in Table 76 were similar, indicating that visits to public dental clinics were associated with higher impact predominantly among those who made problem-motivated visits.

2) The relationship between missing anterior teeth and social impact was stronger among those who visited public clinics compared with those who visited private clinics. The relationship is demonstrated in Figure 15 which uses least squares means from the model in Table 76. Levels of social impact among private dental patients increased only marginally with increasing numbers of missing anterior teeth among private dental patients. There was a more pronounced increase for public dental patients, as indicated by the steeper slope of the regression line.

3) The relationship between missing anterior teeth and social impact was stronger among those who reported a lot of difficulty paying a $100 dental fee. The relationship is demonstrated in Figure 16. In this instance the group reporting a lot of difficulty displayed a sharp increase in social impact as the number of missing teeth increased. Regression lines for the other three groups overlapped and were not as steep.

4) The relationship between decayed root surfaces and social impact was more pronounced among public dental patients (Figure 17) compared

with private dental patients. Indeed, the regression line for private dental patients was nearly flat, indicating only a weak relationship.

5) The relationship between decayed root surfaces and social impact varied substantially among age groups (Figure 18). Within the youngest age group (60-69 years) there was an almost two-fold increase in standardized OHIP scores (4.58 units) between persons with no decayed root surfaces and persons with two decayed root surfaces. However the regression lines for the two older age groups were virtually horizontal, indicating only a very weak relationship between social impact and decayed root surfaces. In fact, the regression line had a negative slope for persons aged 70-79 years.

6) Relationships between unreplaced posterior spaces and social impact varied substantially according to the number of self-reported medical conditions (Figure 19). For persons with no medical conditions, there was a negative relationship, such that a greater number of unreplaced posterior spaces was associated with lower social impact. The reasons for a negative relationship are not clear. In contrast, among those with four or more medical conditions, a greater number of unreplaced posterior spaces was associated with increasing social impact. Consequently, as Figure 19 demonstrates, there was intersection of the regression lines for groups with different numbers of medical conditions.

FIGURE 15 STANDARDIZED OHIP* – MISSING ANTERIOR TEETH AND SITE OF VISIT

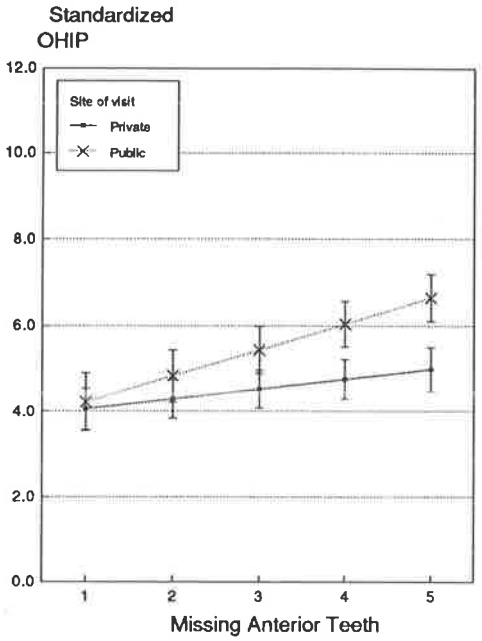


FIGURE 16 STANDARDIZED OHIP* – MISSING ANTERIOR TEETH AND FINANCIAL HARDSHIP

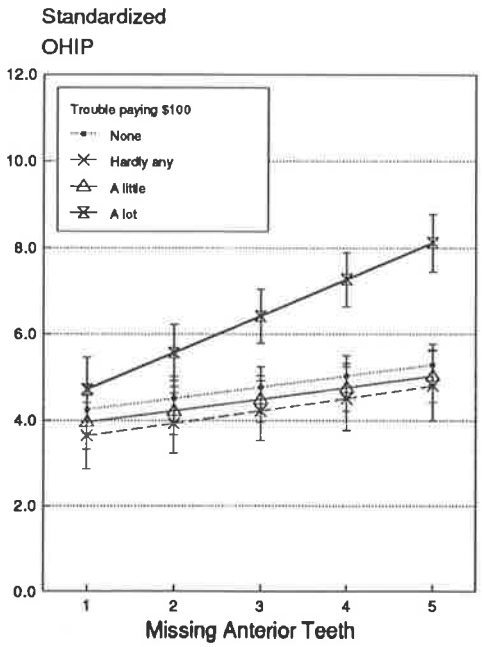


FIGURE 17 STANDARDIZED OHIP* – DECAYED ROOT SURFACES AND SITE OF VISIT

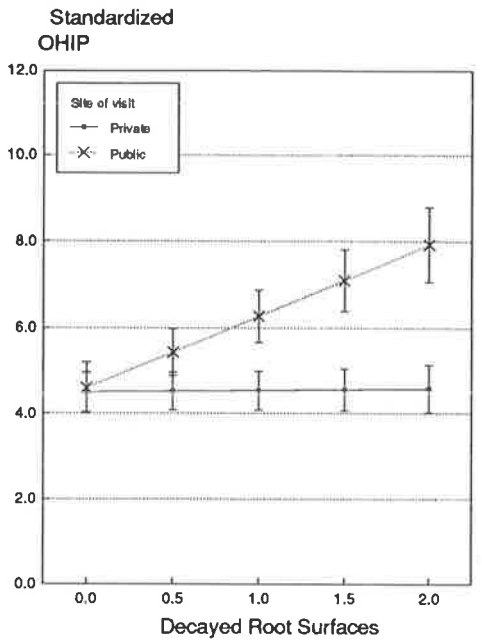
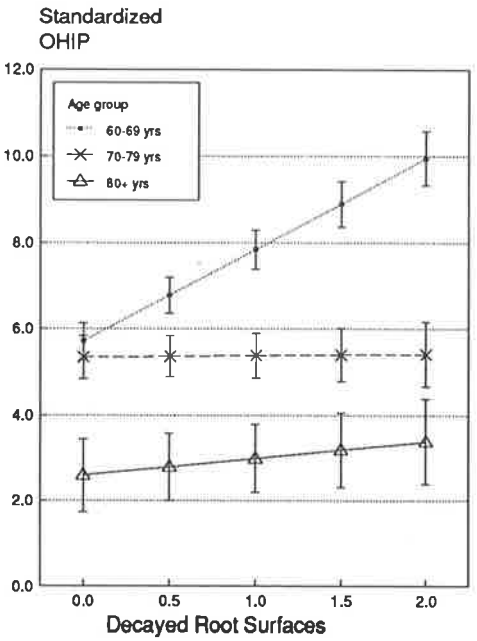
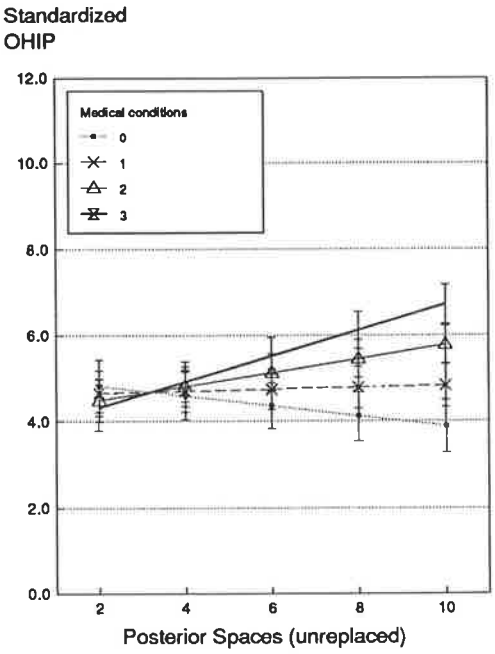


FIGURE 18 STANDARDIZED OHIP* – DECAYED ROOT SURFACES AND AGE GROUPS



* Standardized OHIP scores are least squares means obtained from the multivariate model in Table 76. Error bars are +/- one standard error.

FIGURE 19 STANDARDIZED OHIP* – POSTERIOR SPACES AND MEDICAL CONDITIONS



* Standardized OHIP scores are least squares means obtained from the multivariate model in Table 76. Error bars are +/- one standard error.

In comparison with the previous general linear models which considered epidemiological and non-epidemiological variables without interactions (Table 75, page 275), the current model portrays more complex relationships. The effects were most apparent among public and private dental patients, where relationships between oral epidemiological variables and social impact varied substantially according to the sector (private or public) providing care. It remains uncertain whether variations in the relationships can be attributed to differences in the process of care within those sectors, or whether it relates to underlying characteristics of persons who seek care in each sector. The former mechanism could arise, for example, due to longer waiting lists at public clinics or restrictions in the range of services provided at those clinics. The latter mechanism could occur if, for example, users of public services had more severe disease or intractable problems. However, the presence within the model of oral epidemiological variables and sociodemographic characteristics should control any such phenomena. In the event, the finding suggest that the process of dental care was very important as a determinant of social impact and as a modifier of other mechanisms (such as oral epidemiological measures) related to social impact.

It should also be emphasized that there were a number of general relationships which persisted in models with and without interactions – missing anterior teeth, upper denture wearing, period since last dental visit, perceived treatment needs and educational attainment continued to exert independent effects, with little alteration to parameter estimates in the more complex model presented in Table 76.

6.3.5 Relationships among OHIP subscales

The analysis to this stage has focussed on oral epidemiological and non-epidemiological features which might be associated with social impact. This section turns to the fourth aim of the thesis and examines basic relationships among impact subscales and then the modifying effects of specific oral conditions on those relationships.

6.3.5.1 Bivariate relationships among subscales

Table 77 presents the correlation matrix for all seven subscales, using the weighted data from all 1,217 interviewed persons (examined and non-examined). Only the lower half of the matrix is presented, and the diagonal (containing correlations of 1.0) has been excluded. Pearson's correlation coefficients ranged from 0.56 to 0.82. In general, the coefficients were greater towards the diagonal, indicating, for example, that there was a more linear relationship between functional limitation and physical pain than between functional limitation and handicap. Such a phenomenon should be expected, since there are numerous intervening events which are hypothesized to mediate between functional limitation and handicap. The general tendency of greater coefficients towards the diagonal therefore provides some overall support for the theoretical model underlying the OHIP: handicap is most closely related to disability; and disability is most closely related to functional limitation and pain.

TABLE 77 PEARSON'S CORRELATION COEFFICIENTS* BETWEEN SUBSCALES – ALL OHIP RESPONDENTS

	Subscale					
	Func Limit	Phys Pain	Psych Disc	Phys Disab	Psych Disab	Phys Disab
Phys Pain	0.75					
Psych Disc	0.75	0.67				
Phys Disab	0.82	0.68	0.71			
Psych Disab	0.70	0.68	0.78	0.76		
Social Disab	0.58	0.56	0.57	0.68	0.77	
Handicap	0.63	0.58	0.65	0.70	0.75	0.75

* All coefficients were statistically significant ($p<0.01$).

Despite this general tendency, the largest correlations for a given subscale were not always closest to the diagonal of Table 77. For example, the largest coefficient (0.82) was observed between functional limitation and physical disability. Again, this is not surprising, and indicates that specific subgroups within Locker's conceptual model (in this case, the physical subgroup within disability) appear to be identified by the OHIP.

Table 78 considers the matrix of subscale correlations among dentate and edentulous persons. Correlations generally were slightly larger among edentulous persons compared with dentate: 13 correlations were greater, two were equivalent and six were smaller when edentulous correlations were compared with the corresponding dentate correlations. However, the greatest discrepancy (for the functional limitation and social disability coefficient) was not large – 0.65 for edentulous and 0.51 for dentate.

TABLE 78 PEARSON'S CORRELATION COEFFICIEINTS* BETWEEN OHIP SUBSCALES – DENTATE AND EDENTULOUS PERSONS

	Func Limit	Phys Pain	Psych Disc	Phys Disab	Psych Disab	Phys Disab
	DENTATE PERSONS (n=677)					
Phys Pain	0.71					
Psych Disc	0.75	0.65				
Phys Disab	0.82	0.71	0.74			
Psych Disab	0.68	0.68	0.75	0.77		
Social Disab	0.51	0.55	0.53	0.63	0.77	
Handicap	0.58	0.58	0.63	0.67	0.78	0.76
	EDENTULOUS PERSONS (n=537)					
Phys Pain	0.79					
Psych Disc	0.76	0.70				
Phys Disab	0.82	0.69	0.73			
Psych Disab	0.72	0.67	0.82	0.77		
Social Disab	0.65	0.58	0.62	0.73	0.76	
Handicap	0.68	0.59	0.68	0.73	0.72	0.75

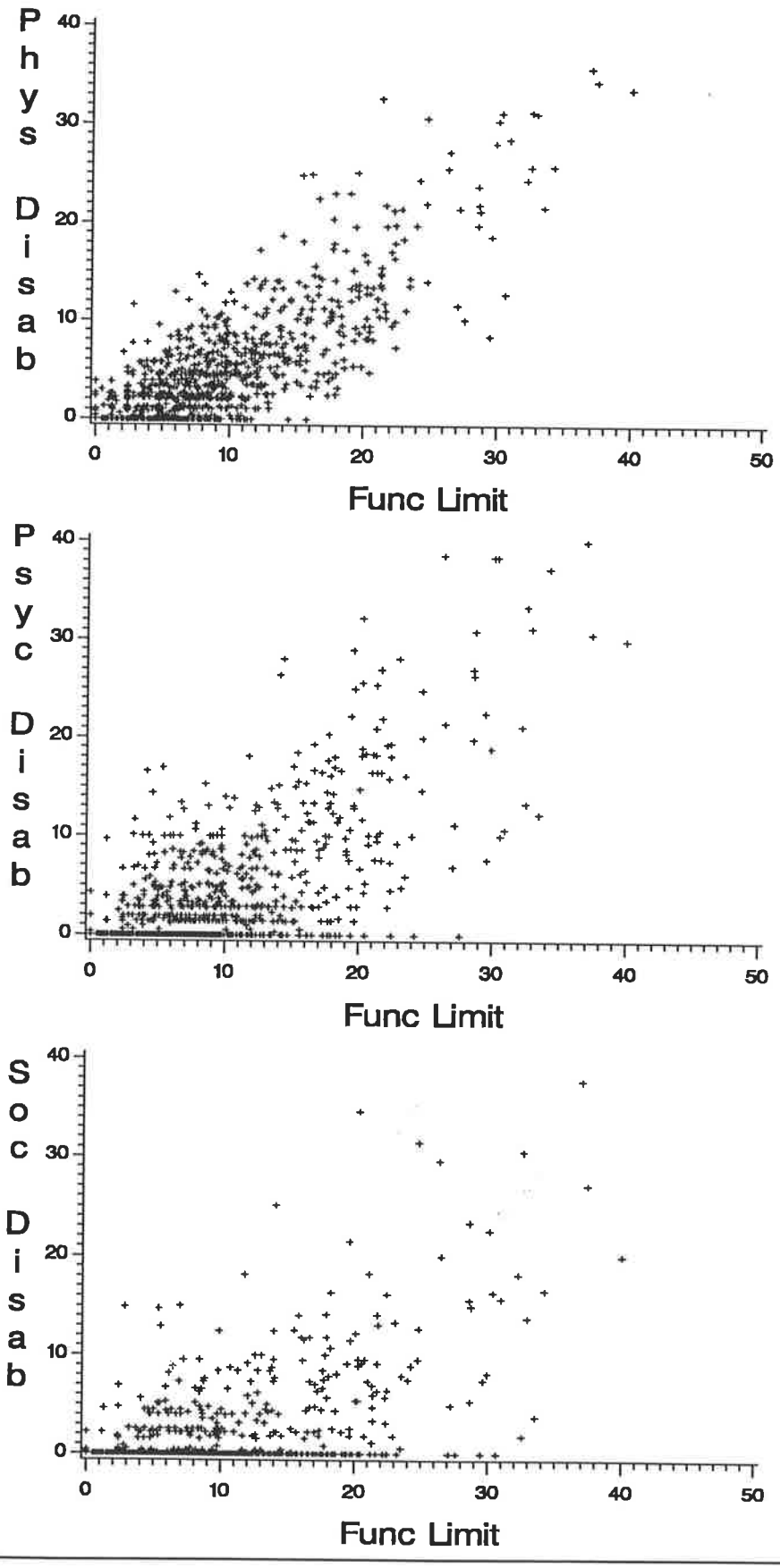
* All coefficients were statistically significant ($p<0.01$).

The subscale in which correlations among edentulous were consistently greater than or equal to the correlations among dentate was observed for functional limitation. This might suggest that, among edentulous, discomfort and psychosocial impacts are more immediately related to the underlying functional problems of chewing, speech or appearance than is the case for dentate persons. It is conceivable that intervening factors (possibly related to the dentate individual's pattern of

dental care or their socio-economic status) may have a relatively greater modifying effect on the pathways between dysfunction and disability for dentate persons compared with edentulous persons.

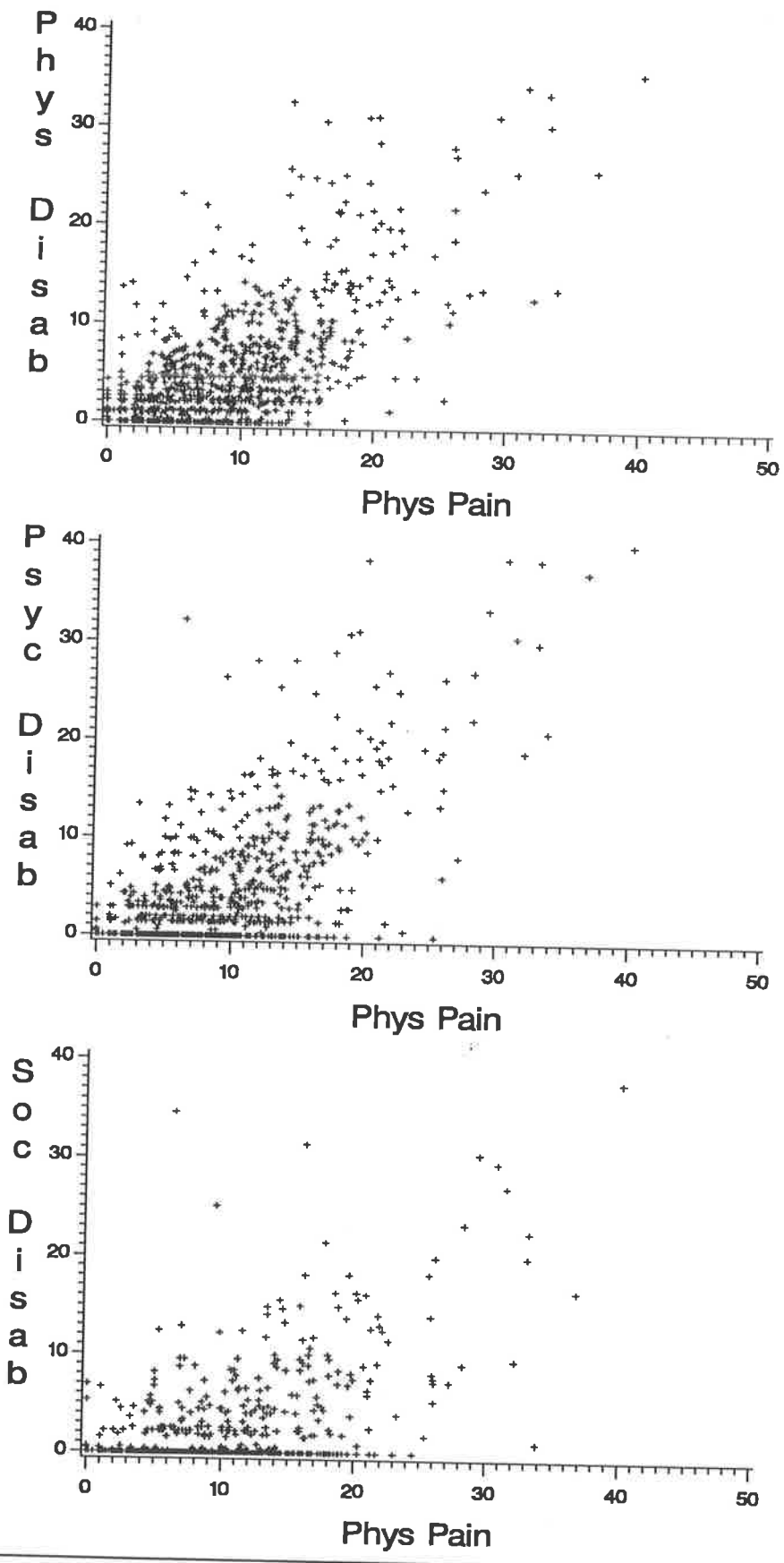
Straight-line correlation coefficients do not necessarily describe the complete nature of relationships among subscales. Figure 20 presents scatterplots of the three disability subscales on the vertical axes against functional limitation on the horizontal axes while Figure 21 contains the three disability subscales plotted against physical pain on the horizontal. The scatterplots have been selected in order to focus on the main hypothesized relationships within Locker's theoretical model – namely the relationships between functional limitation and disability, and between pain and disability. The Figures refer to all persons, both examined and non-examined, and the data are unweighted because it is not possible to plot points which represent weighted numbers of persons.

FIGURE 20 SCATTERPLOTS* OF DISABILITY SUBSCALES VERSUS FUNCTIONAL LIMITATION SUBSCALE



* Unweighted data from 1,217 persons. Each cross represents one case.

FIGURE 21 SCATTERPLOTS* OF DISABILITY SUBSCALES VERSUS PHYSICAL PAIN SUBSCALE



* Unweighted data from 1,217 persons. Each cross represents one case.

The scatterplots are suggestive of a curvilinear relationship between disability and either functional limitation or pain. This suggested appearance assumes that a line of best fit would pass through the origin, and is attributable largely to the clustering of near-zero disability scores (on the vertical axes) towards the lower end of the distributions of functional limitation and pain subscales (on the horizontal axes). While it is not necessary, mathematically, to impose the restriction that a line of best fit passes through the origin, there is no intuitive sense to a negative disability score since the lowest possible score in any OHIP subscale is zero.

The scatterplots also give visual confirmation of the generally lower correlations between disability and physical pain in comparison with disability and functional limitation. Interestingly the lower correlations (quantified in Table 77), for example between physical disability and physical pain, appear to be related to a number of individuals reporting low physical pain but high physical disability, appearing in the upper left quadrant of the top scatterplot in Figure 21. Such a phenomenon should not be surprising. For example, individuals with basically comfortable dentures can nevertheless be expected to have diminished chewing capacity simply due to the technical limitations of artificial teeth.

Relationships between disability and both functional limitation and physical pain were investigated quantitatively through least squares regression analysis. Six models were created with either physical, psychological or social disability subscale as dependent variables. The independent variables included either functional limitation or physical pain subscales, and the quadratic (squared) functions of those subscales. In addition, dentate status was introduced as a dichotomous variable into each of the six models to ascertain if edentulism had an independent effect on

disability after controlling for the other explanatory variables. The findings are presented in Table 79.

In all six models the quadratic term was statistically significant, confirming the apparent curvilinear relationship observed in scatterplots. To gain an understanding of the importance of the quadratic and edentulous terms, it is necessary to compare the R^2 value of each model with the squared bivariate correlations from Table 77. Considering functional limitation and physical disability as an example, the square of the bivariate correlation (from Table 77) is $0.82^2 = 0.67$ compared with the model R^2 of 0.71 in Model 1 of Table 79 . The increases in R^2 for the remaining five models in Table 79 ranged from 0.03 to 0.11, being greatest for Models 5 and 6 where the dependent variable was social disability. In most cases, the main contribution to the increases in R^2 came from the quadratic term rather than the edentulism term, as indicated by the larger F-ratio for the quadratic term. For example, in the case of functional limitation, the F-ratio for the quadratic term was 124 compared to 70 for the edentulism term (Table 79).

TABLE 79 REGRESSION MODELS* RELATING FUNCTIONAL LIMITATION AND PHYSICAL PAIN TO PHYSICAL DISABILITY

Model	Dependent variable	Independent variable	Paramter estimate	StdErr	F	p	Model R^2
1)	Physical disability	FuncLimit	0.33	0.04	2788	<0.01	0.711
		FuncLimit^2	0.01	0.001	124	<0.01	
		Edentulous	1.06	1.49	70	<0.01	
2)	Physical disability	PhysPain	0.33	0.05	1185	<0.01	0.523
		PhysPain^2	0.01	0.002	57	<0.01	
		Edentulous	2.14	0.22	87	<0.01	
3)	Psychological disability	FuncLimit	0.10	0.03	1312	<0.01	0.546
		FuncLimit^2	0.02	0.001	149	<0.01	
		Edentulous	0.15	0.23	<1	0.52	
4)	Psychological disability	PhysPain	0.11	0.05	1146	<0.01	0.517
		PhysPain^2	0.02	0.001	151	<0.01	
		Edentulous	0.45	0.23	4	0.06	
5)	Social disability	FuncLimit	-0.11	0.04	723	<0.01	0.431
		FuncLimit^2	0.02	0.001	197	<0.01	
		Edentulous	0.12	0.17	<1	0.49	
6)	Social disability	PhysPain	-0.10	0.04	642	<0.01	0.412
		PhysPain^2	0.02	0.001	202	<0.01	
		Edentulous	0.46	0.17	7	0.01	

* Multivariate analysis using least squares regression (weighted n = 1,217 OHIP respondents).

The edentulism term was statistically significant in three of the models (Models 1, 2 and 6) in Table 79, and near to significant in Model 4. The sign of the edentulism coefficient indicated that edentulous persons had higher levels of disability after controlling either for functional limitation or physical pain. Furthermore, the magnitude of the coefficient indicated that the additional effect of edentulism was moderate or very strong (0.4 or

greater). It will be recalled from Table 52 (page 203) that differences in subscales of 0.5 were consistent with some marked differentials in frequency of OHIP items. In fact, the strength of the edentulism effect, indicated by the regression coefficients in Table 79, is strikingly similar to the differential in the three disability means for dentate and edentulous persons presented earlier in Table 52. On one hand, this is surprising, since it might be anticipated that higher levels of disability would be accounted for largely by higher overall levels of functional limitation. However, closer scrutiny of Table 52 reveals relatively small differences in the unadjusted means of dentate and edentulous persons for the functional limitation and physical pain subscales.

The extent to which oral status might contribute to disability, independently of any effects of functional limitation and physical pain, was investigated in more detail among the dentate group who received oral examinations. It will be recalled from Table 64 that missing anterior teeth, unreplaced posterior spaces and root decay were independently associated with the three disability subscales. Six new regression models therefore were created adopting the same approach which examined the effect of edentulism in Table 79. The three disability subscales formed dependent variables, and the three oral epidemiological variables were added to each model along with either functional limitation or physical pain (and their quadratic terms).

The findings are presented in Table 80 and there were several consistencies with the previous observations concerning edentulism. The quadratic terms were significant in all models, and the R^2 value for each model was similar to the corresponding values from Table 79. To this extent, the previous interpretations about the curvilinear relationships which applied to all persons (both dentate and edentulous, examined and non-examined) seemed to apply among the dentate examined subgroup. For

five of the models in Table 80, oral epidemiological variables also were significant explanatory variables. Root decay appeared in four models while unreplaced posterior spaces appeared in the three models containing physical pain (Models 2, 4 and 6). Posterior spaces were associated with greater levels of disability in each case.

TABLE 80 REGRESSION MODELS RELATING FUNCTIONAL LIMITATION, PHYSICAL PAIN AND EPIDEMIOLOGICAL VARIABLES TO PHYSICAL DISABILITY – EXAMINED DENTATE PERSONS

Model	Dependent variable	Independent variable	Paramter estimate	StdErr	F	p	Model R^2
1)	Physical disability	FuncLimit	0.26	0.05	1814	<0.01	0.718
		FuncLimit^2	0.02	0.001	111	<0.01	
		MT1	0.09	0.01	8	<0.01	
		SPACE2	0.03	0.03	1	0.26	
		ROOTD	0.36	0.10	13	<0.01	
2)	Physical disability	PhysPain	0.25	0.05	904	<0.01	0.584
		PhysPain^2	0.01	0.002	64	<0.01	
		MT1	0.33	0.04	66	<0.01	
		SPACE2	0.12	0.03	18	<0.01	
		ROOTD	0.60	0.11	25	<0.01	
3)	Psychological disability	FuncLimit	0.001	0.06	789	<0.01	0.550
		FuncLimit^2	0.03	0.002	133	<0.01	
		MT1	-0.14	0.05	7	0.01	
		SPACE2	0.02	0.04	1	0.43	
		ROOTD	0.32	0.13	6	0.02	
4)	Psychological disability	PhysPain	0.002	0.05	825	<0.01	0.571
		PhysPain^2	0.03	0.002	165	<0.01	
		MT1	0.04	0.04	1	0.30	
		SPACE2	0.11	0.03	11	<0.01	
		ROOTD	0.51	0.13	16	<0.01	
5)	Social disability	FuncLimit	-0.16	0.05	346	<0.01	0.382
		FuncLimit^2	0.02	0.002	126	<0.01	
		MT1	-0.01	0.04	<1	0.81	
		SPACE2	0.02	0.03	<1	0.40	
		ROOTD	0.02	0.10	<1	0.91	
6)	Social disability	PhysPain	-0.21	0.04	509	<0.01	0.512
		PhysPain^2	0.02	0.001	282	<0.01	
		MT1	0.06	0.03	3	0.09	
		SPACE2	0.06	0.02	7	0.01	
		ROOTD	0.10	0.08	1	0.25	

* Multivariate analysis using least squares regression (weighted n = 569 dentate persons).

Other relationships in Table 80 were less certain. It may have been expected, for example, that decayed roots would not have an effect independent of physical pain. However it was significant in Models 2 and 4. Missing anterior teeth, which might be expected to cause social impact through effects on self esteem, had an independent effect on psychological disability only for Model 4, where it appeared along with functional limitation variables. Surprisingly, missing anterior teeth were not independently associated with social disability in Model 5 in Table 80.

6.3.5.2 Joint effects of functional limitation and physical pain on disability

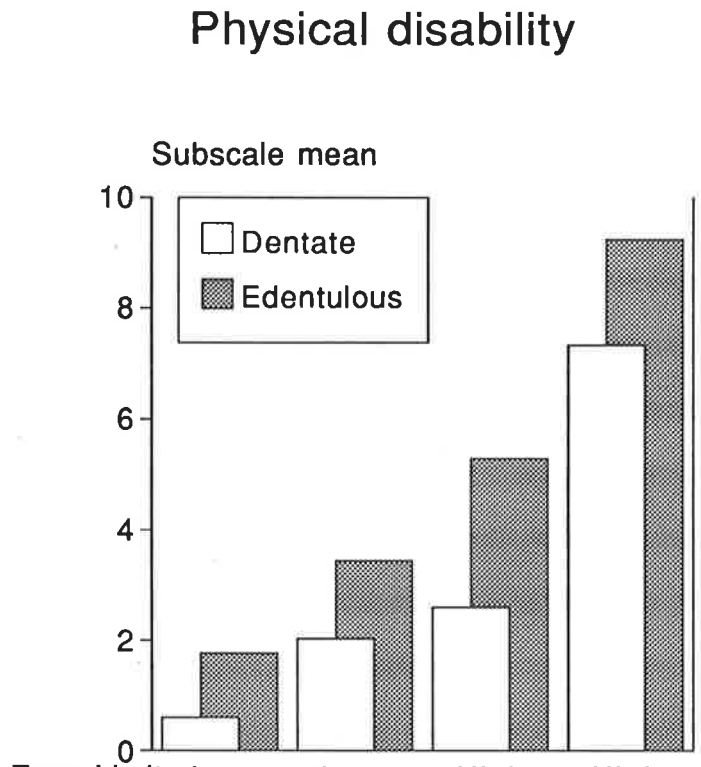
A more thorough explanation of the effects of epidemiological variables on the relationships between subscales could proceed by examining interactions (from Table 80) to indicate the presence of effect-modifiers. For example, the slope of the curvilinear relationship between functional limitation and physical disability may differ between those with and without root decay. Another worthwhile area of investigation is the extent to which functional limitation and physical pain together might affect disability.

However the examination of interactions using linear models is problematic because of multi-collinearity. For example, there would be a lack of reliability in a linear model where the independent variables consisted of functional limitation, physical pain, oral epidemiological terms and their interactions – all of which are inter-correlated. Indeed, it is possible that some of the unexpected findings from Table 80 may be due, in part, to this problem, since the first order terms are inter-correlated. That is, functional limitation is correlated with tooth loss and root decay.

At a descriptive level, it is possible to consider the general issue of more complex relationships among subscales by constructing broad categories of the independent variables and simply examining mean levels of

disability subscales. Figure 22 is a chart of mean physical disability subscale scores (represented on the vertical axis) among eight groups defined by high or low functional limitation, high or low physical pain, and dentate or edentulous status. High and low levels of functional limitation were categorized as scores above or below the median, and physical pain categories also were dichotomized around the median. As expected, physical disability subscale scores increased among the groups towards the right hand side of the horizontal axis in Figure 22. For example, the "high functional limitation-high pain" group had physical disability scores greater than 7.0 – five times the level of the "low functional limitation-low pain" group. This is expected, in view of the correlations examined so far among the subscales, and after considering Models 1 and 2 in Table 79 (page 291) which related physical disability separately to functional limitation and to physical pain.

FIGURE 22 PHYSICAL DISABILITY AMONG FUNCTIONAL LIMITATION, PHYSICAL PAIN AND DENTATE GROUPS – ALL PERSONS



FL: Dent	3.09	4.41	8.69	13.62
FL: Edent	2.76	4.47	8.99	14.10
P: Dent	2.83	9.50	3.78	13.12
P: Edent	2.82	8.62	3.87	12.79

However Figure 22 also demonstrates a consistent disadvantage among edentulous persons. Within each functional limitation/pain grouping, edentulous persons had higher levels of physical disability by a factor of 25 per cent of more. In order to ascertain that the four groupings of functional limitation and physical pain resulted in similar scores of those subscales, the group means of the subscales for the dentate and edentulous groups have been printed in the table below the bar chart in Figure 22. The group means were very similar. For example, mean functional limitation subscale scores for the high dysfunction-high pain group were 13.62

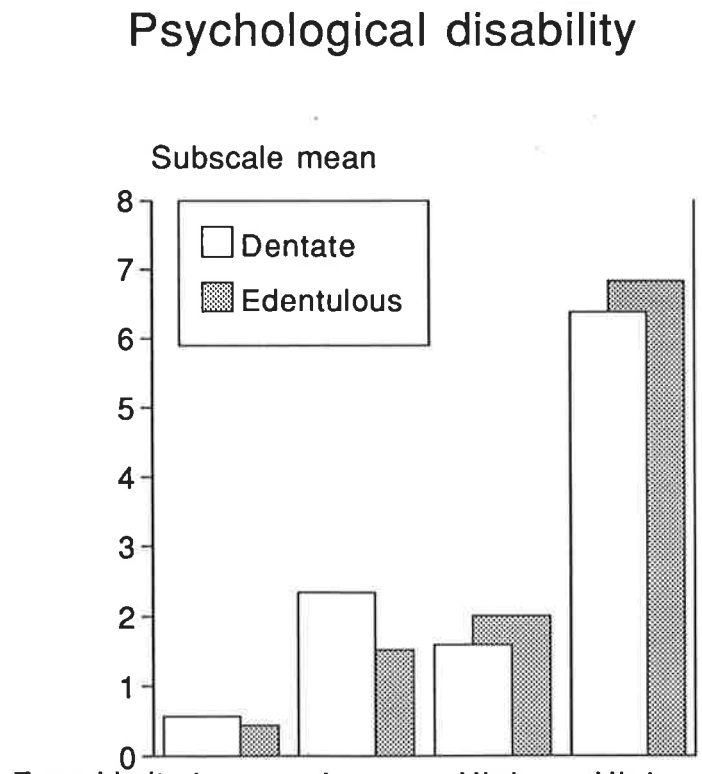
(dentate) and 14.10 (dentate). Pairs of subscale scores for the other dichotomous groupings were also similar. Hence, the disadvantage among edentulous persons within the four groupings in Table 80 cannot be attributed to substantially higher functional limitation of physical pain subscale scores within the dichotomous groupings.

