Strategies for effective antenatal education for socio-economically disadvantaged women

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Definition of Key Terms

Antenatal education - an intervention or tool that provides health information and health promotion relating to pregnancy.

Applications (Apps) - a computer software program that can be web-based or downloaded to be used locally on a mobile device.

Artificial intelligence - a computer system that performs tasks that normally requires human intelligence. With the use of algorithms, artificial intelligence can have visual perception, speech recognition and decision making capabilities.

Body Mass Index (BMI) - a way to estimate body fat using height and weight (divide weight in kilograms by the square of the height in metres.

Cognitive function – internal mental processes that enables perception, memory, thinking, problem solving and decision making.

Cognitive behavioural therapy – a treatment that can help to self-identify negative thoughts or behaviours.

Cyber – relates to the culture of computers, information technology and virtual reality.

Cyberbullying – messages sent via digital technology that are threatening or intimidating.

Digital technology – electronic tools, systems or devices that can generate, store and process data.

Digital platform – a computerised program that has the capability of communicating and exchanging information, goods and services between producers and consumers.

Engagement – interacting with and effectively communicating.

Gamification – an application with elements of a game.

Health Literacy – the ability to access, read, understand and act upon health information to enable appropriate decision making in relation to one's health, wellbeing and treatment.

Ludification - a term that encompasses aspects of gaming that delves into the lives of users on a social level.

Multiparous – a woman having birthed more than one child.

Nulliparous – a woman who has never birthed a child.

Obesity – a state of being grossly overweight (BMI $\geq$ 30).

Perinatal – definitions vary- the period of time from conception to 1 year after the birth or from 20 weeks gestation to 4 weeks after the birth.

PowerPoint presentation – a series of slides that communicate information via a computer, television or other digital device.

Primiparous – a woman having birthed one child.

Search engine – a data base that corresponds with key words by the user to find websites on the World Wide Web.

Self-efficacy- refers to one's confidence and ability to exert control over their own behaviour, motivation and social state.

Socio-economic Index – scores that reflect income, occupation for the evaluation of lifestyle status.

Social media – websites and applications that are used to create and share information on a social interactive level.

Technological literacy – refers to the familiarity of digital technology and one's ability to access, acquire and communicate effectively within it.

Wifi- refers to the wireless internet connection of digital technology

Key Words

Antenatal education, health literacy, socio-economics, disadvantage, digital technology, pregnancy applications (apps), waiting room education, TV education.

Abstract

Background

Antenatal education and pregnancy-related health information can be delivered in several forms. However, women living in disadvantaged circumstances can have difficulties engaging with it. Since the inception of digital media, pregnant women have demonstrated interest in using this medium for health education. However, it is unclear if disadvantaged women can easily access and engage with digital media to obtain accurate information related to their pregnancies. In addition, there remains speculation as to the effectiveness of digital media for antenatal education. The purpose of this research work was to determine whether digital media is the most effective medium for health education in socially disadvantaged women.

Methodology

Data from a prospectively recruited pregnancy cohort attending a tertiary public hospital in the northern suburbs of Adelaide, South Australia (STOP study; n=1300 nulliparous women) were used to characterise the social wellbeing, mental health and physical health issues affecting this disadvantaged antenatal population. Digital media use by health professionals (n=40) was assessed and barriers for the use of technology explored using qualitative methods. Two new antenatal digital education interventions were developed and then trialled in the population of pregnant women; an android digital mobile application (the Health-e Babies App) (n= 100) and a PowerPoint presentation for use in the antenatal clinic waiting room (n=102) using both qualitative and quantitative methodologies.

Results

Of the STOP Study participants, the Socio-Economic Index (SEI 29, Decile 1 in Australia) indicates this population is amongst the most socially disadvantaged in the country. In relation to mental health, 32% (n=416) reported high risk Antenatal Risk Questionnaire scores, 30.1%,

(n=382) medium to high anxiety and 46.9% (n=590) high levels of perceived stress during pregnancy. In addition, pre-conception binge alcohol consumption and drug abuse was reported by 14.1% (n=183) of participants while dietary intake did not meet the recommended dietary guidelines before or during pregnancy.

The Health-e Baby study cohort preferred face-to-face education with a health professional in combination with digital technology. However, 50% (n=20) of midwives had reservations about the use of digital media as a means of antenatal education.

Women who completed the Health-e Baby Study (n=30) reported that they really liked the app. During the 10 week trial women accessed the app 18 times on average, with a mean length of time per episode of 5.7 min. The inability for some participants to complete the study (n=70), enabled the exploration of probable causes and the development of strategies to encourage engagement with apps in the future.

In relation to the PowerPoint presentation, 86.3% (n=88) reported they watched it, 59.8% (n=61) stated that they learned new information and 45.4% (n=40/88) recalled the information. This suggests that this form of waiting room education has the potential to effectively inform given sufficient exposure time.

Conclusion

Disadvantaged pregnant women want relevant, hospital specific, research-based information via multiple media. Face-to-face with a healthcare provider and digital media are their preferred options. However, tailoring information to the specific needs of individuals is required for the socio-economically disadvantaged.

Declaration

I, Julia Anne Dalton, certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

I acknowledge that copyright of published works contained within this thesis resides with the copyright holder(s) of those works. I also give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

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Published Literature and Conference Presentations from this Thesis

Published Literature

1. **Dalton, JA**, Rodger, DL, Wilmore, M, Skuse, AJ, Humphreys, Roberts, CT, Clifton, VL:
   "The Health-e Babies App for antenatal education: Feasibility for socially disadvantaged women' PLOS one, 2018 **50 citations**

2. **Dalton, JA**, Rodger, DL, Wilmore, M, Skuse, AJ, Humphreys, S, Flabouris, M, Clifton, VL: *'Who's Afraid?: Attitudes of Midwives to the Use of Information and Communication Technologies (ICTs) for Delivery of Pregnancy-Related Health Information.'* Women and Birth, July, 2014 **41 citations**

3. Wilmore, M, Rodger, D, Humphreys, S, Clifton, VL, **Dalton, J**, Flabouris, M, Skuse, A: *'How midwives tailor health information used in antenatal care',* Midwifery, June 2014 **28 citations**

4. Rodger, DL, Skuse, AJ, Wilmore, M, Humphreys, S, **Dalton, J**, Flabouris, M and Clifton, VL: *'Pregnant women's use of information and communications technologies to access pregnancy-related health information in South Australia'*, Australian Journal of Primary Health, 5 Sept 2013 **97 citations**

5. A Skuse, D Rodger, M Wilmore, S Humphrys, **J Dalton**, V Clifton: *'Solving 'wicked problems' in the app co-design process'*, Convergence: The International Journal of Research into New Media Technologies, 2020

Conference Presentations

1. Dalton, JA, Rodger,D, Leemaqz, S, Dekker, G, A, Roberts, C, Clifton, VL:
   'Struggling to survive: Factors affecting pregnant women living in disadvantaged circumstances that limits their antenatal education'
   March 2019- PSANZ 23rd Congress, Gold Coast, Queensland (Oral presentation)

2. Dalton, JA, Rodger, D, Leemaqz, S, A, Roberts, C, Clifton, VL:
   '*A midwife's approach: Strategies to reduce anxiety for improved perinatal outcomes'*
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3. Dalton, JA, Rodger,D, Wilmore, M, Humphreys, M, Skuse, A, Roberts, C, Clifton, VL:
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5. Dalton, JA, Rodger,D, Wilmore, M, Humphreys, M, Skuse, A, Roberts, C, Clifton, VL: '*The Health-e Babies App for antenatal education: Feasibility for socially* disadvantaged women'
   April 2017 Perinatal Society of Australia and New Zealand Conference- Canberra (Poster)

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   Nov 2016 Robinson Research Institute Symposium- Adelaide (Poster)

7. Dalton, JA, Rodger,D, Wilmore, M, Humphreys, S, Skuse, A, Roberts, C, Clifton, VL: '*Challenges associated with the introduction of a pregnancy mobile application for pregnant women in a socially disadvantaged population: A pilot trial'*
   Sept 2016 Florey Research Institute Symposium- Adelaide (Poster)

8. Dalton, JA, Rodger,D, Wilmore, M, Humphreys, S, Skuse, A, Roberts, C, Clifton, VL: *'Challenges associated with the introduction of a pregnancy mobile application for pregnant women in a socially disadvantaged population: A pilot trial'*
   March 2016 HDR Seminar- University of Adelaide (Oral presentation)

9. Dalton, JA, Rodger,D, Wilmore, M, Humphreys, S, Skuse, A, Clifton, VL:
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12. Dalton, JA, Rodger,D, Wilmore, M, Humphreys, S, Flabouris, M, Skuse, A, Clifton, VL: *'The 'Health-e Babies App: Evaluating the clinical effectiveness of a smart phone application to compliment antenatal healthcare'*
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    24-26 Sept 2014 Aust College of Midwives- Qld Branch Annual Conference- Gold Coast, Qld (Oral presentation)

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    'Smart pregnancy: Exploring the potential of smart phone applications to improve health outcomes during pregnancy in a disadvantaged South Australian population'
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16. Dalton, JA, Rodger,D, Wilmore, M, Humphreys, S, Flabouris, M, Skuse, A, Clifton, VL
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17. Dalton, JA, Rodger,D, Wilmore, M, Humphreys, S, Flabouris, M, Skuse, A, Clifton, VL
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Knowledge is power. When it comes to health and wellbeing, the more you know, the more empowered you feel and have the ability to change behaviour. Anxiety may not be extinguished but it can be contained. Nursing and midwifery is as much about informing and educating as it is treating, healing and supporting. My passion for educating pregnant women through a variety of ways has been a strong thread that has been woven throughout my career.

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Chapter Outlines

Chapter 1 comprises of a literature review to examine socio-economic disadvantage, health literacy, health information seeking behaviour and behaviour change. In addition, a variety of media for antenatal education is also explored. This provided an understanding of women's preferences of receiving pregnancy related health information as well as barriers and enablers to information seeking, access and behaviour change.