Another feature of Figure 80 is an apparent interaction between dentate status and the dysfunction-pain groupings. Among dentate persons, the high dysfunction-high pain group had markedly higher levels of physical disability than the two middle dentate groups which themselves were similar. In contrast, physical disability scores among edentulous persons increased in a fairly linear manner from left to right. This could represent an interaction whereby functional limitation is more marked among those with high physical pain than among those with low physical pain in the edentulous group. It could be interpreted as a more definite "threshold" for severe physical disability among dentate persons. Those dentate persons who have relatively high levels of functional limitation and physical pain are likely to have the highest levels of physical disability, whereas high functional limitation or high physical pain alone is not so likely to produce high levels of physical disability. Among edentulous, the more linear pattern suggests that each additional increment of dysfunction or pain is as likely to increase levels of physical disability.

The same catgorizations of high and low functional limitation and physical pain were used to illustrate levels of psychological disability (Figure 23) and social disability (Figure 24). Both were in contrast with the previous findings concerning physical disability for two reasons. First, there was a lack of disadvantage among the edentulous subgroup – within each pair of bars, the subscale scores for edentulous persons (shaded bar) differed from dentate persons by no more than 26 per cent. Second, the patterns were suggestive of an interaction between functional limitation and

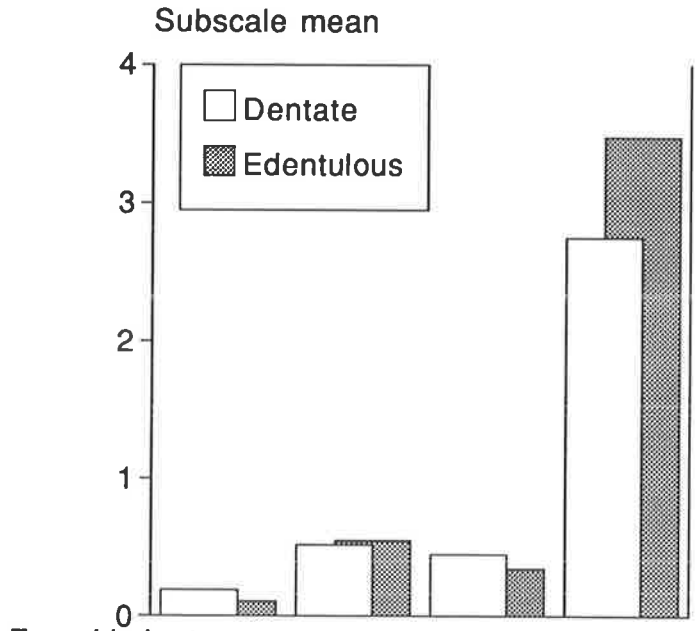
physical pain for both dentate and edentulous, as indicated by the noticeably higher levels for the high dysfunction-high pain groups in comparison with all three other groups. In other words, the patterns for psychological and social disability were more suggestive of a "threshold" for dentate and edentulous persons in which high levels of those disabilities were observed in the presence of high levels of both functional limitation and physical pain.

FIGURE 23 MEAN PSYCHOLOGICAL DISABILITY SUBSCALE SCORES AMONG FUNCTIONAL LIMITATION, PHYSICAL DISABILITY AND DENTATE GROUPS – ALL PERSONS



FL: Dent	3.09	4.41	8.69	13.62
FL: Edent	2.76	4.47	8.99	14.10
P: Dent	2.83	9.50	3.78	13.12
P: Edent	2.82	8.62	3.87	12.79

FIGURE 24 MEAN SOCIAL DISABILITY SUBSCALE SCORES AMONG FUNCTIONAL LIMITATION, PHYSICAL DISABILITY AND DENTATE GROUPS – ALL PERSONS

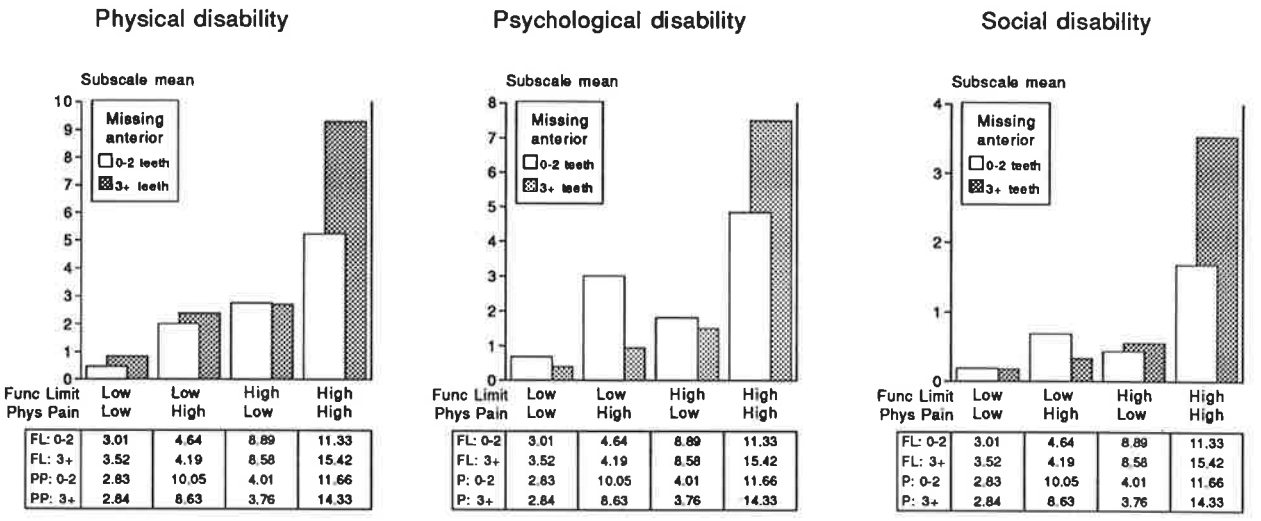


FL: Dent	3.09	4.41	8.69	13.62
FL: Edent	2.76	4.47	8.99	14.10
P: Dent	2.83	9.50	3.78	13.12
P: Edent	2.82	8.62	3.87	12.79

A similar approach was adopted among the dentate group to examine effects of oral epidemiological variables on the relationships between functional limitation, physical pain the three disability subscales. The oral epidemiological variables included missing anterior teeth, unreplaced posterior spaces and decayed root surfaces. Individuals were classified into "high" and "low" subgroupings of each of those variables according to whether they were above or below the median value of the epidemiological variable. Hence, the subgroup with zero to two missing anterior teeth was categorized as "low" and the subgroup with three or more missing anterior

teeth was categorized as "high". The findings are summarized in three charts in Figure 25.

FIGURE 25 MEAN DISABILITY SUBSCALES AMONG FUNCTIONAL LIMITATION, PHYSICAL PAIN AND MISSING ANTERIOR TEETH GROUPS – DENTATE PERSONS



For all three subscales in Figure 25, there were similar patterns among groups defined by functional limitation, physical pain and missing anterior teeth. Most noticeably, the group with high functional limitation and high physical pain had substantially greater levels of disability, while the other three levels of functional limitation and physical pain had less marked variation in disability subscale scores. In some cases a reverse effect was noted. Within the psychological disability subscale, the "low functional limitation-high physical pain group" recorded lower subscales scores if there were three or more missing anterior teeth. For all three subscales, the largest difference between missing teeth subgroups was observed within the high functional limitation/high physical pain group – persons with three or more missing teeth had noticeably higher levels of disability.

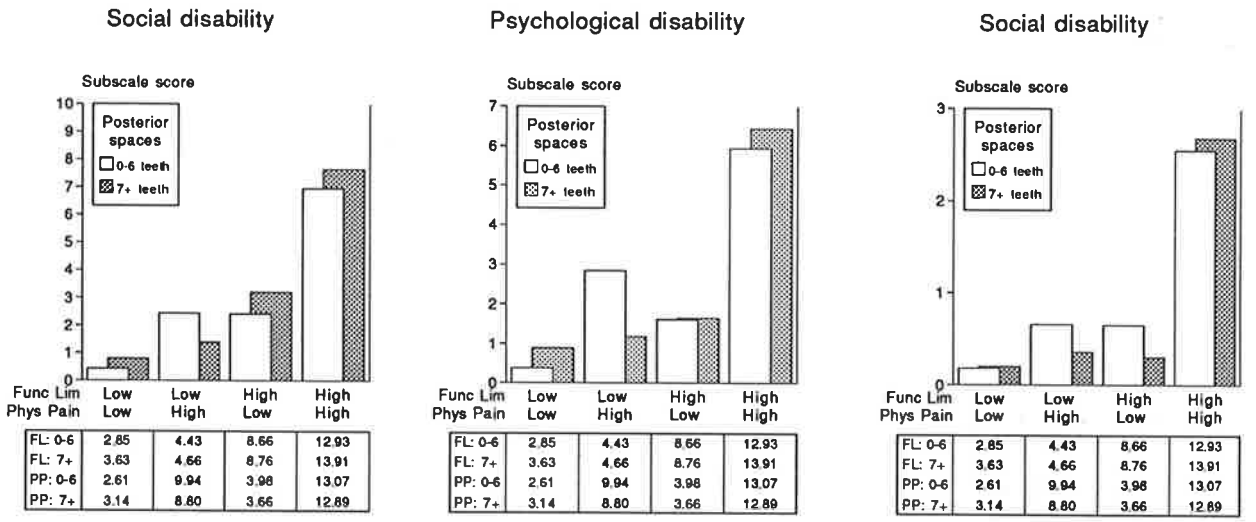
One limitation of the findings in Figure 25 is the level of variation in mean subscale scores of functional limitation and physical pain within the high functional limitation/high physical pain group. (The mean subscale scores are indicated in the table below each bar chart). For example, the subgroup with 0-2 missing teeth had a mean functional limitation score of 11.33 compared with 15.42 for the subgroup with 3 or more missing teeth. There were other discrepancies in physical pain. The low functional limitation/high physical pain group also had noticeable differences among missing teeth subgroups in the values for physical pain.

These variations in the functional limitation and physical pain subscales indicate that the dichotomous catgorization of groups into "low" and "high" had not completely controlled for variations. This was most noticeable within the "high functional limitation/high physical disability" group on the right hand side of each bar chart in Figure 25. Hence, the differentials in disability subscales between oral epidemiological groups must be interpreted with caution. It is possible that the presumed epidemiological effects are simply reflections of the differences in mean subgroup levels in functional limitation and physical pain, rather than any separate modification of effects by missing anterior teeth.

For posterior spaces, two subgroups were defined with zero to six missing posterior spaces or greater than six posterior spaces. The data are presented in Figure 26 using the same layout as the previous figure. The findings were very similar. There were small differences among the two missing teeth subgroups indicating only weak effects of missing posterior teeth on the relationships between functional limitation, physical pain and disability. Furthermore, in four of the groups presented in Figure 26, the subgroup with zero to six posterior spaces (white bars) had higher levels of disability. Consistent with the previous observations, the greatest levels of disability were among the "high functional limitation/high physical pain"

groups. This follows, since the high functional limitation-high physical pain groups are comprised of the same persons in both Figure 25 and Figure 26. The mean subscale scores for functional limitation and physical pain differed to a smaller extent between the two groups defined by epidemiological measures, as indicated in the table below the bar charts. In the "high functional limitation/high physical pain" group, the functional limitation score was higher by 1 unit among persons with 7+ posterior spaces, while the physical pain score was virtually equivalent.

FIGURE 26 MEAN DISABILITY SUBSCALES AMONG FUNCTIONAL LIMITATION, PHYSICAL PAIN AND POSTERIOR SPACE GROUPS – DENTATE PERSONS

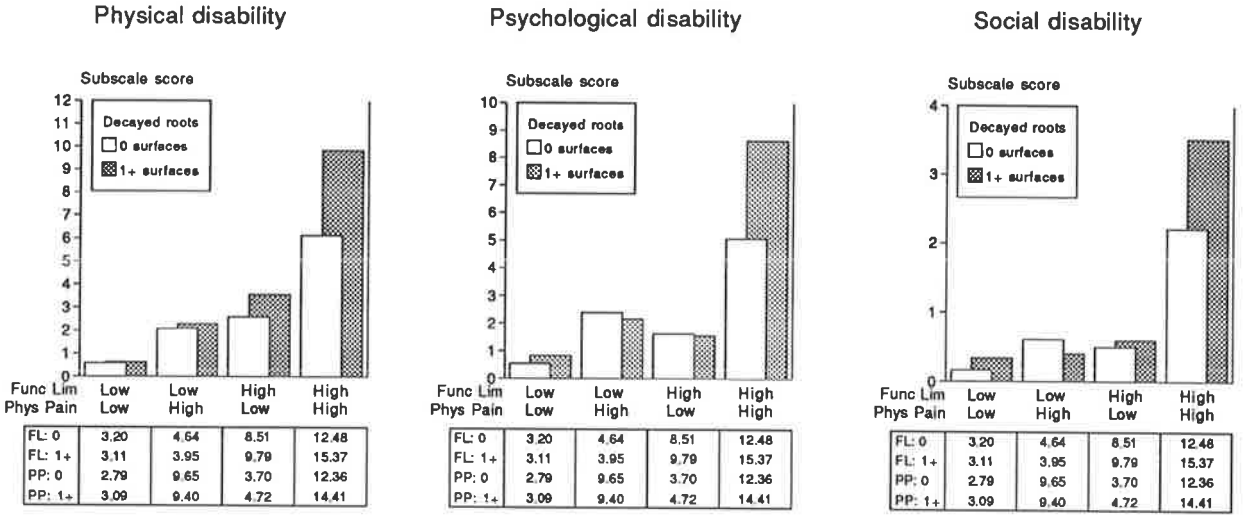


FL: 0-6	2.85	4.43	8.66	12.93
FL: 7+	3.63	4.66	8.76	13.91
PP: 0-6	2.61	9.94	3.98	13.07
PP: 7+	3.14	8.80	3.66	12.89

Figure 27 considers the modifying effects of decayed root surfaces on relationships between functional limitation, physical pain and the three disability subscales. The patterns are similar to Figure 25, featuring relatively small differences between the two subgroups (with or without decayed root surfaces) other than the high functional limitation/high physical pain group. In this instance, functional limitation and physical pain subscale scores were noticeably higher in the "high functional limitation/high physical pain" group with one or more decayed surfaces

(with the respective means differing by 2.9 and 2.1 compared with no decayed surfaces – indicated in the table below each bar chart).

FIGURE 27 MEAN DISABILITY SUBSCALES AMONG FUNCTIONAL LIMITATION, PHYSICAL PAIN AND ROOT DECAY GROUPS – DENTATE PERSONS



In order to evaluate statistically the effects described previously, and to control more fully for variations in levels of functional limitation and physical pain, an alternative approach was adopted. The approach was to construct matched pairs of persons, one dentate and one edentulous, in which each member of the pair had identical (rounded to the nearest integer) functional limitation and physical pain subscale scores. Differences in disability scores between pairs were then computed. Since there were more dentate than edentulous persons, there frequently was more than one dentate person matched to an edentulous person with similar functional limitation and physical pain subscale scores. In those instances, a single dentate person was selected at random.

Table 81 presents the differences in disability subscale scores between matched pairs of edentulous and dentate persons. Differences among all

pairs were statistically significant for the physical disability subscale which was 1.25 greater among edentulous persons. This provides quantitative support for the earlier observations (from Figure 22, page 297) about overall higher levels of physical disability among edentulous subgroups after controlling for functional limitation and pain. Table 81 also indicates that the largest physical disability differences between edentulous and dentate were observed for pairs with levels of functional limitation around the middle of the range. For example, pairs with functional limitation scores between 6 and 11 featured physical disability subscales which differed by more than 1.5. At the lower and upper ends of the functional limitation distribution (0-2 and 12 or more), the differences were less than 1.0, and in the latter case was not statistically significant.

TABLE 81 DIFFERENCES IN DISABILITY SUBSCALE SCORES BETWEEN MATCHED PAIRS* OF EDENTULOUS AND DENTATE PERSONS

		Mean (StdDev) difference between edentulous-dentate pairs:		
Functional limitation	Number of pairs	Physical disability	Psychological disability	Social disability
0-2	48	0.63† (1.51)	0.10 (0.65)	-0.04 (0.73)
3-5	57	1.29† (2.58)	-0.01 (2.23)	0.11 (1.15)
6-8	65	1.57† (3.49)	-0.61 (3.93)	-0.35 (2.60)
9-11	40	2.16† (4.57)	0.35 (4.95)	-0.37 (2.27)
12+	37	0.46 (6.63)	0.09 (9.43)	0.03 (5.93)
ALL	**247**	**1.25† (3.90)**	**-0.07 (4.72)**	**-0.13 (2.85)**

* Pairs were constructed by matching one edentulous person and one dentate person, each with identical (rounded to the nearest integer) functional limitation and physical pain subscale scores.
† Paired t-test, $p<0.05$.

Psychological and social disability subscales in Table 81 did not differ significantly between dentate and edentulous. Furthermore, the magnitude of differences was small, indicating psychological and social disability subscales which were lower among edentulous persons by no more than 0.13.

The final part of this section used a similar methodology to examine differences according to other oral epidemiological measures among the examined dentate group. The oral epidemiological measures were missing anterior teeth, posterior spaces and decayed root surfaces. Each measure was dichotomised (at or near the median), and matched pairs were constructed of persons with identical functional limitation and physical pain scores, again rounded to the nearest integer. For missing anterior teeth the pairs consisted of one person with fewer than three missing teeth and another person with three or more missing teeth. For posterior spaces the pairs consisted of one person with fewer than seven spaces and another with seven or more spaces, while for root decay the pairs consisted of one person with no decayed surfaces and another with one or more decayed surfaces. The findings are presented in Table 82. Differences between matched pairs generally were smaller than observed in the previous instance (Table 81), and were statistically significant only in the case of missing anterior teeth. Persons with three or more missing anterior teeth had higher levels of physical disability compared with matched pairs who had the same levels of functional limitation and physical pain but who had fewer than three missing anterior teeth. However, psychological disability was lower among persons with three or more missing anterior teeth compared with the matched pairs who had fewer than seven missing posterior teeth.

TABLE 82 DIFFERENCES IN DISABILITY SUBSCALE SCORES BETWEEN MATCHED PAIRS OF DENTATE PERSONS HAVING EQUIVALENT FUNCTIONAL LIMITATION AND PHYSICAL PAIN AND CONTRASTING ORAL EPIDEMIOLOGICAL CHARACTERISTICS

		Mean (StdDev) difference in subscales between matched pairs					
Definition of pairs	Number of pairs	Physical disability		Psychological disability		Social disability	
0-2 vs 3+ missing anterior teeth	188	0.59*	(3.07)	-0.89*	(3.86)	-0.03	(2.42)
1-6 vs 7+ posterior spaces	178	0.31	(3.29)	0.36	(3.33)	0.14	(2.10)
0 vs 1+ decayed root surfaces	127	0.35	(3.36)	0.25	(3.34)	0.45	(2.62)

* paired t-test, $p<0.05$.

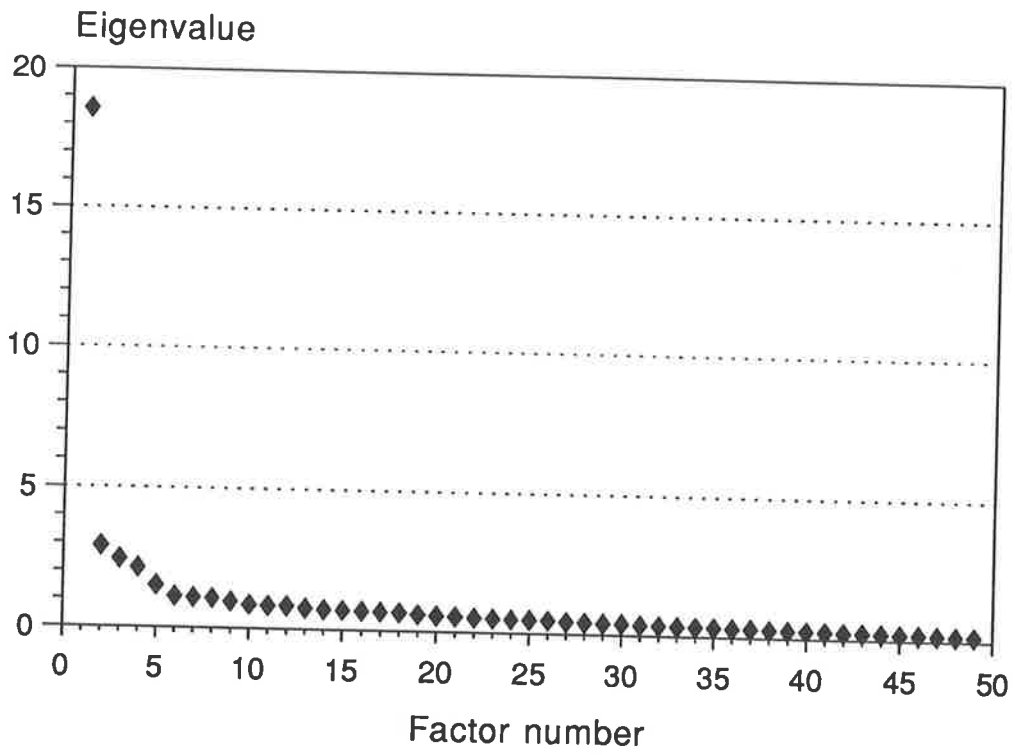
The contrasting effects in Table 82 could be due to further multivariate influences not considered here. For example, levels of psychological discomfort have not been considered. Furthermore, the matched pairs may differ by age or other factors which have effects on overall levels of social impact. Nonetheless, the numerous approaches to analysis adopted in this section have revealed a generally consistent effect: edentulous persons had higher levels of physical disability and more disabling consequences of functional limitation and physical pain. However, oral epidemiological variables among dentate persons did not appear to have a similar effect.

6.3.5.3 Principal components analysis of OHIP questions

The final part of the analysis examined other potential groupings of OHIP items. The complete series of 49 OHIP questions was subject to

principal components analysis in order to identify potential alterntive groupings of OHIP items. The Likert-type responses (coded zero for "never" through to four for "very often") without any item weights were used from all 1,217 OHIP respondents. The scree plot of eigenvalues is presented in Figure 28. The first factor (number one on the horizontal axis) accounted for a substantially larger percentage of the total variance in the scree plot than any other factor, with an eigenvalue of 18.6 representing 37.9 per cent of the total variance. There was a sharp elbow in the scree plot corresponding with the second factor, which had an eigenvalue of 2.9, although the third through to the eighth principal components had eigenvalues ranging above 1.0.

FIGURE 28 SCREE PLOT OF EIGENVALUES FROM THE PRINCIPAL COMPONENTS ANALYSIS OF THE OHIP



The factor pattern for all eight principal factors which had eigenvalues of 1.0 or greater are presented in Table 83. The factor patterns represent

the correlations between individual OHIP items and the principal components. The most striking effect was that all OHIP questions had moderate to strong correlations with the first principal component. Forty one questions had correlations of 0.5 or more, and the weakest three correlations were observed for financial loss (Q45, correlation = 0.29), toothache (Q13 = 0.27) and sensitive teeth (Q12 = 0.23).

TABLE 83 FACTOR PATTERN FROM THE PRINCIPAL COMPONENTS ANALYSIS OF THE OHIP

OHIP Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Q1	0.63	-0.46	0.09	0.07	0.04	0.04	0.12	-0.02
Q2	0.63	-0.14	-0.15	-0.10	0.48	0.17	-0.27	-0.08
Q3	0.34	0.23	0.52	-0.04	0.13	-0.00	0.03	0.06
Q4	0.62	0.04	0.41	-0.37	0.00	-0.09	-0.05	0.18
Q5	0.42	0.11	0.15	0.11	0.31	-0.26	0.14	0.00
Q6	0.62	-0.01	-0.14	-0.01	0.31	-0.20	0.40	-0.05
Q7	0.36	-0.02	0.31	0.19	0.30	0.12	-0.00	0.04
Q8	0.66	-0.13	-0.04	0.03	0.07	-0.19	0.34	-0.02
Q9	0.58	-0.00	0.22	0.43	0.01	-0.06	-0.17	0.13
Q10	0.51	-0.13	-0.03	0.36	0.06	-0.17	-0.22	0.32
Q11	0.51	0.13	-0.11	0.21	0.11	-0.15	-0.10	-0.11
Q12	0.23	0.38	0.46	0.37	0.15	0.15	0.14	-0.17
Q13	0.27	0.37	0.36	0.41	0.08	0.23	0.06	-0.27
Q14	0.55	-0.25	0.08	0.40	0.01	-0.22	-0.13	0.26
Q15	0.67	-0.49	0.07	0.08	-0.02	0.05	0.08	0.02
Q16	0.47	-0.27	0.08	0.35	-0.11	-0.22	-0.15	0.31
Q17	0.59	-0.55	-0.01	0.02	-0.05	0.25	-0.03	-0.02
Q18	0.63	-0.51	-0.04	0.00	-0.09	0.27	-0.03	-0.07
Q19	0.66	-0.09	0.29	0.07	-0.14	0.10	0.07	-0.14
Q20	0.65	0.03	0.41	-0.39	-0.01	-0.05	-0.02	0.14
Q21	0.76	-0.04	0.11	0.06	-0.20	-0.04	-0.01	-0.17
Q22	0.65	0.02	0.44	-0.40	-0.05	-0.09	-0.05	0.12
Q23	0.77	-0.02	0.11	-0.01	-0.23	-0.01	-0.05	-0.19
Q24	0.68	-0.06	-0.13	-0.15	0.46	0.12	-0.30	-0.14
Q25	0.68	-0.02	-0.18	-0.08	0.45	0.05	-0.23	-0.09
Q26	0.66	-0.03	-0.22	-0.05	0.25	-0.14	0.35	-0.06
Q27	0.34	0.16	0.34	0.26	0.05	-0.01	0.03	-0.07
Q28	0.63	-0.41	-0.02	0.01	-0.08	-0.03	0.22	-0.03
Q29	0.67	-0.10	-0.15	-0.11	0.04	-0.18	0.23	-0.06
Q30	0.65	-0.39	-0.11	-0.04	-0.07	0.23	0.04	-0.07
Q31	0.61	0.15	0.23	-0.42	-0.01	-0.04	-0.08	0.05
Q32	0.61	-0.36	-0.12	0.03	-0.09	0.04	-0.03	-0.01
Q33	0.58	0.13	-0.03	0.28	-0.14	-0.07	-0.08	-0.10
Q34	0.78	0.01	0.02	-0.02	-0.25	0.03	-0.03	-0.18
Q35	0.78	0.12	-0.07	0.07	-0.24	-0.04	-0.11	-0.16
Q36	0.78	0.19	-0.03	-0.03	-0.23	-0.08	-0.06	-0.12
Q37	0.72	0.27	-0.19	0.06	-0.09	-0.07	-0.08	-0.07
Q38	0.73	0.06	0.23	-0.38	-0.04	0.01	-0.08	0.05
Q39	0.70	0.27	-0.16	-0.12	-0.07	0.02	-0.02	0.01
Q40	0.64	0.29	-0.28	0.05	-0.05	-0.10	-0.11	-0.10
Q41	0.65	0.26	-0.34	-0.05	0.04	-0.00	-0.06	0.02
Q42	0.63	0.22	-0.23	0.09	-0.19	-0.08	-0.07	-0.05
Q43	0.59	0.30	-0.26	0.11	-0.09	0.19	0.06	0.12
Q44	0.68	0.16	-0.09	0.01	-0.01	-0.06	0.12	0.06
Q45	0.29	0.21	0.07	0.12	-0.03	0.50	0.20	0.34
Q46	0.71	0.28	-0.17	-0.14	-0.03	0.02	-0.05	0.11
Q47	0.73	0.13	-0.08	-0.19	-0.14	0.08	0.06	0.04
Q48	0.58	0.25	-0.25	-0.05	0.07	0.14	0.09	0.31
Q49	0.56	0.28	-0.25	0.11	-0.02	0.23	0.14	0.29

The second principal component had only moderate positive correlations (0.30 to 0.38) with toothache (Q13), sensitive teeth (Q12) and difficulty doing jobs (Q43), although there were moderate to strong negative correlations (–0.36 to –0.55) with seven OHIP questions, most of them concerning chewing and denture disorders. The third factor had moderate positive correlations (0.31 to 0.52) with eight OHIP questions mostly relating to appearance, and generally weak negative correlations with handicap questions. The fourth factor had moderate positive correlations (0.35 to 0.43) with six of the physical pain questions and moderate negative correlations (–0.37 to –0.42) with a series of questions concerning appearance. The fifth factor had moderate positive correlations with the functional limitation items other than chewing, and moderate negative correlations with psychological disability questions. Factors six, seven and eight featured only a few or no moderate correlations, whether positive or negative.

6.4 Discussion

6.4.1 Limitations of the data

There has been acknowledgement already of several general features of this research which limit the conclusions which can be drawn about the social impact of oral disease. The epidemiological orientation of the research has excluded many qualitative features of social impact. The focus on the main links between epidemiological measures and social impact has, to a large extent, ignored other factors which might influence social impact such as: attitudes to oral health, preventive health behaviours, quality of dental care, and personality and internal feeling states. Such factors potentially would add to the explanatory power of multivariate models, and may also influence the interpretations about the effects of oral disease parameters.

An indication is provided by the findings of interactions between oral epidemiological variables and dental care variables. In order to better understand those interactions it would have been desirable to have additional information about the types of dental care and possibly satisfaction with that care.

Other epidemiological measures, not used in the examination protocol for the SADLS, may have provided a greater understanding of social impact. Parameters of temporomandibular dysfunction were not collected, and the periodontal assessment did not consider tooth mobility. Other clinical parameters such as malocclusion, salivary flow rate and assessments of mandibular atrophy, may have strong correlations with social impact. Despite the difficulties of reliable and valid assessment of these parameters, it should be borne in mind that they could have provided additional explanation.

The cross-sectional nature of the SADLS survey, its conduct among a sample of older adults, and the exploratory nature of the analyses represent another general limitations of the research, all of which have been noted previously. These basic issues in the design of the research were acknowledged within the aims and objectives, and it is possible only to speculate about the effects of alternative designs on the interpretations which may have been made. It is more appropriate to use those limitations as the basis for discussion about additional research (Chapter 7).

Specific limitations about the SADLS arise from the levels of participation in the survey, including levels of missing data, the observed distributions of social impact and the analytic methods. The findings from the factor analysis raise other questions about the use of separate

dimensions of the OHIP, and they are discussed in further detail below (Section 6.4.3).

6.4.1.1 Participation and response

The potential effects of participation bias on the estimates of population prevalence were assessed in some detail. Only 60 per cent of sampled persons took part in the interview, and both the oral epidemiological and OHIP data were available for only 61.6 per cent of them. Consistent with other surveys of older adult populations (Locker et al, 1990), this level of participation and the analyses of non-participation bias suggested that the effects on the prevalence estimates for specific items were small. Nonetheless, it is conceivable that non-participation could influence other interpretations about combinations of social impact and the overall hierarchy of conceptual dimensions. For example, non-participants could potentially represent a group with more uniform combinations of social impact. This could also influence the interpretation about the widespread distribution of low to moderate levels of impact, the approximate normality of summary OHIP scores, and the associations between social impact and explanatory factors.

Some additional information was available about the general nature of non-participation from the longitudinal follow-up of participants in the pilot study (Chapter 4) when it was observed that there were greater rates of loss to follow–up among older persons and those who did not take part in the baseline examination. The findings concerning age are consistent with the effects observed at the time of recruiting the SADLS sample (Table 35, page 165) when a lower participation in the interview was observed among older persons. However the participation in examinations among persons interviewed for the SADLS did not vary significantly according to reported

medical conditions (Table 36, page 168). The pilot survey findings, therefore, can be used to support the intuitive perception that many older adults declined to take part in the interview because of illness.

The interpretation of potential non-participation biases becomes more complex when variations in examination and OHIP responses were considered within the interviewed sample (Table 36, page 167). It was observed that the combined examination and OHIP participation varied according to: age, sex, dentition status, living arrangements, dwelling ownership, annual household income, health benefit card possession, period since last dental visit, usual reason for dental visit, and private dental insurance. Many of those characteristics featured in multivariate relationships with social impact, including interactions with oral epidemiological variables (Table 76, page 277).

Clearly one of the effects of lower participation is to reduce the size of the available sample, hence reducing the statistical power of hypothesis test. In that regard, these effects of non-participation could be regarded as conservative effects (tending towards the null hypothesis) within the exploratory analyses. However, findings from the multivariate models for chewing incapacity indicated that associations observed within the smaller group of examination/OHIP participants could be generalized with some confidence to the full sample of interviewed persons (Table 39, page 176). There were small and variable differences in parameter estimates obtained for five explanatory variables when the examination/OHIP participants were compared with the full sample. Some multivariate effects were slightly stronger among the examination/OHIP participants, while others were slightly weaker. There appeared to be no consistent biases, either towards the null hypothesis or towards exaggerated effects among participants.

Certainly there appeared to be little which could be done to improve the percentage participation rate in the SADLS. Considerable effort was made to gain access to a suitable sampling frame, and professional interviewers followed detailed instructions for call-back approaches to households which did not respond. This included calls at different times of the day and contact with neighbours. All non-contacted households were re-approached after three months. The largest source of non-participation was either disinterest or illness. While the primary approach letters and the efforts of interviewers were directed towards encouraging participation, it was neither desirable nor ethically responsible to disregard the wishes of non-respondents or to harass them.

Within the constraints of the overall participation in the study, most questions in the household questionnaire were answered by virtually all respondents. Two areas in which responses were low concerned the period since last dental extraction (B–5, nine per cent non-response), apparently related to difficulty in recollection, and annual household income (F–6, three per cent non-response), predominantly related to concerns about privacy. One way to improve the former may have been to prompt with questions about other major life events such as birth of children or grandchildren, retirement or changes of address. An alternative was to use household income data would be to use small area measures such as the SEIFA database (Australian Bureau of Statistics, 1987) used in the analysis of non-response. While small area measures of socio-economic status are becoming increasingly popular tools for analysis (Locker, 1993), it was not used in this instance primarily because it was felt that the question about difficulty paying a $100 fee (B–10) provided a pragmatic indicator of financial hardship.

6.4.1.2 Distribution of social impact and oral disease

While it has been emphasized that the distribution of summary OHIP scores was approximately normal, the distributions were skewed. The effect was more noticeable within the social disability and handicap subscales (Table 42, page 186). This leads to a theoretical concern about the appropriateness of least squares linear models for dependent variables which are not normal. However there is some consensus that the F–test is sufficiently robust, given a sufficiently large sample, to justify its use (Kleinbaum et al, 1988).

Of more concern is the statistical inefficiency, for the purpose of examining associations with social impact, of a sample in which a large proportion of respondents report little if any social disability and handicap. A related issue is the distribution of explanatory variables such as the low mean number of decayed surfaces and severely attrited teeth (Table 50, page 199). Presumably a larger number of relationships would be discerned from a group with severe disease and higher levels of impact, for example persons requiring complex restorative and prosthodontic care. This would suggest a conservative effect (towards the null hypothesis) on the capacity of this analysis of the SADLS sample to detect relationships with social impact.

In contrast to those speculated effects were specific findings concerning the effects of non-participation on multivariate models. It has been noted already (Table 39, page 176) that multivariate relationships between chewing incapacity and five explanatory variables were quite consistent between the examination/OHIP sample and the full interview sample.

6.4.1.3 Analytic methods

The examination of factors associated with social impact was confined primarily to ordinary least squares analysis which concentrate on means and standard errors. While the limited analysis of individual OHIP items (for example, denture-related factors associated with the denture-specific questions in the OHIP - Table 56, page 217) supported the more general interpretations obtained from subscales and the standardized OHIP, different approaches could be used. For example, specific "case definitions" could be identified, and multivariate analysis undertaken using logistic regression. Although not presented previously, logistic regression analyses using case definitions developed from the descriptive findings (such as persons reporting impacts in all seven dimensions, Table 44, page 190) revealed far fewer associations with epidemiological variables, and measures of missing teeth were not statistically significant.

There are other restrictions imposed with the use of means and standard errors, rather than qualitative descriptions of social impact. For example, Patrick et al (1973) constructed symptom/problem complexes in the process of developing the Index of Well-being, and they provide visual analogues of impact. However the statistical analysis of variation in multiple, categorical states of health is very complex (Manton and Woodbury, 1992), and in the absence of statistical analysis, it becomes impossible to draw conclusions from visual analogues within large surveys such as the SADLS.

6.4.2 Descriptive findings

The social impact of oral disease within the SADLS sample indicates a substantial burden of illness among older South Australians. The level of

social impact reflects the nature of oral disease and impairment as well as characteristics of the SADLS population base. The most common pain/discomfort items appeared to be associated directly with disorders of natural teeth (sensitive teeth, toothache) or dentures (sore spots, uncomfortable dentures). Periodontal attachment loss, decay and deteriorating restorations were frequent in this sample and are known to be repetitive. It is apparent that symptoms associated with those events were widespread. Similarly, denture wearing is frequent in this population, and impacts associated with dentures were common. Symptoms such as headache and sore jaw, possibly caused by temporomandibular disorders or other more complex pathology, are much less frequent.

The descriptive findings also provided insight into different dimensions of social impact. The OHIP revealed high levels of dysfunction and pain, and relatively lower levels of disability, thus confirming the hypothesized pattern in frequency of social impact. For example, four of the OHIP items categorized as functional limitation, and seven categorized as physical pain, were reported by at least 20 per cent of persons "occasionally", "fairly often" or "very often". In contrast, the majority of psychological and social disability items were reported by fewer than ten per cent.

Subscale scores, summarized in Table 42, page 186, revealed a more than five-fold difference in means between functional limitation (mean = 8.38) and social disability (mean = 1.44). In Table 43 (page 188), more than 60 per cent of persons reported at least two items in the functional limitation dimension and in the physical pain dimension compared with 30 per cent or less in each of the three disability dimensions.

This pattern can readily be understood. For example, an event of pain would often be an internal experience, apparent only to the individual and interpreted simply as a sensation. It might cause psychological or social impacts only if other conditions exist such as: inability to control the pain ("I can't make it go away"); inability to compensate for the dysfunctional effects of the pain during social interaction ("I can't stop it bothering me when it's there"); or factors relating to the social relationship ("bothering about it is interfering with the things I usually do"). Even with more severe or chronic pain, there are likely to be elements of stoicism or resignation which lead people to tolerate physical problems. For example, "I have this ache, but it won't go away, so I just live with it".

This is consistent with the WHO (1980) theoretical model and emphasises two features of the social impact of oral conditions:

1) Severe episodes of oral disease in which symptoms are sufficient to affect psychosocial well-being, are infrequent; and

2) Most individuals can tolerate low or moderate levels of impact (such as functional limitation and pain) without effects on psychosocial well-being. Indeed, minor impacts within the OHIP may even be regarded as physiological processes (for example, tooth sensitivity) or normal adaptation (for example, food catching), especially if they occur only "occasionally" or "hardly ever".

Together, these phenomena indicate a substantial buffer between the most prevalent forms of dysfunction and pain and the relatively uncommon psychosocial impacts. This was demonstrated by ranking dimensions from functional to physical, psychological, social and handicapping impacts as indicated in Table 44 (page 190). When reports of two or more items were used, the majority of persons (61.9 per cent) reported no impact, only

functional limitation or functional limitation with physical pain. More disruptive forms of social impact, in which individuals experienced additional psychosocial impacts such as psychological disability, social disability or handicap, were less frequent – 14.4 per cent of persons were ranked into those three groups in Table 44.

A similar interpretation was obtained when the total number of dimensions was considered – 7.2 per cent of persons reported impact across all seven dimensions (Table 45, page 191). Finally, 5.4 per cent experienced "multiple morbidity" across five groupings of functional limitation: eating, speech, appearance, dentures and breath/taste (Table 46, page 193). These types of "case definitions" undoubtedly have intuitive sense when describing social impact, and convey more meaning about severe impact than subscale values alone.

There were a number of features of the distribution of the summary OHIP statistics within the SADLS sample which also help to clarify the nature of social impact. First, the observation that the summary statistics were roughly uni-modal, skewed, bell-shaped curves provides reassurance that the quantitative OHIP measures were roughly normally distributed (Figure 6, page 184 and Figure 7, page 187). There was no additional mode within the distributions. This was significant, because an additional mode can indicate the existence of more than one configuration (and therefore underlying cause) of social impact. If, for example, untreated caries was necessarily associated with a dozen or more specific items within the OHIP, the distribution would most likely have had a second mode. Such a distribution could then be taken to indicate two "cases" of impact: one in which non-caries items were reported, with a distribution which was more or less normal; and a second in which a larger number of items (all associated with caries) were distributed around a larger mean.

In summary, therefore, the descriptive findings from the OHIP convey a picture of highly frequent dysfunction and pain and less common psychosocial impacts. The hierarchy suggests a buffer against underlying oral conditions which presumably create "everyday aches and pains". This is consistent with Holtzman's (1988) assertions about the "undramatic" nature of many oral disorders. On the other hand, groups of OHIP items provide an intuitively appealing method of describing some of the more disruptive levels of impact (such as 7.2 per cent of persons experiencing impact across all seven dimensions – Table 45, page 191).

It is important to confine these interpretations to the population of older adults represented in the SADLS. Indeed, part of the rationale for studying social impact within an older adult population was based on the view that there would be a substantial amount of disease experience, and speculation about the potential for widespread social impact (Gift and Redford, 1992). In view of the history of oral disease, it should not be surprising that the majority of persons reported low to moderate levels of impact. In contrast, a group of young teenagers might have a large proportion with little or no experience of caries or periodontal disease who may report minimum levels of social impact, and a group with malocclusion who may report substantial psychosocial impact.

Another caveat concerns the way in which the very concepts of impairment, disability and handicap have been developed and applied to the OHIP. The WHO (1980) model anticipates both a hierarchy of impacts and considerable diversity in each individual's reactions to disease. Since the WHO model is the basis for the groupings of items within the OHIP, it is not surprising to observe the current distribution within the SADLS sample. If quite different groupings of OHIP items were used, or if different underlying constructs were sought (such as any positive dimensions of oral health),

quite different interpretations could be expected. The potential for other groupings of OHIP items is discussed in further detail in Chapter 7.

6.4.3 Factors associated with social impact

Differences in mean subscales scores between dentate and edentulous persons were greatest for functional limitation and physical disability (Table 52, page 203) – a finding which was similar to the pilot study (Chapter 5). Examination of individual items (Table 51, page 201) revealed that edentulous persons were approximately twice as likely to report "avoiding foods" (Q28), "dentures not fitting" (Q17) and "uncomfortable to eat foods" (Q15). However dentate persons were more likely to report impacts relating to appearance. Of course dentate persons also reported toothache, tooth sensitivity and inability to brush – questions not asked of edentulous persons.

Presumably the most important feature accounting for differences between dentate and edentulous groups relates to full upper and lower dentures or disorders associated with them. The reduced masticatory efficiency of full upper and lower dentures compared with natural teeth has been documented in a range of clinical studies (Gordon et al, 1985). Higher levels of functional limitation and physical disability among edentulous persons therefore are not surprising. Furthermore, dentate persons with a full upper denture also reported high levels of functional limitation and physical disability. This is consistent with a study of institutionalized older adults in Finland (Ekelund, 1989) which noted that persons with between one and seven natural teeth reported chewing problems with a greater frequency than edentulous persons with full dentures.

The more intriguing observation was the lack of difference between dentate and edentulous in their pain and psychosocial impacts. This suggests the existence of other features of complete dentures, or additional characteristics of edentulous persons themselves. One explanation is that edentulous persons are more sensitive to dysfunction and physical disability, but relatively resilient to psychosocial impacts. Alternatively, edentulous persons could have a greater sense of resignation to reduced function. On the other hand, chewing and eating may be seen as essentially private activities with little influence on social behaviour or psychological well-being.

Part of the explanation comes from the findings concerning denture wearing among dentate persons (Table 53, page 206). Dentate denture wearers had markedly higher levels of functional limitation and physical disability compared with non-wearers. There were smaller differences in the other subscales among dentate persons with and without dentures, although the statistical analysis (Figure 8, page 209) revealed significant effects of denture wearing on six subscales. An important observation was that dentate persons with one full denture had mean values on all subscales which were similar to or greater than the mean values for edentulous persons with two full dentures.

Clearly dentures pose an additional hazard for the experience of functional limitation and physical disability among dentate persons. This appears to extend beyond the two denture-specific questions (Q17 and Q18) to more generic impacts such as avoiding foods. Surprisingly, there was a very limited group of clinical denture-related conditions (retention and stability) which appeared to be associated with higher impact among denture wearers (Table 56, page 217). Indeed, stability of upper dentures was the only clinical indicator significantly associated with social impact among upper denture wearers, and the effects were confined to functional

limitation and physical disability subscales (Table 58, page 221). In the case of physical disability, there was an additional independent effect of edentulism, with edentulous persons reporting higher levels of impact. This represents the single independent effect of edentulism (as distinct from denture wearing) suggesting that the bivariate relationships between dentate and edentulous should be viewed primarily as denture effects. At the same time, it emphasizes that the disadvantage (that is, higher impact) among edentulous is primarily a physical one. In other words, there appears to be no separate stigma or distress caused by edentulism contributing to psychosocial impacts.

A consistent and revealing factor concerning dentures was the strong effect of denture wearing frequency – those with satisfactory dentures wore them frequently, and those with unsatisfactory dentures wore them infrequently. While this may seem self-evident, it indicates that dentate denture wearers are, to some extent, a self-selected group. For example, a number of dentate persons said that they had dentures made some time ago which they had stopped wearing. This tends to eliminate from the analysis persons with particularly problematic dentures who do not wear them at all. (It will be recalled that dentures were assessed during the examination only if they were worn daily.) For that reason, much of the variation in social impact in relation to clinical denture conditions could be eliminated. For example, if dentate persons experience ulceration or some other symptoms they can readily remove their dentures (temporarily or permanently) and therefore reduce their levels of impact. This phenomenon indicates one of the likely pathways underlying higher levels of physical disability among the edentulous who, faced with similar denture-related symptoms, have little option but to continue wearing the denture and accept a certain level of disability (such as avoidance of food).

The bivariate analyses, of dental epidemiological variables associated with social impact among dentate persons, revealed a large number of low to moderate correlations (Table 60, page 226). Tooth loss measures had the strongest correlations, and it is noteworthy that the effects were greatest for functional limitation and physical disability. While virtually all dental epidemiological measures were expected to contribute to social impact, enamel attrition and some periodontal measures featured negative correlations – effects which predominantly were attributable to tooth survival. This interpretation was supported in the multivariate analyses (Table 64, page 238) where tooth loss and decayed root surfaces were the most consistent effects.

The effects of tooth loss were more subtle than a simple increase in impact with greater numbers of missing teeth. Anterior tooth loss was associated with greater levels of impact regardless of whether those teeth had been replaced with prosthodontic units (indicated by the MT1 variable in Table 64). On the other hand, posterior tooth loss was associated with greater impact only if the teeth were unreplaced (SPACE2 variable in Table 64). In the Piedmont dental study (Drake and Strauss, 1990) perceptions of chewing ability were most strongly related to the number of missing anterior teeth, followed by the total number of missing teeth and perceived needs for extraction. Oosterhaven et al (1988) found that posterior occlusal contacts had a greater impact on chewing capacity (as measured using a sieve test) than the number of posterior teeth present.

The more specific analyses (Figures 12 and 13, page 244) reveal slightly more complex effects, apparently related to the types of dentures and combinations of missing and unreplaced teeth. In Figure 12, social impact increased as the number of posterior spaces increased, irrespective of the number of missing anterior teeth. However in Figure 13, social impact decreased as the number of posterior missing teeth increased among

persons with larger numbers (more than three) of missing anterior teeth. The interpretation was that full upper dentures provide better function than large partial upper dentures with complex designs. A related factor could be a greater sense of "resignation" among persons with high levels of tooth loss.

On the face of it, the interpretation that full dentures provide better function than large, complex partial dentures is in conflict with the earlier discussion which has emphasized the limits of full dentures, both for dentate and edentulous persons. However, there are two important features of these findings which need to be emphasized.

1) Measures of the number and location (anterior or posterior) of missing teeth and unreplaced spaces provide a far more detailed account of the net effects of tooth loss and denture wearing than the categorical variables which indicate dentate status and the type of denture worn. It should not be surprising that the specific combination of tooth loss and replacement, apparently representing persons with large, complex partial dentures, should constitute a special group with noticeably higher levels of impact.

2) The analysis of the SADLS findings intentionally adopted a population perspective, so that the effects within regression analyses reflect not only the strength of (presumed) underlying causal relationships, but also the population distribution of factors involved in those relationships. That intention provided the justification for using weighted analyses of bivariate and multivariate relationships. Consequently, effects such as an inverse relationship between social impact and posterior missing teeth which were confined to a specific subgroup (such as persons with larger numbers of missing anterior teeth in Figure 13, page 244) may nevertheless be non-significant in the more global multivariate analyses (Table 64, page 238). The

practical consequence in this interpretation is that, while benefits exist for some groups of full denture wearers, the population-wide effect is that full denture wearers have higher levels of social impact.

In some respects this second point is an example of the differing orientation of a public health perspective and a clinical perspective. In the interpretation of tooth loss and dentures, the population-wide effect is that wearers of complete dentures are worse off. However, there clearly were specific groups or more selective individuals who were better off with full dentures compared, say, with persons wearing large and complex partial dentures.

The other consistent feature of the multivariate analyses of dental epidemiological variables (Table 64, page 238) was the effect of decayed root surfaces, which was independently associated with all subscales. Root decay undoubtedly can cause pain and may be unsightly . Furthermore, it generally is associated with more severe gingival recession. The surprising feature was that coronal decay did not have a similar effect in the multivariate analyses. Indeed, in the bivariate analyses (Table 60, page 226) coronal decay (CROWND) and total decay (TOOTHD) had weaker correlation coefficients. Another noteworthy feature of root decay was the relatively consistent strength of the relationship across all subscales. This was in contrast to the tooth loss variables which tended to have weaker correlation coefficients and smaller regression coefficients for the psychosocial subscales.

One factor which may explain variations between coronal and root decay is the different clinical nature of the two conditions. Root caries is nearly always associated with gingival recession. Consequently there may be greater thermal sensitivity and (for anterior teeth) observable effects on

appearance. However the measures of untreated disease in cross-sectional surveys can also be affected by a self-limiting mechanism. People with caries would be unlikely to tolerate severe symptoms, and dentists would be inclined to intervene in the presence of severe symptoms (for example, to fill or extract the tooth). It is possible that this self-limiting mechanism varies for coronal and root caries. Unfortunately there is little capacity within this cross-sectional analysis to establish, with certainty, the unique features of root decay which apparently contribute to these phenomena.

The separate analyses of sociodemographic characteristics were undertaken primarily to give a background to subsequent multivariate analyses. However, the findings revealed some effects which deserve comment. First, they reveal age- and sex-variations among dentate persons which probably differ from anecdotal reports or clinical experience – higher levels of social impact were reported by younger persons and males (Table 67, page 250). However there is consistency with the age-related findings of Reisine and Bailit (1980). They reported greater dissatisfaction with oral health among younger persons and concluded that older persons accept tooth loss more readily than young persons.

More anticipated were the findings of higher impact among socially or economically disadvantaged groups (Table 69, page 255). The effects were observed predominantly among dentate persons. While these variations may be related primarily to the distribution of existing clinical conditions, they represent useful non-epidemiological indicators of the burden of oral disease. An association with reported medical conditions was quite consistent, and is plausible on a number of grounds. At one level, it may be consistent with poorer oral health which itself could be related to xerostomic medications taken for medical conditions, or to reduced oral hygiene among those with physical illness. On the other hand, people with several medical conditions may be more susceptible to social impact from oral conditions

due to a lower "threshold", possibly related to diminished capacity to cope with the oral conditions.

The multivariate findings (Table 71, page 261) indicated important effects of access to and use of dental care. Higher levels of social impact were reported by: those who visit for dental problems; who had financial barriers; whose last visit was at a public dental clinic; or who perceived treatment needs. The latter two were quite consistent effects across subscales and among dentate and edentulous persons. Together, they suggest that routine (presumably more comprehensive and preventive) dental care is a major buffer against social impact.

This interpretation about the effects of dental care holds despite the observation that persons with more recent dental visits have higher levels of impact. Presumably there are a number of different causal effects involved in this relationship. People with higher levels of impact are probably more likely to have attended recently for symptomatic care – in this regard, social impact can be seen as a "cause" of dental visits. On the other hand, those who obtained treatment which involved extractions or new dentures probably are more likely to report subsequent symptoms – and therefore those forms of dental care can be seen as a "cause" of social impact.

Factors concerning access to dental care therefore need to be carefully delineated when examining the effects of dental care on social impact. Factors such as attendance for problems, and financial barriers were associated with higher levels of impact while recent access was also associated with higher levels of impact. This probably demonstrates the importance of visit intention and capacity to receive comprehensive treatment in the process of obtaining care. In other words, a recent visit made because of dental problems by a person unable to afford optimum

treatment is unlikely to reduce levels of impact and indeed is likely to be associated with high levels of impact.

The findings with regard to users of public dental clinics could also be seen as reflecting limited comprehensiveness of dental care, since those clinics had long waiting periods and limited forms of care at the time of the survey. On the other hand, those who used public dental clinics necessarily were health card holders and therefore differ in some respects from the general population. Health card entitlement was one of the factors considered in the multivariate models, although it was not statistically significant, suggesting that the characteristics of health card holders were not as important in affecting social impact as the type of care which they receive.

The interaction between the site of previous visit and usual reason for visits provided some useful clarification of the effect of public clinics. Higher levels of impact among public dental patients were confined to those who usually attended for dental problems. The practical problem for those patients is that the types of treatment during emergency dental visits necessarily are limited, and frequently compromised. Of course, these cross-sectional findings could also be interpreted with a reversal of this presumed causal relationship – undoubtedly persons experiencing symptoms are much more likely to make emergency visits.

From a theoretical viewpoint, however, the interaction between site and reason for visit, as well as other interactions in subsequent models containing oral epidemiological variables (Table 76, page 277), highlights the importance of the dental care system in the process of social impact. For example, missing anterior teeth (Figure 15, page 280) and root decay

(Figure 17, page 280) had effects on social impact which were substantially stronger among public dental patients.

There are a number of possible explanations for the modifying effects of public clinics. A simple explanation is that treatment at those clinics is somehow less effective in controlling the rates of disease. However, this does not reveal the reasons for higher impact among public compared with private patients who have identical levels of disease, such as root decay (Figure 17). A given level of root decay presumably should cause social impact, regardless of whether it came about because of ineffective treatment or new increments of disease. Another explanation could be that public patients have more long-standing disease (such as untreated root decay) which has not been treated because of long waiting lists at public clinics. In contrast, private patients may, at the time of the survey, have only recently developed root decay which had caused less symptoms. However this phenomenon would not appear to explain the modifying effects of public clinics on missing anterior teeth (Figure 15, page 280) – a condition which generally is long-standing.

A related, although slightly more complex, explanation could be due to the "safety net" features of the public dental system. Individuals who can readily afford private dental care may continue to receive treatments which, in some cases may be complex and expensive. However, if there are treatments which cannot be afforded, or if there are barriers to the receipt of general dental care in private dental practice, individuals become reliant on public dental services. In effect, disadvantaged persons with more complex dental conditions could be forced away from private dental practice to be managed within the "safety net" of public dental care. The unfortunate irony is that public dental clinics are less able to offer complex care – fixed prosthodontics, metal dentures, crowns, periodontal surgery and aesthetic

dentistry are rarely provided within public clinics in South Australia. Public dental patients therefore may be a group with more complex needs, and they may have developed an opinion that the dental care system has a very limited capacity to meet their needs.

Such an interpretation highlights some of the important features of dental care systems, aside from the technical processes in provision of efficacious treatment. The preceding explanation would suggest that the organization of services and behavioural aspects of dentist-patient interactions can have an important influence on the reaction by individuals to their symptoms. The importance of a reliable source of care can be epitomized in the types of anecdotes reported by some individuals in the survey. A common view of some people with very few dental problems was that they had "...a good dentist who would be able to fix anything that went wrong." Others with long-standing complaints sometimes made comments such as "...the waiting lists are very long, and when you get in they can't always fix the problem." While these selective anecdotes refer only to the comments offered by some participants in the study, they help to illustrate the potential for dental care to influence individuals' subjective experience of social impact through means other than the purely technical aspects of restorative dentistry or prosthodontics.

These effects of dental care could also indicate something about the prognosis for a given state of oral health. It is quite conceivable that an individual who was aware even of comparatively advanced dental disease would experience less impact if there was a perception that the condition could be treated. The importance of the future course of disease would be consistent with the general orientation of Patrick et al (1973) who advocate the use of health status and prognosis in measures of well–being.

While these speculated effects have some intuitive appeal, it is surprising that other effects are missing from the multivariate models. Dental insurance did not appear as a first order term in any of the multivariate models relating non-epidemiological characteristics to social impact (Table 71, page 261 or Table 72, page 264), even though dental insurance is expected to have an influence on the capacity of persons to undertake regular or complex treatment. Indeed, dental insurance did not have a strong effect in bivariate analyses (Table 68, page 253).

Dental insurance among older adults in Australia is purchased almost exclusively by individual subscribers rather than as a group benefit. Furthermore, dental insurance represents one "ancillary" benefit purchased along with optical, pharmaceutical and other services, and the ancillary package must be purchased in addition to a basic package of hospital/medical insurance. Dental insurance benefits are paid as indemnities to the insured person, rather than direct reimbursement to the service provider. In addition, there are numerous exclusions, financial caps and co-payments involved in most dental insurance packages. For these reasons, the expected effects of dental insurance on the type of dental treatment (and subsequently on levels of social impact) may be obscured. For example, some individuals may select ancillary insurance primarily for coverage of other para-medical services, while the co-payments and exclusions associated with dental insurance could diminish the potential for changes to the demand for dental treatment or use of dental services.

In this analysis, it is also possible that the financial hardship variable (question B–10, significant for dentate persons in five subscales and in the standardized OHIP) accounted for effects of dental insurance. For example, persons with more generous dental insurance packages would be likely to report little or no difficulty in paying a $100 dental bill.

There was also a surprising lack of significance among other potential interactions involving measures more directly related to dental care, such as the usual reason for visits or perceived treatment needs. As has been noted previously, these analyses were both exploratory and "population based", so it is conceivable that factors such as perceived treatment needs would have interactions with epidemiological variables if a specific analysis was confined to a smaller number of variables within subgroups of the sample. Presumably the effect of the site of last visit constitutes the most consistent overall effect in this population.

Other sociodemographic characteristics which modified the relationships between epidemiological parameters and social impact included: financial hardship (Figure 16, page 280), age (Figure 18, page 280) and medical conditions (Figure 19, page 281). The stronger effect of missing anterior teeth among those with financial hardship could be due to the phenomena considered already concerning the prognosis for care. Age was interesting because there was a stronger effect of decayed root surfaces on social impact among younger persons (60-69 years). A possible explanation could be a tendency for older persons to be more resigned to oral problems. Kiyak (1983) speculates that older adults may adopt such a perspective in the process of "healthy coping" with chronic oral disease. Finally a larger number of medical conditions was associated with a stronger effect of posterior spaces on social impact. This may represent an effect of "multiple morbidity" whereby those who are more frail experience a greater reaction to tooth loss. Hickey (1988) has described more subtle psychological mechanisms, such as a growing uncertainty about future health among older adults who experience multiple medical conditions or declining health status.

Aside from these modifying effects of dental visits and other characteristics on oral epidemiological variables, it must be stressed that there were a number of very consistent relationships between social impact and epidemiological variables.

1) Missing anterior teeth were always associated with greater standardized OHIP values, even when interactions were evaluated. The consistency of this effect can probably be related to the pervasive effects of missing anterior teeth among the individual subscales. As noted in Table 64 (page 238), missing anterior teeth featured in all seven models for the individual subscales. This in turn probably reflects the importance of incisors and canines in all areas of social impact concerning chewing, facial appearance and self-esteem.

2) Persons wearing upper dentures had consistently higher standardized OHIP values in multivariate models with and without epidemiological variables. This effect was independent of missing teeth or unreplaced spaces, although as noted elsewhere, the overall effect masks some of the subtle influences of full dentures, partial dentures and the location of missing teeth. No doubt the overall effect indicates that dentures themselves are likely to create specific symptoms and therefore social impact.

3) The period since last dental visit appeared in models with epidemiological variables (Table 76, page 277) and without (Table 71, page 261). In both models, higher levels of impact occurred for persons with a visit during the last 12 months, as indicated by the magnitude of the positive regression coefficients. The effect was independent of the usual reason and site of visit. A likely explanation is that the experience of social impact provides a motive to visit a dentist. However a reversal of this proposed cause-and-effect is

conceivable, since many dental treatments themselves can be painful and iatrogenic symptoms are not uncommon.

4) Perceived treatment needs appeared in models both with and without epidemiological variables – persons perceiving treatment need had higher impact. Again, there may be a circular mechanism at work. Existing disease is likely to create both an awareness of needs and social impact, while social impact itself is likely to create an awareness of needs.

5) Educational attainment had a consistent effect, both with and without epidemiological variables. Leaving school at a later age was associated with lower levels of social impact (Table 75, page 275).

There are two points to note from the latter finding concerning education. First, it demonstrates that reports about social impact, which at first appearance may appear to be based on relatively abstract concepts of oral health, are clearly not confined to persons with higher levels of educational attainment. It may be expected, for example, that persons with lower education may have less comprehension of some of the psychosocial impacts such as self-consciousness or tolerance of others. However, the observed higher levels of social impact refute that view. Second, the effect of education was independent of oral epidemiological variables and utilization patterns. In other words, it suggests that there are factors other than clinical parameters of disease and characteristics of dental care which influence social impact.

A final general feature of the multivariate models concerns the overall explanatory capacity of epidemiological variables (R^2 = 0.096 for the standardized OHIP, Table 64, page 238) and non-epidemiological characteristics (R^2 = 0.240 for the standardized OHIP, Table 71, page 261).

A practical implication is that there are limits in the extent to which clinical parameters explain levels of social impact in this population. The virtually universal experiences of tooth loss, caries and periodontal destruction no doubt account in part for this effect. That is, the widespread experience of disease could be expected to create a high "base level" of social impact in this population. If that is the case, it may not be surprising that social impact variations are driven more by differences in social circumstances and varying patterns of dental services utilization.

If this interpretation is correct, it could be speculated further that there would be limits in the capacity of clinical intervention to control or reduce levels of social impact within this population. Some conditions such as tooth loss appeared not to be altered by clinical intervention – for example, missing anterior teeth, with or without prosthodontic replacement, were consistently associated with greater levels of impact. However, even the replacement of missing posterior teeth or restoration of decayed root surfaces may have limited effects on social impact.

Such speculation would be in contrast to the observed effects of dental care on social impact. Indeed, many of the other significant correlates of social impact are modifiable. For example, the period between visits, reason for visits, site of visit, perceived treatment needs and financial barriers to care would all appear to be aspects of the dental care system which are both alterable and quite consistently associated with social impact. There clearly are limitations within a cross-sectional survey of this kind to speculate with any certainty about such effects. Undoubtedly further research is required to obtain information about the types of intervention which would be able to reduce levels of social impact. Areas for further research are discussed at the end of this Chapter.

6.4.4 Relationships among OHIP subscales

The other general area of investigation within the SADLS addressed the fourth aim of this research and concerned the relationships among different aspects of impact contained within the WHO model of impairment, disability and handicap. The analysis examined bivariate correlations and more complex relationships among subscales. As expected, bivariate correlations were high. However edentulism was associated with some significant modifying effects on the relationships with functional limitation. An important finding quantified in Table 81 (page 305) was a greater level of physical disability among edentulous persons after controlling for functional limitation and physical pain. This was apparent particularly for low to moderate levels of functional limitation and physical pain. However this "heightened sensitivity" of edentulous persons was not observed with regard to psychological or social disability.

In order to interpret this effect it is appropriate to return to earlier comments regarding dentate and edentulous groups. It was suggested that edentulous persons would be likely to react more to limitations of dentures or to disorders associated with dentures, primarily because they rely completely on dentures for oral functioning. In contrast, dentate persons with denture related problems may more readily compensate for them and maintain oral function. The more detailed analysis of relationships between functional limitation, physical pain and physical disability helps to confirm that interpretation. Interestingly, however, a heightened sensitivity among edentulous was not observed in the other psychological and social disability subscales (Table 81, page 305).

High levels of physical disability among edentulous persons therefore could reflect the often-stated maxim that "dentures are never as good as

your own teeth". These findings suggest that the maxim is true, primarily because complete dentures are less efficient and secondarily because of an additional sense of complete dependence on dentures. As discussed previously, the additional effect of dependence appeared to occur only with regard to physical disability, suggesting a predominantly physiological process by which dependence influences physical disability. The physiological process could be confined to chewing, although effects on facial form and speech may also be involved. However, the lack of an independent effect of edentulism on psychological or social disability (after controlling for dysfunction and pain) suggested that there was no particular stigma or distress associated with the state of edentulism within this group of older adults.

This lack of effect within psychological and social disability reiterates the importance of maintaining distinctions between theoretical dimensions of social impact. The different effects may indicate that quite separate mechanisms influence psychological and social disability. The mechanisms could include individual expectations, aspects of personality and cultural values. For example, underlying levels of self-esteem and the process of maintaining self-esteem may be very important in determining the psychosocial reactions to oral dysfunction or pain. It is quite conceivable that such mechanisms would be quite independent of oral status among these older adults.

Another interesting "null effect" was the general lack of variation in disability subscales (after controlling for functional limitation and physical pain) according to oral epidemiological factors within the dentate group (Table 82, page 307). This presumably represents some finite limits regarding the direct consequences of clinical conditions. For example, while root decay may cause physical pain, it is unlikely to carry any additional stigma, sense of shame or distress. Consequently, the disabling effects of

root decay appear to operate predominantly through the more direct effects on function and physical pain. The same appears to be true of the two indicators of missing teeth, although as noted, there were contrasting findings concerning missing anterior teeth. It should be reiterated that functional limitation included a question relating to facial form ("a tooth which doesn't look right" – Q3) and to speech and taste. The findings in Table 82 therefore suggest that disabling consequences of missing teeth (even in psychosocial dimensions) are related primarily to the anatomical deficits which individuals experience because of tooth loss.

The final part of the analysis of relationships among OHIP subscales was an exploratory factor analysis to identify different combinations of OHIP questions which potentially could be regarded as new dimensions or subscales. There are two generally accepted criteria for selecting the principal components from the analysis (Cattell, 1978). The first is to select principal components which are to the left of the "elbow" in a scree plot, and according to that criterion only a single factor would be selected (Figure 28 (page 308). The second criterion is to select principal components with eigenvalues greater than 1.0, and according to that criterion eight would be selected.

Regardless of the criterion used, there was a conspicuous effect of the first factor from the principal components analysis. It featured moderate to strong correlations with nearly all OHIP questions (Table 83, page 310). The remaining seven factors which potentially could be considered were dominated by much weaker correlations. Within that constraint, there was some indication that the other factors related to "symptom groupings". They apparently were related to: pain among non-denture wearers (factor two); appearance (factor three); physical pain questions (factor four); and the

remaining functional limitation questions relating to speech, breath and taste.

The findings from the principal components analysis are very similar to the findings concerning the GOHAI (Atchison and Dolan, 1990). The 12 items which make up that questionnaire were found to correlate with a single factor, leading the authors to suggest that social impact could be viewed as a single construct. The current findings with the OHIP support the notion that there was a single underlying construct dominating the observed correlations. Other constructs were much less apparent, both in the scree plot of eigenvalues, and in the correlations with individual OHIP questions, although they appeared to be weakly related to symptom groupings. While rotation of the factors obtained from the first stage, principal components factor analysis would help to isolate high and low correlations, the basic effect of high correlations with the first factor would be expected to persist.

This finding raises questions about the appropriateness of using the seven dimensions hypothesized within the theoretical model underlying the OHIP given the absence of empirical evidence from the factor analysis to support those dimensions. A central concern is the role of factor analysis, a technique used primarily to explain relationships among "several difficult-to-interpret, correlated variables" (Kleinbaum et al, 1988, p 601). Factor analysis is a technique which has not been used widely in development of many indices of general health status such as the SIP, NHP and IWB, which instead nominate *a priori* the dimensions of interest. Mosse (1983) suggests that this approach is analogous to the selection of a single biological parameter for the evaluation of a clinical trial, and is consistent with the epidemiological uses of many health status indicators. Kaplan et al (1976), commenting on factor analysis as a means of establishing validity, consider

it "generally inappropriate for constructing health indices" (p 482). They base their argument on the grounds that factor analysis, and the related procedure of principal components analysis, identifies underlying dimensions based on correlations which themselves are dependent on the patterns of response frequencies to each question within a battery. They note that in factor analysis "factors and items that contribute little to explaining variance in occurrence or frequency are considered ... unimportant", but they reject this substitution of "variation in frequency for variation in social importance" (Kaplan et al, 1976, p 482). They cite an example of a household survey in which very low levels of function may be infrequent and poorly correlated with other measures, but which nonetheless are very important when they do occur.

There are similarities in the current situation with the OHIP. The findings from the factor analysis indicated that the response frequencies of the great majority of individual OHIP items are correlated, while the earlier analyses demonstrated marked differences in the prevalence of apparently distinctive forms of impact (Table 40, page 179). For example, unsatisfactory diet (Q29, reported by 5.4 per cent of persons) would appear to be a more serious form of impact than avoiding some foods (Q28, reported by 33.3 per cent).

In summary, therefore, the findings from the principal components alalysis demonstrate an absence of "several difficult-to-interpret" correlated measures underlying the OHIP. This can be used to justify the use of a single summary statistic from the OHIP. However the arguments of Kaplan et al (1976), coupled with the observed distribution of OHIP scores, demonstrate that a single statistic may be overly parsimonious in some circumstances. For example, the standardized OHIP did not differ significantly between dentate and edentulous persons, while functional limitation and physical disability did (Table 52, page 203). The richer

picture conveyed by OHIP subscales clearly is of theoretical interest and is relevant from a public health perspective when selecting criteria to identify priorities and target groups.