Chapter 2 characterises nulliparous pregnant women attending the study hospital, using data from the STOP Study. This was done to understand their health status and social circumstances that may affect their ability to seek health information, learn and change behaviours. In addition, it assists in the development of pregnancy health interventions.

Chapter 3 comprises of a publication arising from this research that reported on the opinions of the health professionals caring for the pregnant women at the study hospital. It discusses their views on the use of digital media in healthcare and health education and the barriers of its use for pregnant women as well as themselves.

Chapter 4 examines the use of an Antenatal Education PowerPoint presentation developed for the waiting room of the antenatal clinic at the study hospital. It evaluates the intervention for its usefulness and effectiveness.

Chapter 5 discusses the development of the Health-e Babies App. It includes data collected and collated from focus groups and downloaded data from the app during and after the development of the app.

Chapter 6 comprises of the publication arising from the development of the Health-e Babies App. This paper examined the use of the app and highlighted issues such as engagement and barriers to its use.

Chapter 7 is the final discussion and outlines future research considerations and recommendations generated from this thesis.

CHAPTER 1

Literature Review

1.1 Introduction

Socio-economically disadvantaged communities generally have poorer maternal and neonatal health outcomes [1, 2]. Therefore, access to health information, healthcare and support for healthy behaviour is imperative. Disadvantaged populations have greater difficulties in accessing information which reduces their ability to change behaviour for optimal physical and mental health [3]. Furthermore, health knowledge does not equate to having the ability to change behaviours [4] thus, effective strategies to achieve health literacy and behaviour change are necessary. The effectiveness of health education interventions are reliant on being easily accessible and engaging, in addition to being easily understood [5]. However, the most effective way to convey health messages and educate women experiencing disadvantaged circumstances is uncertain.

Pregnancy and childbirth are life changing events; physically, emotionally and psychologically. For first time mothers in particular, there is the fear of the unknown [6] with some claiming not to know what they need to know about pregnancy and childbirth [7]. The provision of antenatal education and pregnancy-related health information is necessary for women to prepare for pregnancy, childbirth and parenting [8]. The empowerment of women during pregnancy is important to enable a sense of control over their pregnancy, health and lifestyle choices [9]. Being health literate can help to provide this sense of empowerment [10]. Pregnancy is also a time that can affect lifestyle and dietary change for the whole family thereby effecting generational change. So pregnancy is a particular life event for healthcare providers to make a significant impact with health promotion strategies.

This thesis explores the importance of health literacy and behaviour change for pregnant women living in socio-economically disadvantaged circumstances. It seeks to identify barriers and enablers to education in the context of disadvantage and understanding of the elements of disadvantage that affect a person's ability to engage in antenatal health education and becoming health literate. Antenatal education and health promotion methods are examined to assess their degree of effectiveness in improving health literacy, resulting in positive behaviour change. Several different media are utilised to impart health information but each has its limitations and pitfalls. It is unclear as to the most effective way to reach, educate and motivate lifestyle change in the disadvantaged. Whilst there has been a shift from traditional methods of antenatal education to digital media, there remain concerns about accuracy, reliability and safety of information from the internet and mobile applications (apps). The accessibility and utilisation of digital media amongst disadvantaged women is questioned. Thus, it is imperative that this research be conducted.

1.2 Socio-economic disadvantage

Socio-economically disadvantaged communities are categorised by three main factors; income, education and employment [11]. Education is major indicator of low socio-economic status (SES), particularly as a lack of education can have a cascading effect leading to low paid employment or unemployment, thereby affecting income [12]. Less education also leads to poorer literacy and health literacy. Low income reduces the ability to purchase a home, food and access healthcare.

To compound this, there is social stigma attached to communities recognised for its socio-economic disadvantage that supports a perpetuation of disadvantage [13]. A persons' identity

with a particular community can limit their social interactions, affect their mental health as well as their employment prospects, thereby their ability to afford a comfortable lifestyle [13].

Other factors associated with low SES includes higher rates of single parenthood, mental health issues, drug and alcohol abuse, domestic violence and limited access to healthcare and community support [14-16]. All of these factors can interconnect and have a significant impact on healthy behaviours and health outcomes.

The most recently published Australian National Health Survey for 2017-2018 (https://www.abs.gov.au/australianhealthsurvey) showed that people experiencing the most disadvantage, had the highest incidence of chronic disease. For women of childbearing age (18-44 years of age) between 40-60% (depending on age group) were in the obese category, with a significantly greater proportion being in the most disadvantaged. Obesity is associated with metabolic diseases and increased perinatal risks [1, 17-21]. Perinatal risks include an increased risk of preeclampsia and gestational diabetes mellitus (GDM) and there is also the potential to affect future health with an increased risk of type 2 diabetes and cardiovascular disease [18]. People living in disadvantaged circumstances are more than twice as likely to suffer psychological distress, experiencing more depression and anxiety relative to those of higher SES. In addition to this, those most disadvantaged also have higher rates of cigarette smoking even though prevalence is decreasing in those aged 18-24 years in the general population.

The association between SES and health can vary within communities due to factors such as ethnicity, age and gender and it is considered that SES in early childhood can influence health in adulthood [12, 22]. One study found that there is a significant 3-way association between

"adverse childhood experiences" (such as child abuse, incarceration of a parent, domestic violence, exposure to drugs and alcohol by a parent, dysfunctional family environment), low SES and poorer health in adulthood [23]. Depression and anxiety, tobacco and drug abuse, obesity and binge drinking have shown to be significantly elevated [23]. Exposure to adversity, such as poverty, abuse and psychological trauma, can affect cardiovascular, metabolic, immune and mental health [24].

The trauma of colonisation, marginalisation, racism, violence and forced removal of children, particularly amongst Australian Aboriginal and Torres Strait Islander people, can be passed on inter-generationally affecting all aspects of their life [25, 26]. Physical and psychological effects of trauma limits their ability to find employment, access to housing and healthcare, therefore more likely to be living in disadvantaged circumstances [25].

It is vitally important that we break the cycle of poverty and the effects of low SES so as not to perpetuate poor health from one generation to the next [27]. This is a major challenge for all societies [2]. Some studies have shown multi-generational and trans-generational effects of low SES, environmental and health issues impacting on the health of children [28-30]. Drug and alcohol abuse can have epigenetic effects on future abuse and addictive behaviour for generations to come [30]. In addition, early onset (<55 years of age) hypertension significantly increases the risk of hypertension in children and grandchildren [31]. It is not just shared genetics but also poor living conditions, poor diet, lack of role models can lead to the perpetuation of disadvantage [27]. Therefore, it is in the community's interest to address these health issues. However, financial constraints can impact on the ability to access health information [32, 33] and enact behaviour change [34].

If positive behaviour change can be made through education and promotion of a healthy lifestyle before, during and after pregnancy then perhaps negative health cycles can change and provide optimal health and wellbeing for generations to come.

1.3 Health Literacy

Health literacy can be defined as the ability to understand health information that enables decisions and actions to be taken to change behaviour for improved health outcomes [5, 35-38]. It is more than simply being able to read and write. Health literacy involves a set of skills and can vary between individuals [38]. These skills include the ability to access health information, a level of motivation for the individual to seek this information and then have the cognitive ability and confidence to use the information effectively for improving their health [39, 40]. Poor literacy skills are also seen as a potential 'risk factor' for poor health [40].

1.3.1 Health literacy's link with health outcomes

Studies have shown a close association between health literacy, SES and health outcomes [2, 41, 42]. Low health literacy can delay access to healthcare and health information for a variety of reasons, including failure to recognise symptoms that require treatment, fear of embarrassment and shame, plus a poor understanding of the health system and how to navigate it. These all impact health outcomes [41]. However a systematic review on health literacy and health literacy interventions reported whilst some interventions have improved dietary choices and anxiety, there was limited evidence of them improving health outcomes [43].

Individuals with low health literacy living with chronic disease are particularly at risk. With poor ability to self-care, they are less likely to manage their medication correctly (e.g. the

effective use of inhalers for asthma management or calculate doses of insulin according to blood glucose levels in diabetes mellitus) and identify changes in health status [41, 44] which results in poorer health outcomes. Thus improving health literacy is extremely important to achieve optimal health outcomes for the individual and also the community.

1.3.2 Improving health literacy

When initiating health education, it is important to understand an individual's numeracy and literacy and their current health knowledge [40]. Health information/communication needs to be 'tailored' to the individual's needs and communicated in a way that suits them. It requires information that is relevant to the age of the person, their health status and current circumstances [40]. To enable behaviour change, the individual may require negotiation and support to make healthy lifestyle changes.

There are various models and literacy tools to assist educators. The "Health Literacy Tapestry Model" consists of 4 areas of health literacy; verbal, written and environmental communication plus engagement, empowerment and activation (grouped as one area) (Appendix 1.1) [45, 46]. It highlights the competencies needed for each area of education to ensure effective health education is achieved, thus health literacy improved.

In addition, a questionnaire utilising 'Nine Dimensions of Health Literacy' creates literacy profiles through competencies and experiences (Appendix 1.2)[39]. This tool can help to determine how best to assist the individual in attaining health literacy and behaviour change.

The nine dimensions reflect an individual's ability to use the health information effectively and can explain why some individual's health literacy is better than others when they are given

exactly the same information. If an individual lacks competence in any of these 'dimensions', their ability to make good decisions and effectively change behaviour is altered. A person doesn't have to be able to read and write to be health literate. They need to have the ability to access information in a way that is understandable to them as well as have supportive people, communities and systems to enable effective change and a positive healthy environment to sustain this change [39].

Verbal patient and family education should not be the sole means of teaching [47]. Education requires written material that complements and reinforces the verbal information. The EDUCATE model for verbal education was developed to assist healthcare providers educate patients (Appendix 1.3) [47]. This model explains the need to understand the audience; recognising cultural and linguistic diversity, their current level of knowledge, what their learning needs are, how they prefer to learn and barriers to learning. However this model requires face-to-face contact with two-way communication, which is not always possible or desired by some women [48].

Those with low socio-economic status, limited education and diminished cognitive function are more likely to have poor health literacy [46]. However, those with high levels of literacy can also experience poor health literacy at times of high anxiety. This has been demonstrated by difficulties in recalling information or understanding complex instructions by well-educated individuals [46, 47, 49]. Highlighting that psychological issues having the potential to affect health literacy.

1.3.3 Health literacy and mental health status

Anxiety can affect verbal information both positively and negatively [49]. Memory can be enhanced by higher anxiety but extreme anxiety can result in poor retention of information. Mental health issues can affect organisational skills, concentration, motivation, tiredness as well as disruptions with coping mechanisms [50]. The ability to participate in educational activities is also an issue, thus mental illness can negatively affect learning, literacy and health literacy.

A study in the United States of America (USA) concurs that mental illness can disrupt cognitive functioning such as memory, the ability to focus and ignore external or environmental distractions [51]. In addition, the medications required to manage mental illness often cause further cognitive decline, making it more difficult to learn and retain information. Thus, mental health can have a significant effect on engagement with learning, understanding and capacity to change behaviour. This can then lead to the inability to manage or prevent other health issues.

1.4 Health- information seeking behaviour

Pregnant women often want to be empowered and participate in their decision making which can be a driving force to seek health information [9, 52]. Motivation for seeking health information is possibly at its peak during pregnancy. Women become motivated to become more aware of their body and health needs during pregnancy because they recognise their responsibility for the health and development of their fetus [53, 54]. These women actively seek information to learn about pregnancy and to improve their lifestyle by quitting smoking and alcohol consumption, as well as following a healthy diet and exercise program. However, this is not always the case with women living in disadvantaged circumstances as their focus may be on other aspects of their life rather than the pregnancy [48]. They may not know how to access

information nor how to change their lifestyle or habits. They may not understand why it is so important. This group of women can be seen as more vulnerable particularly if they do not have sufficient family or social support compounding their risk of poorer health outcomes [55].

'Wilson's Model of Information-Seeking Behaviour' [56] adopts the assumption that "information-seeking behaviour is influenced by the individual's needs (such as their work and personal life) and intervening variables" (such as their environment, demographics, interpersonal relationships, mental health and access to information) [56, 57]. These variables can enable access to information, as well as become barriers.

Some research has shown that women prefer a variety of sources to access pregnancy-related health information as it enabled them to compare and verify information. However, health professionals were their first choice as they believed the information they provided was more accurate and relevant to them as individuals [57].

There has been a growing trend towards the use of the internet for health information in preference to paper-based literature, especially for younger women with high SES, higher level of education and digital technology experience [58]. It has been argued that those of low SES are being further disadvantaged by the increasing use of digital health information due to their limited access, presumed to be due to financial constraints [58]. Women of low SES have been found to prefer family and friends to gain pregnancy information plus face-to-face discussions with other mothers for peer group for support and advice [58, 59].

Multiparous women were less likely to seek nutritional pregnancy-related information due to their previous knowledge [60]. Other studies concur that women in their first pregnancy were more likely to seek pregnancy-related health information [57, 61, 62]. Therefore, pregnancy experience plays a factor in the information sought and the greater the need for information, the greater the seeking of information [59].

1.4.1 Barriers to information-seeking behaviour

It is important to understand what prevents or reduces an individual's ability to seek information and to what extent SES acts as a barrier. As discussed above, low literacy can be a barrier to seeking information as it reduces the confidence to access information that may be difficult to read and understand [63]. The disadvantaged may have numerous issues that can distract from information seeking behaviour such as interpersonal concerns, domestic violence, housing issues, financial limitations and mental health issues [16, 63]. Women can lack motivation and if time is limited, they may want information any time of the day or night, reducing their options [64]. Furthermore some women find that too much information creates added stress and anxiety and therefore shy away from seeking health information [65].

Barriers to seeking health information, reported by low income pregnant women, included low access to information via mass media such as television, radio and internet based media [57]. Limited family and friend support also prevented women from asking questions and seeking advice. In addition, women who had greater need for information and with fewer barriers, were more likely to actively seek information and engage more effectively [57]. This is congruent with the 'Nine Dimensions of Health Literacy' previously discussed, in that the fewer barriers and more competence within each dimension, contribute to greater ability to access information and utilise resources [39].

1.4.2 Socio-economic status and accessibility to health information

Financial constraints can prevent women from seeking health information, such as internet access and the purchase of paper-based literature [32, 33]. Whilst one study reported no significant difference between SES of women regarding their access to health information via the internet [66], other studies disagree [57, 58]. Therefore, the impact of SES and which aspects of low SES on digital technological use remains unclear. Is it the affordability of internet access, low level of literacy due to poor education, a lack of motivation to learn, domestic violence preventing access or a low level of knowledge in digital technology? Specific socio-economic details are missing in these reports.

Another study showed that people with low income often had technological literacy issues as well as frustration with internet connection and connectivity [67]. With some families only affording one digital device, the problem of other family members also using the internet, creates a barrier. Public libraries exist throughout Australia, enabling free access to the internet and paper-based literature albeit within library opening hours. Whilst this may negate some arguments about finances being a barrier to seeking health information, the question of whether or not those with low levels of literacy and/or technological literacy would use a library for internet access needs to be considered.

1.5 Behaviour Change

The main aim of providing pregnancy-related health information, is to promote a healthy lifestyle and be a driver for change. However, it is well known that accessing information does not equate to behaviour change, therefore understanding motivation for change is important.

1.5.1 Motivation for behaviour change

Self-efficacy motivates healthy behaviour change [4]. The interaction between self-efficacy and health literacy is needed to enable behaviour change. Many interventions fail to engage disadvantaged women and the Capability, Opportunity and Motivation Behaviour (COM-B) model has been utilised to understand behaviour (Appendix 1.4) [68, 69]. Each domain of the COM-B model has attributes that interact with each other to create behaviours. Drivers of behaviour can have either a positive (enabler) or negative (barrier) influence. For example, when discussing abstinence of smoking throughout pregnancy, good knowledge of the risk of harm increases psychological capacity to effect change. Having a belief that smoking causes physical harm is also a positive capability. However, if there are doubts about the level of risk of smoking, then it reduces psychological capability. The social opportunity can also have a positive or negative effect depending on an individual's social support. If family members have strong views and support the woman not to smoke, then she is more likely to change to a positive behaviour. However, shaming and stigmatising smoking during pregnancy may cause the woman to hide her smoking from others, thus the environmental opportunity is negative.

The development of behaviour interventions should consider the social and environmental opportunities [68]. Engaging in positive and supportive social networks can assist in positive behaviour. Knowledge, confidence, partner support and expert support are vital for changes in addictive behaviour (smoking and alcohol use), as well as for learning practical pursuits such as breastfeeding [68]. Thus single women with minimal or no friend and family support are less likely to have the capacity to enable behaviour change [70].

1.5.2 Understanding 'risk' and its motivation for behaviour change

A woman's perception of her degree of risk in developing medical complications during pregnancy can affect her decision making and motivation in accepting medical recommendations [35]. Therefore, if women have an inadequate understanding of their health risks, they may choose a potentially harmful direction for themselves and their babies. For instance, if they do not understand the importance of diagnosing gestational diabetes mellitus (GDM), the degree of risk they have in developing it and its perinatal consequences, they may choose not to have the diagnostic test. This is an example where health literacy is vital for understanding the possible consequences of not having diagnostic tests and treatment.

1.5.3 Barriers and enablers to behaviour change

Fatigue associated with balancing family and work pressure is a known barrier to maintaining a healthy lifestyle for women who are pregnant and new mothers [64, 71]. First time mothers have felt guilty going to a gym to exercise due to their feelings of responsibility towards their children and placing them 'first', hence not wanting to spend time away from them [71]. Work hours, family commitments, tiredness, costs associated with attending a gym were considered barriers to exercise. However physical activity, such as walking, does not have to cost anything and can be incorporated into their daily lifestyle. Barriers to eating a nutritious diet also consisted of tiredness, a lack of time due to the needs of their children and the perception that the cost of buying fresh produce regularly was unaffordable at times [71].

Barriers and enablers for lifestyle change during pregnancy, have been categorised as emotional, interpersonal, cognitive, environmental and physiological [53]. Emotional barriers included low motivation or preference to cook or exercise because they don't like it, as well as making pregnancy an 'excuse' for not exercising. Interpersonal barriers were having family or

work commitments that left little time to exercise or to focus on cooking [53]. Physiological reasons included medical complications or chronic health conditions, as well as being too tired. Cognitive barriers were identified as a lack of knowledge (how to cook or what constitutes a healthy diet and safe exercise) and concern for the developing fetus and not knowing what is required for a healthy baby [53]. Constraints to healthy eating also included the perception of not having time to prepare food and cook, therefore frozen or pre-prepared foods and fast foods were more often consumed [70].

1.5.4 Financial constraints and healthy behaviour

Income has been identified as affecting women's ability to change behaviour and focus on their health [53]. Low income can effect affordability of regular healthy meals for women and their families [70]. It is arguable that the cost of a wide variety of fruit and vegetables is impossible for disadvantaged communities [72, 73]. A South Australian study reported that low income families would be more likely to try to save money on food rather than other things and consume less healthy foods such as high energy dense diets and fast foods [74, 75]. However, another study reported that Australians were spending more on unhealthy food than healthy food and that it was not simply a matter of income that affected diet [76]. A health promotion strategy that includes budgeting and setting a healthy eating plan could assist disadvantaged communities greatly [73].

There remains conjecture over the ability to balance the budget to incorporate a healthy eating and exercise plan during pregnancy. Financial constraints can be used as an excuse for poor lifestyle habits when there may be other aspects of life that could affect achieving a healthy lifestyle.

The disadvantaged recognise that affordability of fresh produce and its perishability impacted on their ability to maintain a healthy diet [34]. Individuals living on a very tight budget do not often act upon health promotional strategies regarding the future benefits of a healthy diet, as the future was not their main concern. They needed to eat today, with the money they have today. Sometimes healthy food is seen as a luxury but perhaps women simply need some guidance in this area.

The concept of focussing health promotion strategies amongst low income families that also assists them in budgeting, food selection and meal preparation is one consideration. However, the nature and effects of their social environment may be more of a challenge for some women to enable them to focus on behaviour change. They may not be the cook in the household and have little say into what is being prepared for meals, thus family members may need to be included in this education.