6.5 Further research

While the findings from the SADLS add substantially to knowledge about social impact, further research could address some of the limitations inherent in the current design. There are three areas which merit attention in the short term:

1) Examination of social impact using the OHIP in other age groups and with additional epidemiological measures;

2) Examination of social impact within specific patient groups or other samples not representative of the wider population; and

3) Prospective study designs, particularly ones which could address with greater certainty the effects of tooth loss and the role of dental care.

These additional studies would help to further validate the OHIP as an instrument for the assessment of social impact. For example, patient groups requiring complex restorative care for advanced levels of untreated disease would be expected to record high levels of social impact and to experience reductions in social impact after effective treatment. Prospective study designs would also help to clarify the presumed causative mechanisms which have been inferred from this research only from cross-sectional findings.

Specific findings from this research suggest a significant role of dental care in the impact of oral disease. The phenomenon could be addressed in greater detail in additional studies which capture information about the nature of treatment, quality of care and satisfaction with care. Furthermore, there appears to be an effect of more severe impact when there are barriers to treatment. This effect, which clearly has important practical implications for public health, requires clarification through prospective studies among specific groups with combinations of oral disease and barriers to care. At a theoretical level, it suggests that prognosis is an important additional dimension which may need to be incorporated into theoretical models of social impact.

There undoubtedly is a need to investigate the different multidimensional measures of oral health impact which now exist. In addition to the OHIP, the GOHAI and DIP have been identified as recently developed indices, while the psycho-social impact scale of Kiyak et al (1984) and the dental functional status questionnaire of Rosenberg et al (1988) have been used previously. There is value in using more than one instrument within a given research project in order to identify their extent of similarity or dissimilarity and, at the same time, to determine which indices are more or less sensitive and more or less reliable in different settings.

The use of more than one index could be extended to evaluate the two major theoretical frameworks about social impact reviewed here. Measures of work-loss and of other social roles, possibly drawing on items within the SIP or other existing measures, could be used concurrently with the OHIP. The aim would be to assess the extent to which individuals experience disruption to work and social roles compared with dysfunction, psychological and physical disability.

In order to develop socio-dental measures which can have practical applications within clinical settings, it is important to move beyond the observational studies just described. One general area which warrants research is the extent to which clinicians' and patients' views about quality of life influence the type of dental treatment (Gift and Redford, 1992). The role of social impact both in clinical decision-making by dentists, and as a predictor of the health-related behaviours of patients could be investigated in general dental practice and, at a theoretical level, in simulations of treatment plans.

The final general area which will require additional research is the extent to which clinical treatments and preventive interventions can control or reduce levels of social impact. While quality of life measures have been incorporated routinely into many clinical trials of medical care (Hollandsworth, 1988), little is known about the effects of dental care on quality of life. Clinical trials represent one likely area for research. Similarly, many health promotion campaigns seek to enhance awareness of and control over oral conditions, and presumably they would represent useful settings in which to evaluate changes in the impact of oral disease.

CHAPTER 7. CONCLUSIONS

This Chapter draws conclusions about the social impact of oral disease among older adults by bringing together the findings from the three projects presented in Chapters 4, 5, and 6. Some major themes, identified from the literature review, are reviewed first and then the principal conclusions from these projects are listed in summary form.

7.1 Major themes

There were three major themes which emerged as areas of disagreement in the literature review, and which provide a useful framework to draw general conclusions about this research:

1) What is the extent of and how substantial is the social impact of oral disease?;

2) To what extent can the social impact of oral disease be seen as multi-dimensional?; and

3) Is it appropriate to construct a theoretical framework about social impact around role disruption (Davis, 1987; Reisine, 1981) or a hierarchy from disease to handicap (WHO, 1980)?

7.1.1 The extent of social impact

The findings from Chapters 4, 5 and 6 add to knowledge developed during the last two decades about the extent of oral health impact. Investigations by other researchers frequently involved speculation based around a few aspects of social impact which were constructed as generic

indicators (such as work-loss and days of limited activity) or which were thought by researchers to be relevant. In the current research, the very process of enumerating statements about social impact (Chapter 5) and the frequency of OHIP items reported within the SADLS (Chapter 6) has demonstrated a substantial "burden of illness". For example, individuals, when asked to describe oral conditions, described substantial ill-effects. Some of the most frequent forms of impact related to dysfunction and pain. While they may not be catastrophic, these forms of social impact differ from the set of consequences, such as aesthetics and self–esteem, which Davis (1976) suggested would form the predominant ill-effects of oral disease. Furthermore, in the current research, it was possible to identify important minorities (approximately five per cent) of older adults who had a broad range of impacts indicating that they experienced "multiple morbidity" due to oral conditions.

As suggested previously, the extent of social impact observed in the SADLS probably can be attributed to accumulated disease experience within the population of older adults in the survey. High levels of dysfunction and discomfort, coupled with lower levels of disability or handicap are consistent with a substantial tolerance by most individuals of many oral disorders. In some respects, this is consistent with Holtzman's (1988) suggestion that many oral conditions simply are not "dramatic". It is a very different interpretation from the view that most oral disorders are inconsequential.

While it is necessary to be cautious in imputing cause from cross-sectional relationships, the oral conditions most immediately related to social impact appeared to be tooth loss and root decay – conditions which have a high prevalence in most populations of older adults. However the non-epidemiological characteristics also featured strong associations with social impact, particularly those relating to financial hardship and the

nature of dental care. These effects and interactions between epidemiological and non-epidemiological factors suggest that dental care and socio-economic resources provide a substantial buffer between oral disease and the experience of social impact.

7.1.2 The multidimensional nature of social impact

The projects reported here have sought deliberately to enumerate a comprehensive range of impacts based around several dimensions which, it is argued, are consistent with contemporary views of health and illness. The comprehensiveness is reflected in the length of the OHIP questionnaire and the subtle differences in the dimensions which it aims to capture through the seven subscales.

In view of the intended multidimensional nature of the OHIP it should be no surprise that there were variations in mean subscale scores and, further, that subscale scores differed in their associations with explanatory variables. For example, physical disability was more frequent among edentulous persons in the SADLS and its relationship to functional limitation and physical pain varied among edentulous compared with dentate persons. Those effects of edentulism were not observed for psychosocial forms of disability.

The observed differences regarding separate dimensions of the OHIP provide empirical justification for the concept that social impact is a multidimensional construct. Other justifications relate to the reasons originally advocated for the use of social impact measures (Nikias, 1985; Reisine, 1981). For example, the evaluation of dental care may, in some instances, be concerned primarily with the effects of dental treatment on functional limitation or on physical pain. In addition, different dimensions

of social impact are likely to be of interest to dental health researchers and public health practitioners in order to fully understand the burden of oral disease.

In contrast, there are uses proposed for social impact measures which would support the adoptions of a uni-dimensional measure. A "global indicator" describing the burden of oral disease would have practical uses for identifying priority groups and advocating for dental care resources. Indeed, multidimensional scales may create some ambiguities in the practical task of planning public health initiatives. Within research applications, multidimensional measures may not allow parsimonious analyses to be undertaken. For this reason, the analyses of combined epidemiological and non-epidemiological effects in Chapter 6 were undertaken using the summed, standardized OHIP.

Other results from the SADLS can support the use of a uni-dimensional measure of social impact. The findings from the principal components analysis of the OHIP (Table 83, page 310) provide evidence that the frequency of OHIP responses is dominated by a single underlying construct. At the same time, it has been argued here that it is appropriate in some circumstances to retain theoretical distinctions between dimensions of social impact. As argued by Kaplan et al (1976), the frequency of responses should not be confused with other validity criteria, such as the theoretical importance or "face validity" of different states of health.

As suggested already, the practical applications of the OHIP will, to a large extent, dictate whether or not social impact is viewed as a multidimensional construct. The findings from this research suggest that there would be no particular disadvantage from such an expedient (albeit unsophisticated) approach. For example, most associations observed

between social impact and explanatory variables were reasonably consistent throughout the seven subscales and the standardized OHIP. Consequently, the use of a single subscale or summary statistic would be unlikely to produce misleading interpretations. However, the OHIP subscales appear to contain sufficiently subtle features which permit examination of more complex questions about social impact, such as separate effects on physical versus psychosocial dimensions.

7.1.3 The theoretical framework of social impact

This research has not examined directly the merits of the two competing frameworks of social impact – the Parsonian concept of role disruption compared with the WHO's hierarchy of impairment, disability and handicap. However a number of findings permit a discussion of the issues. The first finding is a simple methodological issue about the extent to which effects on social roles can adequately be measured. In Chapter 4 it was observed that the pilot study questions about "social disability" elicited low levels of impact which had few associations with oral health status. In Chapter 5, the social disability subscale within the OHIP contained a broader array of questions and was associated with oral health status. Furthermore, the OHIP social disability subscale revealed relationships with perceived treatment needs, whereas the pilot study questionnaire did not. The method used in the OHIP to define and enumerate social disability impacts (which represent the main elements of the roles described by Davis, 1987) appeared to have a substantial influence on interpretations about the impact of oral disease on social roles. Hence, inferences about disruptions to social roles can vary according to the instrument used to measure impact.

Another phenomenon which obscures the interpretation of impacts on socially defined roles was observed in the ranking of social disability

statements (Table 18, page 87). The highest ranked (most unpleasant) of the five social impact statements was "less tolerant of spouse or family" (OHIP Q40) followed by "being irritable with others" (OHIP Q42). "Difficulty doing jobs" and "avoiding going out" received lower ranks. The ranks appear to be in contrast with the primary importance of work and productivity implicit within the Parsonian framework of role disruption. The importance of personal social interaction may reflect, in part, the relatively high representation of older adults within the judging panel described in Chapter 5. Nonetheless, the finding casts doubt on the appropriateness of the prior, normative judgements of researchers about the most substantial areas of social impact.

A third observation which questions the appropriateness of role disruption as a framework for social impact concerns the quite consistent differences observed between physical disability and psychosocial disability in the SADLS (Chapter 6). Unlike social disability, the physical disability subscale was: significantly higher among edentulous persons (Table 52, page 203); associated with clinical features of upper dentures (Table 58, page 221); and featured varying relationships with functional limitation and physical pain among dentate and edentulous groups (Table 27, page 305).

These findings suggested that while physical disability was closely related to functional and painful conditions, there was added disadvantage among edentulous persons who were reliant on dentures. However the added disadvantage appeared to be confined to physical disability. There appeared to be no particular stigma or features associated with edentulism which contributed independently to social disability after allowing for dysfunction and pain. This interpretation might simply serve to confirm that the effect of oral status on social roles is confined to its dysfunctional or painful consequences. However such a conclusion would not be drawn if only the social disability subscale was used (Table 27, page 305). Hence, it

must be regarded as unsatisfactory to conceptualize the social impact of oral disease in such a limited way that there is no specific disadvantage associated with a most basic aspect of oral health, namely edentulism. The findings from the SADLS indicate that, in order to capture such disadvantage, it is important to consider a physical disability dimension.

The focus of this research has favoured a framework of social impact constructed around the WHO hierarchy of impairment, disability and handicap. The empirical findings from all three stages of the research provide strong support for the use of such a framework among older adults, and suggest that a conceptual framework confined to social role disruption would be inadequate.

7.2 Principal conclusions

Chapters 4, 5, and 6 have dealt with the background, development and use of the OHIP. Twenty two principal conclusions have drawn from the research and they are listed below.

1) The social impact questionnaire used in the pilot survey (a group of 12 items developed from the prior experiences of other researchers) revealed that approximately one in five older adults experienced pain and eating disability, although there appeared to be deficiencies in the scope of the questionnaire relating particularly to social disability.

2) During the development of the OHIP, a broad range of social impact statements was obtained during interviews with dental patients. The statements related to dysfunction and pain as well as physical, psychological, and social disability.

3) Thurstone's method of paired comparisons allowed statements to be judged according to unpleasantness. While there was diversity in those judgements (the greatest majority was 76.9 per cent of persons who rated "less tolerant of spouse or family" as more unpleasant than "difficulty doing jobs") there was evidence that the diversity represented the candid judgements of participants. Variations in judgements were consistent with socio-demographic characteristics and states of oral health among subgroups of participants (Figure 4, page 91).

4) The levels of agreement in the judgements about social impact statements were statistically significant (Table 20, page 89) allowing weights to be formulated and subscales to be computed describing seven dimensions of social impact.

5) The OHIP questionnaire, when evaluated among older adults in Adelaide (Chapter 5), revealed widespread functional limitation and physical disability which was reported by more than one half of all persons. While psycho-social impacts were less frequent, they were distributed adequately to reveal variations among dentate and edentulous groups (Table 25, page 96).

6) When it was evaluated among older adults, the OHIP questionnaire was reliable, both in terms of internal reliability and test-retest reliability (Table 22, page 92).

7) The OHIP questionnaire performed best as a self-complete instrument (Table 24, page 94) compared with the alternative interview methods which featured greater regression towards the mean and apparent instrument effects.

8) There good evidence that the OHIP was a valid instrument, as demonstrated by higher levels of social impact among persons with perceived treatment needs compared to persons without perceived treatment needs (Figure 5, page 98). Furthermore, the OHIP subscales demonstrated this relationship more consistently and efficiently than the 12-item questionnaire developed previously for the pilot survey.

9) The OHIP questionnaire was used successfully in the larger SADLS baseline survey, which was an oral epidemiological study of a random sample of South Australians aged 60+ years (Chapter 6).

10) The most frequent forms of impact in the SADLS were functional limitation and physical pain – two or more items within those dimensions were reported "occasionally", "fairly often" or "very often" by 60 per cent of persons (Table 42, page 186). Social disability and handicap were less frequent (reported by five per cent of persons) demonstrating a substantial buffer between painful or dysfunctional oral disorders and the most disruptive psychosocial impacts. Consistent with this distribution was a more than five-fold difference in mean scores between functional limitation and social disability subscales.

11) Some 7.2 per cent of persons reported impact across all seven OHIP dimensions (Table 45, page 191), and therefore could be regarded as experiencing "multiple morbidity".

12) Edentulous persons had significantly higher subscale scores for functional limitation and physical disability (Table 52, page 203). They were approximately twice as likely as dentate persons to report "avoiding foods" (Q28), "dentures not fitting" (Q17) and

"uncomfortable to eat foods" (Q15), while dentate persons were more likely to report impacts relating to appearance (Table 51, page 201).

13) Differences between dentate and edentulous persons were related partly to denture-wearing. Dentate persons with one full denture had mean scores for all subscales which were similar to or greater than the mean scores for edentulous persons with two full dentures (Table 53, page 206).

14) In multivariate analyses (Table 58, page 221), the only independent effect of edentulism (as distinct from denture wearing) was observed for physical disability, suggesting that there was no separate stigma or distress caused by edentulism contributing to psychosocial impacts.

15) The most consistent association between social impact and denture-related factors concerned the frequency of denture-wearing. Lower levels of social impact were reported by persons who wore their dentures frequently (Table 57, Table 57).

16) Multivariate analyses confined to dentate persons revealed generally consistent effects across subscale scores of three epidemiological variables. Missing anterior teeth, unreplaced posterior spaces and decayed root surfaces were all associated with higher levels of social impact (Table 64, page 238).

17) When non-epidemiological variables were added to the multivariate models, there were independent effects concerning access to and use of dental care. Higher levels of social impact were reported by: those who visited for dental problems; who had financial barriers; whose last visit was at a public dental clinic; or who perceived treatment needs (Table 71, page 261). In addition there was higher social impact

reported by: younger persons, persons with an upper denture, those with lower educational attainment and persons with more chronic medical conditions.

18) The were additional interactions between oral epidemiological variables and four of the non-epidemiological variables: use of public dental clinics, financial hardship, age and chronic medical conditions. The most consistent interactions occurred for dental care, whereby associations between oral status and social impact were greater among persons with reduced access to comprehensive care (Figures 15 to 17, page 280).

19) There were strong correlations between all OHIP subscales (Table 77, page 284), and this was consistent with the underlying theoretical model which proposed a hierarchy from dysfunction to disability and handicap.

20) While physical disability was associated strongly with both functional limitation and physical pain, there was an independent effect of edentulism (Table 81 (page 305), most apparent for low to moderate levels of functional limitation and physical pain. However this "heightened sensitivity" of edentulous persons to functional limitation and physical pain was not observed with regard to psychological or social disability. Consistent with earlier observations, this effect suggested that edentulous persons would be likely to react more to functional limitation and physical pain, primarily because they rely completely on dentures for oral functioning.

22) A greater reaction among edentulous persons was not observed for the other psychological and social disability subscales (Table 81, page 305) suggesting that there was no particular stigma or distress

associated with the state of edentulism within this group of older adults. This finding also emphasized the value of separating theoretically distinct dimensions of social impact.

These conclusions draw attention to the relevance for dentistry of the social impact of oral disease. The dimensions of social impact, captured within the OHIP questionnaire, convey a more intricate picture of ill-health than the narrow clinical description obtained from epidemiological measures alone. The burden of oral disease among older adults in South Australia extends beyond aesthetics and self-esteem to have numerous, often subtle effects on social well-being. Information about social impact therefore represents a valuable resource to identify priorities for dental care and to advocate for oral health.

However, the ramifications for practice and research within dental public health are not confined to an appreciation of the burden of oral disease. Oral epidemiological parameters associated with social impact (including distinct aspects of anterior and posterior tooth loss) can be used as a rational basis for prevention and clinical intervention. In addition, there were numerous aspects of dental care which influenced those associations. This leads to the challenging prospect that the benefits of oral health and dental care may be most appropriately evaluated using concepts of social impact. The OHIP therefore has substantial scope as an instrument to better understand oral health behaviours and the interactions between dental patients and dental services.

CHAPTER 8. APPENDICES

Appendix 1 Pilot survey questionnaire

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

Workload Number	|__|__|
Serial Number	|__|__|__|
Postcode	|__|__|__|__|
Sample	|P_|__|__|__|
Date of Interview Dd Mm	|__|__|__|__|
Time Interview Began	|__|__|__|__|
Time Interview Finished	|__|__|__|__|
Final Response	|__|__|

AUSTRALIAN LONGITUDINAL STUDY OF AGEING

INITIAL SURVEY QUESTIONNAIRE

H. DENTAL

Now I have a few questions about your teeth.

H-1 How long ago did you see anyone about your teeth, dentures or gums?

12 months or less	- 1
12 months to 2 years	- 2 *(Go to H-2)*
> 2 years to 5 years	- 3 *(Go to H-2)*
> 5 years to 10 years	- 4 *(Go to H-2)*
More than 10 years	- 5 *(Go to H-2)*
Never	- 6 *(Go to H-5)*

a. How many visits did you make in the last 12 months? Number of visits |__|__|

H-2 Do you normally have a check-up or do you visit only for a specific problem?

Check-up	- 1
Specific problem	- 2

H-3 For your last course of dental treatment did you go to a private dentist, a public hospital/clinic, or dental technician?

Private dentist	- 1
Public hospital/clinic	- 2
Dental technician	- 3

H-4 What exactly was done during your last course of dental treatment?
Code all treatment received

Dental examination	- 01
Teeth cleaned or polished	- 02
Floride treatment	- 03
Dental X-ray	- 04
Dental filling or crown	- 05
Tooth extracted	- 06
Gum treatment	- 07
Denture(s); preparation/fitting	- 08
Denture(s); maintenance/repair	- 09
Other	- 10

H-5 Do you need dental treatment at present?

Yes	- 1
No	- 2 *(Go to H-6)*
Don't know	- 8

a. What do you need to have done?

Fillings	- 1
Gum treatment	- 2
Teeth extracted	- 3
Teeth replaced	- 4
New dentures	- 5
Dentures fixed	- 6
Teeth Cleaned	- 7
Other	- 8

H-6 Have you lost all your teeth from your upper jaw?

Yes - 1
No - 2

H-7 Do you have a plate or false teeth for your upper jaw?

Yes - 1
No - 2 *(Go to H-8)*

a. Is this a full or partial set?

Full - 1
Partial - 2

H-8 Have you lost all your teeth from your lower jaw?

Yes - 1
No - 2

H-9 Do you have a plate or false teeth for your lower jaw?

Yes - 1
No - 2 *(Go to H-10)*

a. Is this a full or partial set?

Full - 1
Partial - 2

H-10 How long have you had the dentures (you wear now)?

Years |_|_|

H-11 I am now going to ask about some common dental problems. For each one please tell me how much of a problem it has recently been for you -- very much, quite a bit, not much or not at all?

	Very much	Quite a bit	Not much	Not at all
Toothache or pain	1	2	3	4
Sensitivity to food	1	2	3	4
Food packing	1	2	3	4
Denture discomfort	1	2	3	4

H-12 How much difficulty or restriction have you recently had in any of the following because of problems with your mouth or teeth -- very much, quite a bit, not much, or not at all?

	Very much	Quite a bit	Not much	Not at all
Chewing	1	2	3	4
Biting hard	1	2	3	4
Taking a big bite	1	2	3	4
Talking	1	2	3	4
Smiling	1	2	3	4
Laughing	1	2	3	4
Kissing	1	2	3	4

H-13	**How much have you recently had to change the types of food you eat because of problems with your mouth or teeth -- very much, quite a bit, not much, or not at all?**	Very much - 1 Quite a bit - 2 Not much - 3 Not at all - 4
H-14	**Are you dissatisfied with the appearance of your teeth/dentures -- very much, quite a bit, not much, or not at all?**	Very much - 1 Quite a bit - 2 Not much - 3 Not at all - 4
H-15	**Do you have private insurance for dental expenses?**	Yes - 1 No - 2
H-16	**Do you have entitlement to free dental services?**	Yes - 1 No - 2

Appendix 2 Paired judgements questionnaires

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

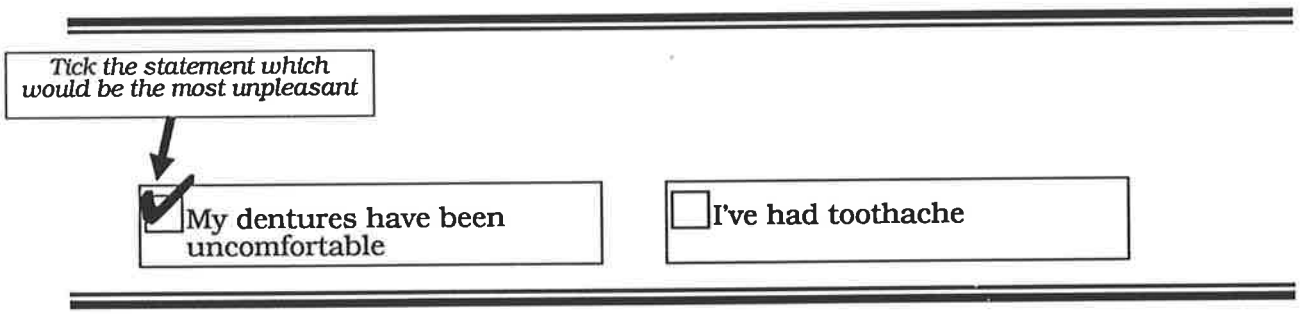
Which dental problems are the most unpleasant?

Introduction

This questionnaire is part of a research program being undertaken by Professor John Spencer and Dr Gary Slade at The University of Adelaide. We need your help to work out which dental problems cause the greatest impact on people's everyday lives. The findings from this research will be used in a longitudinal study to examine the causes and effects of common dental problems among older Australians.

How to answer the questions

This questionnaire contains a series of 82 pairs of statements. You should examine each pair, one at a time, and tick the statement which would be most unpleasant for you, based on your experience or knowledge of dental problems. For example, if you felt that uncomfortable dentures would be more unpleasant than a toothache you would respond as shown:



In each of the statements, you should remember that the problem is related to disorders of the teeth, gums, dentures or mouth. So, for example, "My sense of taste has worsened" means that the sense of taste is worse because of a dental problem and not because of some other disorder. Also, when you make a judgment about the unpleasantness of each statement, concentrate on the impact it would have on your everyday life, rather than any problems with getting treatment or possible underlying cause.

This questionnaire contains all possible combinations of statements in the 82 pairs. Although some of the pairs may look similar, none of them are repeated. Please try to decide which item in each pair would be the most unpleasant for you. If you have difficulty deciding, try to think of the last time you may have experienced the type of problem. If you can't recall ever having had the problem, try to imagine how you think it might affect you if you had the trouble right now.

Your answers to this questionnaire will be maintained in strict confidence. Your name does not appear on the questionnaire, and you cannot be personally identified by answering these questions. If you have any queries concerning the questionnaire or this research, please phone Dr Gary Slade at The University of Adelaide, telephone 228-5438

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2
1	☐ I've had headaches	☐ My jaw has been sore
2	☐ I've had painful aching in my mouth	☐ My dentures have been uncomfortable
3	☐ I've had painful aching in my mouth	☐ I've had headaches
4	☐ My dentures have been uncomfortable	☐ I have had toothache
5	☐ It has been uncomfortable to eat some foods	☐ My dentures have been uncomfortable
6	☐ I have had toothache	☐ My gums have been painful
7	☐ I have had toothache	☐ I've had headaches
8	☐ I've had painful aching in my mouth	☐ My gums have been painful
9	☐ My gums have been painful	☐ My teeth have been sensitive (eg due to hot or cold foods)
10	☐ My jaw has been sore	☐ I've had painful aching in my mouth
11	☐ I've had sore spots in my mouth	☐ My gums have been painful
12	☐ I have had toothache	☐ My jaw has been sore
13	☐ I have had toothache	☐ I've had painful aching in my mouth
14	☐ My teeth have been sensitive (eg due to hot or cold foods)	☐ My dentures have been uncomfortable
15	☐ I've had sore spots in my mouth	☐ My dentures have been uncomfortable
16	☐ It has been uncomfortable to eat some foods	☐ I've had headaches
17	☐ My jaw has been sore	☐ My gums have been painful

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2	
18	☐ I've had headaches	☐ My teeth have been sensitive (eg due to hot or cold foods)	
19	☐ My gums have been painful	☐ I've had headaches	
20	☐ My teeth have been sensitive (eg due to hot or cold foods)	☐ It has been uncomfortable to eat some foods	
21	☐ My jaw has been sore	☐ My dentures have been uncomfortable	
22	☐ It has been uncomfortable to eat some foods	☐ I have had toothache	
23	☐ I've had sore spots in my mouth	☐ I've had painful aching in my mouth	
24	☐ My dentures have been uncomfortable	☐ My gums have been painful	
25	☐ My jaw has been sore	☐ It has been uncomfortable to eat some foods	
26	☐ I've had painful aching in my mouth	☐ My teeth have been sensitive (eg due to hot or cold foods)	
27	☐ I've had painful aching in my mouth	☐ It has been uncomfortable to eat some foods	
28	☐ I've had headaches	☐ My dentures have been uncomfortable	
29	☐ I've had sore spots in my mouth	☐ My jaw has been sore	
30	☐ I've had headaches	☐ I've had sore spots in my mouth	
31	☐ I have had toothache	☐ I've had sore spots in my mouth	
32	☐ My gums have been painful	☐ It has been uncomfortable to eat some foods	
33	☐ I've had sore spots in my mouth	☐ It has been uncomfortable to eat some foods	
34	☐ My teeth have been sensitive (eg due to hot or cold foods)	☐ My jaw has been sore	

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2
35	☐ I've had sore spots in my mouth	☐ My teeth have been sensitive (eg due to hot or cold foods)
36	☐ My teeth have been sensitive (eg due to hot or cold foods)	☐ I have had toothache
37	☐ Dental problems have made me miserable	☐ I have been worried because of dental problems
38	☐ I have been self conscious because of my teeth	☐ I have been worried because of dental problems
39	☐ I've felt uncomfortable about the appearance of my teeth	☐ I have been worried because of dental problems
40	☐ I have been self conscious because of my teeth	☐ I've been feeling tense because of dental troubles
41	☐ I've been feeling tense because of dental troubles	☐ Dental problems have made me miserable
42	☐ Dental problems have made me miserable	☐ I've felt uncomfortable about the appearance of my teeth
43	☐ I have been self conscious because of my teeth	☐ Dental problems have made me miserable
44	☐ I've been feeling tense because of dental troubles	☐ I have been worried because of dental problems
45	☐ I've felt uncomfortable about the appearance of my teeth	☐ I have been self conscious because of my teeth
46	☐ I've been feeling tense because of dental troubles	☐ I've felt uncomfortable about the appearance of my teeth
47	☐ There has been less flavour in my food	☐ I've had to avoid eating some foods
48	☐ I've been unable to brush my teeth properly	☐ People haven't understood some of my words
49	☐ My diet has been unsatisfactory	☐ There has been less flavour in my food
50	☐ My speech has been unclear	☐ I've been unable to brush my teeth properly
51	☐ My diet has been unsatisfactory	☐ I haven't been able to eat with my dentures

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2	
52	☐ My diet has been unsatisfactory	☐ People haven't understood some of my words	
53	☐ People haven't understood some of my words	☐ I've avoided smiling	
54	☐ I've been unable to brush my teeth properly	☐ There has been less flavour in my food	
55	☐ I've had to avoid eating some foods	☐ People haven't understood some of my words	
56	☐ I haven't been able to eat with my dentures	☐ There has been less flavour in my food	
57	☐ There has been less flavour in my food	☐ People haven't understood some of my words	
58	☐ I've avoided smiling	☐ I haven't been able to eat with my dentures	
59	☐ I've had to interrupt meals	☐ There has been less flavour in my food	
60	☐ My diet has been unsatisfactory	☐ I've been unable to brush my teeth properly	
61	☐ My diet has been unsatisfactory	☐ I've had to avoid eating some foods	
62	☐ I haven't been able to eat with my dentures	☐ My speech has been unclear	
63	☐ My diet has been unsatisfactory	☐ I've had to interrupt meals	
64	☐ I've been unable to brush my teeth properly	☐ I've had to avoid eating some foods	
65	☐ My speech has been unclear	☐ There has been less flavour in my food	
66	☐ I've had to avoid eating some foods	☐ I've avoided smiling	
67	☐ My speech has been unclear	☐ I've had to interrupt meals	
68	☐ I haven't been able to eat with my dentures	☐ I've been unable to brush my teeth properly	

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2
69	☐ I've avoided smiling	☐ There has been less flavour in my food
70	☐ I've avoided smiling	☐ My speech has been unclear
71	☐ I've avoided smiling	☐ I've been unable to brush my teeth properly
72	☐ I've had to interrupt meals	☐ I've been unable to brush my teeth properly
73	☐ I've had to interrupt meals	☐ I haven't been able to eat with my dentures
74	☐ I haven't been able to eat with my dentures	☐ People haven't understood some of my words
75	☐ My speech has been unclear	☐ My diet has been unsat-isfactory
76	☐ I've had to avoid eating some foods	☐ I've had to interrupt meals
77	☐ I haven't been able to eat with my dentures	☐ I've had to avoid eating some foods
78	☐ I've avoided smiling	☐ I've had to interrupt meals
79	☐ I've had to avoid eating some foods	☐ My speech has been unclear
80	☐ I've had to interrupt meals	☐ People haven't understood some of my words
81	☐ My diet has been unsat-isfactory	☐ I've avoided smiling
82	☐ My speech has been unclear	☐ People haven't understood some of my words

Finally we need to know some information about you for the analysis of our results.

Q.83 What is your present age? (circle number)

1 - 15-24 YEARS
2 - 25-34 YEARS
3 - 35-44 YEARS
4 - 45-54 YEARS
5 - 55-64 YEARS
6 - 65 YEARS OR OVER

Q.84 What is your sex? (circle number)

1 - MALE
2 - FEMALE

Q.85 Have you lost all your teeth in your upper jaw?

1 - YES
2 - NO

Q.86 Do you have a plate or false teeth for your upper jaw?

1 - YES
2 - NO

Q.87 Have you lost all your teeth in your lower jaw?

1 - YES
2 - NO

Q.88 Do you have a plate or false teeth for your lower jaw?

1 - YES
2 - NO

Q.89 How long ago did you see anyone about your teeth, dentures or gums? (circle number)

1 - 12 MONTHS OR LESS
2 - 12 MONTHS TO 2 YEARS
3 - 2 TO 5 YEARS
4 - 5 TO 10 YEARS
5 - MORE THAN 10 YEARS
6 - NEVER

If you have not had a dental visit within the last year, go to Q.91

If you have never had a dental visit, go to Q.94 on the next page

Q.90 How many visits did you make in the last 12 months? _____

Q.91 Do you normally have a check-up or do you visit only for a specific problem? (circle number)

1 - CHECK-UP
2 - SPECIFIC PROBLEM
3 - DON'T KNOW

Q.92 For your last course of dental treatment did you go to a private dentist, a public hospital or clinic, or to a dental technician?

1 - PRIVATE DENTIST
2 - PUBLIC HOSPITAL OR CLINIC
3 - DENTAL TECHNICIAN

Q.93 What exactly was done during your last course of dental treatment (circle one or more numbers for each type of treatment)

1 - DENTAL EXAMINATION
2 - TEETH CLEANED OR POLISHED
3 - FLUORIDE TREATMENT
4 - DENTAL X-RAY
5 - DENTAL FILLING OR CROWN
6 - TOOTH EXTRACTED
7 - GUM TREATMENT
8 - DENTURE PREPARATION OR FITTING
9 - DENTURE MAINTENANCE OR REPAIR
10 - OTHER (specify _____)
11 - DON'T KNOW

Q.94 Do you need dental treatment at present?

1 - YES
2 - NO → If you do not need dental treatment at present, there are no further questions.
3 - DON'T KNOW

Q.95 What do you need to have done?

1 - FILLINGS
2 - GUM TREATMENT
3 - TEETH EXTRACTED
4 - TEETH REPLACED
5 - NEW DENTURES
6 - DENTURES FIXED
7 - TEETH CLEANED
8 - OTHER (specify _____)
9 - DON'T KNOW

Thank you! Your contribution to this study is very much appreciated. Please return this questionnaire to the researchers at the next scheduled meeting. Otherwise please post this completed questionnaire to:

Dr. Gary Slade
Department of Dentistry
The University of Adelaide
Box 498 GPO
Adelaide SA 5001

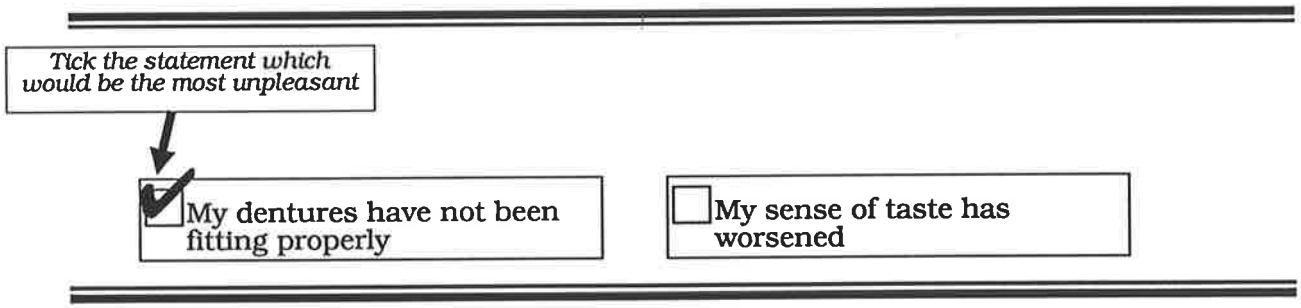
Which dental problems are the most unpleasant?

Introduction

This questionnaire is part of a research program being undertaken by Professor John Spencer and Dr Gary Slade at The University of Adelaide. We need your help to work out which dental problems cause the greatest impact on people's everyday lives. The findings from this research will be used in a longitudinal study to examine the causes and effects of common dental problems among older Australians.