1.5.5 Social support and behaviour change

Enablers to behaviour change were seen as knowledge about how to be healthy, self-belief in achieving change and positive peer-pressure and family support [53]. Constant reassurance and support by health providers is beneficial to encourage continuing positive behaviours. It has been suggested that a challenge for health professionals was to include the woman's support network in education about diet and exercise in pregnancy as they would more likely succeed with behaviour change [53]. However, it is noted that some friends and family can provide negative influences by encouraging unhealthy behaviours such as fast foods, drugs and alcohol [70]. Lack of support from a partner can also act as a barrier [70].

1.5.6 Expectations of weight management in pregnancy and low SES

Pressures of weight gain and weight management in pregnancy by family, friends and health professionals, is one that causes guilt, anxiety and angst for some women [60]. These perceived pressures can result in negative responses, thus the refusal to comply with 'paternalistic norms' of diet and exercise regimes. An Australian study investigated the move from education interventions towards regulations to address the increasing rate of obesity [34]. It was reported that assumptions are often made about the socio-economically disadvantaged having 'self-inflicted' obesity due to their ignorance about healthy eating. In this view, knowledge equates to healthy behaviours; higher social class means higher education therefore less obesity. One would therefore expect no obesity amongst those with higher SES, which is known to be an incorrect assumption.

Those who are well educated with a higher income sometimes stigmatise those less fortunate with perceptions that ignorance and lack of knowledge caused obesity. It has been suggested that those on welfare payments should be forced to attend healthy eating classes to enable them to receive their welfare payment [34]. This view negates many systemic issues that may influence diet and lifestyle factors.

Thus it is sometimes considered that education based interventions are ineffective in reducing obesity and that addressing social issues is also required [34]. Financial struggles and other personal priorities of life and motherhood can compete with any desire to act upon health messages and manage obesity [77].

1.5.7 Perception of 'motherhood' and its impact on behaviour change

The concept of 'motherhood' and one's belief as to what it means, can lead to active information seeking behaviour and behaviour change thus, being a 'good mother' meant change of behaviour to a healthier lifestyle [60]. Therefore women's sense of responsibility to provide for their fetus and children motivated them to seek information [60, 77], therefore health professionals should take advantage of this time in their life to promote health and wellbeing. Dietary modifications during a first pregnancy extended to family members, thus reflecting a positive change within the family unit [60].

Therefore, it is evident that there are many individual innate, social and financial reasons for failing to follow healthy diet and lifestyle recommendations. How to address apathy or the conscious decision not to comply with recommended guidelines and achieve optimal health and wellbeing remains a puzzle.

1.6 Antenatal Education

An examination of the different forms of health promotion interventions and antenatal education is necessary to assist in identifying women's preferences, the utility and effectiveness of these media. Knowledge of potential pitfalls that may be encountered are important when developing an antenatal health promotional intervention. Antenatal education has been traditionally via paper-based literature, group/class settings [48] in addition to one-to-one information during antenatal appointments by the doctor or midwife.

1.6.1 One-to-one education

Appointments with healthcare providers enable an opportunity to educate pregnant women, particularly as the information can be tailored to the woman's specific needs. It is an opportunity for healthcare providers to quickly identify the woman's level of literacy and health literacy through two-way conversation and attempt to provide information in a way that is understandable to them. Unfortunately antenatal appointment times are often too brief to gain an understanding of the individual's literacy and health literacy, and provide sufficient information and support for behaviour change and prepare for birth [60, 78]. However, the 'continuity of care model' creates a better relationship between the woman and healthcare provider, enabling the woman to feel able to discuss her pregnancy, birthing options and develop a birth plan in an emotionally supportive environment [78, 79].

One-to-one education has been shown to significantly improve women's knowledge of healthy food options, exercise and feeling reassured about the health of their baby and own health and wellbeing [80]. This could suggest that one-to-one education has the potential for on-going confidence in continuing healthy behaviours. However, antenatal appointment times are barely sufficient to assess a pregnant woman's health status and progress of pregnancy, leaving no time to educate them effectively for behaviour change [60, 78]. Specific separate education opportunities are required on top of the usual antenatal appointments.

1.6.2 Waiting room education

Pregnancy-related information provided in hospital or clinic waiting rooms include leaflets, booklets, posters and television presentations [32, 36-38]. They provide an avenue for opportunistic education. However, very few studies have been conducted on the effectiveness of waiting room education.

1.6.2.a Paper-based literature

Some women prefer to read books and leaflets to gain information about pregnancy and childbirth and consider these to be very useful [48]. A randomised controlled trial for the promotion of influenza vaccination via pamphlets and posters in general practitioners (GP) waiting rooms failed to have a positive impact on vaccination rates [81]. The study concluded that it was the degree of motivation by the doctor to promote vaccination to patients that had a greater impact. A combination of paper-based literature and a conversation with the health professional may be more effective.

Multilingual information about pregnancy is limited in Australia, thus the ability to provide paper-based literature to non-English speaking/reading women is often not achieved [82, 83]. This highlights a large deficit in antenatal educational materials. An Australian website, (www.mhcs.health.nsw.gov.au), provides written material for numerous health education needs in multiple languages. However, pregnancy and childbirth information is limited and the contact details are for New South Wales only, with the exception of the Australian Breastfeeding Association's helpline that has a national phone number. Also, much of the information lacks updating. Another Australian website (www.mcwh.com.au) provides access to a multilingual online library, including videos, however it too has localised content that may exclude its relevance to a broader Australia.

A study conducted in Melbourne, Victoria, reported that culturally and linguistic diverse (CALD) women preferred written literature but there was insufficient written information [83]. Whilst the Royal Women's Hospital in Melbourne was reported to provide 150 online fact sheets in 29 languages, there was limited pregnancy-related information and it was not

identified how many women actually read them. Whilst the report stated that many women sought the internet for information, the websites they accessed was not identified. It was suggested that the non-English speaking/reading women did not seek information as readily as English speaking/reading women [83].

1.6.2.b Television based education

The use of audio-visual equipment in waiting rooms such as televisions with video/dvds or PowerPoint presentations is a relatively new way to capture the attention of people in waiting rooms [84-86]. It is seen as a good way to engage with patients and their relatives/carers and has the potential to become a motivational tool for behaviour change [87, 88]. However, discussion with a health professional about the information presented was seen to effect change rather than the presentation itself [87]. It is possible a TV presentation in the waiting room has the potential to begin conversations with doctors and midwives about specific topics as do the paper-based literature and posters.

1.6.3 Antenatal Classes

Antenatal classes have been utilised for decades as a means of providing information and education to prepare women and their partner for childbirth [89, 90]. During the 1950's to 1970's, antenatal education was developed with a focus on reducing fear of labour and pain of childbirth, followed by a focus on the experience of childbirth, partner involvement and how to have a more positive experience in the 1980's to 1990's [6]. Since the 1990's, empowerment, developing coping strategies and decision-making were a priority. Today the model has become one that focusses on healthy lifestyle, self-confidence, family support and self-efficacy. However, antenatal class content is predominantly focussed on birthing and parenting late in the pregnancy, relying on other methods of education for early pregnancy information. Class

content is largely dictated by the person conducting the class and there is a risk of not fulfilling the needs of individuals if the educator does not allow for flexibility of content and provide an avenue for consumers to guide the educator in what they want to learn [6]. Some warn that the content of antenatal classes has the potential to encourage compliance with the hospital expectations and the medicalisation of antenatal and intrapartum care by educators who provide information that has been "censored"[91].

The attendance at antenatal classes can be varied [92]. A main strength of antenatal education classes was identified as the facilitator, who is able to provide educational resources and answer questions face-to-face [48, 93]. Better preparedness for birthing, improved recognition of problems and ability to seek care with minimal delay have been reported [93]. It seemed that the discussion between healthcare providers and pregnant women in a group setting assisted in better recall of information and perhaps increased the woman's empowerment and ability to self-care [93]. Also classes have the ability to reduce pregnancy and childbirth related anxiety and the potential to give women greater confidence in their ability to cope with labour and birthing [94].

However, other women consider classes to be "boring", they dislike the class environment and are fearful of graphic videos of birthing. This suggests that there was a lack of information about antenatal classes and benefits women may experience by attending [48]. There is sometimes a sense of being told what to do and how it should be done by 'over-enthusiastic' class participants that is off putting [48].

A Swedish study reported that women who did not find antenatal classes particularly helpful, were more likely to be younger, of single marital status, less educated and smoked before and

during the pregnancy compared to those who found the antenatal classes to be useful [92]. This suggests that women more ‘at risk’ of problems in their pregnancy failed to engage effectively in the class setting.

Development of relationships with other new parents is seen as an important way to create a social support network and assist with parenting confidence [48, 92]. Classes also offer peer mentoring whereby women who had already experienced birthing and parenting could engage with the class attendees and discuss their experiences and what they could expect as a new parent.

Studies have shown some positive effect of group antenatal education but the most ‘at risk’ groups often fail to engage with this mode of education. Disadvantaged groups were thought to benefit more from one-on-one education due to their ability to be more flexible to meet the individual’s needs [95]. However, group settings can provide a supportive environment for learning and relationship building with other pregnant couples. It is possible the introduction of digital media can also provide important information for antenatal education and will be the focus of this thesis.

1.6.4 Digital media

Digital media can be defined as information and communication that can be transmitted over internet and computer networks, such as websites, blogs, mobile apps and social media [96].

A qualitative study into the use and value of digital media for the provision of pregnancy-related information, identified nine characteristics that women wanted; immediate, regular, detailed,

entertaining, customised, practical, professional, reassuring and unbiased information [97]. The main search engine used by participants was ‘Google’ and they liked the ability to type in questions and they would instantly get numerous response options. This was done not simply to get a quick answer but to avoid having to ask a health professional who may think their question was trivial and unimportant.

Women enjoyed receiving messages, newsletters and snippets of information ‘fed’ to them via websites and apps without having to keep looking for information. Social media updates on local community group activities, baby products and news items were also valued. Media sites that created a sense of fun and enjoyment were important to many women, encouraging greater engagement [97].

Apps or websites that enabled a degree of customisation through accessing information about local parenting groups, childcare and hospital information were considered useful to some women. It created more relevance to them personally. Participants enjoyed how ‘Youtube’ provides practical explanations of how to do things via video but greatly appreciated the professional input by health professionals and organisations such as the Australian Breastfeeding Association [97].

It has also been reported that women would appreciate the ability to talk ‘live’ online to a midwife or other health professionals to discuss issues to reduce any anxieties they may have [97]. The concept of talking ‘live’ online with a health professional creates the question as to whether health professionals want to or have the capability of talking ‘live’ online.

Apps and websites offer women the opportunity to enter data for tracking the fetus, their own health, videos and self-help tips. They also offer regular notifications. All of these were found to be useful and provide enjoyment. However, some women were cautious regarding online information particularly those associated with commercial businesses, suggesting a possible hidden agenda by these companies [97].

1.6.4.a Internet/web-based education

Women access websites to reduce their anxiety and fears about pregnancy and childbirth as well as providing them with some knowledge to assist in their decision making [98, 99]. They want reliable and relevant information in an instant, any time of the day or night and the internet is often the most accessible place to find it [64, 97, 100]. However, the easy availability of the internet does not necessarily constitute quality, research-based information [35] nor is it necessarily produced by a health professional [101]. It can be argued that misinformation may endanger the life of the reader, should they not be sufficiently discerning in their assessment and understanding of this information nor able to verify its accuracy and personal relevance with a health professional. Fast and easy access to information is desirable but can be hazardous by creating ideas of what is 'truth' and what is an 'untruth' with the potential of giving false expectations of health outcomes [101]. Internet websites by their nature, cannot take into consideration the specific needs of individuals including their current health status, lifestyle and behaviours, accessibility to healthcare and support networks when they read their information [102].

Women use internet forums and social media to gain ideas and practical advice regarding pregnancy and parenting [103, 104]. Commercial sites are attractive due to competitions that award prizes and because they are often more user-friendly compared to non-commercial sites.

However, there is awareness of the motivation of commercial organisations to capture their attention for their financial gain. This has led some women to not always trust websites nor social media [103]. Websites recommended by a health professional were trusted. The information that is sought on the internet and apps are basic facts about pregnancy and parenting, with the option to seek further information by way of being 'sent' to another website. Women like easy-to-read information, quizzes and games as a means of learning and regular alerts or notifications pertinent to their stage of pregnancy. They want to assess their own health and be given information about diet and exercise to improve their health status. Women want "facts not opinions", reassurance as to their health and progress and to know where they can seek community support if needed [103].

Some reports young women (aged 18-23 years) seeking health information from a healthcare provider and family rather than the internet [105], suggesting that young women's interest in internet-based information would increase during specific life changing events such as pregnancy. Those with higher income and tertiary education are seen to be more inclined to utilise the internet, probably because for their familiarity and confidence with the technology. However, others have reported that some disadvantaged communities do not use the internet for health information, preferring family and friends to share their experiences [106]. Pregnant women have complained of conflicting information from the internet, health professionals, family and friends that created confusion [60]. These issues indicate there is a need for the consistency of evidence based information that targets pregnant women and their extended families.

Accuracy and reliability of website information

Concerns of accuracy and reliability of health information on the internet has been raised by health professionals, as well as consumers [60]. The evaluation of internet sites is important to understand the accuracy of information for users. Scientific information and resources have been found to provide the most accurate and reliable data compared to news commentary and commercial websites [107, 108]. Many websites were noted to lack readability in their articles thereby creating difficulties for the general public to understand and discern accuracy and reliability [108]. This is congruent with other studies [109, 110].

One study identified that most of the pregnancy-related information on websites was "fairly accurate and but not uniformly accurate", reporting that search engines used to answer questions, presented some websites with inaccurate information [111]. In this study, 71% of participants reported having discussions with their healthcare provider about the information they found on the internet and 60% used this information in decision making. Many decisions were made using the internet information without consultation with their healthcare provider [111]. This would suggest that healthcare providers need to advise or guide pregnant women to the most accurate and relevant websites to seek information.

Patterns of internet use

Understanding when women seek online pregnancy-related health information and the type of information is important when developing an education intervention.

The timing of the commencement of antenatal care can influence their information seeking behaviour [99]. Australian guidelines recommend the commencement of antenatal care in their

first trimester (https://www.health.gov.au/resources/pregnancy-care-guidelines/summary-of-recommendations-and-practice-points), thus enabling education to commence via face-to-face appointments, paper-based literature and information regarding appropriate websites. However education at this time is highly dependent on the healthcare provider in regards to the information they provided.

Internet searches to seek further information when positive fetal anomalies are identified, have been made to assist in understanding of the conditions, treatment and prognosis [112]. Medical websites have been seen to become influential in decision making due to their reliability[61]. However it is questionable as to whether or not those with low levels of literacy can understand these medical sites. Furthermore, users should be warned that the internet should not be an alternative for informed medical advice [99]. In addition, internet users with low literacy skills may be overwhelmed by the extensive amount of health information on the internet, thereby not knowing where to find relevant and accurate sources of information[67]. The use of mobile pregnancy apps provides short bursts of information rather than a long read and therefore may more likely draw the attention of users.

Health professionals should be aware of mobile apps and internet websites [113]. These sites should be evaluated to enable health professionals to confidently refer them to pregnant women.

1.6.4.b Mobile Applications

Mobile applications (apps) are used extensively throughout the world to access, learn, store and share information about pregnancy. How women learn and benefit from them is of interest to help establish their needs and wants.

App access and use

In Australia, women often use more than one pregnancy app [114, 115]. They seek regular reassurance that their pregnancy is progressing well and know how their baby should be growing and developing.

Studies have suggested that websites and apps are easily accessible to the disadvantaged [103] with apps being preferred by women of 'younger' age, who are nulliparous, more highly educated and recommended by a health professional [52], particularly if it was initiated and tailored by their healthcare provider [61].

However if a digital app utilises too much data space on the phone, the use of an internet search engine via a computer may be more easily accessible for low SES women by not overloading their phone's storage capacity [116]. In a review of pregnancy apps available via the google app store, twenty-nine apps (38.2%) required internet access to enable their use, so this can be prohibitive for women with low income as they may not be able to afford to access it [117]. Their use may only be available in a free 'wifi' zone. Therefore, apps need to be developed to reduce the need for internet access to enable their reach to disadvantaged populations.

Apps and culturally and linguistically diverse

Lower income and non-English speaking women are less likely to use a pregnancy app while CALD women often face difficulties due to differences between Western approaches and their own culture [118] making them seem less relevant for culturally diverse groups [119].

App content, features and quality

Pregnant women want to know what is happening to their fetus and if what they are experiencing is normal. They seek information about fetal development, maternal physical changes and general health information [114], weight, sleep, diet and exercise, emotional status and social life [64].

Few commercially available apps rate well in terms of quality information [117]. This could suggest a lack of input by health professionals and/or a low emphasis on quality information during the developmental phase of the app. If the apps were not developed to actually provide quality educational information, one must ask the purpose of the app, particularly those that enable in-app purchases.

Cognitive behavioural therapy mobile apps have the potential to enhance the relationship between user and healthcare provider, with these apps mostly tracking behaviour and symptoms, as well as providing information about cognitive behavioural therapy techniques [120]. However, they failed to have any involvement or integration with healthcare providers or the health system, thus denying its full potential to build on the patient and healthcare provider relationship.

Apps that enable questions and diary entries to remind women what to ask their healthcare provider as the next appointment has been popular [121]. The promotion of self-efficacy when problems arise with information about health issues and how to deal with them have also been useful. Fetal movements and uterine contractions can also be self-monitored, suggesting that smart phone apps can create ‘expert’ mothers through tracking and monitoring features [121].

Apps have been categorised as informative, interactive, tools and social media [122]. Informative apps provide pregnancy facts, information about diet and offer advice, however have the potential to cause anxiety [122]. Informative apps provide pregnancy facts, information about diet and offering advice, however, have a greater potential to cause more anxiety than reduce it. Informative apps are not personalised. Interactive apps permit data to be entered by the user to enable the app to provide information relevant to the user's gestation, such as fetal development and maternal physical changes and procedures. Tool apps consisted of kick counters, fetal heart detectors and level of fetal acidosis which were highly likely to cause extreme worry and concern for the user or alternatively provide false reassurance. Social media apps provide the ability for users to share fetal/baby photos, develop a network with other mothers and provide information to medical services. Consumers have rated interactive apps as the most popular [122].

Interactive computerised educational tools have been found to significantly increase knowledge compared to other educational strategies, regardless of the user's educational status, health literacy or technological experience [123]. Some suggest that eHealth interventions that provide personalised or tailored information to an individual user was more likely to increase the level of engagement [124].

Women can expect a lot from apps, sometimes utilising them instead of a health professional with expectations of immediate answers to health questions. The use of artificial intelligence (AI) that generate responses via individualised algorithms from data that the user entered is wanted [125]. For example, if the user entered their blood pressure into the app, the user wanted a response such as "your blood pressure is high today, so this is what you can do to lower it…".

This can place the woman and fetus at greater risk if the AI is not set up to appropriately advise women to seek medical assistance. Therefore, unless AI is developed with health professional involvement and up to date research based information, this type of app could prove extremely dangerous.

Engagement with apps

As previously highlighted, pregnant women trust the information provided and recommended by health professionals [52]. If a health app does not meet the needs of the consumer or is too difficult to use then they will not engage with it [126]. Language used on the app must be acceptable for those with low literacy and be meaningful for the user giving them a sense of improving their health and answering questions. Hedonic motivation is an important aspect to the on-going engagement with an app [126] as the degree of enjoyment obtained when using an app will affect how often it is used. Therefore gamification in an app can improve user engagement by enhancing the experience of using it [127].

1.6.4.c Games for education

The definition of 'ludification' is an act of deception or making a mockery (www.merriam-webster.com) but in the realms of digital media, ludification is a term that encompasses aspects of gaming that delve into the lives of users and is a "social and cultural phenomenon" [128]. The term describes play as part of one's daily routines. Gamification occurs when elements of game design such as video are incorporated into an app in a non-gaming context [128, 129].