How to answer the questions

This questionnaire contains a series of 76 pairs of statements. You should examine each pair, one at a time, and tick the statement which would be most unpleasant for you, based on your experience or knowledge of dental problems. For example, if you felt that ill-fitting dentures would be more unpleasant than a worsened sense of taste you would respond as shown:



In each of the statements, you should remember that the problem is related to disorders of the teeth, gums, dentures or mouth. So, for example, "My sense of taste has worsened" means that the sense of taste is worse because of a dental problem and not because of some other disorder. Also, when you make a judgment about the unpleasantness of each statement, concentrate on the impact it would have on your everyday life, rather than any problems with getting treatment or possible underlying cause.

This questionnaire contains all possible combinations of statements in the 76 pairs. Although some of the pairs may look similar, none of them are repeated. Please try to decide which item in each pair would be the most unpleasant for you. If you have difficulty deciding, try to think of the last time you may have experienced the type of problem. If you can't recall ever having had the problem, try to imagine how you think it might affect you if you had the trouble right now.

Your answers to this questionnaire will be maintained in strict confidence. Your name does not appear on the questionnaire, and you cannot be personally identified by answering these questions. If you have any queries concerning the questionnaire or this research, please phone Dr Gary Slade at The University of Adelaide, telephone 228-5438.

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2
1	☐ My breath has been stale	☐ My digestion has worsened
2	☐ I've noticed a tooth which doesn't look right	☐ Food has been catching in my teeth or dentures
3	☐ My appearance has been affected	☐ My breath has been stale
4	☐ My breath has been stale	☐ Food has been catching in my teeth or dentures
5	☐ My dentures have not been fitting properly	☐ My breath has been stale
6	☐ My sense of taste has worsened	☐ My digestion has worsened
7	☐ My sense of taste has worsened	☐ My breath has been stale
8	☐ My digestion has worsened	☐ Food has been catching in my teeth or dentures
9	☐ My sense of taste has worsened	☐ My dentures have not been fitting properly
10	☐ I've had difficulty chewing some foods	☐ My breath has been stale
11	☐ I've had difficulty chewing some foods	☐ I've had trouble pronouncing some words
12	☐ I've had difficulty chewing some foods	☐ Food has been catching in my teeth or dentures
13	☐ I've had trouble pronouncing some words	☐ Food has been catching in my teeth or dentures
14	☐ I've noticed a tooth which doesn't look right	☐ I've had trouble pronouncing some words
15	☐ My appearance has been affected	☐ Food has been catching in my teeth or dentures
16	☐ My dentures have not been fitting properly	☐ My digestion has worsened
17	☐ I've had difficulty chewing some foods	☐ I've noticed a tooth which doesn't look right

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2
18	☐ I've noticed a tooth which doesn't look right	☐ My dentures have not been fitting properly
19	☐ My sense of taste has worsened	☐ I've had difficulty chewing some foods
20	☐ Food has been catching in my teeth or dentures	☐ My sense of taste has worsened
21	☐ My appearance has been affected	☐ My dentures have not been fitting properly
22	☐ My appearance has been affected	☐ My sense of taste has worsened
23	☐ My dentures have not been fitting properly	☐ I've had trouble pronouncing some words
24	☐ My appearance has been affected	☐ I've had difficulty chewing some foods
25	☐ My sense of taste has worsened	☐ I've noticed a tooth which doesn't look right
26	☐ Food has been catching in my teeth or dentures	☐ My dentures have not been fitting properly
27	☐ My digestion has worsened	☐ I've had trouble pronouncing some words
28	☐ I've had trouble pronouncing some words	☐ My appearance has been affected
29	☐ My digestion has worsened	☐ I've had difficulty chewing some foods
30	☐ My digestion has worsened	☐ I've noticed a tooth which doesn't look right
31	☐ I've had trouble pronouncing some words	☐ My sense of taste has worsened
32	☐ I've had trouble pronouncing some words	☐ My breath has been stale
33	☐ My breath has been stale	☐ I've noticed a tooth which doesn't look right
34	☐ My appearance has been affected	☐ My digestion has worsened

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2	
35	☐ I've noticed a tooth which doesn't look right	☐ My appearance has been affected	
36	☐ My dentures have not been fitting properly	☐ I've had difficulty chewing some foods	
37	☐ I've been upset	☐ My concentration has been affected	
38	☐ I've been a bit embarrassed	☐ I've been upset	
39	☐ It's been difficult to relax	☐ My sleep has been interrupted	
40	☐ My sleep has been interrupted	☐ My concentration has been affected	
41	☐ I've been feeling depressed	☐ I've been upset	
42	☐ My concentration has been affected	☐ It's been difficult to relax	
43	☐ I've been feeling depressed	☐ My sleep has been interrupted	
44	☐ It's been difficult to relax	☐ I've been upset	
45	☐ I've been feeling depressed	☐ It's been difficult to relax	
46	☐ It's been difficult to relax	☐ I've been a bit embarrassed	
47	☐ My sleep has been interrupted	☐ I've been a bit embarrassed	
48	☐ I've been a bit embarrassed	☐ I've been feeling depressed	
49	☐ My sleep has been interrupted	☐ I've been upset	
50	☐ I've been feeling depressed	☐ My concentration has been affected	
51	☐ I've been a bit embarrassed	☐ My concentration has been affected	

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2	
52	☐ I've had trouble getting on with other people	☐ I've been less tolerant of my spouse or family	
53	☐ I've had difficulty doing my usual jobs	☐ I've avoided going out sometimes	
54	☐ I've had trouble getting on with other people	☐ I've had difficulty doing my usual jobs	
55	☐ I've had trouble getting on with other people	☐ I've been a bit irritable with other people	
56	☐ I've been less tolerant of my spouse or family	☐ I've had difficulty doing my usual jobs	
57	☐ I've been a bit irritable with other people	☐ I've had difficulty doing my usual jobs	
58	☐ I've avoided going out sometimes	☐ I've had trouble getting on with other people	
59	☐ I've been less tolerant of my spouse or family	☐ I've avoided going out sometimes	
60	☐ I've been a bit irritable with other people	☐ I've been less tolerant of my spouse or family	
61	☐ I've avoided going out sometimes	☐ I've been a bit irritable with other people	
62	☐ Life in general has been less satisfying	☐ I've been unable to work to my full capacity	
63	☐ Life in general has been less satisfying	☐ I've been unable to enjoy other people's company as much	
64	☐ I've been financially disadvantaged	☐ Life in general has been less satisfying	
65	☐ My general health has worsened	☐ Life in general has been less satisfying	
66	☐ I've been unable to enjoy other people's company as much	☐ I've been totally unable to function	
67	☐ I've been financially disadvantaged	☐ I've been unable to work to my full capacity	
68	☐ I've been totally unable to function	☐ My general health has worsened	

Tick the statement in each pair which, for you, would be the most unpleasant

Pair	Statement 1	Statement 2
69	☐ Life in general has been less satisfying	☐ I've been totally unable to function
70	☐ My general health has worsened	☐ I've been financially disadvantaged
71	☐ I've been financially disadvantaged	☐ I've been totally unable to function
72	☐ I've been unable to work to my full capacity	☐ My general health has worsened
73	☐ I've been unable to work to my full capacity	☐ I've been totally unable to function
74	☐ I've been unable to work to my full capacity	☐ I've been unable to enjoy other people's company as much
75	☐ My general health has worsened	☐ I've been unable to enjoy other people's company as much
76	☐ I've been unable to enjoy other people's company as much	☐ I've been financially disadvantaged

Finally we need to know some information about you for the analysis of our results.

Q.77 What is your present age? (circle number)

1 - 15-24 YEARS
2 - 25-34 YEARS
3 - 35-44 YEARS
4 - 45-54 YEARS
5 - 55-64 YEARS
6 - 65 YEARS OR OVER

Q.78 What is your sex? (circle number)

1 - MALE
2 - FEMALE

Q.79 Have you lost all your teeth in your upper jaw?

1 - YES
2 - NO

Q.80 Do you have a plate or false teeth for your upper jaw?

1 - YES
2 - NO

Q.81 Have you lost all your teeth in your lower jaw?

1 - YES
2 - NO

Q.82 Do you have a plate or false teeth for your lower jaw?

1 - YES
2 - NO

Q.83 How long ago did you see anyone about your teeth, dentures or gums? (circle number)

1 - 12 MONTHS OR LESS
2 - 12 MONTHS TO 2 YEARS
3 - 2 TO 5 YEARS
4 - 5 TO 10 YEARS
5 - MORE THAN 10 YEARS

If you have not had a dental visit within the last year, go to Q.85

6 - NEVER → If you have never had a dental visit, go to Q.88 on the next page

Q.84 How many visits did you make in the last 12 months? _____

Q.85 Do you normally have a check-up or do you visit only for a specific problem? (circle number)

1 - CHECK-UP
2 - SPECIFIC PROBLEM
3 - DON'T KNOW

Q.86 For your last course of dental treatment did you go to a private dentist, a public hospital or clinic, or to a dental technician?

1 - PRIVATE DENTIST
2 - PUBLIC HOSPITAL OR CLINIC
3 - DENTAL TECHNICIAN

Q.87 What exactly was done during your last course of dental treatment (circle one or more numbers for each type of treatment)

1 - DENTAL EXAMINATION
2 - TEETH CLEANED OR POLISHED
3 - FLUORIDE TREATMENT
4 - DENTAL X-RAY
5 - DENTAL FILLING OR CROWN
6 - TOOTH EXTRACTED
7 - GUM TREATMENT
8 - DENTURE PREPARATION OR FITTING
9 - DENTURE MAINTENANCE OR REPAIR
10 - OTHER (specify _____)
11 - DON'T KNOW

Q.88 Do you need dental treatment at present?

1 - YES
2 - NO → If you do not need dental treatment at present, there are no further questions.
3 - DON'T KNOW

Q.89 What do you need to have done?

1 - FILLINGS
2 - GUM TREATMENT
3 - TEETH EXTRACTED
4 - TEETH REPLACED
5 - NEW DENTURES
6 - DENTURES FIXED
7 - TEETH CLEANED
8 - OTHER (specify _____)
9 - DON'T KNOW

Thank you! Your contribution to this study is very much appreciated. Please return this questionnaire to the researchers at the next scheduled meeting. Otherwise please post this completed questionnaire to:

Dr. Gary Slade
Department of Dentistry
The University of Adelaide
Box 498 GPO
Adelaide SA 5001

Appendix 3 Social impact questionnaires used in evaluation of the OHIP

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

The Australian Longitudinal Study of Ageing



Dental Follow-up Questionnaire

HOW TO ANSWER THE QUESTIONS

Each question on the left hand side of the page asks you about a particular dental problem and you are asked to consider two possible answers for each question. Circle your response to answer a) in the middle of the page to indicate how often you have had the problem in the past one or two years (Very often, Fairly often, Occasionally, Hardly ever or Never). If you have had the problem during the last one or two years, next circle your response to answer b) on the right hand side to indicate how long it has been since you last had the problem (Less than 1 month, between 1 and 6 months, 6-12 months or 1-2 years) - Example 1.

EXAMPLE 1

Q.1 Have you had difficulty chewing any foods because of problems with your teeth, mouth or dentures?

a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
VERY OFTEN	FAIRLY OFTEN	(OCCAS-IONALLY)	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	(6-12 MONTHS)	1-2 YEARS	DON'T KNOW

☞ Remember to also fill in answer b) on the right hand side if you have had the problem sometime in the last one or two years,

If you have never had the problem during the last year or two, simply circle your answer to question a) and then move on to the next question on the left hand side of the page - Example 2.

EXAMPLE 2

Q.1 Have you had difficulty chewing any foods because of problems with your teeth, mouth or dentures?

a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	(NEVER)	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)							b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
Q.1 Have you had difficulty chewing any foods because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.2 Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.3 Have you noticed a tooth which doesn't look right?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.4 Have you felt that your appearance has been affected because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.5 Have you felt that your breath has been stale because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.6 Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.7 Have you had food catching in your teeth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.8 Have you felt that your digestion has worsened because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.9 Have you had painful aching in your mouth?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)							b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
Q.10 Have you had a sore jaw?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.11 Have you had headaches because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.12 Have you had sensitive teeth, for example, due to hot or cold foods or drinks?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.13 Have you had a toothache?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.14 Have you had painful gums?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.15 Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.16 Have you had sore spots in your mouth?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.17 Have you felt that your dentures have not been fitting properly?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.18 Have you had uncomfortable dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

If you have not had any of the problems mentioned in Q.1 - Q.18, please skip to Q.50 on page 7.
Otherwise, continue with Q.19 - Q.49

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
Q.19 Have you been worried by dental problems?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.20 Have you been self conscious because of your teeth mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.21 Have dental problems made you miserable?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.22 Have you felt uncomfortable about the appearance of your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.23 Have you felt tense because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.24 Has your speech been unclear because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.25 Have people misunderstood some of your words because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.26 Have you felt that there has been less flavour in your food because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
Q.27 Have you been unable to brush your teeth properly because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.28 Have you had to avoid eating some foods because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.29 Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.30 Have you been unable to eat with your dentures because of problems with them?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.31 Have you avoided smiling because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.32 Have you had to interrupt meals because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.33 Has your sleep been interrupted because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.34 Have you been upset because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.35 Have you found it difficult to relax because of problems with your teeth, mouth or dentures?											
Q.36 Have you felt depressed because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS.	DON'T KNOW
Q.37 Has your concentration been affected because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.38 Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.39 Have you avoided going out because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.40 Have you been less tolerant of your spouse or family because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.41 Have you had trouble getting on with other people because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.42 Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
Q.43 Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.44 Have you felt that your general health has worsened because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.45 Have you been financially disadvantaged because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.46 Have you been unable to enjoy other people's company as much because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.47 Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.48 Have you been totally unable to function because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.49 Have you been unable to work to your full capacity because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

Now we have some questions about changes in your medical and dental conditions since the **first interview in 1988** that is, around April last year.

Q.50 Since the first interview at your house in 1988, have you developed any major medical disorders, such as heart trouble, bronchitis or asthma, high blood pressure, stroke, kidney disorders, diabetes, joint trouble, arthritis, cancer or nervous problems? (Circle number)

1 - YES (specify)_____
2 - NO
3 - DON'T KNOW

Q.51 Thinking about your general medical health, would you say that it is better, about the same, or worse than it was at the time of the interview in 1988? (Circle number)

1 - BETTER
2 - ABOUT THE SAME
3 - WORSE
4 - DON'T KNOW

Q.52 Since the first interview in 1988, have you seen anyone about your teeth, dentures or gums? (Circle number)

1 - YES
2 - NO
3 - DON'T KNOW → If you haven't seen anyone about your teeth, dentures or gums, skip from here to Q.54 on the next page

Q.53 What did you have done? (Circle one or more numbers for each item you had done)

1 - DENTAL EXAMINATION
2 - TEETH CLEANED OR POLISHED
3 - FLUORIDE TREATMENT
4 - DENTAL X-RAY
5 - DENTAL FILLING OR CROWN
6 - TOOTH EXTRACTED
7 - GUM TREATMENT
8 - DENTURE(S) PREPARATION/FITTING
9 - DENTURE MAINTENANCE/REPAIR
10 - OTHER
11 - DON'T KNOW

Q.54 Do you need dental treatment at present? (Circe number)

1 - Yes
2 - No → If you don't need any dental treatment, skip to Q.56 below
3 - Don't know

Q.55 What do you need to have done? (Circle one or more numbers for each treatment you require)

1 - FILLINGS
2 - GUM TREATMENT
3 - TEETH EXTRACTED
4 - TEETH REPLACED
5 - NEW DENTURES
6 - DENTURES FIXED
7 - TEETH CLEANED
8 - OTHER
9 - DON'T KNOW

Finally we would like to know about any changes in your household since the **telephone interview early this year.**

Q.56 Since we talked to you early this year, has your marital status changed? That is, have you been married, widowed, divorced or separated since then? (Circle number)

1 - NO CHANGE
2 - WIDOWED
3 - MARRIED
4 - DIVORCED
5 - SEPARATED

Q.57 Were there any persons living with you at the time of the interview early this year who are no longer living with you? (Circle number)

1 - YES
2 - NO

Q.58 Are you currently living with any persons who were not living with you at the time of the interview early this year? (Circle number)

1 - YES
2 - NO

Thank you! Your contribution to this study is very greatly appreciated. Please put this completed questionnaire in the stamped addressed envelope and post it to:

Dental Follow-up Survey
Centre for Ageing Studies
Flinders University of South Australia
254 Greenhill Rd
Glenside 5065

Serial Number: ☐☐☐

AUSTRALIAN LONGITUDINAL STUDY OF AGEING

Dental Follow-up Questionnaire

SERIAL NUMBER

DATE OF INTERVIEW
dd mm yy

FINAL RESPONSE
1 ○ TELEPHONE
2 ○ FACE-TO-FACE
3 ○ MAIL

INTERVIEW TIMES
START hour min
FINISH hour min

Interviewer: Refer to Household Information Sheet

Q1. Are you still living at: *(address on HH Information Sheet)*

Same address - 1
Change - 2

Q1 ① ② ▬

Interviewer: if moved or address incorrect, update HH Information Sheet

Q2. Since we talked to you last on the telephone in _____ this year, has your marital status changed? That is, have you been married, widowed, divorced or separated since then?

No change - 1
Widowed - 2
Married - 3
Divorced - 4
Separated - 5

Q2 ① ② ③ ④ ⑤ ▬

If interviewee lives alone, go to Q3.b)

Q3. When we last spoke with you on the telephone in _____ this year, the persons living in your house were:

Read first names and relationship from HH Information Sheet

Q3.a) Are all of these persons still living with you?

Yes - 1
No - 2

Q3a ① ② ▬

If 'No', amend HH Information Sheet

Q3.b) Is there anyone else living in your household (besides yourself/whom I did not mention)?

Yes - 1
No - 2

Q3b ① ② ▬

If 'Yes', amend HH Information Sheet

Now I have some questions about changes in your health and medical conditions since the first interview in _____ 1988 that is, last year.

Q4. Since the first interview in _____ 1988, have you developed any major medical disorders, such as heart trouble, bronchitis or asthma, high blood pressure, stroke, kidney disorders, diabetes, joint trouble, arthritis, cancer or nervous problems?

Yes - 1 *(Go to Q4.a)*
No - 2 *(Go to Q.5)*
Don't know - 9 *(Go to Q.5)*

Q4 ① ② ⑨ ▬

Q4.a) What was/were the problem/s? _____

Q4a ⓪⓪ ①① ②② ③③ ④④ ⑤⑤ ⑥⑥ ⑦⑦ ⑧⑧ ⑨⑨ ▬▬

Q5. Thinking about your general medical health, would you say that it is better, about the same, or worse than it was in _____ 1988?

Q5

Better - 1
About the same - 2
Worse - 3
Don't know - 9

Now I have some questions about dental visits.

Q6. Since the first interview in _____ 1988, have you seen anyone about your teeth, dentures or gums?

Q6

Yes - 1 *(Go to Q6.a)*
No - 2 *(Go to Q.7)*
Don't know - 9 *(Go to Q.7)*

Q6.a) What did you have done? *(record all items at all visits)*

Q6a

Dental examination - 1
Teeth cleaned or polished - 2
Fluoride treatment - 3
Dental X-ray - 4
Dental filling or crown - 5
Tooth extracted - 6
Gum treatment - 7
Denture(s) preparation/fitting - 8
Denture maintenance/repair - 9
Other - 10
Don't know - 99

Q7. Do you need dental treatment at present?

Q7

Yes - 1 *(Go to Q7.a)*
No - 2 *(Go to Q.8)*
Don't know - 9 *(Go to Q.8)*

Q7.a) What do you need to have done? *(record all items)*

Q7a

Fillings - 1
Gum treatment - 2
Teeth extracted - 3
Teeth replaced - 4
New dentures - 5
Dentures fixed - 6
Teeth cleaned - 7
Other - 8
Don't know - 9

Interviewer: Terminate proxy interview here - Go to Q58., p10.

Q8. Thinking about your teeth, dentures or mouth in general, would you say that your dental health is better, about the same, or worse than than it was in _____ 1988?

Q8

Better - 1 ①
About the same - 2 ②
Worse - 3 ③
Don't know - 9 ⑨

Now I have some questions about your teeth. Many people have problems with their teeth or dentures from time to time. I'm going to read out a list of dental problems and I'd like you to tell me if you can remember having had the same sort of problem within the last year or two. Please tell me if you've had the problem very often, fairly often, occasionally, hardly ever, or never in the last one or two years.

For all questions: **In the past one or two years:**

Q9. Have you had difficulty chewing any foods? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occas-tonally | Hardly ever | Never | Don't know → *Go to Q10*

↓ *(Go to Q9.a)*

Q9.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q10. Have you had trouble pronouncing any words? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q11*

↓ *(Go to Q10.a)*

Q10.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q11. Have you noticed a tooth which doesn't look right?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not Applicable → *Go to Q12*

↓ *(Go to Q11.a)*

Q11.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q12. Have you felt that your appearance has been affected? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q13*

↓ *(Go to Q12.a)*

Q12.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q13. Have you felt that your breath has been stale? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q14*

↓ *(Go to Q13.a)*

Q13.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q14. Have you felt that your sense of taste has worsened? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q15*

↓ *(Go to Q14.a)*

Q14.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q15. Have you had food catching in your teeth or dentures?

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know | Not Applicable → *Go to Q16*

↓ *(Go to Q15.a)*

Q15.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q16. Have you felt that your digestion had worsened? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q17*

↓ *(Go to Q16.a)*

Q16.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q17. Have you had painful aching in your mouth?

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q18*

↓ *(Go to Q17.a)*

Q17.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q18. Have you had a sore jaw?

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q19*

↓ *(Go to Q18.a)*

Q18.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q19. Have you had headaches? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q20*

↓ *(Go to Q19.a)*

Q19.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q20. Have you had sensitive teeth (for example, due to hot or cold foods or drinks)?

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know | Not applicable → *Go to Q21*

↓ *(Go to Q20.a)*

Q20.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q21. Have you had a toothache?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q22*

↓ *(Go to Q21.a)*

Q21.a)When did you last have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q22. Have you had painful gums?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q23*

↓ *(Go to Q22.a)*

Q22.a)When did you last have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q23. Have you found it uncomfortable to eat any foods? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q24*

↓ *(Go to Q23.a)*

Q23.a)When did you last have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q24. Have you had sore spots in your mouth?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q25*

↓ *(Go to Q24.a)*

Q24.a)When did you last have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q25. Have you felt that your dentures had not been fitting properly?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q26*

↓ *(Go to Q25.a)*

Q25.a)When did you last have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q26. Have you had uncomfortable dentures?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q27*

↓ *(Go to Q26.a)*

Q26.a)When did you last have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Can you please wait for just a moment while I record your answers.

Interviewer: review responses to questions Q9. - Q26.
If no disorders have been recorded (Q9. - Q26.) go to Q58. (page 10)

If any disorders (Q9. - Q26.) have been reported in the last 1-2 years, continue:

Now I would like you to think about the problems that you have just mentioned (_____). The next questions concern the way in which these dental problems may have had an impact on you.

For all questions: **In the past one or two years:**

Q27. Have you been worried because of dental problems?

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q28*

↓ *(Go to Q27.a)*

Q27.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q28. Have you been self conscious because of your teeth?

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q29*

↓ *(Go to Q28.a)*

28.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q29. Have dental problems made you miserable?

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q30*

↓ *(Go to Q29.a)*

Q29.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q30. Have you felt uncomfortable about the appearance of your teeth?

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q31*

↓ *(Go to Q30.a)*

Q30.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q31. Have you felt tense? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q32*

↓ *(Go to Q31.a)*

Q31.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q32. Has your speech been unclear? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q33*

↓ *(Go to Q32.a)*

Q32.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q33. Have people misunderstood some of your words? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q34*

↓ *(Go to Q33.a)*

Q33.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q34. Have you felt that there has been less flavour in your food? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q35*

↓ *(Go to Q34.a)*

Q34.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q35. Have you been unable to brush your teeth properly? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q36*

↓ *(Go to Q35.a)*

Q35.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q36. Have you had to avoid eating some foods? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q37*

↓ *(Go to Q36.a)*

36.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q37. Has your diet been unsatisfactory? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q38*

↓ *(Go to Q37.a)*

Q37.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q38. Have you been unable to eat with your dentures? (Because of problems with them).

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q39*

↓ *(Go to Q38.a)*

Q38.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q39. Have you avoided smiling? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q40*

↓ *(Go to Q39.a)*

Q39.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q40. Have you had to interrupt meals? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q41*

↓ *(Go to Q40.a)*

Q40.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q41. Has your sleep been interrupted? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q42*

↓ *(Go to Q41.a)*

Q41.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q42. Have you been upset? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q43*

↓ *(Go to Q42.a)*

Q42..a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q43. Have you found it difficult to relax? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q44*

↓ *(Go to Q43.a)*

43.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q44. Have you felt depressed? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q45*

↓ *(Go to Q44.a)*

Q44.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q45. Has your concentration been affected? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q46*

↓ *(Go to Q45.a)*

Q45.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q.46 Have you been a bit embarrassed? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q47*

↓ *(Go to Q46.a)*

Q46.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q.47 Have you avoided going out? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q48*

↓ *(Go to Q47.a)*

Q47.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q48. Have you been less tolerant of your spouse or family? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know | Not applicable → *Go to Q49*

↓ *(Go to Q48.a)*

Q48.a)How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q49. Have you had trouble getting on with other people? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q50*

↓ *(Go to Q49.a)*

Q49.a)How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q50. Have you been a bit irritable with other people? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q51*

↓ *(Go to Q50.a)*

Q50.a)How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q51. Have you had difficulty doing your usual jobs? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q52*

↓ *(Go to Q51.a)*

Q51.a)How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

The last few questions are about the effects that dental problems can sometimes have on people's other daily activities. Please tell me if these dental problems have affected your everyday activities very often, fairly often, occasionally, hardly ever or never in the past one or two years.

Q52. Have you felt that your general health had worsened? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q53*

↓ *(Go to Q52.a)*

Q52.a)How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q53. Have you been financially disadvantaged? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q54*

↓ *(Go to Q53.a)*

Q53.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q54. Have you been unable to enjoy other people's company as much? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q55*

↓ *(Go to Q54.a)*

Q54.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q55. Have you felt that life in general was less satisfying? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q56*

↓ *(Go to Q55.a)*

Q55.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q56. Have you been totally unable to function? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q57*

↓ *(Go to Q56.a)*

Q56.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q57. Have you been unable to work to your full capacity? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable

↓ *(Go to Q57.a)*

Q57.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q58. That is the end of the questions about your dental and general health. Thank you very much for helping us - your answers are most important for this study. Early next year we would like to contact you again about your views on life and well-being. This will just be an informal chat to get your ideas on what makes a good life.

Interviewer: guage response (if any) and mark appropriate response.

Agreeable - 1
Uncertain - 2
Opposed - 3
No response - 4

This concludes the interview. THANK PARTICIPANT

Time interview finished: _____

Interview Details and Observations

59. Was the interview completed?

Yes, with little or no missing information - 1 ①
Yes, but with considerable missing information - 2 ②
No, terminated - 3 ③

Reason for non-response or missing information_____

60. Was the interview completed by proxy?

No - 1 (Go to 62) ①
Yes - 2 ②

61. Reason for proxy

Refusal - 1 ①
Speech problems - 2 ②
Hearing problems - 3 ③
Physical health - 4 ④
Language problems - 5 ⑤
Mental heath - 6 ⑥
Hospital or nursing home - 7 ⑦
Moved 8 ⑧
Other 9 ⑨

62. How well do you think the participant understood the questions?

Very well - 1 ①
Fairly well - 2 ②
Somewhat - 3 ③
Very little - 4 ④
Not at all - 5 ⑤

63. The respondent's co-operation was:

Excellent - 1 ①
Good - 2 ②
Average - 3 ③
Fair - 4 ④
Poor - 5 ⑤

ENTRE FOR AGEING STUDIES

nders University of South Australia

Serial: ☐☐☐



The Australian Longitudinal Study of Ageing

Supplementary Dental Questionnaire

Thank you for agreeing to participate in this part of the Australian Longitudinal Study of Ageing. This survey contains questions about your dental health which are identical to the ones which you answered in December 1989. On this occasion we are asking you to answer the questions a second time to ensure that our methods are working properly. Please answer each question indicating whether you have had the problem during the previous two years and, if so, when you last had it. Further instructions are provided on the next page. If you have any queries about this questionnaire please contact the researchers at the University of Adelaide Department of Dentistry, Professor John Spencer or Dr. Gary Slade - telephone 228-5438.

Thank you very much for your continuing, valued assistance with this study.

HOW TO ANSWER THE QUESTIONS

Each question on the left hand side of the page asks you about a particular dental problem and you are asked to consider two possible answers for each question. Circle your response to answer a) in the middle of the page to indicate how often you have had the problem in the past one or two years (Very often, Fairly often, Occasionally, Hardly ever or Never). If you have had the problem during the last one or two years, next circle your response to answer b) on the right hand side to indicate how long it has been since you last had the problem (Less than 1 month, between 1 and 6 months, 6-12 months or 1-2 years) - Example 1.

EXAMPLE 1

Q.1 Have you had difficulty chewing any foods because of problems with your teeth, mouth or dentures?

a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)

VERY OFTEN | FAIRLY OFTEN | (OCCAS-IONALLY) | HARDLY EVER | NEVER | DON'T KNOW

b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)

1 MONTH OR LESS | 1-6 MONTHS | (6-12 MONTHS) | 1-2 YEARS | DON'T KNOW

☞ Remember to also fill in answer b) on the right hand side if you have had the problem sometime in the last one or two years,

If you have never had the problem during the last year or two, simply circle your answer to question a) and then move on to the next question on the left hand side of the page - Example 2.

EXAMPLE 2

Q.1 Have you had difficulty chewing any foods because of problems with your teeth, mouth or dentures?

a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)

VERY OFTEN | FAIRLY OFTEN | OCCAS-IONALLY | HARDLY EVER | (NEVER) | DON'T KNOW

b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)

1 MONTH OR LESS | 1-6 MONTHS | 6-12 MONTHS | 1-2 YEARS | DON'T KNOW

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)							b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.1 Have you had difficulty chewing any foods because of problems with your teeth, mouth or dentures?												
Q.2 Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.3 Have you noticed a tooth which doesn't look right?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.4 Have you felt that your appearance has been affected because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.5 Have you felt that your breath has been stale because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.6 Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.7 Have you had food catching in your teeth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.8 Have you felt that your digestion has worsened because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.9 Have you had painful aching in your mouth?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)							b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
Q.10 Have you had a sore jaw?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.11 Have you had headaches because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.12 Have you had sensitive teeth, for example, due to hot or cold foods or drinks?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.13 Have you had a toothache?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.14 Have you had painful gums?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.15 Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.16 Have you had sore spots in your mouth?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW		1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.17 Have you felt that your dentures have not been fitting properly?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.18 Have you had uncomfortable dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	NOT APPLICABLE	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

If you have not had any of the problems mentioned in Q.1 - Q.18, please skip to Q.50 on page 7.
Otherwise, continue with Q.19 - Q.49

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.19 Have you been worried by dental problems?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.20 Have you been self conscious because of your teeth mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.21 Have dental problems made you miserable?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.22 Have you felt uncomfortable about the appearance of your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.23 Have you felt tense because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.24 Has your speech been unclear because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.25 Have people misunderstood some of your words because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.26 Have you felt that there has been less flavour in your food because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.27 Have you been unable to brush your teeth properly because of problems with your teeth, mouth or dentures?											
Q.28 Have you had to avoid eating some foods because of problems with your teeth, mouth or dentures?											
Q.29 Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?											
Q.30 Have you been unable to eat with your dentures because of problems with them?											
Q.31 Have you avoided smiling because of problems with your teeth, mouth or dentures?											
Q.32 Have you had to interrupt meals because of problems with your teeth, mouth or dentures?											
Q.33 Has your sleep been interrupted because of problems with your teeth, mouth or dentures?											
Q.34 Have you been upset because of problems with your teeth, mouth or dentures?											

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.35 Have you found it difficult to relax because of problems with your teeth, mouth or dentures?											
Q.36 Have you felt depressed because of problems with your teeth, mouth or dentures?											
Q.37 Has your concentration been affected because of problems with your teeth, mouth or dentures?											
Q.38 Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?											
Q.39 Have you avoided going out because of problems with your teeth, mouth or dentures?											
Q.40 Have you been less tolerant of your spouse or family because of problems with your teeth, mouth or dentures?											
Q.41 Have you had trouble getting on with other people because of problems with your teeth, mouth or dentures?											
Q.42 Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?											

	a) HOW OFTEN have you had the problem during the last one or two years (circle your answer)						b) IF YOU HAVE HAD THE PROBLEM during the last one or two years, how long ago did you last have it (circle your answer)				
	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW	1 MONTH OR LESS	1-6 MONTHS	6-12 MONTHS	1-2 YEARS	DON'T KNOW
Q.43 Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?											
Q.44 Have you felt that your general health has worsened because of problems with your teeth, mouth or dentures?											
Q.45 Have you been financially disadvantaged because of problems with your teeth, mouth or dentures?											
Q.46 Have you been unable to enjoy other people's company as much because of problems with your teeth, mouth or dentures?											
Q.47 Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?											
Q.48 Have you been totally unable to function because of problems with your teeth, mouth or dentures?											
Q.49 Have you been unable to work to your full capacity because of problems with your teeth, mouth or dentures?											

The final questions concern any changes which may have occurred **since you completed the dental questionnaire in December 1989.**

Q.50 Since the Questionnaire in December 1989, have you seen anyone about your teeth, dentures or gums?(Circle number)

1 - YES
2 - NO
3 - DON'T KNOW

Q.51 Do you need dental treatment at present? (Circle number)

1 - YES
2 - NO
3 - DON'T KNOW

Q.52 Thinking about your dental health, would you say that it is better, about the same, or worse than it was in December 1989? (Circle number)

1 - BETTER
2 - ABOUT THE SAME
3 - WORSE
4 - DON'T KNOW

Thank you! Your contribution to this study is very greatly appreciated. Please put this completed questionnaire in the reply paid envelope and post it to:

Dr Gary Slade
Dental Statistics and Research Unit
The University of Adelaide
Box 498 GPO
Adelaide 5001

Serial Number: ☐☐☐

AUSTRALIAN LONGITUDINAL STUDY OF AGEING
Supplementary Dental Questionnaire

SERIAL NUMBER

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111
222
333
444
555
666
777
888
999

DATE OF INTERVIEW

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22	2	
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9	9	

FINAL RESPONSE

1 ○ TELEPHONE
2 ○ FACE-TO-FACE
3 ○ MAIL
4
5
6
7
8
9

INTERVIEW TIMES

START		FINISH	
hour	min	hour	min
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1111		1111	
2222		2222	
333		333	
444		444	
555		555	
666		666	
7	7	7	7
8	8	8	8
9	9	9	9

Thank you for agreeing to participate in this part of the Australian Longitudinal Study of Ageing. This survey contains questions about your dental health which are identical to the ones you answered in December 1989. On this occasion we are asking you to answer the questions a second time to ensure that our methods are working properly.

These questions are about your teeth. Many people have problems with their teeth or dentures from time to time. I'm going to read out a list of dental problems and I'd like you to tell me if you can remember having had the same sort of problem within the last year or two. Please tell me if you've had the problem very often, fairly often, occasionally, hardly ever, or never in the last one or two years.