It is thought that gamification can effect behaviour change and, in health, this can be used to improve health literacy, gain confidence and improve the user's ability for self-help [130]. This

type of app can improve emotional state, changing negative feelings to positive feelings [130]. Therefore, perhaps women experiencing depression, anxiety or living with domestic violence may feel more positive or learn ways to cope through a specific gamified app that is designed to assist them in this way.

Gamification apps follow a set pathway where the user moves through various levels to achieve rewards [130] (Appendix 1.5). There is a component of social support within the app as the user progresses. However, studies have reported high drop-out rates, despite supposedly offering an enjoyable experience [131-133]. Cognitive behavioural theory has also been used in gamified apps but evidence to support its effectiveness in educating and changing behaviour is inconclusive [132, 133].

Young people of reproductive age in particular, are likely to engage well with a gamified app and healthcare providers can monitor progress with user positive behaviours and assess their ability to self-care [134]. However, there are dangers of some gamified apps that can have serious negative impact on women by exploitation, misinformation and stereotyping women [129]. Whilst not every woman is naïve and vulnerable, concern was raised during pregnancy for young women, relating to their ability to be astute to the dangers of stereotyping and exploitation [129].

Regulations and accountability of apps

There are concerns regarding the lack of regulation of the content of online apps and how inaccurate information can increase health risks [117]. In addition, stereotyping and body image issues are a major concern for the wellbeing of women [129] and should be taken seriously by

regulatory bodies. These risks are concerning and a cause for angst by health professionals [122]. A lack of accountability by app developers needs to be addressed [117].

Cyber safety

Vulnerability and personal data safety is not always considered by pregnant app users. Thus, the personal safety of the information women unknowingly offer online via pregnancy apps or internet interactions is uncertain. Participants in an Australian study [114] did not seem to seek validity or credibility of the information on the app nor were they particularly concerned about cyber safety despite the app having the ability to gather personal information that may be accessed by unknown sources.

One study on pregnancy apps reported that only eight apps stated their affiliations with organisations/companies [117]. Thus, the concern here is, who is gathering information on users by their failure to disclose? This highlights a pitfall in antenatal education via the internet and apps. However, any real threats remain very unclear.

1.6.4.d Social media

Social media such as Facebook groups, Twitter and Youtube are very popular with the current childbearing generation. The content of social media is often user-generated, meaning that information posted is produced by a user rather than a professional body [135]. This can distort the perception of origin of the information between professional and layperson and open the doorway to inaccuracies and misconceptions.

Many women like the ability to communicate with other women and share experiences combined with the concept of having a chat room for pregnant women with a health professional providing accurate information [125]. However, others expressed discomfort with communicating online with other pregnant women due to concerns of bullying and the creation of a sense of 'drama'. Yet they enjoy social media to overcome geographical distance with relatives and close friends [136].

'You-tube' videos were seen to have a great potential for education, by its ability to demonstrate procedures or birthing practices but the information is often flawed [110]. Inaccuracies and conflicting information exists.

Multiple social media platforms are used to gain pregnancy-related health information [108, 137]. Health topics sought are pregnancy, childbirth, newborn care, newborn growth and development, breastfeeding, healthy living, sleep and anxiety and depression. Social media platforms are seen to expand their network of friends and reduce feelings of isolation. In addition, blogs are accessed to communicate with other mothers about pregnancy [137]. These media can be quite effective as a health promotion tool and the inclusion of fathers could also influence the health and wellbeing of the family.

Whilst information about pregnancy is also sought, creating an online community to discuss pregnancy and gain psychological support is important for many [121]. There has become a culture with the utilisation of social media and 'birth boards' to discuss personal experiences, yet there is concern that this discussion can incorporate medical information that may or may not be appropriate nor accurate [138]. Personal experiences that are clouded by the authors own

beliefs, misinformation, societal expectations of what the perfect labour and birth should be, can create anxieties for new mothers.

Women often seek other women experiencing the same issues; some for emotional support and advice; others for further information and treatment options [139]. Web-based forums have increased participant's health literacy and awareness of the risks to their health and enable the confidence to approach health professionals for healthcare and empowerment over their body and self-care. In addition, women like to share personal experiences of pregnancy and learn from others [140]. However, acceptance of material as trustworthy was more often due to the number of 'likes' and not necessarily explaining the correctness of the information.

The reliability of health information on social media can be questionable when it consists of 'crowd-sourced thinking' and collaboration with lay health consumers [135]. The creation of an online social network that presents and discusses health information through their own analysis of what is accurate can lead to their own creation of 'truth'. However, it does not mean it is reliable or correct. How much of this can women with low literacy and health literacy skills recognise as correct?

1.6.4.e Technological literacy

The relationship between health literacy and internet access, suggests that those with 'adequate levels' of health literacy were most likely to access health information via internet websites [33]. However, a person needs to be skilled in using the technology and not just have access to it. Disadvantaged populations are more likely to be lacking in digital technological skills, therefore be less likely to engage effectively with them [141]. Encouragement and support in

the use of digital media by health professionals will assist better usage by disadvantaged women and increase their confidence in seeking health information [63, 141].

1.6.4.f Health professional attitudes to digital media accessed by pregnant women

Midwives and doctors have been warned of the potential 'disaster' effects of using social media in healthcare, risking their professional identity when discussing health issues with consumers [142, 143]. In addition, midwives have expressed concern regarding inaccurate information on websites accessed by pregnant women. However, most considered that pregnant women were better informed by the internet, with some midwives feeling professionally challenged and pressured to keep their knowledge and expertise up to date [144]. Whilst concerned about accuracy of information on websites, many midwives and doctors do not recommend accurate, evidence-based websites [144, 145]. Perhaps doctors and midwives are unsure as to which websites they should recommend pregnant women.

1.7 What is known

Health professionals are in the best position to provide accurate and relevant information needed in an understandable and engaging way. However, there can be disparity in the information that health professionals consider important for women to know and what women actually need and want to know [7]. Thus, it is important to discuss with women their individual needs. Identifying how women prefer to engage with antenatal education is vital if behaviour change is necessary and also for relieving pregnancy anxiety. If a woman does not like to engage with a particular medium, then she won't be motivated to use it. There can also be a fine balance between providing information in a way that seems "too pressured" with that which is not too ineffectual for behaviour change [68].

Women will choose whatever media they want at any given point in time, depending on what is accessible and the sites they consider to have reliable and accurate information.

Antenatal education classes can offer social engagement with other couples, as well as being a learning environment. However, classes conducted in the 3rd trimester of pregnancy fail to address aspects of healthy lifestyle that could and should have been implemented early in the pregnancy. Consequently, women are either forced to seek information themselves preconception and in 1st and 2nd trimesters of pregnancy, if they know where or how to access it, or alternatively not seek it at all. The inclusion of family and friends who have experienced pregnancy and childbirth is an obvious choice for first time mothers, as they are usually easy to reach out to. However, this can be fraught with inaccuracies of information.

Digital technology offers a broad spectrum of media to the masses and is increasingly popular with its ease of access. However, it lacks individualised health information and cultural variation of pregnancy-related information, thereby limiting its use by some groups of women. Digital media also requires a level of technological literacy to enable effective engagement, again limiting some potential users [141].

Svensson, Barclay [146] reported ten years ago that women and their partners highly valued interaction with other couples having already experienced childbirth and parenting during their antenatal classes. Perhaps this can be assimilated to the new phenomenon of couples using social media and internet blogs to learn of others' experiences [8]. The relaying of personal experiences and sharing of information has moved on from the class setting to the internet and the relationships that can be built online. Whether this is a positive change for society is unclear

but it is happening and health professionals need to acknowledge this shift to ensure safety for women and accuracy of imparted information.

Health professionals should accept the challenge of being a curator of information exchange; informing, moderating chat rooms and validating or negating information seen on websites. It is vitally important that educational tools be developed with input by health professionals and that ethical considerations are taken into account so as not to send the wrong messages that could harm the user, mentally, emotionally or physically. Barriers to access information and education need to be eliminated to ensure the disadvantaged are not prevented from utilising it.

Whilst many women seek information from the internet and apps, this is not always their first choice. It seems evident that whilst there is a major shift to seeking online pregnancy-related health information, all other forms of education still have a place in our society for women of all SES.

1.8 Gaps in knowledge

Several gaps in knowledge have been identified that will be addressed in this current thesis. These include the role health professionals play in accessing and recommending internet and mobile app use to pregnant women.

The current literature suggests that digital technology could be a means of improving health literacy for pregnant women in conjunction with antenatal care but there is very little information about its use in an Australian context. The impacts that mental health and social

disadvantage have on the accessibility and feasibility of digital antenatal education needs further exploration.

Technological/digital literacy is often assumed by information and communication technology developers, as well as health professionals. Whilst mobile digital technology is ubiquitous, it is unclear whether or not everyone knows how to use it effectively, especially disadvantaged women.

1.9 Hypothesis

This project hypothesises that:

1. Health professionals believe there is too much misinformation in digital technology and are hesitant to encourage its engagement.
2. A TV presentation in the clinic waiting room can improve health literacy and access to healthcare.
3. Disadvantaged pregnant women prefer mobile digital technology to access pregnancy-related health information.
4. Disadvantaged pregnant women are frequently consumed by social and mental health issues, affecting their ability to engage effectively in antenatal education and pregnancy-related health information for positive behaviour change.

1.10 Aims

1. To characterise pregnant women birthing at the Lyell McEwin Hospital (LMH).
2. To understand the digital literacy of health professionals at the LMH.

3. To assess the feasibility (in terms of usability, usefulness and frequency of engagement) of a pregnancy app specifically for pregnant women attending the LMH.
4. To assess the usefulness of a TV presentation in the antenatal clinic waiting room.

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CHAPTER 2

Characterisation of pregnant women attending the Lyell McEwin Hospital

2.1 Introduction

An effective education intervention requires the provision of information that is relevant and tailored to the needs of the target audience [1] with respect to their demographics, such as socio-economic status, level of education attained, age, employment and marital status [2, 3]. If the intervention lacks relevance, then the target audience is unlikely to engage with it. In particular, when behavioural change is an aim of the intervention, gaining an understanding of the lifestyle, nutritional status, exposures and behaviours is vital.

This chapter characterises nulliparous pregnant women who attend the study hospital. This information can provide valuable insights into the health and welfare of the target population that can assist in the development of a relevant and effective educational intervention. The study site, the Lyell McEwin Hospital (LMH), is situated in a northern suburb of Adelaide, South Australia. Whilst this tertiary metropolitan hospital accommodates most of the high risk healthcare needs of the mid-north regional areas of South Australia, the main catchment area encompasses 2 local councils; the Salisbury and Playford City Councils.

The Social Health Atlas of South Australia (http://data.sa.gov.au) reported the status of residents within these council areas (Table 2.1). These data show that around one third of families have just one parent within the household, thus limiting the family income. Around 26% of mothers with children aged 15 years or younger, completed year 10 or less schooling thus limiting their level of literacy and numeracy. This limits their employment opportunities and financial security. Furthermore, the long-term unemployment rate is between 8.1% (Salisbury) and 11.4% (Playford). Financial hardship across the communities is evident with of 15.3% - 23.2%) of families relying on welfare payments. Smoking during pregnancy (15.5% Salisbury - 24.1% Playford) and psychological distress (18.1% Salisbury– 22.1% Playford) are

also reported to be high. The type or cause of the psychological distress has not been identified in the Atlas data.

Table 2.1 Salisbury and Playford Councils- Social data

	City of Salisbury Council	Playford City Council
Single parent families with children under 15 years	26.7%	36%
% of children (under 15 years) where the mother achieved year 10 or below or did not attend schooling	24%	28.8%
Female sole parent pensioners	5.8%	9.8%
Long term unemployment	8.1%	11.4%
Families with children and with low income, welfare dependent	15.3%	23.2%
% children in families with low income, welfare dependent	35.2%	45.3%
Smoking during pregnancy	15.5%	24.1%
People with psychological distress (modelled estimates 2014-2015)	18.1%	22.1%

The perinatal statistical data collected by the South Australian Pregnancy Outcomes Unit in 2017 (http://sahealth.sa.gov.au) reported a higher rate of teenage mothers and Indigenous women attending the LMH compared to the state average (Table 2.2). Whilst the obstetric complication rate is higher than the state average, the report does not identify the co-morbidities and all obstetric complications specifically for women birthing at the LMH. The percentage of infants with low birth weight (<2500 g) was less than the state average. This is most likely due to pregnant women birthing at less than 32 weeks' gestation, being transferred to another hospital prior to birthing and neonatal care, as the LMH does not have a neonatal intensive care unit. The perinatal outcome data does not identify the number of maternal transfers to a higher acuity hospital for preterm births or fetal abnormalities.

Table 2.2 Perinatal Statistics Lyell McEwin Hospital 2017 compared to state data

Maternal data	**LMH n= 3689 n (%)**	**South Australia n= 19117 n (%)**
Indigenous women	155 (4.2)	(3.8)
Teenage mothers	114 (3.1)	(2.1)
Women ≥ 35 years of age	557 (15.1)	(21.7)
Primiparous	1343 (36.4)	(42.0)
Obstetric complications	1822 (49.4)	(43.9)
Gestational Diabetes		2638 (13.7)
Pregnancy Hypertension		1371 (7.1)
Intrauterine Growth Restriction		1010 (5.3)
Labour complications	1343 (36.4)	(36.0)
Birth Outcomes	**LMH n= 3732 n (%)**	**South Australia n= 19,407 (%)**
Birthweight <2500 g	228 (6.1)	(7.3)
Preterm birth (<37 weeks)	276 (7.4)	(9.6)
Neonatal Intensive Care (This does not include antenatal transfer to a Level 6 hospital)	37 (1.0)	(3.3)

Aboriginal and Torres Strait Islander (Indigenous) women birthing at the LMH come from many regional areas of South Australia and not just the local council areas. This is largely due to medical co-morbidities that exacerbate or increase the risk of complications during pregnancy, hence requiring tertiary healthcare.

There are significant disparities in socio-economics and health between Indigenous and non-Indigenous Australians [4]. The rate of homelessness in Indigenous Australians is three times greater than for non-Indigenous [5]. Poverty within the Indigenous population is accompanied by chronic disease, higher rates of pregnancy complications, higher child mortality rates, poorer literacy due to limited education and consequent restricted employment opportunities. There are also higher rates of incarceration for this population [5, 6]. The South Australian perinatal outcomes data also show a significantly higher rate of preterm births in Aboriginal women (19.1%, n= 143 compared to 9.6%, n= 1373 Caucasian) and stillbirth is more common (1.6%, n=12 compared to 0.6%, n=80 Caucasian) (http://sahealth.sa.gov.au).

Whilst the atlas of mental health conditions in South Australia (http://phidu.torrens.edu.au) reports that an estimated 45.5% of the population experience mental health issues at some time during their life, it does not report their long term impact nor their association with other social and health issues. Indigenous Australians' experience transgenerational negative effects of colonisation, dispossession and racism that cause anxiety for many and can have an ongoing effect on their lifelong emotional and psychological wellbeing [6, 7]. These can also affect the willingness of indigenous Australians to engage with mainstream healthcare [6].

With the exception of a small area in the southern suburbs of Adelaide, the Playford and Salisbury City Council regions were reported to have more than twice the rate of adults over 20 years of age utilising community mental health services than the rest of the Greater Adelaide region (http://phidu.torrens.edu.au). Presentations for 20 – 65 year olds at emergency departments for mental health issues during 2013-2014 (most recent data) were seen largely from those living in the Lyell McEwin Hospital catchment area. Teenage girls aged 15 – 19 years within these council regions are more likely to suffer from anxiety and mood related disorders. Substance abuse, schizophrenia and anxiety disorders were the primary mental health issues for admission to hospital for women of child-bearing age during 2012-2013. In addition to this, it was reported that the largest proportion of developmentally vulnerable children in South Australia reside in the Salisbury and Playford City Council areas.

In 2008, Edwards, Galletly [8] reported on the mental health of pregnant women who attended the LMH for their antenatal care. Of the 421 participants, it was noted that 35.6% (n=150) of pregnant women reported they were abused as a child, 34.9% (n=147) of women suffered major life stressors, 24.5% (n= 103) had thoughts of self-harm and 30% (n=126) of pregnant women

were diagnosed with depression during their antenatal care. These women were considered to be a very vulnerable group with limited social supports. Whilst some participants did not answer questions regarding drug and alcohol use, there was still a high level of drug (n= 19, 5.4% of 351 participants), alcohol (n=70, 20.3% of 345 participants) and tobacco (n=143, 35.3% of 405 participants) use reported [8]. Another more recent study conducted at LMH on asthma in pregnancy and its association with depression and anxiety, reported that 44.9% (n=85) participants had a history of depression and anxiety [9]. Of these 85 women, 87.5% (n=70) self-reported a high Antenatal Risk Questionnaire (ANRQ) score and 18.8% (n=15) had a high Edinburgh Postnatal Depression Score (EPDS) [9]. Interestingly, this study found that women with poorly controlled asthma during pregnancy were more likely to have mental health issues than those who had good asthma control. Whilst exacerbations of asthma during pregnancy could not be specifically linked to high anxiety, the ability to manage asthma effectively seemed to be compromised by anxiety.

One study reported that 54% (n=193) of participants in a LMH cohort (n= 352) had asthma with 38% (n= 136) having a history of any type of anxiety disorder [10]. Whilst this cohort's anxiety symptoms remained steady throughout pregnancy, their physical Health Related Quality of Life (HRQoL) decreased but mental HRQoL improved as the pregnancy progressed. In contrast, other studies have shown changes in anxiety and depression throughout the trimesters of pregnancy, with less anxiety during the 2nd trimester compared to the 1st and 3rd trimesters [11, 12]. However, the causal mediators of anxiety during pregnancy may be a factor in how and when anxiety symptoms present over time.

The data provided by the health atlases, perinatal statistics and other studies are extremely useful in gaining a generalised view of women attending the LMH. However, to enable a targeted approach for the development of a pregnancy-related health literacy intervention for

women attending the LMH for antenatal care, further investigation and analysis of the lifestyle, mental and physical health of a contemporary cohort can provide additional valuable information.

2.2 STOP Study

The STOP study (**S**creening **T**ests to predict poor **O**utcomes in **P**regnancy) was conducted between 2015 and 2018. The aim of this project was to validate algorithms developed from the SCOPE study (SCreening Of Pregnancy Endpoints, 2004-2011) [13, 14] for the prediction of major pregnancy complications in nulliparous women. In my role as research midwife on the STOP Study, I sought to measure the degree of disadvantage and its effect on maternal and neonatal outcomes. Both the SCOPE (n=1164 at LMH, and n=5628 over 6 centres and 4 countries including Adelaide) and STOP projects were conducted at the Lyell McEwin Hospital. The STOP Study provides a snapshot of the degree of disadvantage, health, lifestyle and social issues relating to women having their first baby.

2.2.1 Hypothesis

Pregnant women attending the Lyell McEwin Hospital have significant health and social issues that are known to affect their pregnancy and general wellbeing.

2.2.2 Aim

1) To understand the health status and the social issues that characterise pregnant women attending the Lyell McEwin Hospital for their antenatal care.

2.2.3 Methodology

The STOP project was a prospective cohort study that involved recruitment of nulliparous pregnant women and the paternal partners (where possible) at their first antenatal appointment, between 9 and 16 weeks' gestation. Exclusion criteria included twin pregnancy and pre-existing medical conditions that would be expected to increase risk for pregnancy complications e.g. medicated hypertension and type 2 diabetes. Quantitative data was collected via questionnaires and haemodynamic and physical assessment. Informed consents were obtained, including consent to enable access to the medical records data for mother and baby.

Ethics approval for the STOP Study was obtained from the Women's and Children's Health Network (WCHN) Human Research Ethics Committee, approval number HREC/14/WCHN/90 (Appendix 2.1).