For all questions: **In the past one or two years:**

Q1. Have you had difficulty chewing any foods? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occas-tonally | Hardly ever | Never | Don't know → *Go to Q2*

↓ *(Go to Q1.a)*

Q1.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

---

Q2. Have you had trouble pronouncing any words? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q3*

↓ *(Go to Q2.a)*

Q2.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

---

Q3. Have you noticed a tooth which doesn't look right?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not Applicable → *Go to Q4*

↓ *(Go to Q3.a)*

Q3.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

---

Q4. Have you felt that your appearance has been affected? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q5*

↓ *(Go to Q4.a)*

Q4.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

---

Q5 . Have you felt that your breath has been stale? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q6*

↓ *(Go to Q5.a)*

Q5.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q6. Have you felt that your sense of taste has worsened? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q7*

↓ *(Go to Q6.a)*

Q6.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q7. Have you had food catching in your teeth or dentures?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not Applicable → *Go to Q8*

↓ *(Go to Q7.a)*

Q7.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q8. Have you felt that your digestion had worsened? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q9*

↓ *(Go to Q8.a)*

Q8.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q9. Have you had painful aching in your mouth?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q10*

↓ *(Go to Q9.a)*

Q9.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q10. Have you had a sore jaw?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q11*

↓ *(Go to Q10.a)*

Q10.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q11. Have you had headaches? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q12*

↓ *(Go to Q11.a)*

Q11.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q12. Have you had sensitive teeth (for example, due to hot or cold foods or drinks)?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q13*

↓ *(Go to Q12.a)*

Q12.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q13. Have you had a toothache?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q14*

↓ *(Go to Q13.a)*

Q13.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q14. Have you had painful gums?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q15*

↓ *(Go to Q14.a)*

Q14.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q15. Have you found it uncomfortable to eat any foods? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q16*

↓ *(Go to Q15.a)*

Q15.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q16. Have you had sore spots in your mouth?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q17*

↓ *(Go to Q16.a)*

Q16.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q17. Have you felt that your dentures had not been fitting properly?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q18*

↓ *(Go to Q17.a)*

Q17.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q18. Have you had uncomfortable dentures?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q19*

↓ *(Go to Q18.a)*

Q18.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Can you please wait for just a moment while I record your answers.

Interviewer: review responses to questions Q1. - Q18.
If no disorders have been recorded (Q1. - Q18.) go to Q50. (page 10)

If any disorders (Q1. - Q18.) have been reported in the last 1-2 years, continue:

Now I would like you to think about the problems that you have just mentioned (_____). The next questions concern the way in which these dental problems may have had an impact on you.

For all questions: **In the past one or two years:**

Q19. Have you been worried because of dental problems?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q20*

↓ *(Go to Q19.a)*

Q19.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q20. Have you been self conscious because of your teeth?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q21*

↓ *(Go to Q20.a)*

20.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q21. Have dental problems made you miserable?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q22*

↓ *(Go to Q21.a)*

Q21.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q22. Have you felt uncomfortable about the appearance of your teeth?

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q23*

↓ *(Go to Q22.a)*

Q22.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q23. Have you felt tense? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q24*

↓ *(Go to Q23.a)*

Q23.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q24. Has your speech been unclear? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q25*

↓ *(Go to Q24.a)*

Q24.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q25. Have people misunderstood some of your words? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q26*

↓ *(Go to Q25.a)*

Q25.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q26. Have you felt that there has been less flavour in your food? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q27*

↓ *(Go to Q26.a)*

Q26.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q27. Have you been unable to brush your teeth properly? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know | Not applicable → *Go to Q28*

↓ *(Go to Q27.a)*

Q27.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q28. Have you had to avoid eating some foods? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q29*

↓ *(Go to Q28.a)*

28.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q29. Has your diet been unsatisfactory? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q30*

↓ *(Go to Q29.a)*

Q29.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q30. Have you been unable to eat with your dentures? (Because of problems with them).

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know | Not applicable → *Go to Q31*

↓ *(Go to Q30.a)*

Q30.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q31. Have you avoided smiling? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q32*

↓ *(Go to Q31.a)*

Q31.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q32. Have you had to interrupt meals? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q33*

↓ *(Go to Q32.a)*

Q32.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q33. Has your sleep been interrupted? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q34*

↓ *(Go to Q33.a)*

Q33.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q34. Have you been upset? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q35*

↓ *(Go to Q34.a)*

Q34.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q35. Have you found it difficult to relax? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q36*

↓ *(Go to Q35.a)*

35.a) When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q36. Have you felt depressed? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q37*

↓ *(Go to Q36.a)*

Q36.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q37. Has your concentration been affected? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q38*

↓ *(Go to Q37.a)*

Q37.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q.38 Have you been a bit embarrassed? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasionally | Hardly ever | Never | Don't know → *Go to Q39*

↓ *(Go to Q38.a)*

Q38.a)When did you last have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

For all questions: **In the past one or two years:**

Q.39 Have you avoided going out? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q40*

↓ *(Go to Q39.a)*

Q39.a)When did you last have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q40. Have you been less tolerant of your spouse or family? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable → *Go to Q41*

↓ *(Go to Q40.a)*

Q40.a)How long ago did you have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q41. Have you had trouble getting on with other people? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q42*

↓ *(Go to Q41.a)*

Q41.a)How long ago did you have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q42. Have you been a bit irritable with other people? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q43*

↓ *(Go to Q42.a)*

Q42.a)How long ago did you have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

Q43. Have you had difficulty doing your usual jobs? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q44*

↓ *(Go to Q43.a)*

Q43.a)How long ago did you have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

The last few questions are about the effects that dental problems can sometimes have on people's other daily activities. Please tell me if these dental problems have affected your everyday activities very often, fairly often, occasionally, hardly ever or never in the past one or two years.

Q44. Have you felt that your general health had worsened? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q45*

↓ *(Go to Q44.a)*

Q44.a)How long ago did you have this problem?	<1 month	1-6 months	>6-12 months	1-2 years	>2 years	Don't know

For all questions: **In the past one or two years:**

Q45. Have you been financially disadvantaged? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q46*

↓ *(Go to Q45.a)*

Q45.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q46. Have you been unable to enjoy other people's company as much? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q47*

↓ *(Go to Q46.a)*

Q46.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q47. Have you felt that life in general was less satisfying? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q48*

↓ *(Go to Q47.a)*

Q47.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q48. Have you been totally unable to function? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know → *Go to Q49*

↓ *(Go to Q48.a)*

Q48.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q49. Have you been unable to work to your full capacity? (Because of problems with your teeth, mouth or dentures)

Very often | Fairly often | Occasion-ally | Hardly ever | Never | Don't know | Not applicable

↓ *(Go to Q49.a)*

Q49.a) How long ago did you have this problem? <1 month | 1-6 months | >6-12 months | 1-2 years | >2 years | Don't know

Q50. Since the questionnaire in December 1989, have you seen anyone about you teeth dentures or gums?

Yes - 1
No - 2
Don't know - 9

Q51. Do you need dental treatment at present?

Yes - 1 ①
No - 2 ②
Don't know - 9 ⑨

Q52. Thinking about you teeth, mouth, dentures or mouth in general, would you say that your dental health is better, about the same or worse than it was in December 1989.

Better - 1 ①
About the same - 2 ②
Worse - 3 ③
Don't know - 9 ⑨

This concludes the Interview. THANK PARTICIPANT

Time interview finished: _____ ①②

Interview Details and Observations

53. Was the interview completed?

Yes, with little or no missing information - 1 ①
Yes, but with considerable missing information - 2 ②
No, terminated - 3 ③

Reason for non-response or missing information_____

54. Was the interview completed by proxy?

No - 1 (Go to 62) ①
Yes - 2 ②

55. How well do you think the participant understood the questions?

Very well - 1 ①
Fairly well - 2 ②
Somewhat - 3 ③
Very little - 4 ④
Not at all - 5 ⑤

56. The respondent's co-operation was:

Excellent - 1
Good - 2 ①
Average - 3 ②
Fair - 4 ③
Poor - 5 ④ ⑤

Appendix 4 Statements about social impact

Functional limitation

My appearance has been altered
My digestive system has been affected
My digestion has been upset
I haven't felt like eating
My digestion has been affected
I didn't want to eat much
My dentures have made me cough
My dentures make me snore
I have felt sick
I have been taking extra medications
I don't want to eat
I haven't been feeling well
I have had poor digestion
I have felt a bit nauseous
I have been feeling weak
I've been feeling ill because of my mouth
My appearance has altered
My smile has been affected
My teeth don't look right
The appearance of my face has been affected
My facial appearance has suffered
I have noticed a discoloured tooth
My (front) teeth have not looked right
My smile has been affected
My face has sunken in a bit
I have become aware of a discoloured tooth
The teeth on my dentures don't look right
I have been aware of a discoloured tooth
My front teeth don't have the right appearance
I have noticed a discoloured tooth
The appearance of my lip has not been right
I have a tooth which doesn't look right
I've been aware of the appearance of a tooth
My dentures don't look right
My teeth have been looking discoloured
My mouth doesn't look right when I eat
My mouth has been dry
My mouth has had too much saliva
My breath has been affected
My mouth has felt too full
My mouth tasted awful
My breath has been affected because of my dentures
My breath has been affected
I have noticed that my gums smell
My breath has been stale
My taste has been altered
My breath has smelt
My mouth has felt different
I get too much saliva in my mouth (because of dentures)
Food gets trapped under my denture
Food gets stuck under my dentures
Food has been getting stuck
Food gets stuck between my teeth
I've been unable to get my dentures out
My dentures have been ill-fitting
Dentures can affect my breathing
When I smile I have to make sure I hold my dentures in

My dentures slip
Food gets stuck under my denture
My dentures have loosened
My dentures have caused ulcers
Nuts get caught under my denture
My dentures have been loose
My dentures don't fit properly
My denture has been loosened
I have been aware of grinding my teeth
My dentures make me grind my teeth
I grind my teeth
My teeth have been loose
I've been accidentally biting my mouth sometimes
I've had trouble pronouncing some sounds
I've been more careful with my speech
My speech sounds strange to some people
My general health has been affected
My general health has been affected
I haven't been feeling so good about myself generally
I've had to lie down
My general health has been affected
I've felt sick
My general health has been affected
My general health has suffered
My well being has suffered
My general health hasn't been so good
I have felt less healthy in myself

Physical pain

I had pain for a few days
I had a sore mouth
I had aching in my mouth
I've had sudden pain
I have had a dull ache
I have had severe pain
I had occasional discomfort
My mouth has been sore
It has been sore when I've eaten
I had a throbbing pain
I had immense pain
I had bad pain
I have had aching jaws when I eat
I've had an aching jaw
I had a pain for a short time
I have had a sore jaw
I've had a painful infection
I've had a sore jaw
I've had shooting pains
I have had bad headaches
I've had very bad pain in my mouth
I have had headaches
I have had aches in my mouth
I have been in unbearable pain
I've had a sharp pain in my jaws
I've had attacks of pain
It has hurt when I eat
I've had headaches

I have had a headache
I've had a burning pain in my mouth
I've had a headache
I had a slightly sore tongue
I have had a painful tooth
I had an aching tooth all night
I have been aware of sensitivity in my teeth
I had faint toothache
My teeth have been sensitive
I have had painful teeth
My tooth has been sensitive
My fillings have felt sensitive
My teeth have been painful
My fillings have been sensitive
My teeth have been sensitive
I had throbbing toothache
I have had toothache
My teeth have felt sensitive
My teeth have sometimes ached
I have had sensitive teeth
I have had a painful tooth
I had teeth which were sensitive to hot and cold food
I have had sensitive teeth
Seeds have been getting caught under my denture
My denture has been rubbing
It has been uncomfortable to eat with my dentures
My dentures have been uncomfortable
I've had a lot of pain from my dentures
I've had pain because of my denture
My dentures have been uncomfortable in my mouth
My dentures have been uncomfortable
I've had pressure from my denture
I've had sore spots on my gums
My dentures make my mouth sore at night time
Food gets trapped under my denture
I've had sore spots under my dentures
My dentures rub on my gums
My gums have been rubbed and irritated
I've had painful gums
My teeth have been feeling tight
I had painful gums
I have had some discomfort
My gums have been sore because of my dentures
I had some discomfort
I have had pressure on my gums
My gums have been uncomfortable
My gum have been painful
My mouth has been uncomfortable
I had discomfort with hot and cold foods
It has been uncomfortable to eat
I have been uncomfortable
I've had a painful mouth (due to ulcers)
I have sore spots all the time
My mouth has been sore with ulcers
I've had painful gums (due to dentures)
I've had some painful ulcers
I have sore spots when I eat
I've had a few painful ulcers
I've had sore ulcers
I've had occasional sore spots in my mouth

Psychological discomfort

I've been bothered by the appearance of my teeth
I have been depressed
I was worried that my dentures would fall out
I have been bothered by the appearance of my denture
I've been upset
I have been worried about my teeth
I have been concerned about the smell of my breath
I haven't been felling myself
I was depressed
I've been feeling frustrated
I've been worried about the appearance of my face
I'm scared that my denture will fall down
I have been frustrated
I have been annoyed about my dentures
I've been tense
I've been miserable because of the pain
I have been annoyed
I have been worried that my breath was stale
I have been worried a bit
I've been worried
I have felt miserable
I have been annoyed
I've been annoyed
Sometimes I get hangups about my teeth
I've been worried that my dentures will loosen
I've been feeling unhappy because of ulcers
I'm conscious of my teeth when I smile
I don't like to smile because of my teeth
I don't like others to see me eat
I had to concentrate more on my eating
I've been conscious that other people have noticed my mouth
I have been conscious of my appearance
I was conscious of what I ate
My teeth have looked horrible
I have been conscious of my appearance
I have been self conscious
I've been more aware of how I ate
I have felt uncomfortable about my appearance
I've been scared to chew some foods
The enjoyment of my meals has been affected
My mouth doesn't feel right sometimes
Other people have noticed my teeth
I've thought that my teeth don't look so good
I don't like the appearance of my teeth when I smile
I don't like the appearance of my teeth
I have been disappointed about the appearance of my teeth
I've been a bit irritable
I have been irritated
I'm bothered by my dentures when I eat with others
I've been very irritable because of my mouth
I've been bothered by the appearance of my denture
I've been a bit irritable
I've been bothered because of my dentures
I have been conscious that other people notice my teeth
I have been self conscious
I have been conscious of what others think

Physical disability

My speech has been unnatural
My speech as been affected
I have had trouble pronouncing "S"
I have trouble clearly pronouncing some words
I have spoken more softly
My speech has been less clear
I have had difficulty speaking
My speech wasn't natural
I have slowed down my speech
It has been difficult speaking
Sometimes I couldn't speak clearly
I have lisped sometimes
Pronunciation has been difficult
Sometimes I've made "s" sounds in my speech
It has been hard to speak properly
My voice has been changed
I had difficulty making some sounds
My speech has been slurred
It has been very difficult to talk properly
My speech has been affected because of denture problems
I've had to stop speaking in mid sentence
My speech has been affected (when I speak without dentures)
I have had some difficulty speaking
I haven't been able to speak properly (because of dentures)
I have had to speak slower
I've been speaking less clearly
I haven't wanted to talk
I have been unable to talk properly
I have lisped sometimes
I've had trouble pronouncing some words
My speech has been affected
My speech isn't as clear
I have to be careful when I speak (because of dentures)
People haven't been able to understand my speech so well
I've had a lisp
I've been lisping a bit
I haven't been speaking properly
It has been hard to speak properly
I have been slurring my speech
I've been making "s" sounds when I speak
I can't chew on some foods
I have had reduced taste
The flavour of my food has been affected
My food has been less enjoyable
My taste has diminished
There has been less flavour in my food
Some drinks taste awful
Some foods have been difficult to taste
I have been unable to brush my teeth properly
I have avoided toothbrushing
I have been unable to brush my teeth
I haven't been able to chew so well
I haven't been able to chew on some foods
I had to be careful to chew the right way
I haven't eaten hard foods
I have avoided some hard foods
I had to chew more slowly

I haven't been able to eat cold things
I've had to eat some foods on one side
I haven't been able to bite into ice cream
I had to chew on one side
I've been avoiding hard foods
My appetite has been spoiled
I had to be careful what I ate
I've avoided ice cream
I've had to stick to eating soft foods
I didn't want to eat some foods
I have had to eat less food than I would like to
I had to chew on one side
I couldn't eat some foods
I have avoided eating hard foods
I haven't been able to eat some hard foods
I have been unable to eat on one side
I've avoided eating hard foods
I had to chew on one side
I lost my appetite
I have to cut food up finely to eat it
I have avoided tough foods such as apples
I have missed a meal altogether
I have been put off my food
I have avoided cold foods
I have avoided hot and cold foods
I've had to eat soft foods
I haven't been able to eat at all
I haven't been able to chew on one side
I have avoided hard foods
I cannot eat some foods
I have only eaten soft foods
I have avoided chewing hard foods
I have had an unsatisfactory diet
My meals have been disrupted
I have been unable to bite hard foods
I have avoided cold foods
I haven't been able to eat hot or cold food
I couldn't eat solid foods
I couldn't completely chew my foods
I've been unable to bite on one tooth
I have to take more care when eating
I have been unable to chew on one side
I can't bite into an apple
I have been unable to bite onto some foods
I have avoided hot and cold foods
I've had to prepare my food specially
I've had to eat more slowly
I haven't been able to eat nuts
I can't eat some foods because of ulcers
I couldn't bite on one tooth
I can't eat some foods because of dentures
I have had difficulty eating on front teeth
I can't eat some foods
I have had trouble eating
I can't chew at all with my dentures
I've had trouble eating hard foods
It has been painful to chew
I have been cautious about the foods I eat
I have to eat sloppy foods
Eating has been less enjoyable
I have to cut up my food finely
I have to be careful when I eat
I can't chew meat well

I have to cut food finely to eat it
I don't eat some foods when I go out
I can't bite whole apples
It has been hard to chew on tough foods
I've been unable to eat toffee
I have to chop food finely
I can't eat nuts
I haven't been able to eat steak
I can't bite hard
I had to avoid spongy foods (because of dentures)
I have to eat my food slowly
I had to eat on one side of my mouth
I can't eat hard foods
I have difficulty eating tough meat
I haven't been eating as much
I have to be careful of the foods I eat
I couldn't eat hard foods
I can't bite into some foods
I've had to chew on one side
I've only been able to eat soft foods
I have avoided eating some foods altogether
I avoid eating ice cream
I can't chew with my dentures
Relatives have said that my teeth don't suit me
I have to be careful my dentures don't dislodge when I eat
Relatives have said my dentures are loose
I haven't been able to wear my dentures (due to ulcers)
I've been unable to wear my dentures
The shape of my lips has been affected
I avoid smiling
Sometimes I've put my hand over my mouth when I speak
My appearance has been affected because of denture problems
I've avoided smiling sometimes
I've had to interrupt my meal
I have to take my dentures out sometimes
I've had to stop eating because food has caught in my denture
I've had to interrupt my meals because of my dentures
I have to clean my denture immediately after a meal
I've had to take my dentures out at times
I have to interrupt my meals to clean my denture
I've had to interrupt meals to clean my dentures
I've have to interrupt meals because of my dentures

<u>Psychological disability</u>

I've felt a little bit embarrassed
I have been embarrassed while eating
I have been less confident about my appearance
I have had trouble relaxing
I have been woken up
My sleep has been interrupted
I haven't felt like doing much at all
I was hardly able to sleep
I have been woken up during the night
I've lost some sleep
I haven't been able to get to sleep
I have been woken up
I have been tired

I've had difficulty getting to sleep
I have had trouble getting to sleep
My sleep was poor
I haven't been able to get to sleep
I have been woken up
I have been unable to sleep properly
I have been woken up
I've had trouble relaxing
I've had trouble getting to sleep
I have been unable to get to sleep
I had a bad night's sleep
I couldn't sleep properly
I missed a night's sleep
I was kept awake by toothache
My sleep has worsened
I have been unable to get to sleep
I have been upset with myself
I have been edgy
I have felt terrible
I have cried
I have not been my normal happy self
I have been upset
I have panicked
I have been short tempered
I've felt fed-up because of my dentures
I've been a bit short tempered
I have been short tempered
I have been worried
I haven't been able to control my mood
I have felt very depressed
I have been miserable
I have been short tempered
I have been angry and irritable
Sometimes I have been depressed
I have been depressed
I have felt sorry for myself
I have been worried
I have been irritable
I've been feeling irritable
I have been a bit depressed
I have been depressed
I haven't been my usual happy self
I've had to take nerve tablets
My whole personality has been affected
I have been very upset
My personality has been affected
I have been irritable
I have felt a bit down
I have been nervous
I have been nervous
I have been distracted
My reasoning has been affected
My concentration has been affected
I've had poor concentration
I have been distracted
I've been embarrassed about my dentures
I've been worried because of my teeth
I've felt a bit embarrassed
I have been embarrassed about the appearance of my tee
Sometimes I have been embarrassed
I've tended not to smile
I have been embarrassed to speak
I have been worried about the effect of my breath on others

I was worried that my dentures would drop when I smiled
I've been embarrassed because of my dentures
I've avoided showing my teeth
I've hated my appearance sometimes
I've been wary when I smile
I have been embarrassed eating with other people
I've avoided smiling a bit
I have covered my teeth when I've smiled
I've closed my mouth to cover my teeth when I smile

Social disability

I couldn't go out because I couldn't wear my dentures
I've avoided going out because of my dentures
I've had to cancel appointments because of denture troubles
I avoid speaking in public
I have been totally disrupted
I stayed at home
I haven't wanted to do anything
I haven't felt like doing anything
I didn't want to go out of the house
I've sometimes avoided going out
I've been staying at home
I have just wanted to sleep
I haven't been going out sometimes
I didn't want to leave the house
I wanted to be left alone
I wanted to be left alone
I have just wanted to stay in bed
I haven't been able to do anything
I haven't been going out because of my dentures
I couldn't be bothered going out
I couldn't be bothered going out
I've been unable to go out because of my dentures
Other people notice that I don't look myself
I avoid eating with some people
Relatives have commented about my appearance
I have apologized to others about my teeth
I'm reluctant to speak with others sometimes
I have been unsociable
I have covered my mouth with my hand
I have covered my mouth when eating with others
I wasn't in the mood to talk to anyone
I wanted to be left alone
My behaviour with other people has been affected
I've been upsetting other people
I haven't wanted to have people around
I have been less tolerant of family or friends
It is terribly awkward when I eat with others
I have been offensive to others sometimes
It's been difficult dealing with other people
I've avoided talking a bit
I have postponed some appointments with people
I couldn't bear to have people around me
I haven't wanted to see other people
Sometimes my close family has commented about my teeth
I don't smile the way I'd like to
I can't be bothered with other people

I have avoided going out to other people's places
I've had difficulty doing my work
I've had difficulty caring for my (child)
I had to stop work
I have taken time off work
I had to leave work
I had to stop and lie down
I have taken time off work
I haven't felt like caring for my family
I haven't been able to do my usual jobs
I've been unable to do housework

Handicap

My general health has worsened
I've been unable to work
I was totally unable to function

Appendix 5 The Oral Health Impact Profile questionnaire

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

THE UNIVERSITY OF ADELAIDE

Department of Dentistry

South Australian Dental Longitudinal Study

ORAL HEALTH IMPACT PROFILE

THE QUESTIONNAIRE.

This questionnaire is about how troubles with the teeth, mouth or dentures cause problems in our daily lives. We would like you to complete the questionnaire even if you have good dental health. We would like to know how often you have had each of the problems during the LAST YEAR.

HOW TO ANSWER THE QUESTIONS.

Each question on the left hand side of the page asks you about a particular dental problem. You should think about each question in turn, and circle the answer to the right of the question, to indicate how often you have had the problem during the last year.

For example, if you occasionally have had food catching in your teeth, mouth or dentures, you would circle the answer as shown in this example.

EXAMPLE

	HOW OFTEN have you had the problem during the last year? (circle your answer)					
	VERY OFTEN	FAIRLY OFTEN	(OCCAS-IONALLY)	HARDLY EVER	NEVER	DON'T KNOW
Q7 Have you had food catching in your teeth, mouth or dentures?						

If you have never had the problem during the last year, circle "NEVER" as follows.

	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	(NEVER)	DON'T KNOW
Q7 Have you had food catching in your teeth, mouth or dentures?						

WHAT IF THE QUESTION DOES NOT APPLY?

A few of the questions only apply to people who have all or some of their own teeth. Some questions apply to people who wear full or partial dentures. If the question does not apply to you then you would answer by checking the box as follows.

	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q17 Have you felt that your dentures have not been fitting properly?						

Does not apply - I do not have dentures ☑

When you have finished, please go back over the questionnaire to check that you have put an answer beside each of the questions. Once again, thank you for your help!

	HOW OFTEN have you had the following problems during the last year? (Circle your answer)					
Q1 Have you had difficulty chewing any foods because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q2 Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q3 Have you noticed a tooth which doesn't look right?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q4 Have you felt that your appearance has been affected because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q5 Have you felt that your breath has been stale because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q6 Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q7 Have you had food catching in your teeth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q8 Have you felt that your digestion has worsened because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q9 Have you had painful aching in your mouth?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q10 Have you had a sore jaw?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q11 Have you had headaches because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW

HOW OFTEN have you had the following problems during the last year? (Circle your answer)

	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q12 Have you had sensitive teeth, for example, due to hot or cold foods or drinks?						
Does not apply - I do not have my own teeth ☐						
Q13 Have you had toothache?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Does not apply - I do not have my own teeth ☐						
Q14 Have you had painful gums?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q15 Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q16 Have you had sore spots in your mouth?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q17 Have you felt that your dentures have not been fitting properly?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Does not apply - I do not have dentures ☐						
Q18 Have you had uncomfortable dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Does not apply - I do not have dentures ☐						
Q19 Have you been worried by dental problems	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q20 Have you been self conscious because of your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q21 Have dental problems made you miserable?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q22 Have you felt uncomfortable about the appearance of your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q23 Have you felt tense because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW

HOW OFTEN have you had the following problems during the last year? (Circle your answer)

Q24 Has your speech been unclear because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q25 Have people misunderstood some of your words because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q26 Have you felt that there been less flavour in your food because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q27 Have you been unable to brush your teeth properly because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
	Does not apply - I do not have my own teeth ☐					
Q28 Have you had to avoid eating some foods because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q29 Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q30 Have you been unable to eat with your dentures because of problems with them?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
	Does not apply - I do not have dentures ☐					
Q31 Have you avoided smiling because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q32 Have you had to interrupt meals because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW

HOW OFTEN have you had the following problems during the last year? (Circle your answer)

	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q33 Has your sleep been interrupted because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q34 Have you been upset because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q35 Have you found it difficult to relax because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q36 Have you felt depressed because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q37 Has your concentration been affected because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q38 Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q39 Have you avoided going out because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q40 Have you been less tolerant of your spouse or family because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q41 Have you had trouble getting on with other people because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW

HOW OFTEN have you had the following problems during the last year? (Circle your answer)

Q42 Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q43 Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q44 Have you felt that your general health has worsened because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q45 Have you suffered any financial loss because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q46 Have you been unable to enjoy other people's company as much because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q47 Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q48 Have you been totally unable to function because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW
Q49 Have you been unable to work to your full capacity because of problems with your teeth, mouth or dentures?	VERY OFTEN	FAIRLY OFTEN	OCCAS-IONALLY	HARDLY EVER	NEVER	DON'T KNOW

Q50 Please write today's date in this space: _____/____ / ____

day month year

When you have completed this questionnaire, please return it by handing it to the dentist when you have a dental examination (if you will be having an examination as part of this study within the next few weeks) or post it in the reply-paid envelope to:

Professor John Spencer
Department of Dentistry
The University of Adelaide
Box 498 GPO
Adelaide 5001

THANK YOU FOR YOUR PARTICIPATION IN THIS STUDY

ID: |_|_|_|_|_|_|

Appendix 6 Primary approach letter for the SADLS

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

THE UNIVERSITY OF ADELAIDE

Department of Dentistry

The Householder

Dear Sir/Madam

Your household has been selected for inclusion in a major study of dental health among older South Australians - The South Australian Dental Longitudinal Study. The purpose of the study is to obtain information about dental problems and the ways in which they affect people's everyday activities. The information which we collect from some 2000 people will help us to develop ways to prevent dental disorders and improve quality of life in years to come.

There are two parts to this study. The first is an interview by one of our trained interviewers who will visit your household during the next few weeks. The interviewer will select one person from your household to answer questions about dental health, dental practices, general health and social circumstances. We will interview a range of people throughout South Australia including people with or without their own teeth, people who may have dental problems and others who enjoy very good dental health. In this way we will obtain an accurate picture of dental health in South Australia. The second part of the study is a dental examination which will be arranged at a clinic in your area. The examination is similar to a regular dental check-up and will be conducted by qualified dentists from The University of Adelaide. No treatment will be provided, although the dentist will give a written report to each person and will be able to provide advice about dental care.

The study is being conducted by researchers led by Professor John Spencer at the Department of Dentistry, The University of Adelaide and it is supported by the National Health and Medical Research Council. Participation in the study is voluntary. Of course, any information which is supplied for the study will be maintained in strict confidence by the researchers. The interviewer who visits your home will be identified by an official University of Adelaide identification card and will be able explain the study in more detail. If you have any queries please telephone Dr Gary Slade or Professor John Spencer at the Department of Dentistry on (08) 228-5438.

Your assistance will be a very valuable contribution towards improved dental health for older adults in South Australia. We look forward to your co-operation.

Yours faithfully,

A. John Spencer
Professor, Social and Preventive Dentistry

Dr Gary D. Slade
NH&MRC Public Health Research Fellow

Appendix 7 Interviewer training manual for the SADLS

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

THE UNIVERSITY OF ADELAIDE

Department of Dentistry

SOUTH AUSTRALIAN DENTAL LONGITUDINAL STUDY

GUIDE TO THE HOUSEHOLD QUESTIONNAIRE

Chief Investigators: Professor A John Spencer (University of Adelaide)
Dr Gary Slade (University of Adelaide)
Dr Martin Dooland (South Australian Dental Service)

Contact person Gary Slade
Department of Dentistry
The University of Adelaide
Box 498 GPO
Adelaide 5001

Phone: 228-5438, 228-5027 (Business Hours)
235-0333 (Home)

May, 1991

DESCRIPTION OF THE SOUTH AUSTRALIAN DENTAL LONGITUDINAL STUDY

Researchers at the The University of Adelaide's Department of Dentistry have initiated a longitudinal, epidemiologial study of oral health among persons aged 60+ in South Australia. This represents the first Australian study of oral health among a representative sample of non-institutionalized older adults, and it comes after two years of preparation and pilot studies. The study has been planned to run over a five year period with major data collections occurring at baseline in 1991, and after two and five years. The study has received support from the National Health and Medical Research Council, and is a collaborative project of the Department of Dentistry, the South Australian Dental Service and the Australian Institute of Health's Dental Statistics and Research Unit (at the University of Adelaide).

The South Australian Dental Longitudinal Study was designed to provide information which could address the changing circumstances and dental health requirements of older adults in Australia. Such information is vital, not only because of the well documented "ageing" of the Australian population, but also because of a dramatic reduction in tooth loss and a greater retention of natural teeth into later life. These trends mean that the dental requirements of the "new elderly" population within Australia will become more complex, and will need to involve more than the maintenance of dentures alone. At the same time, there is a lack of knowledge about risk factors for dental disease among older adults. Consequently, the best methods for preventing dental decay, gum disease, or tooth loss are not clearly understood. Furthermore, there is a lack of information describing the social impact of oral conditions on everyday activities or overall well-being of older adults. Hence, it is difficult to determine the types of dental disorders which are most likely to cause dysfunction, discomfort or disability.

Aims

The South Australian Dental Longitudinal Study seeks to provide important information about oral disease and its social impact among non-institutionalized persons aged 60+. There are three specific aims:

1) To assess the extent and distribution of dysfunction, discomfort and disability due to oral disorders among older adults in South Australia;

2) To assess the distribution and causes of oral disease among older adults. This includes an examination of the effects of potential preventive factors (for example, fluorides) on the development of oral disease; and

3) To examine the factors which contribute to or prevent the development of dysfunction, discomfort or disability due to oral disorders.

The study will be relevant to public health dentistry by providing information about a random sample of the largest portion of older adults - the non-institutionalized. It will assist dental practitioners through the identification of risk factors and methods for preventing dental disease. The information from the study will be used to enhance quality of life among future groups of older adults by minimizing the extent of dysfunction, discomfort and disability caused by oral disorders.

Design of the Study

During 1991, a sample of 2000 persons will be recruited into the study. Persons have been sampled from Adelaide and Mt Gambier in order to provide a range of exposures to water fluoridation - a factor which is known to prevent dental decay among children, and which appears to be effective among adults. Sampled persons will be invited to participate in a household interview providing background data and information about dental behaviours. Also, they will be asked to complete a questionnaire about the impact of oral disorders on everyday activities. Subsequently, participants will receive

an oral examination conducted by one of four qualified and calibrated dentists at a local school dental clinic.

In 1993 and 1996 interviews and examinations will be repeated to assess changes in dentally-related behaviours and to monitor the development of any new dental disease.

Source of Subjects

A sample of 5000 households in Adelaide and Mt Gambier has been drawn from the South Australian Electoral Roll, and residents of those households will be approached and invited to participate in the study. The State Electoral Department is able to provide access to the Electoral Roll for approved research projects, and on this occasion it has reviewed and approved the use of the Electoral Database for the selection of a stratified random sample of persons aged 60 years and over.

Information supplied by the State Electoral Department includes the age and sex of each of 4,850 electors aged 60+ and the elector's residential address. In order to ensure confidentiality, the State Electoral Department did not supply the names of individual electors. A geographic code (Census Collector's District) was added to the sampling frame to enable the selection of a stratified random sample of addresses. Additional selection criteria will be applied at the time of the initial approach to each household and, after allowing for some further sample loss and non-participation, it is anticipated that the list of 5,000 addresses will yield a total of approximately 2,000 completed interviews.

Ethical Requirements and Consent for Participation

This study conforms to the requirements for medical research specified by the National Health and Medical Research Council in its 1988 guidelines. The study has received approval from The University of Adelaide's Committee on the Ethics of Human Experimentation, the Australian Institute of Health's Ethics Committee, and the South Australian Dental Service's Ethics review process.

In accordance with NHMRC guidelines, participation in this study is voluntary, and signed, informed consent is required from each participant. However, it is recognized that consent for participation in an interview is implied through the voluntary act of answering questions. Also, it is important to maintain a workable procedure for the conduct of an interview. Hence, there are two aspects of consent for the household interviews for this study.

1) The provision of sufficient information about the study prior to and during each interview. This involves the usual forms of introduction and explanation used at the start of household interviews.

2) Procurement of each subject's signed consent for the use of the interview in the study. This is covered in question G-3 of the questionnaire. The subject is provided with an information sheet and asked to sign the consent form on page 15 of the questionnaire.

Personnel and Organizations Involved in the Study

Professor John Spencer and Dr Gary Slade (of the Department of Dentistry, The University of Adelaide) and Dr Martin Dooland (of the South Australian Dental Service) are the chief investigators in this project. They are collaborating with researchers at the University of North Carolina (USA) and the University of Toronto (Canada) where similar, longitudinal studies of older adult populations are underway. The collaborative aspect of the study includes the use of common dental examination protocols and the Oral Health Impact Profile at each site.

The South Australian Dental Longitudinal Study has received support from a Medical Research Project Grant of the National Health and Medical Research Council.

PROCEDURES FOR HOUSEHOLD INTERVIEWS

An introductory letter will be mailed through Australia Post to each household which has been sampled for the study. A copy of the letter is contained in Appendix A.

Residential addresses obtained from the South Australian Electoral Department will be approached and one target person will be identified in each household. This involves enumeration of usual residents aged 60 and over at each address, and the application of specified selection criteria. When a target person is identified, the household questionnaire is administered. It consists of questions about dental health status, dental behaviours, medical conditions, residential history and social background. A self-complete questionnaire, the Oral Health Impact Profile, along with reply-paid envelope, will be issued to each subject. They will also be advised about a forthcoming invitation to participate in an oral examination.

Each of the steps is described in the next six sub-sections.

Workload Assignments

Each interviewer will be assigned a workload of approximately 70 addresses, and these are expected to comprise approximately one week's work in Adelaide. (Larger workloads will be assigned in Mt Gambier, since more subjects will be excluded in that area). It is expected that each workload will yield 38 completed interviews on average, with the remaining 32 addresses comprising excluded subjects, refusals or non-contacts.

Workloads in metropolitan Adelaide have been arranged around each of 31 dental clinics which subsequently will be used for dental examinations. It is important to co-ordinate interview workloads with the schedule of the examination teams. Workloads approached in one week will, insofar as possible, be provided with dental examinations during the following week. Accordingly, interview workloads will be staggered across time and across geographic areas in an attempt to conform with the examination schedule in an orderly manner, and which will allow delayed examination appointments to be completed.

Workload packages for interviewers will be collated to include:

1) Pre-labeled, household enumeration cards;

2) Baseline Household Questionnaires and prompt cards;

3) Information sheets and copy of consent form;

4) A single page household enumeration sheet for excluded and non-sampled households;

5) Oral Health Impact Profile Questionnaires and reply-paid envelopes.

These items will be kept in D-ring binders and envelopes. They should be collected from and returned to the research office (Room 3105), 3rd Floor, Adelaide Dental Hospital, Frome Rd, Adelaide.

Household Enumeration (Yellow A4 Card)

Each household enumeration card contains a pre-labeled address printed at the top right hand corner, along with identifying and selection information for the target subject in the household. The address should be sought out and any responsible adult at that address is to be approached. There are four tasks then involved in enumeration of the household:

1) **List usual residents.** List the name, age, date of birth and sex of each person aged 60 years or more who usually lives in the household.

2) **Scope Selection.** Select the person (or persons) who matches the age and sex criteria listed in the identification label. If more than one person matches the criteria, select the one who will next have a birthday. If no persons match the criteria, thank the respondent and terminate the interview.

3) **Dentition Status.** Enquire if the selected person has any of their own natural teeth (Question 3). If the selected person does not have any natural teeth (meaning they are edentulous) consult the identification label. This will indicate if the person is to be included or excluded. For excluded persons, thank the respondent and conclude the interview. If the selected person has one or more natural teeth (meaning they are dentate), then they are **always** selected to be in the sample.

4) **Sample Selection.** Mark the sample selection status of the target person. Proceed to interview him/her in person or through a proxy.

Information notice (blue, half page) to excluded households

Before terminating interviews with households which contain no persons in scope, or in which an edentulous person has been excluded, issue a blue information sheet to the resident.

Approaches to collective living centres

Addresses which are not residential dwellings or which have been demolished etc are not approached. In these cases, or where all persons are out of scope, or where the selected person is excluded, mark the outcome of the household enumeration at the back of the yellow card. In addition, mark the outcome on the questionnaire cover page for non-sampled households.

Collective living residences which are hostels should be included. In those instances, it may be most efficient to approach the administrator and examine a list of residents by age and sex to ascertain those in scope. Hospitals and nursing homes should not be approached and should be coded as 9 for final response.

Household Questionnaire

The household questionnaire should be completed through face-to-face interview with each sampled person. Interviews may be conducted with the assistance of a third person or by proxy, but this should only be done when a personal interview would not otherwise be possible. Sampled persons who appear to be cognitively impaired must always be excluded, even if a third person is prepared to act as proxy. This is an ethical requirement, since such persons would be unable to voluntarily provide valid, informed consent. (In such circumstances, the "final response" on the cover page should be coded as 7 "Death or illness".)

The questionnaire follows conventional formats. Read bold, capitalized text, unless it is in brackets, in which case the text is optional. Mark responses by ticking the appropriate box. Tick only one box where response boxes are connected by vertical lines. More than one box can be marked if they are not connected. Open boxes require a written, numeric response. A few questions have space for longhand description - in those cases a bold, open box is included for subsequent office use. There are five prompt cards which accompany the questionnaire.

Some specific terminology and word usage may arise and is described below.

DENTATE (A-1 and elsewhere) defines the presence of one or more natural teeth, whether or not dentures are worn.

EDENTULOUS (A-1 and elsewhere) defines the complete absence of natural teeth.

DENTURE (A-3 and elsewhere) is referred to by some as a plate or false teeth. Dentures are removable, unlike bridges or crowns which are cemented to natural teeth and which cannot be removed.

DENTAL PROFESSIONAL personnel (B-1) include dentists, dental hygienists or denture technicians. The latter may also be known as clinical dental technicians, denturists, or denture therapists.

PUBLIC HOSPITALS OR CLINICS (B-4) which provide dental services include the Adelaide Dental Hospital, numerous community dental clinics (Gilles Plains, Somerton Park, Port Adelaide, Elizabeth Field, the Parks, East Marden and Noarlunga) and general hospitals (Lyell McEwan, Queen Elizabeth, Flinders).

Consent for Use of Information (G-3)

Although consent for participation in the interview is implied through the process of voluntarily answering questions, it is an additional requirement that signed consent be obtained from each subject. Item G-3 of the questionnaire includes the formal process of obtaining signed consent for use of the information provided in the questionnaire. Possible dialogue is included in brackets, although this should be varied as required.

Procedure: Issue each subject with the double sided information sheet/consent form - this is to be retained for their record. Explain that the information which they supply will be maintained in strict confidence, and that their agreement to be part of the study is voluntary. Record the subject's name in the space at the top of page 15 of the questionnaire, and ask them to sign in the space below. The interviewer should then sign and date the consent form as witness.

Distribution of Oral Health Impact Profile (G-4)

Subjects who provide consent should be issued with the Oral Health Impact Profile Questionnaire. The questionnaire should be completed in their own time, after the interviewer has left. Subjects who require assistance in completing the questionnaire may call on another person, but interviewers should not perform this task. The questionnaire can be posted to the researchers using the reply paid envelope. However it would be preferable that the completed questionnaire be brought along to the dental clinic during the subsequent dental examination (see next step). Any queries about the questionnaire could be answered at that time, or by telephoning the researchers (as indicated on the back page of the questionnaire). Up to three reminders will be issued to non-respondents from the central office.

Procedure: Describe the nature and purpose of the self-complete questionnaire. Explain that the questionnaire covers a wide range of dental problems, and emphasize that their answers will be valuable, even if their dental health is very good. Suggested dialogue is included for item G-4, but should be varied as needed. Describe the procedure for returning the questionnaire through the post, or at a subsequent appointment for the dental examination.

Appointment for Dental Examination (G-5)

All interviewed persons will be invited to attend a nearby dental clinic for a dental examination. This includes subjects who are edentulous, those who have no particular dental problems, and those who regularly have dental check-ups. Dental appointments will be scheduled from the research office by telephoning those subjects who have been interviewed and who provide a telephone number, or by writing to those who cannot be contacted by phone. Item G-5 seeks to advise the subject of the importance and value of an examination for the purpose of the study, and to obtain a contact telephone number. It may be the subject's own phone number, or that of a friend or relative who would be able to help with scheduling. Dental examinations will be conducted by one of

four qualified dentists from the Department of Dentistry who are involved in the project. No x-rays will be taken, and no treatment will be undertaken. Participants will be advised of the findings from the examination and provided with a written report. There will be an opportunity to discuss dental treatment needs or other aspects of dental health with the dentist. Examinations will be free of charge.

Procedure: Advise the subject that the researchers would like to telephone each person during the next few weeks with the intention of making an appointment for a dental examination. Suggested dialogue is included for item G-5, but can be varied as required. Record and tick the appropriate response. Do not specifically ask for consent to contact subjects, but when the subject indicates a clear unwillingness to be contacted for this purpose, mark the response as 3 "Outright refusal".

ADMINISTRATIVE DETAILS

University of Adelaide Personnel Requirements

Interviewers will be contracted directly by the University of Adelaide for the purpose of this study. Interviewers should identify themselves to members of the public as University of Adelaide staff at all times during fieldwork for the study. Do not associate the Australian Bureau of Statistics with any part of the study, and avoid the display of any stationery or materials which may carry an ABS insignia.

An identification card will be supplied to each interviewer. It is signed by Dr David Wilson, Head of the Department of Dentistry at The University of Adelaide. Any questions about the authenticity of the study or identity of any personnel involved with the study should be directed initially to Professor John Spencer or Dr Gary Slade at the Department of Dentistry - phone (08) 228-5438.

All interviewers will need to complete tax forms and other personnel documents prior to the commencement of fieldwork. These will be available from the research office, 3rd Floor, Adelaide Dental Hospital, Frome Rd, Adelaide.

Rates of Pay and Mileage

Remuneration for interviews will be paid at fixed rates for each of four categories of response. The rates have been calculated using existing (May 1, 1991) ABS hourly pay scales, but will be subject to any changes to awards which may occur in the future. The rates are:

Response	Base level	Senior level
Non-dwelling	$3.61	$3.71
Person excluded, refusal, all persons out of scope, death or illness	$4.13	$4.24
Non-contact, language problems	$5.16	$5.30
Full/partial response	$8.25	$8.48

Mileage will be reimbursed at existing ABS rates subject to vehicle size. Mileage should be recorded on ABS worksheets (AP9) and forwarded to the research office, along with completed workloads. (As noted above, please ensure that ABS worksheets are not recognized by members of the public who are approached for the study.) Time for interview training will be reimbursed at the hourly rate of pay, and provision will be made for bus fares or parking associated with training.

QUESTIONS AND ANSWERS

How did you get my address?
Your address was obtained at random from the Electoral Roll. The State Electoral Department is able to provide information for approved research projects, and it has approved the use of the Electoral Database for this study. The random selection procedure ensures that a representative group of households is included so that a complete and accurate picture of dental health is obtained from across South Australia.

Do I have to be part of this study?
Your participation in this study is voluntary. However your involvement in the study is most important to ensure that we have a complete picture of dental health from across South Australia. It is only by speaking with a broad range of people that we can be sure that we have information which is accurate and which reflects the different circumstances of all people in the State.

Why are you doing a study of older adults?
Nowadays, older adults are much more likely to have some of their own natural teeth. So it is important to understand which people are prone to developing dental decay and gum disease, especially if this is related to the presence of medical conditions or difficulties in obtaining dental care. We also hope to find out which factors prevent the development of dental problems. The study has a special focus on the ways in which dental problems may affect people's usual activities or quality of life, and from this information the researchers intend to identify the best ways of preventing dental disorders for future groups of older adults.

Why do you need to know about my household income?
Many health conditions vary among groups of people with different social backgrounds, and the researchers need to understand whether socio-economic background influences dental disease. For example, this information will be used to see if dental treatment, in either the private or public dental sector, is able to adequately meet the needs of older people with different income levels. It is also important to ensure that the study has information from a wide cross-section of people from different backgrounds.

I see my dentist regularly - why do I need to be in this study?

I don't have any dental problems - why do I need to be in this study?

I don't have any of my own teeth - why do I need to be in this study?
It is most important that the researchers obtain an accurate picture of dental conditions as they exist today throughout South Australia. Therefore we need information from:

- people who have regular dental treatment, as well as others who may not
- people who have very good dental health as well as others who may not;
- people who have their own teeth, as well as those who have only dentures;

Information from these different types of people will also help to identify the best ways of reducing dental problems for others in the future. This can be done by comparing factors between those who have no dental disorders with those who do.

Who will use this information?
All information which you supply for this study will be maintained in strict confidence, and only the three researchers will have access to your answers. The questionnaires will be stored in the Department of Dentistry at the University of Adelaide, and none of the information about you will be passed onto anyone outside the study. When the findings from the study are published, your name will not be used. Nor will it be possible to identify you by any other means in the written reports.

Who are the researchers?
Professor John Spencer and Dr Gary Slade are from the Department of Dentistry at The University of Adelaide. Dr Martin Dooland is from the South Australian Dental Service. They are the chief investigators in this project, and they can be contacted by telephoning (08) 228-5438.

Appendix 8 Household enumeration card for the SADLS

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

THE UNIVERSITY OF ADELAIDE

SOUTH AUSTRALIAN DENTAL LONGITUDINAL STUDY

Workload: **41** ID: **55913**

ADDRESS1
ADDRESS2 POSTCODE

Age:**65-74 yrs** Sex:**Female**
If Edentulous (Column F=2): **INCLUDE**

SUMMARY OF CALLS								
IN								
OUT								

Comments . . . . . .

. . . . . .

. . . . . .

. . . . . .

1. **WHAT ARE THE NAMES OF ALL PEOPLE AGED 60 YEARS OR MORE WHO USUALLY LIVE HERE?** *Interviewer: Complete Columns A, B, C, D*

2. *Interviewer: Select person matching Age and Sex selection criteria: If more than one match, select person with next birthday. Mark selection in Column E.*

3. **I NEED TO KNOW ABOUT** *(SELECTION)*; **DO YOU HAVE ANY OF YOUR OWN NATURAL TEETH, OR HAVE YOU LOST THEM ALL?** *Interviewer: Complete Column F.*

4. *Interviewer: If Dentate=2 consult identification label and include or exclude as instructed. Otherwise, select this person. Mark selection in column G.*

	A	B	C	D	E SCOPE SELECTION	F DENTATE	G SAMPLE SELECTION
Person No.	Name	Age last birthday (years)	Date of birth (dd/mm/yy)	Sex 1-M 2-F	0-Out of scope 1-In scope, not selected 2-In scope, selected	1-Dentate 2-Edentulous	1-Sampled 2-Excluded
01			/ /				
02			/ /				
03			/ /				
04			/ /				
05			/ /				

A		B	C	D	E	F	G
					SCOPE SELECTION	DENTATE	SAMPLE SELECTION
Person No.	Name	Age last birthday (years)	Date of birth (dd/mm/yy)	Sex 1-M 2-F	0-Out of scope 1-In scope, not selected 2-In scope, selected	1-Dentate 2-Edentulous	1-Sampled 2-Excluded
07			/ /				
08			/ /				
09			/ /				
10			/ /				

FINAL RESPONSE ⌊_⌋

1 - Fully responding
2 - Person in scope/excluded from sample
3 - Refusal
4 - Part refusal
5 - Non-contact
6 - Language problems
7 - Death or illness
8 - All persons out of scope
9 - Not a residential dwelling

Appendix 9 Face-to-face questionnaire for the SADLS

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

THE UNIVERSITY OF ADELAIDE

Department of Dentistry

Workload Number	⌊_⌋⌊_⌋⌊_⌋
Identification Number	⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋
Date of Interview	⌊_⌋⌊_⌋ dd ⌊_⌋⌊_⌋ mm ⌊_⌋⌊_⌋ yy
Time interview began	⌊_⌋⌊_⌋ hh ⌊_⌋⌊_⌋ mm
Time interview finished	⌊_⌋⌊_⌋ hh ⌊_⌋⌊_⌋ mm
Dentate (Unkown=9)	⌊_⌋
Final Response	⌊_⌋

South Australian Dental Longitudinal Study

BASELINE HOUSEHOLD QUESTIONNAIRE

SECTION A. DENTAL HEALTH STATUS

A-1. *Sequence guide:*

If dentate (➠ *A-2*) . . . . . ☐ 1
Otherwise (➠ *A-3*) . . . . . ☐ 2

A-2. **HAVE YOU LOST ALL YOUR TEETH FROM YOUR UPPER JAW?**

Yes (➠ *A-3*) . . . . . ☐ 1
No . . . . . ☐ 2

I WOULD LIKE TO GET SOME IDEA OF HOW MANY NATURAL TEETH YOU HAVE IN YOUR UPPER JAW. INCLUDING THE WISDOM TEETH, THERE ARE 16 TEETH MAKING UP A COMPLETE SET OF TEETH IN THE UPPER JAW.

A) **COULD YOU TELL ME EITHER: THE NUMBER OF REMAINING TEETH OR THE NUMBER OF TEETH WHICH ARE MISSING IN YOUR UPPER JAW?** *(DK=99)*

Number remaining . . . . . ☐☐
OR Number missing . . . . ☐☐

A-3. **DO YOU HAVE A DENTURE OR FALSE TEETH FOR YOUR UPPER JAW?**

Yes . . . . . ☐ 1
No (➠ *A-4*) . . . . . ☐ 2

A) **WHEN DO YOU USUALLY WEAR THE UPPER DENTURE:**

WHEN YOU ARE SLEEPING? . . . . . ☐ 1
WHEN YOU ARE WITH OTHERS? . . ☐ 1
WHEN YOU ARE EATING? . . . . . ☐ 1

B) **HOW OLD IS YOUR UPPER DENTURE?**

Less than 1 year . . . . . ☐ 1
Between 1 and 4 years . . . ☐ 2
Between 5 and 9 years . . . ☐ 3
Between 10 and 19 years . . ☐ 4
Between 20 and 29 years . . ☐ 5
30 years or more . . . . . ☐ 6
Don't know . . . . . ☐ 9

C) **HOW MANY YEARS AGO DID YOU FIRST GET AN UPPER DENTURE?**

Less than 10 years . . . . . ☐ 1
Between 10 and 19 years . . ☐ 2
Between 20 and 29 years . . ☐ 3
Between 30 and 39 years . . ☐ 4
Between 40 and 49 years . . ☐ 5
More than 50 years . . . . . ☐ 6
Don't know . . . . . ☐ 9

A-4. *Sequence guide:*

If dentate (➡ *A-5*) . . . . . ☐ 1
Otherwise (➡ *A-6*) . . . . . ☐ 2

A-5. **HAVE YOU LOST ALL YOUR TEETH FROM YOUR LOWER JAW?**

Yes (➡ *A-6*) . . . . . ☐ 1
No . . . . . ☐ 2

INCLUDING THE WISDOM TEETH, THERE ARE 16 TEETH MAKING UP A COMPLETE SET OF TEETH IN THE LOWER JAW ALSO.

A) **COULD YOU TELL ME EITHER: THE NUMBER OF REMAINING TEETH OR THE NUMBER OF TEETH WHICH ARE MISSING IN YOUR LOWER JAW?** *(DK=99)*

Number remaining . . . . . ☐☐
OR Number missing . . . . ☐☐

A-6. **DO YOU HAVE A DENTURE OR FALSE TEETH FOR YOUR LOWER JAW?**

Yes . . . . . ☐ 1
No (➡ *A-7*) . . . . . ☐ 2

A) **WHEN DO YOU USUALLY WEAR THE LOWER DENTURE:**

WHEN YOU ARE SLEEPING? . . . . . ☐ 1
WHEN YOU ARE WITH OTHERS? . . ☐ 1
WHEN YOU ARE EATING? . . . . . ☐ 1

B) **HOW OLD IS YOUR CURRENT LOWER DENTURE?**

Less than 1 year . . . . . ☐ 1
Between 1 and 4 years . . . ☐ 2
Between 5 and 9 years . . . ☐ 3
Between 10 and 19 years . . ☐ 4
Between 20 and 29 years . . ☐ 5
30 years or more . . . . . ☐ 6
Don't know . . . . . ☐ 9

C) **HOW MANY YEARS AGO DID YOU FIRST GET A LOWER DENTURE?**

Less than 10 years . . . . . ☐ 1
Between 10 and 19 years . . ☐ 2
Between 20 and 29 years . . ☐ 3
Between 30 and 39 years . . ☐ 4
Between 40 and 49 years . . ☐ 5
50 years or more . . . . . ☐ 6
Don't know . . . . . ☐ 9

A-7. **ARE YOU ORDINARILY ABLE TO:**

CHEW BOILED VEGETABLES? . . . . . ☐ 1
(CHEW) HAMBURGER? . . . . . ☐ 1
(CHEW) FRESH LETTUCE SALAD? . . . . . ☐ 1
(CHEW) A PIECE OF FRESH CARROT? . . . . . ☐ 1
(CHEW) FIRM MEAT SUCH AS STEAK OR CHOPS? . . ☐ 1
BITE OFF AND CHEW A PIECE FROM A WHOLE FRESH APPLE? . . . . . ☐ 1

SECTION B. USE OF DENTAL SERVICES

B- 1. **HOW LONG AGO DID YOU SEE A DENTAL PROFESSIONAL ABOUT YOUR TEETH, DENTURES OR GUMS?**

- 12 months or less . . . . . ☐ 1
- 12 months to 2 years (➠ B-2) . . . . . ☐ 2
- More than 2 years to 5 years (➠ B-2) . ☐ 3
- More than 5 years to 10 years (➠ B-2) ☐ 4
- More than 10 years (➠ B-2) . . . . . ☐ 5
- Never (➠ B-6) . . . . . ☐ 6
- Don't know (➠ B-3) . . . . . ☐ 9

A) **HOW MANY VISITS DID YOU MAKE IN THE LAST 12 MONTHS TO A DENTAL PROFESSIONAL?** *(DK=99)*

Number of visits (➠ B-3) . . ☐☐

B- 2. *(SHOW YELLOW PROMPT CARD)* **WHAT WAS THE MAIN REASON YOU DIDN'T VISIT THE DENTIST IN THE LAST YEAR?**

Main reason . . . . . ☐☐

- No reason (➠ B-3) . . . . . ☐ 98
- Don't know (➠ B-3) . . . . ☐ 99

A) **WERE THERE ANY OTHER REASONS?** *(Write up to three other reasons; 98 if no reason)*

- a) Other reason . . . . . ☐☐
- b) Other reason . . . . . ☐☐
- c) Other reason . . . . . ☐☐

B- 3. **WOULD YOU SAY THAT YOU VISIT THE DENTIST ON A REGULAR BASIS, OR DO YOU ONLY GO WHEN YOU ARE IN DISCOMFORT OR WHEN YOU NEED SOMETHING FIXED?**

- Regular basis . . . . . ☐ 1
- When in discomfort . . . . . ☐ 2
- Something needs to be fixed . . . ☐ 3
- Don't know . . . . . ☐ 9

B- 4. **FOR YOUR LAST COURSE OF DENTAL TREATMENT, DID YOU GO TO A PRIVATE DENTIST, A DENTAL TECHNICIAN OR A PUBLIC HOSPITAL OR CLINIC?**

- Private dentist . . . . . ☐ 1
- Dental technician . . . . . ☐ 2
- Public hospital or clinic . . ☐ 3
- Don't know . . . . . ☐ 9

B- 5. **HOW OLD WERE YOU WHEN YOU LAST HAD A TOOTH EXTRACTED (OR HOW MANY YEARS AGO WAS THAT)?** *(Age=00 if no extractions; DK=99)*

Age . . . . . ☐☐

OR Number of years ago . ☐☐

B- 6. **DO YOU NEED DENTAL TREATMENT AT PRESENT?**

- Yes . . . . . ☐ 1
- No (➠ B-7)) . . . . . ☐ 2
- Don't know (➠ B-7)) . . . . . ☐ 9

A) *(SHOW BLUE PROMPT CARD)* **WHAT DO YOU NEED TO HAVE DONE?**

Record code . . . . . ☐

B- 7. **DO YOU HAVE INSURANCE COVER FOR DENTAL EXPENSES?**

Yes . . . . . ☐ 1
No . . . . . ☐ 2
Don't know . . . . . ☐ 9

B- 8. **DO YOU HAVE A PENSIONER HEALTH CARD OR A REPATRIATION HEALTH CARD?**

Yes, Pensioner Health Card (➠ *B-10*) . . . ☐ 1
Yes, Repatriation Health Card (➠ *B-10*) ☐ 2
No . . . . . ☐ 3
Don't know . . . . . ☐ 9

B- 9. **ARE YOU ENTITLED TO FREE DENTAL TREATMENT?**

Yes . . . . . ☐ 1
No . . . . . ☐ 2
Don't know . . . . . ☐ 9

B- 10. *(SHOW PURPLE PROMPT CARD)*
IF YOU NEEDED TO PAY A ONE HUNDRED DOLLAR DENTAL BILL IN THE NEXT MONTH, HOW MUCH DIFFICULTY WOULD THAT CREATE FINANCIALLY?

No difficulty . . . . . ☐ 1
Hardly any difficulty . . . . ☐ 2
A little difficulty . . . . . ☐ 3
A lot of difficulty . . . . . ☐ 4
Don't know . . . . . ☐ 9

B- 11. *(SHOW PURPLE PROMPT CARD)*
IF YOU NEEDED DENTAL CARE IN THE NEXT MONTH, HOW MUCH DIFFICULTY WOULD YOU HAVE TRAVELLING TO THE DENTIST?

No difficulty . . . . . ☐ 1
Hardly any difficulty . . . . ☐ 2
A little difficulty . . . . . ☐ 3
A lot of difficulty . . . . . ☐ 4
Don't know . . . . . ☐ 9

A) *(SHOW PINK PROMPT CARD)*
IF YOU NEEDED TO VISIT A DENTIST IN THE NEXT MONTH WOULD YOU FACE ANY OTHER PROBLEMS?

No problem . . . . . ☐ 98
a) Main problem . . . . . ☐
b) Other problem . . . . . ☐☐

B- 12. *Sequence Guide*

If dentate (➠ *Section C*) . . . . . ☐ 1
Otherwise (➠ *Section D*) . . . . . ☐ 2

SECTION C. DENTAL BEHAVIOURS - DENTATE PERSONS

C- 1. HOW OFTEN DO YOU BRUSH YOUR TEETH? *(excluding dentures)*

- Twice a day or more . . . . . ☐ 1
- Once a day . . . . . ☐ 2
- Four to six times a week . . . . . ☐ 3
- Once to three times a week . . . . ☐ 4
- Less than once a week . . . . . ☐ 5
- Intermittent or hardly ever . . . . ☐ 6
- Never *(➧ C-2)* . . . . . ☐ 7

A) WHAT BRAND(S) OF TOOTHPASTE DO YOU USE?
(Write brand(s))

_____ ☐

_____ ☐

C- 2. HOW OFTEN DO YOU USE DENTAL FLOSS, TOOTHPICKS OR A SPECIAL BRUSH TO CLEAN THE SPACES BETWEEN YOUR TEETH?

- Twice a day or more . . . . . ☐ 1
- Once a day . . . . . ☐ 2
- Four to six times a week . . . . . ☐ 3
- Once to three times a week . . . . ☐ 4
- Less than once a week . . . . . ☐ 5
- Intermittent or hardly ever . . . . ☐ 6
- Never . . . . . ☐ 7

C- 3. HOW OFTEN DO YOU USE A COMMERCIAL MOUTHRINSE? *(excluding denture cleansers)*

- Twice a day or more . . . . . ☐ 1
- Once a day . . . . . ☐ 2
- Four to six times a week . . . . . ☐ 3
- Once to three times a week . . . . ☐ 4
- Less than once a week . . . . . ☐ 5
- Intermittent or hardly ever . . . . ☐ 6
- Never *(➧ C-4)* . . . . . ☐ 9

A) WHAT BRAND(S) OF MOUTHRINSE DO YOU USE?
(Write brand(s))

_____ ☐

_____ ☐

C- 4. HOW OFTEN DO YOU HAVE FLUORIDE APPLIED TO YOUR TEETH DURING DENTAL VISITS?

(THIS INVOLVES PAINTING FLUORIDE OR APPLYING THE SOLUTION TO THE TEETH WITH PLASTIC TRAYS.)

- More than once a year . . . . . ☐ 1
- Once a year . . . . . ☐ 2
- Once every two or three years . . . . ☐ 3
- Intermittent or hardly ever . . . . . ☐ 4
- Never . . . . . ☐ 5
- Don't know . . . . . ☐ 9

C- 5. *(SHOW PURPLE PROMPT CARD)*
HOW MUCH DIFFICULTY DO YOU HAVE CLEANING YOUR TEETH?

No difficulty	☐ 1
Hardly any difficulty	☐ 2
A little difficulty	☐ 3
A lot of difficulty	☐ 4
Don't know	☐ 9

SECTION D. MEDICAL CONDITIONS, HEALTH BEHAVIOURS AND MEDICATIONS

I'M NOW GOING TO ASK ABOUT MEDICAL CONDITIONS.

Interviewer: Repeat (i) for each condition as necessary. Ask (ii) immediately following a "yes" response to (i). Otherwise, go on to next condition.

D-1. (i) DID A DOCTOR EVER TELL YOU THAT YOU HAD *(condition)*?

(IF YES)
(ii) ARE YOU NOW PREVENTED IN ANY WAY FROM DOING ANY ACTIVITIES BECAUSE OF *(condition)*?

	(i) Ever had	(ii) Prevented
A) ASTHMA	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9
B) CHRONIC BRONCHITIS OR EMPHYSEMA	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9
C) HYPERTENSION OR HIGH BLOOD PRESSURE	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9
D) A HEART CONDITION OR HEART ATTACK	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9
E) A STROKE OR A SMALL STROKE (ALSO CALLED "TIA")	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9
F) DIABETES	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9
G) ARTHRITIS	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9
H) CATARACTS	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9	Yes . . . ☐ 1 No . . . ☐ 2 DK . . . ☐ 9

I) **OSTEO-POROSIS OR HIP FRACTURE**

Yes . . .	☐ 1	Yes . . .	☐ 1
No . . .	☐ 2	No . . .	☐ 2
DK . . .	☐ 9	DK . . .	☐ 9

J) **A CANCER OR MALIGNANCY**

Yes . . .	☐ 1	Yes . . .	☐ 1
No . . .	☐ 2	No . . .	☐ 2
DK . . .	☐ 9	DK . . .	☐ 9

D-2. **DO YOU USE ANY OF THE FOLLOWING SERVICES?**

HOME HELP?	☐ 1
HOME NURSING?	☐ 1
HOME THERAPY?	☐ 1
RESPITE CARE AT HOME?	☐ 1
HOME DELIVERED MEALS? . . .	☐ 1
HOME MAINTENANCE?	☐ 1

D-3. **CAN YOU GO SOMEWHERE AWAY FROM HOME, SUCH AS TO THE SHOP, WITHOUT HELP?** *(Help from another person)*

Yes	☐ 1
No	☐ 2
Doesn't leave house	☐ 3

D-4. **DO YOU SMOKE CIGARETTES?** *(exclude pipes or cigars)*

Yes	☐ 1
No *(➠ D-6)*	☐ 2

A) **HOW MANY CIGARETTES DO YOU USUALLY SMOKE A DAY?**

Less than 10 per day	☐ 1
10 to 19 per day	☐ 2
20 to 30 per day	☐ 3
More than 30 per day . . .	☐ 4

D-5. ➠ D-7

D-6. HAVE YOU EVER SMOKED CIGARETTES REGULARLY?

Yes . . . . . ☐ 1
No (➡ *D-7*) . . . . . ☐ 2

A) HOW LONG AGO DID YOU QUIT SMOKING?

Quit less than 6 months ago . . . . ☐ 1
Quit 6 to 12 months ago . . . . . ☐ 2
Quit 1 to 5 years ago . . . . . ☐ 3
Quit more than 5 years ago . . . . ☐ 4
Don't know . . . . . ☐ 9

D-7. HAVE YOU DRUNK ANY ALCOHOL DURING THE LAST 12 MONTHS?

Yes . . . . . ☐ 1
No (➡ *D-8*) . . . . . ☐ 2

A) WE ARE ESPECIALLY INTERESTED IN RECENT TIMES. HAVE YOU HAD ANY ALCOHOL DURING THE LAST MONTH?

Yes . . . . . ☐ 1
No (➡ *D-8*) . . . . . ☐ 2

B) OVER THE LAST MONTH, HOW OFTEN HAVE YOU HAD ALCOHOL?

Times per month . . . . . ☐☐

Interviewer: Record number of times per month, or if response is given as times per week or day, use guide below:

Monthly frequency guide

3 or more times per day = 90	5 times per week = 22
2 times per day = 60	4 times per week = 17
1 time per day = 30	3 times per week = 13
6 times per week = 26	2 times per week = 09
	1 time per week = 04

C) WHEN YOU HAD SOME ALCOHOL, HOW MANY STANDARD DRINKS DID YOU USUALLY HAVE AT ONE TIME?
(Standard drink=schooner of beer, glass of wine, nip of spirits)

Number of drinks . . . . . ☐☐

D-8. DO YOU HAVE ANY PRESCRIBED MEDICINES THAT YOU HAVE TAKEN OR WERE SUPPOSED TO TAKE REGULARLY IN THE LAST TWO WEEKS?

Yes . . . . . ☐ 1
No (➡ *E-1*) . . . . . ☐ 2

A) WHAT ARE THE NAMES OF THE PRESCRIBED MEDICINES WHICH YOU TAKE?
(List names; view labels if necessary)

_____ ☐
_____ ☐
_____ ☐
_____ ☐
_____ ☐
_____ ☐
_____ ☐

SECTION E. LIVING ARRANGEMENTS AND RESIDENTIAL HISTORY

E- 1. DO YOU LIVE ALONE OR WITH OTHER PEOPLE?

Live alone (➡ E- 2) . . . . . ☐ 1
Live with others . . . . . ☐ 2

A) DO YOU LIVE WITH YOUR SPOUSE, FAMILY OR OTHER PEOPLE?

Spouse . . . . . ☐ 1
Other family . . . . . ☐ 2
Other person(s) . . . . . ☐ 3

E- 2. DO YOU OWN OR RENT YOUR ACCOMMODATION?

Own . . . . . ☐ 1
Rent . . . . . ☐ 2
Free board . . . . . ☐ 3
Other . . . . . ☐ 4

E- 3. THINKING BACK IN TIME, PLEASE TELL ME THE CITIES, TOWNS OR LOCATIONS YOU HAVE LIVED IN FOR MORE THAN TWO YEARS. BEGIN WITH YOUR CURRENT LOCATION, AND GO BACK TO 1960. THEN TELL ME THE THE TYPE OF DRINKING WATER YOU USED AT EACH LOCATION?

Interviewer: List location of residence, calendar years of residency and source of water used predominantly for drinking (including water used to make tea, coffee or cordial).

City, Town or Location and State or Country *(begin with current location)*	Years (From,To)	Drinking water 1=Public/mains 2=Other source 3=DK	Office use: FL	Office use: FL Years	Office use: non-FL Years
	☐☐,☐☐	☐			
	☐☐,☐☐	☐			
	☐☐,☐☐	☐			
	☐☐,☐☐	☐			
	☐☐,☐☐	☐			
	☐☐,☐☐	☐			
	☐☐,☐☐	☐			
	☐☐,☐☐	☐			
	☐☐,☐☐	☐			

SECTION F. DEMOGRAPHICS INCOME, EDUCATION AND OCCUPATION

F- 1. WHAT IS YOUR MARITAL STATUS?

- Never married . . . . . ☐ 1
- Married . . . . . ☐ 2
- De-facto . . . . . ☐ 3
- Separated . . . . . ☐ 4
- Divorced . . . . . ☐ 5
- Widowed . . . . . ☐ 6

F- 2. IN WHICH COUNTRY WERE YOU BORN?

Overseas country of birth codes:

02 - UK and Ireland	06 - Holland
03 - Italy	07 - Germany
04 - Greece	08 - New Zealand
05 - Yugoslavia	09 - Poland

10 - Other *(Specify)* _____

- Australia *(➠ F-4)* . . . . . ☐ 01
- Overseas *(Record code)* . . . . ☐☐

☐☐

F- 3. IN WHICH YEAR DID YOU ARRIVE IN AUSTRALIA?
(DK=9999)

Record year . . . . . ☐☐☐☐

F- 4. HOW OLD WERE YOU WHEN YOU LEFT SCHOOL?

- Never went to school . . . . ☐ 1
- Under 14 years . . . . . ☐ 2
- 14 years . . . . . ☐ 3
- 15 years . . . . . ☐ 4
- 16 years . . . . . ☐ 5
- 17 years . . . . . ☐ 6
- 18 years or more . . . . . ☐ 7

F- 5. SINCE LEAVING SCHOOL HAVE YOU OBTAINED A CERTIFICATE, DIPLOMA, DEGREE OR OTHER QUALIFICATION?

- Yes . . . . . ☐ 1
- No *(➠ F-6)* . . . . . ☐ 2

A) *(SHOW BROWN PROMPT CARD)* WHAT IS YOUR HIGHEST QUALIFICATION SINCE LEAVING SCHOOL?

- Secondary school course . . ☐ 1
- Trade/apprenticeship . . . ☐ 2
- Certificate/diploma . . . . . ☐ 3
- Bachelor degree/post graduate diploma . . . . . ☐ 4
- Higher qualification . . . . . ☐ 5
- Adult education . . . . . ☐ 6
- Other . . . . . ☐ 7

*Specify:*_____

F- 6. *(SHOW GREEN PROMPT CARD)*
WHICH OF THESE GROUPS REPRESENTS YOUR (AND YOUR HUSBAND'S/WIFE'S) TOTAL WEEKLY INCOME, INCLUDING ALL SOURCES BEFORE TAX OR ANYTHING ELSE IS TAKEN OUT?

Record group . . . . . ⌊_⌋⌊_⌋

F- 7. **HOW MANY PEOPLE ALTOGETHER LIVE ON THIS INCOME? (THAT IS, IT PROVIDES AT LEAST HALF THEIR INCOME.)**

Record number . . . . . ⌊_⌋

SECTION G. FUTURE ADDRESS, APPOINTMENT RESPONSE AND INTERVIEWER OBSERVATIONS

G-1. **THIS INTERVIEW IS PART OF A STUDY BEING DONE BY PROFESSOR SPENCER AND DR SLADE AT THE DEPARTMENT OF DENTISTRY. WE WOULD LIKE TO BE ABLE TO CONTACT YOU AGAIN, TWO YEARS FROM NOW FOR ANOTHER INTERVIEW TO CHECK HOW DENTAL HEALTH CHANGES WITH TIME.**

DO YOU EXPECT TO BE MOVING TO ANOTHER ADDRESS WITHIN TWO YEARS?

No . . . . . ☐ 1
Yes *(Record details below)* . . . . . ☐ 2

_____
_____
_____

G-2. **IN THE EVENT THAT WE HAVE TROUBLE CONTACTING YOU TWO YEARS FROM NOW, IT WOULD BE HELPFUL TO HAVE THE NAME AND ADDRESS OF ANOTHER PERSON WHO WOULD BE WILLING TO HELP US IF NECESSARY.**

WOULD YOU BE ABLE TO GIVE ME THE NAME AND ADDRESS OF SUCH A PERSON?

Name: _____
Address: _____
_____
_____

G-3. **(THANK YOU FOR AGREEING TO ANSWER THESE QUESTIONS. I WILL NEED TO HAVE YOUR SIGNATURE TO CERTIFY THAT YOU CONSENT TO THE USE OF THESE ANSWERS IN THE STUDY.)**

Interviewer: Issue "Information sheet" and seek signed consent.

Consent form signed . . . . . ☐ 1
Otherwise (➠ *G-6*) . . . . . ☐ 2

G-4. **(I ALSO HAVE A QUESTIONNAIRE ABOUT DENTAL PROBLEMS WHICH WE WOULD LIKE YOU TO COMPLETE IN YOUR OWN TIME.)**

Interviewer: Mark ID and issue questionnaire

Questionnaire issued with ID . . . ☐ 1
Otherwise . . . . . ☐ 2

G-5. **(IN ORDER TO HAVE INFORMATION ABOUT YOUR DENTAL HEALTH, WE WOULD LIKE TO PHONE YOU TO MAKE AN APPOINTMENT FOR A FREE DENTAL EXAMINATION.)**

Interviewer: Telephone number for future scheduling of dental examination.

Telephone: _____ ☐ 1
No phone, willing to participate . . . . . ☐ 2
Outright refusal . . . . . ☐ 3

G-6. *Personal interview obtained:*

Fully in English . . . . . ☐ 1
Partly or fully in another language . . . . . ☐ 2
PROXY due to English language difficulty . ☐ 3
PROXY for other reasons . . . . . ☐ 4

The South Australian Dental Longitudinal Study

Interview Consent Form

I, the undersigned,_____ hereby consent to participate in the research study entitled "The South Australian Dental Longitudinal Study" conducted by Professor John Spencer and Dr. Gary Slade (Department of Dentistry, The University of Adelaide) and Dr. Martin Dooland (South Australian Dental Service). A copy of the information sheet has been given to me.

I have had the study, so far as it affects me, fully explained to my satisfaction by the interviewer and I have been given the opportunity to have a relative or friend present while the study was being explained. I have been informed that, while information gained during the study may be published, I will not be identified and my personal results will not be disclosed.

Although I understand that the purpose of this study is to improve the quality of dental care, it has also been explained to me that my involvement may not be of any benefit to me directly. I am aware that I may retain a copy of this Consent Form. I also understand that I am free to withdraw from the study at any time and that this will not affect my entitlements to dental care now or in the future. My consent to participate in this study is freely given.

_____ Date:_____

(Signature)

Name of witness: _____

Signed: _____ Date: _____

Appendix 10 Examination protocol for the SADLS

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

SOUTH AUSTRALIAN DENTAL LONGITUDINAL STUDY

BASELINE ORAL EXAMINATIONS - 1991

CALIBRATION AND CODING MANUAL

May, 1991

INTRODUCTION

This manual draws extensively on the oral examination protocol specified for the US National Institute of Dental Research which was developed for their survey of employed adults and seniors. The same protocol forms the basis for the Piedmont study in North Carolina (USA) and the Ontario Study of Adult Dental Health (Canada). The South Australian Dental Longitudinal Study aims to achieve 1265 oral examinations at baseline during 1991. The subjects, who constitute a stratified random sample of persons aged 60+ from Adelaide and Mt Gambier, will complete a face-to-face interview at their home prior to the oral examination. Appointments for examinations will be arranged from the offices of Social and Preventive Dentistry.

The manual describes the protocol as well as the administrative details for the oral examinations.

CLINIC SCHEDULES AND MATERIALS

Clinic schedules for each examination session will be obtained from the office in Social and Preventive Dentistry. Appointments for each session will feature the following details:

1) Clinic.
2) Name of examiner.
3) Name of recorder.
4) Timeslot, subject name, subject identification number, subject phone number and dentate status.

This schedule should be taken to the clinic and the outcome (examined, reschedule required or failed to attend) for each subject should be noted during the session. This should also be used to make any special comments or observations about subjects, equipment etc. Return the completed schedule to the office after the session.

Other materials will need to be collected from the office. These should be put into a plastic cube box and include:

1) Bagged instruments comprising: mirror, sickle probe, NIDR periodontal probe, tweezers and gauze.
2) Fibre optic light, mirror mount and mirrors.
3) Gloves, masks and glasses for subjects.
4) DATA forms, consent forms with information sheets, pencils and eraser.
5) Report forms (to be completed and handed to subjects after the examination) and information to advise subjects about seeking dental care.

The clinic's supply of bibs and bib chains can be used for examinations. Other instruments (mirrors, probes etc) should be available at the clinics if they are needed, but please ensure that any such items are cleaned and replaced, or that they are clearly marked for sterilization.

The Report Form should be completed for all subjects following their examination. In most cases it will be the only form of follow-up which will be undertaken. However, for persons requiring immediate attention because of a life threatening condition (for example, undiagnosed tumor) phone Dr Jane Boroke at Adelaide Dental Hospital (223-9211). She will then make an arrangement for the subject to have an appointment at the ADH. The first appointment will be free of charge for persons with a life threatening condition. Any subsequent treatment will be arranged according to usual eligibility criteria of SADS.

After completing a session you should return dirty instruments in their original bags (with "Gary Slade" marked clearly). These will be sterilized at the Adelaide Dental Hospital. Wipe the light and mirrors with methylated spirits and return them in the cube box. Return unused and completed forms to their respective boxes at the office in Social and Preventive Dentistry.

SUBJECT'S CONSENT FOR PARTICIPATION

Prior to the examination, introduce yourself and explain the procedures which will be involved. A double sided information sheet and copy of consent form should be given to each subject, and their signed consent should be obtained on a separate (single sided) consent form. You or the dental assistant should act as the witness for the signature, and also record the subject identification number.

SUBJECT IDENTIFICATION DETAILS (ALL DATA FORMS)

ID (Subject Identification Code). Record this number from the examination schedule in longhand and by shading circles.

Name: Record subject's name in longhand.

Examiner: 1=BELL; 2=ROBERTS-THOMSON; 3=SLADE; 4=SPENCER.

Repeat: Mark this circle if this is a repeat examination being conducted for reliability assessment.

ORAL HEALTH AND DENTURE ASSESSMENT (RED DATA FORM)

Examination Details

Examination times: Use 24 hour clock (eg 1.05 PM = 13 hr 05 min).

Examination data: Mark today's date

Recorder: 11= ADEY; 12=CARLESSO; 13=HEWETT; 14=PAUL

Clinic: Consult examination schedule for clinic code.

Series: Mark "Caries" if the caries examination is completed; Mark "Perio" if the periodontal examination is completed.

Further notes:

1. The oral health and denture assessment form is completed for all examined subjects.
2. The caries and periodontal examination forms should be used only for those dentate persons when the respective examination is completed.

ORAL HEALTH AND DENTURE ASSESSMENT (continued)

Denture Assessment

Dentate is marked Y if one or more teeth or roots are remaining in the arch or N otherwise.

Denture is marked as **F**ull or **P**artial if the subject wears such a denture at least daily: **Nf** or **Np** is marked when a full or partial denture is owned but is no longer worn on a regular basis. (Do not assess the clinical adequacy of dentures which are not worn).

Retention is marked as unsatisfactory if there is displacement of the denture from the alveolar mucosal ridge when the subject opens wide but without strain.

Stability is marked as unsatisfactory if 3mm or more displacement can be achieved by rotation of the denture in the horizontal plane **or** if there is displacement of the denture from the ridge when moderate occlusal force is applied to the contralateral premolar area.

Occlusion is marked as unsatisfactory if, during light tapping by the subject, there is either: a lack of three point contact (anterior, left and right) for full dentures; a lack of contact with groups of teeth replaced by partial dentures; or if there is displacement of the denture upon closing. If the opposing arch is edentulous, the occlusion is regarded as satisfactory.

Material inadequacies are marked as: **P**orosity or crazing covering more than one third of surface; **L**ining which is deficient or temporary; **S**taining or calculus which is extensive (covering one third or more of surface). Multiple marks can be made for one denture.

Defects of denture design or material are marked as: **S**mall where 1 or 2 teeth are missing or fractured, less than $1cm^2$ of denture material is lost, cracks are less than 2 cm or extension of the flanges is inadequate; **L**arge where 3 or more teeth are missing or fractured, more than $1cm^2$ of denture material is lost, cracks are 2cm or greater, or the denture has no flanges; or **M**ultiple, where there is more than one large defect, or total fracture of the denture.

Hyperplasia, Stomatitis, Cheilitis, Ulceration, or Other Lesions are marked if their presence is attributable to the denture.

Prosthodontic treatment needs are assessed for all subjects, with or without dentures. Make a conservative clinical judgement that would be similar to that made by a general practitioner after examination of the mouth and dentures, and after discussion concerning the subject's best interests and existing function. Take into consideration the most conservative treatment which would be acceptable, the subject's satisfaction with existing dentures, and health status. Treatment categories are: **F**ull denture, **P**artial denture, **B**ridge, **Rp**=Repair of existing denture, **Rl**=Reline or rebase of existing denture, or **A**djustment of existing denture.

Treatment wanted should be marked after discussion with the subject. Use the same coding scheme to mark if the subject wants treatment for: **F**ull denture, **P**artial denture, **B**ridge, **Rp**=Repair of existing denture, **Rl**=Reline or rebase of existing denture, or **A**djustment of existing denture.

Oral Mucosal Tissue Examination

Mark one or more lesions. If denture related lesions were noted, also mark them here.

CPITN Assessment

This assessment is made after the clinical examination of periodontal tissues. Review the coding sheet and mark each sextant using the following rules. In order to be scored, **sextants** must have two or more teeth which were probed for pocket depth. A third molar should be considered only if it occupies the space of a second molar. Sextants with one or no teeth are excluded (**X**). Other sextants are marked with the highest score among all the teeth in the sextant:

0 = Gingival and periodontal health
1 = Gingival bleeding
2 = Calculus
3 = Periodontal pockets of 4-5mm
4 = Periodontal pockets of 6mm+

CORONAL AND ROOT CARIES (GREEN DATA FORM)

Missing/Replacement Teeth

Procedure: *Pass through the quadrant or arch marking all missing teeth and their replacement status as well as retained roots and full crowns.*

Missing (M) is coded for teeth which have been extracted as well as those which may be unerupted. There is no distinction according to presumed reason for extraction.

Replaced with **removable (Rr)** denture is coded when the space of a missing tooth is replaced by a removable denture (full or partial) which is worn on a daily basis at least.

Replaced with **fixed (Rf)** bridge is coded when the space of a missing tooth is replaced by a fixed bridge.

No Space (NS) is coded when there is a lack of space due to drifting of adjacent teeth precluding any prosthodontic replacement of the missing unit.

Note: Where there is no replacement but sufficient space for prosthodontic replacement, mark the tooth only as **M**issing.

Present

Sound (S) is coded when all coronal surfaces are sound and unrestored. Mark this only after assessing all surfaces, and do not make any individual marks for those surfaces.

Crown (C) coverage is marked when there is full crown coverage, regardless of the reason for placement.

Root Decayed (RD) status is marked when one quarter or less of the crown remains and is affected by caries.

Root Sound (RS) status is marked when one quarter or less of the crown remains, but is sound.

Pocket

Procedure *Mark pocket depth at all sites, even if the measurement of recession has been excluded **(X)** at this site.*

Pocket distance in millimetres is marked to indicate pocket depth from the FGM to the bottom of the pocket. Distance is rounded down to the nearest whole millimetre. Where the distance is 0 to 5mm or 10mm, a single circle is marked. Between 6 and 9mm, the 5 and either 1, 2, 3 or 4 is marked. Above 10mm, the 10 and either 1, 2, 3, 4, or 5 is marked.

Excluded (X) is marked if the pocket depth cannot be assessed, for example because of calculus or difficulty aligning the probe correctly.

Calculus (C) is marked if supra- or sub-gingival calculus is detected at this site. Calculus may be observed visually or is detected with the aid of the NIDR probe.

CPITN

Mark CPITN category after examining all three tooth sites. Use the worst finding from those sites to mark CPITN status of the tooth. No mark is made for a missing tooth.

CPITN 0 is marked when there is gingival and periodontal health at all sites.

CPITN 1 is marked when the worst finding is gingival bleeding after probing.

CPITN 2 is marked when the worst finding is the presence of calculus.

CPITN 3 is marked when the worst finding is one or more pockets of 4-5 mm.

CPITN 4 is marked when the worst finding is one or more pockets of 6mm+.

Additional notes:

1. Approach the mesial site from the buccal aspect, keeping the probe in the direction of the long axis of the tooth and as close to the contact point as possible, even if the adjacent tooth is missing. The buccal site is assessed at the midpoint of the buccal surface and, in the case of upper and lower molars, over the mesial root. Approach the distal site from the lingual aspect, keeping the probe in the direction of the long axis of the tooth and as close to the contact point as possible, even if the adjacent tooth is missing.

3. The probing pressure is very light and is not to exceed 25 grams. The tip of the probe is pointed toward the apex of the tooth.

4. The location of the CEJ often must be estimated. If a crown is in place use the margin of the crown as the CEJ. If a root restoration is present, estimate the location of the original CEJ.

Excluded jaw (box in upper right hand corner)

Excluded upper or lower can be marked when an arch is edentulous.

CONSENT FORM AND INFORMATION SHEET

The South Australian Dental Longitudinal Study

Dental Examination Consent Form

I, the undersigned,_____ hereby consent to participate in the dental examination for the research study entitled "The South Australian Dental Longitudinal Study" conducted by Professor John Spencer and Dr. Gary Slade (Department of Dentistry, The University of Adelaide) and Dr. Martin Dooland (South Australian Dental Service). A copy of the information sheet describing the examination has been given to me.

I have had the study, so far as it affects me, fully explained to my satisfaction by the dentist. I understand that the examination follows procedures used in a regular dental check-up and that it will not be harmful. No x-rays will be taken. I have been informed that, while information gained during the examination may be published, I will not be identified and my personal results will not be disclosed.

Although I understand that the purpose of this study is to improve the quality of dental care, it has also been explained to me that my involvement may not be of any benefit to me directly. I am aware that I may retain a copy of this Consent Form. I also understand that I am free to withdraw from the study at any time and that this will not affect my entitlements to dental care now or in the future. My consent to participate in this study is freely given.

_____ Date:_____

(Signature)

Name of witness: _____ Subject ID:_____

Signed: _____ Date: _____

Crown Surfaces

Procedure *Examine all remaining teeth and crown surfaces beginning with the crown, if present, and then the root surfaces. Follow the order marked on the data form: Occlusal (if applicable), Mesial, Buccal, Distal, Lingual.*

Filled (F) surfaces are marked when the surface contains one or more permanent or temporary restorations, regardless of the reason for placement. An exception exists for full crown coverage, which is marked as C above. No other coronal surfaces are marked for teeth with full coverage. Crowns of less than full coverage are marked as individual surfaces. In order to be marked as Filled, restorations must be:

(i) Free of recurrent current caries (Marked as **R**); and
(ii) Free of non-carious defects (Marked as **Fu**).

A Filled category includes restorations which have the following acceptable deficiencies:

a) Surface which is irregular, rough or discoloured;
b) Abnormal aesthetic appearance but not displeasing;
c) Undercontouring, or faulty occlusal contact;
d) Mal-contouring of embrasures which can be corrected;
e) Marginal discrepancy which can be penetrated by a probe;
f) Overhang which can be corrected; or
g) Joined or repaired restorations.

Filled unsatisfactory (Fu) is marked when a filled surface contains one or more of the following unacceptable defects which cannot be corrected:

a) Surface which is flaking or fractured;
b) Surface which is aesthetically unacceptable;
c) Dentine or base exposed;
d) Missing or fractured and mobile restoration;
e) Traumatic occlusion causing pain or damage to tissues;
f) Mal-countouring of embrasures;
g) Gross marginal discrepancy with potential for recurrent caries;
h) Overhang causing tissue damage; or
i) Temporary fillings.

Decayed (D) coronal surfaces are coded using the following criteria (based on Radike, 1968):

Frank lesions are coded as **D** and occur when cavitation and softening of the cavity floor are present. Cavitation is defined as a discontinuity of the enamel surface caused by the loss of tooth substance. It must be distinguished from fractures, erosion and abrasion.

Lesions not showing frank cavitation may still be coded as decayed under the following circumstances:

A. PITS AND FISSURES

1. The area is coded as **D** when the explorer "catches" or resists removal after insertion into a pit or fissure with moderate pressure **and** when one or more of the following occurs:
   a) Softness at the base of the area;
   b) Opacity indicating adjacent undermining or demineralization; or
   c) Softened enamel that can be scraped away with the explorer.

2. The area is coded as **D** if there is loss of the normal translucency of enamel around a pit or fissure, even if the explorer does not catch or penetrate the fissure.

B. SMOOTH SURFACES ON BUCCAL AND LINGUAL SURFACES

1. The area is coded as **D** if the surface is etched or there is a white spot **and** if dentine seems to be involved as indicated by:
   a) Penetration with an explorer; or
   b) Scraping away with an explorer.

   If there is no softness, the area is sound.

C. PROXIMAL SURFACES

For areas exposed to direct visual or tactile examination, use the criteria in B above. Otherwise use three diagnostic cues:

1. Visual examination: if the marginal ridge shows darkening as evidence of undermined enamel, the proximal surface is carious;

2. Tactile examination: any discontinuity of the enamel in which an explorer will enter is carious **if** it also shows other evidence of decay such as softness, shadow by illumination or loss of translucency; and

3. Transillumination (for anterior teeth mainly): a loss of translucency producing a characteristic shadow in a calculus-free and stain-free proximal surface is adequate evidence of caries.

Additional notes:

1. Stain and pigmentation are not regarded as evidence of caries since they occur in sound teeth.

2. Erosion, abrasion, hypoplasia, attrition, fractures, mottled enamel, and enamel opacities on exposed hard surfaces are not classified as carious.

Recurrent (R) caries is marked when a surface has caries which is contiguous with a restoration. The criteria above for each of the tooth surfaces are applied when determining the existence of recurrent caries.

Root Surfaces

Decayed (D) surfaces are marked when there is a discrete, well-defined or discoloured cavitation on the root surface **and** softness into which the explorer enters easily.

Filled, (F) Filled Unsatisfactory (Fu) and Recurrent caries (R) is recorded, if present, using the criteria described above for coronal surfaces.

Sound exposed roots (S) are marked where there is gingival recession (that is, visible root surface) but the exposed root surface is sound (neither filled nor decayed).

Additional notes:

1. All teeth, including wisdom teeth, are assessed. When any part of a crown projects through the gum, the tooth is considered as erupted. In the case of supernumerary teeth, mark only the tooth which is regarded as the "legitimate" one.

2. If less than one quarter of the crown remains, code it as a root fragment.

3. Surfaces which are not visible and which cannot be probed should be regarded as sound.

4. Use the natural, coronal landmarks to define surfaces when a tooth is rotated, rather than the "new" orientation which has been adopted.

5. Calculus will not be removed for the purpose of the examination

6. Order of surfaces: Occlusal (if present), Mesial, Buccal, Distal, Lingual.

7. Incisal edges are not considered as separate surfaces. If a lesion is confined solely to an incisal edge, code the nearest surface.

8. If both the coronal and root surfaces are affected by caries or a restoration, it is necessary to determine the lesion's origin. If more than half of the lesion is above the CEJ, it is regarded only as a coronal lesion; if more than half of the lesion is below the CEJ it is regarded only as a root surface lesion.

9. Use the following criteria for scoring multiple surfaces on crowns or roots:

   Use the "ONE THIRD RULE" for restorations or carious lesions which are continuous over one or more of the mesial, buccal, distal or lingual surfaces. The restoration or lesion must extend at least one third of the circumferential distance across the surface. (If a restoration or lesion extends less than one third the circumference around both surfaces, select the surface which has the majority of the circumferential distance.)

   For restorations or lesions which extend beyond the occlusal surface (ie over the marginal ridge), always include the other surface(s).

Tooth Treatment

Restorations are marked according to the number of surfaces required to restore any existing caries, trauma or unsatisfactory restorations. Restorations may also be needed for bridge work. There may be one (**R1**), two (**R2**), three (**R3**), or four or more (**R4**) surfaces requiring restoration. (If full coronal coverage is required, mark C as described below). If a surface requires restoration with more than one individual filling (for example, buccal crown and buccal root surfaces) it is still marked as a single surface restoration.

Preventive treatment (**P**) includes contouring, application of fluoride or other solutions, or possibly even fissure sealants. This should be marked only when there is a specific need for an individual tooth. Do not mark all teeth if fluoride tray application is required.

Extraction for caries (**Ec**) is marked when a tooth is indicated for extraction because:
1) Caries has so destroyed the crown that it cannot be restored;
2) Caries has progressed to an extent that there is an obvious and open exposure of the pulp; or
3) When caries is the underlying pathology in a tooth which is non-functional and which is to be extracted.

Extraction for periodontal disease (**Ep**) is marked when periodontal disease has progressed so far that the tooth is loose or functionless **and** cannot be restored to a firm and functional state by periodontal therapy.

Extraction for dentures (**Ed**) is marked when a full denture is planned. Individually, the teeth could be restored or conserved, but because there are too few to function properly, the only rational treatment is extraction to make way for a denture.

Crown (C) coverage is marked when full crown coverage is required for restoration (of caries, trauma or unsatisfactory restoration) or for fixed bridge work.

Additional notes:

1. If a tooth is indicated for extraction for more than one reason, use more than one mark.

2. Multiple marks can also be used for other (non-extraction) treatments.

Occlusal Attrition

Mark all teeth, other than those with no crown or with full coronal coverage.

Enamel (E) attrition is marked when the occlusal or incisal enamel is worn so that dentine is exposed.

Dentinal (D) attrition is marked when the entire occlusal or incisal enamel is obliterated, leaving an enamel ring surrounding a central core of dentine.

Severe (S) attrition is marked when the tooth has worn to the gingival margin.

Edentulous Jaw

If an entire arch is edentulous, the box in the upper right hand margin can be marked to indicate missing (**M**) upper and/or lower teeth, and to indicate if the missing units have been replaced (**Rr**).

PERIODONTAL ASSESSMENT (BLUE DATA FORM)

Procedure: *Check for any contra-indications to probing. Ask about heart disease, artificial joint/valve prostheses, or severe bleeding disorders. Mark responses to these three medical history details in the box at the upper right corner of the form. Do not make any assessment for persons who have contra-indications.*

ORDER OF EXAMINATION:
Mesial: Recession, Pocket (Calculus and Gingivitis if noted)
Buccal: Recession, Pocket (Calculus and Gingivitis if noted)
Distal: Recession, Pocket (Calculus and Gingivitis if noted)
CPITN for the tooth.

Gingivitis

Excluded (X) is marked when the tooth is missing, or when no sites are marked for this tooth. In the case of missing teeth, simply mark the gingivitis assessment as X and move to the next tooth without marking individual sites (below) as excluded.

Gingivitis (G) is marked if, after probing to the base of the pocket (described below) at any of the three sites, bleeding is observed. Look for evidence of bleeding immediately after probing. Bleeding which does not appear within ten seconds of probing is not included.

Definitions *Recession is defined as the distance (in millimetres) from the cemento-enamel junction (CEJ) to the free gingival margin (FGM). Pocket depth is defined as the distance from the FGM to the bottom of the periodontal pocket.*

Recession

Excluded (X) is marked when the recession for an individual site cannot be estimated. This occurs most commonly when the position of the CEJ cannot be estimated at that site.

Negative (-) is marked when the CEJ is apical to the FGM by 1mm+. That is, the gingival crest is occlusal (or incisal) to the CEJ. If the CEJ is apical to the FGM by less than 1mm, the distance will be rounded down to zero, and a negative value is not marked.

Recession distance in millimetres is marked to indicate the distance from CEJ to FGM. Distance is rounded down to the nearest whole millimetre. Where the distance is 0 to 5mm or 10mm, a single circle is marked. Between 6 and 9mm, the 5 and either 1, 2, 3 or 4 is marked. Above 10mm, the 10 and either 1, 2, 3, 4, or 5 is marked.

THE UNIVERSITY OF ADELAIDE

Department of Dentistry

The South Australian Dental Longitudinal Study

Information About the Dental Examination

The South Australian Dental Longitudinal Study is a survey of the causes and effects of dental problems among older South Australian adults. The results from this study will be used to help to decide which forms of dental treatment are best able to reduce dental problems affecting everyday activities. Today, your participation in the study involves a dental examination.

The examination involves an inspection of the teeth, gums and lining of the mouth, as well as any dentures which may be worn. The dentist conducting the examination will use a mouth mirror, dental probes and a small light to conduct the examination. No x-rays will be taken, and the examination is not harmful. The procedures are similar to ones which would be used for a dental check-up with your own dentist.

The examination will be conducted by a qualified dentist who is registered to practice with the Dental Board of South Australia. At the end of the examination, the dentist will inform you of the findings, and will be able to give you recommendations for your future dental care. The findings and the dentist's name will be recorded onto a report which will be given to you.

The study is being conducted by Professor John Spencer and Dr. Gary Slade from the Department of Dentistry at The University of Adelaide, along with Dr. Martin Dooland of the South Australian Dental Service. They can be telephoned on (08) 228-5438 during business hours if you wish to discuss any aspects of this study with them.

Your participation in the study is voluntary. Today, you will be asked to sign a consent form for the examination. As a participant in the study, you have the right to withdraw your consent at any time without affecting your rights or the responsibilities of the investigators. All information collected for this study will be strictly confidential. Only the researchers will have access to your answers, and the results published from the study will not include your name or any information which could identify you. You may discuss your participation in the study with another person, and you may choose to have another person present during the study. You also have the right to ask the researchers any questions about the study or your participation before you sign the consent form.

Appendix 11 Optical mark-sense forms used for SADLS examinations

In order to conform with binding margins, the following pages have been photo-reduced by a factor of 85 per cent from the original A4 paper format.

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SOUTH AUSTRALIAN DENTAL LONGITUDINAL STUDY
BASELINE ORAL HEALTH AND DENTURE ASSESSMENT

NAME: _____

EXAMINER 0 1 2 3 4 5 6 7 8 9 REPEAT ○

EXAMINATION TIMES

START hrs	START min	FINISH hrs	FINISH min	DATE day	DATE mth	DATE year
0	0	0	0	0	0	91
1	1	1	1	1	1	92
2	2	2	2	2	2	93
3	3	3	3	3	3	94
4	4	4	4	4	4	95
5	5	5	5	5	5	96
6	6	6	6	6	6	
7	7	7	7	7	7	
8	8	8	8	8	8	
9	9	9	9	9	9	

RECORDER 0 0 / 1 1 / 2 2 / 3 3 / 4 4 / 5 5 / 6 6 / 7 7 / 8 8 / 9 9

CLINIC 0 0 / 1 1 / 2 2 / 3 3 / 4 4 / 5 5 / 6 6 / 7 7 / 8 8 / 9 9

SERIES

CARIES ○

PERIO ○

DENTURES

	UPPER	LOWER
DENTATE	Y N	Y N
DENTURE	F P NI Np	F P NI Np
HYPERPLASIA	○	○
STOMATITIS	○	○
CHEILITIS	○	○
ULCERATION	○	○
OTHER LESION	○	○
MATERIAL	P L S	P L S
DEFECTS	S L M	S L M
RETENTION	○	○
STABILITY	○	○
OCCLUSION	○	○
TREATMENT NEEDED	F P B / Rp RI A	F P B / Rp RI A
TREATMENT WANTED	F P B / Rp RI A	F P B / Rp RI A

ORAL MUCOSAL TISSUE EXAMINATION

Actinic keratosis ○
Acute Necrotizing Ulcerative Gingivitis ○
Amalgam tattoo ○
Angular cheilitis ○
Pseudomembranous Candidiasis ○
Erythematous Candidiasis ○
Cheek/lip biting ○
Erythroplakia ○
Frictional white lesion ○
Galvanic white lesion ○
Gingival hyperplasia ○
Herpes labialis ○
Herpetic gingivostomatitis ○
Leukoplakia, homogenous ○
Leukoplakia, non-homogenous ○
Lichen planus ○
Mucocele ○
Nevus ○
Nicotinic stomatitis ○
Papiloma/warts ○
Recurrent aphthous ulceration ○
Smokeless tobacco, Deg 1 ○
Smokeless tobacco, Deg 2 ○
Smokeless tobacco, Deg 3/4 ○
Fissured tongue ○
Geographic tongue ○
Hairy tongue ○
Median rhomboid glossitis ○
Non-specific tumor ○
Ulcer, non-specific ○
Unknown ○
Other diagnosis ○

CPITN SUMMARY (OFFICE USE)

X 0 1 2 3 4	X 0 1 2 3 4	X 0 1 2 3 4
17 – 14	13 – 23	24 –27
47 – 44	43 – 33	34 – 37
X 0 1 2 3 4	X 0 1 2 3 4	X 0 1 2 3 4

SOUTH AUSTRALIAN DENTAL LONGITUDINAL STUDY
BASELINE CORONAL AND ROOT CARIES

ID: 0 1 2 3 4 5 6 7 8 9 (×5 rows)

NAME: _____

EXAMINER 0 1 2 3 4 5 6 7 8 9 REPEAT ○

EDENTULOUS:
UPPER JAW (M) (Rr)
LOWER JAW (M) (Rr)

		8	7	6	5	4	3	2	1
UPPER RIGHT 1	MISSING / REPLACEMENT	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)
	PRESENT	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)
	CROWN SURFACES 0	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)			
	CROWN SURFACES M	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES B	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES D	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES L	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	ROOT SURFACES M	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES B	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES D	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES L	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	TOOTH TREATMENT	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)
		(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)
	OCCLUSAL ATTRITION	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)
UPPER LEFT 2	MISSING / REPLACEMENT	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)
	PRESENT	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)
	CROWN SURFACES 0	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)			
	CROWN SURFACES M	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES B	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES D	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES L	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	ROOT SURFACES M	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES B	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES D	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES L	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	TOOTH TREATMENT	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)
		(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)
	OCCLUSAL ATTRITION	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)
LOWER LEFT 3	MISSING / REPLACEMENT	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)
	PRESENT	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)
	CROWN SURFACES 0	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)			
	CROWN SURFACES M	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES B	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES D	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES L	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	ROOT SURFACES M	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES B	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES D	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES L	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	TOOTH TREATMENT	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)
		(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)	(Ec) (Ep) (Ed) (C)
	OCCLUSAL ATTRITION	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)	(E) (D) (S)
LOWER RIGHT 4	MISSING / REPLACEMENT	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)	(M) (Rr) (Rl) (NS)
	PRESENT	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)	(S) (C) (RD) (RS)
	CROWN SURFACES 0	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)			
	CROWN SURFACES M	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES B	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES D	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	CROWN SURFACES L	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)	(F) (Fu) (D) (R)
	ROOT SURFACES M	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES B	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES D	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	ROOT SURFACES L	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)	(F) (Fu) (D) (R) (S)
	TOOTH TREATMENT	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)	(R1) (R2) (R3) (R4) (P)

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ID:

0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9

SOUTH AUSTRALIAN DENTAL LONGITUDINAL STUDY
BASELINE PERIODONTAL ASSESSMENT

NAME: _____

EXAMINER	REPEAT
0 1 2 3 4 5 6 7 8 9	○

HEART DISEASE	Y N
PROSTHESIS	Y N
BLEEDING	Y N
EXCLUDED UPPER	○
EXCLUDED LOWER	○

		8	7	6	5	4	3	2	1
UPPER RIGHT 1	GINGIVITIS	X G	X G	X G	X G	X G	X G	X G	X G
	MESIAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	MESIAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	BUCCAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	BUCCAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	DISTAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	DISTAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	CPITN	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
UPPER LEFT 2	GINGIVITIS	X G	X G	X G	X G	X G	X G	X G	X G
	MESIAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	MESIAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	BUCCAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	BUCCAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	DISTAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	DISTAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	CPITN	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
LOWER LEFT 3	GINGIVITIS	X G	X G	X G	X G	X G	X G	X G	X G
	MESIAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	MESIAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	BUCCAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	BUCCAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	DISTAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	DISTAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	CPITN	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
LOWER RIGHT 4	GINGIVITIS	X G	X G	X G	X G	X G	X G	X G	X G
	MESIAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	MESIAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	BUCCAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	BUCCAL CALCULUS & POCKET	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4	C X 5 10 / 0 1 2 3 4
	DISTAL RECESSION	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4	X – 5 10 / 0 1 2 3 4
	DISTAL CALCULUS	C X 5 10	C X 5 10	C X 5 10	C X 5 10	C X 5 10	C X 5 10	C X 5 10	C X 5 10

CHAPTER 9. BIBLIOGRAPHY

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