2.2.3.a Study protocol

The STOP Study protocol (Appendix 2.2) required participants to complete various questionnaires at the time of recruitment (9-16 weeks' gestation) to assess their mental health status, domestic violence, fertility, diet and exercise (Appendix 2.3). Haemodynamic data (electronic blood pressure measurement, non-invasive monitoring of pulse wave velocity, augmentation index and measures of arterial stiffness), physical measurements (height, weight, waist, hip and head circumferences) and biospecimens (blood, urine, saliva) were also collected. Paternal partners who consented to participate also completed a questionnaire, provided blood or saliva specimens and had blood pressure, height, weight, waist and hip measurements taken. Around half of the women were met again between 32 and 36 weeks' gestation and given the same diet, mental health and domestic violence questionnaires as at the time of recruitment, with blood, urine and haemodynamic data collected again. Birthing, maternal and neonatal outcome data were collected via review of the medical records.

The New Zealand Socio-economic Index Scale (SEI) was used to identify the level of socio-economic disadvantage [15, 16] and to enable comparisons with the multi-centred SCOPE study data. This scale is based on occupation to measure socio-economic status with the belief that there is a relationship between the level of education and financial income and applied to census data. Occupational scores and socio-economic scores are calculated to identify socio-economic position. Part-time employment and understatement of income for self-employed workers are adjusted in their calculations. A low score in the Index of Relative Socio-Economic Disadvantage (IRSD) indicates high disadvantage. Council areas are divided into 10 equal sized groups (Deciles 1-10) according to their level of advantage with the lowest number 1, being the lowest level of advantage and rankings across the state and country are made from poorest to highest SEI (www.abs.gov.au).

In the examination of mental health status, the Antenatal Risk Questionnaire (ANRQ) was administered at the time of recruitment, reflecting life experience of mental health issues, social supports, physical, sexual and emotional abuse. A score of 23 or greater is considered high risk for mental health concerns [17]. In addition to this, the Edinburgh Postnatal Depression Score (EPDS) [18, 19], State Trait Anxiety Inventory (STAI) [20] and Perceived Stress Score (PSS) [21] were used to understand current levels of depression, anxiety and stress. Higher scores indicated greater depression, anxiety and stress.

The lifestyle questionnaire administered at the initial appointment and then at around 34 weeks' gestation consisted of domestic violence, dietary and physical activity questions (Appendix 2.2). Questions about domestic violence included the frequency of the violence (never, once, 2-5 times and $\geq$ 5 times) and identification of the perpetrator (partner, ex-partner, family, friend,

stranger or someone else). It was also separated into the 12 months prior to the pregnancy and during pregnancy.

The dietary questions were regarding the frequency of fish, fruit and green leafy vegetables consumed, as well as 'fast foods' (burgers, pizza, hot chips and fried chicken) and if women were vegetarian or vegan. The frequency was documented as being never, 1-3/month, 1-2/week, 3-4/week, 5-6/week, 1-2/day, 3-4/day or $\geq$ 5/day. At recruitment, participants were asked to recall their dietary intake during the 3 months prior to the pregnancy and during the first trimester of pregnancy. Participants who attended the 34 weeks' appointment completed this questionnaire again and were asked to recall aspects of their dietary intake for the 3 months prior to 34 weeks' gestation (Appendix 2.2).

2.2.3.b *Statistical Analysis*

Data was collated and stored on a secure web-based application Research Electronic Data Capture (REDCap) [22] and analysed using IBM SPSS Version 27. Cohort and population statistics were summarized using descriptive statistics. Mean and standard deviation, or median and inter-quartile ranges where appropriate, were reported for continuous variables, and frequency and percentage were reported for categorical variables. Chi-Square tests, or Fisher's exact test where cell counts were small, were used to investigate the association between emotional or social support and marital status.

2.3 Results

2.3.1 Demographics

Initially, 1373 pregnant women were recruited into the STOP Study, including 60 recruited from another tertiary hospital. After some exclusions were made due to twin pregnancy, miscarriage, genetic termination and withdrawal, 1,300 women participated in the study to completion. The age of nulliparous women ranged between 15 and 45 years but were predominantly aged between 20-29 years, with a mean of 26 years (SD 5.07) (Table 2.3). Most participants self-identified as Australian Caucasian (82.5% n=1,073). Almost ninety percent (88.6%, n=1,152) considered they were in a married or de-facto heterosexual or same sex relationship. Whilst there were 20.7% (n=271) who had achieved a university degree or higher, 20.9 % (n= 276) achieved year 10 or less. Almost fifty-four percent (53.7%, n= 700) of participants did not have fulltime employment, which is likely to severely impact their financial status. From the 791 partners participating in the study, 11.3% (n=89) were unemployed, 2.1% (n=17) were students, 11.3% (n=89) were casually employed, 6.6% (n=52) had part-time employment and 68.8% (n=544) were employed fulltime. The estimated combined income of both participants and their partners was $70,000 or less per annum for 45.5% (n=592).

Table 2.3 Maternal demographics at recruitment

Characteristic	n	(%)
Age (years):		
< 20	132	(10.2)
20-29	855	(65.8)
30-34	243	(18.7)
35-40	66	(5.1)
>40	4	(0.3)
Ethnicity:		
Caucasian	1,073	(82.5)
South East Asian	66	(5.1)
Indian	60	(4.6)
Aboriginal	24	(1.8)
African	23	(1.8)
Middle Eastern	25	(1.9)
China/Japan	16	(5.2)
Hispanic	5	(0.4)
Pacific Islander	4	(0.3)

Maori	2	(0.2)
Other	2	(0.2)
Marital Status:		
Single	147	(11.3)
Married	510	(39.2)
Defacto	633	(48.7)
Defacto same sex	9	(0.7)
Separated	0	(0)
Widowed	1	(0.1)
Education:		
< Year 10	27	(2.1)
Year 10	244	(18.8)
Year 12	295	(22.8)
Certificate	462	(35.6)
Bachelor degree	192	(14.8)
Higher degree	76	(5.9)
Missing	4	(0.3)
Employment:		
Full-time employed	600	(46.3)
Part-time employed	227	(17.5)
Casual	171	(13.2)
Student	68	(5.2)
Unemployed	231	(17.8)
Missing	3	(0.2)
Combined Annual Income (participant & partner):		
≤ $20,000	153	(11.7)
$20,001- $40,000	152	(11.7)
$40,001- $70,000	287	(22.1)
$70,001- $105,000	332	(25.5)
$105,001 - $205,000	346	(26.6)
> $205,000	15	(1.1)
Missing	15	(1.1)

The Socio-Economic Index (SEI) data reflects a high level of socio-economic disadvantage for the STOP cohort with the median Minor Group (occupation grouping) SEI of 29 (possible range 10-90 with lowest scores indicating lowest advantage) (Table 2.4). Just 1.23% (n= 16) of participants scored an SEI over 69.

A comparison of the STOP Study data, between the two relevant local government council areas (Playford and Salisbury Councils), South Australia and Australia can be made in relation to the Index of Relative Socio-Economic Disadvantage (IRSD) (Table 2.4) (http://abs.gov.au).

The median IRSD for the STOP Study cohort is more comparable with the Salisbury Council median IRSD but still not significantly different to the Playford council median IRSD. The ranking and decile compared to South Australia and Australia, reflects greater disadvantage. It should be noted that there are 544 Local Government Areas (LGA) in Australia and 70 LGAs within South Australia.

Table 2.4 Socio-economic Index STOP Cohort, Playford and Salisbury Council areas

	n (%)	Median (IQR)	Decile (within Australia)	Decile (within SA)
NZ SEI				
STOP cohort	1296 (99.6)	29 (22-45)		
IRSD				
STOP cohort	1298 (99.8)	907 (851-932)	1	2
Playford Council	89,372 (100)	855[#]	1	1
Salisbury Council	137,979 (100)	917[#]	2	2

New Zealand Socio-economic index (NZ SEI) possible range: 10-90 Quartiles – 1 = 62-90 (highest ranking), 2 = 45-61, 3 = 34-44, 4 = 10-33 (lowest ranking)
Socio-economic indexes for areas (SEIFA) – index of relative socio-economic disadvantage (IRSD) possible range: 120-1200
[#] IQR not applicable
(http://abs.gov.au/AUSSTATS/abs@nsf/DetailsPage/2033.0.55.0012016?opendocument)

2.3.2 Diet

Around sixty percent of participants (n=770, 60.1%) reported that they never consumed oily fish and 42.9% (n= 551) never consumed 'other' fish during the 3 months prior to their pregnancy. In addition, prior to pregnancy, 37.7% (n= 484) consumed green leafy vegetables at least once per day, 51.5% (n= 661) reported eating at least one serve of fruit per day and 71% (n= 910) consumed dairy products. During the first trimester of pregnancy, 10% (n= 128) of participants consumed oily fish and 19.2% (n= 246) ate 'other' fish. Similarly, fewer women consumed green leafy vegetables (31.9% at least 1 serve/day, n= 409) and dairy foods (68.4%

at least 1 serve/day, n= 877) but fruit consumption increased by 10.9% (62.4% at least 1 serve /day, n= 801) in first trimester.

At around 34 weeks' gestation, 42.1% (n=548) of participants reported their dietary intake for the previous three months. Dietary habits of participants in the 3rd trimester of pregnancy were more similar to the pre-pregnancy dietary intake than that in the 1st trimester. The intake of oily fish and green leafy vegetables was near pre-pregnancy levels in the 3rd trimester. More women reported consuming 'Other fish' in the 3rd trimester but there was a decline in the number of women consuming 'other fish' 1-2/week or more. Fruit intake peaked in the 1st trimester and remained at around the same level into the 3rd trimester. However, despite this increase, there were still around 40% of women who did not consume the recommended 2 serves of fruit per day (https://www.nhmrc.gov.au/guidelines-publications/n55). Dairy products consumed were increased by the third trimester with almost 86% (n= 470) of participants having 1-2 serves per day and only 1.1% never having dairy. In relation to 'fast foods' that are generally energy dense and rich in saturated fat, hot chips, burgers, pizza and fried chicken were regularly consumed at least once per week throughout the pregnancy by most participants.

2.3.3 Body Mass Index (BMI)

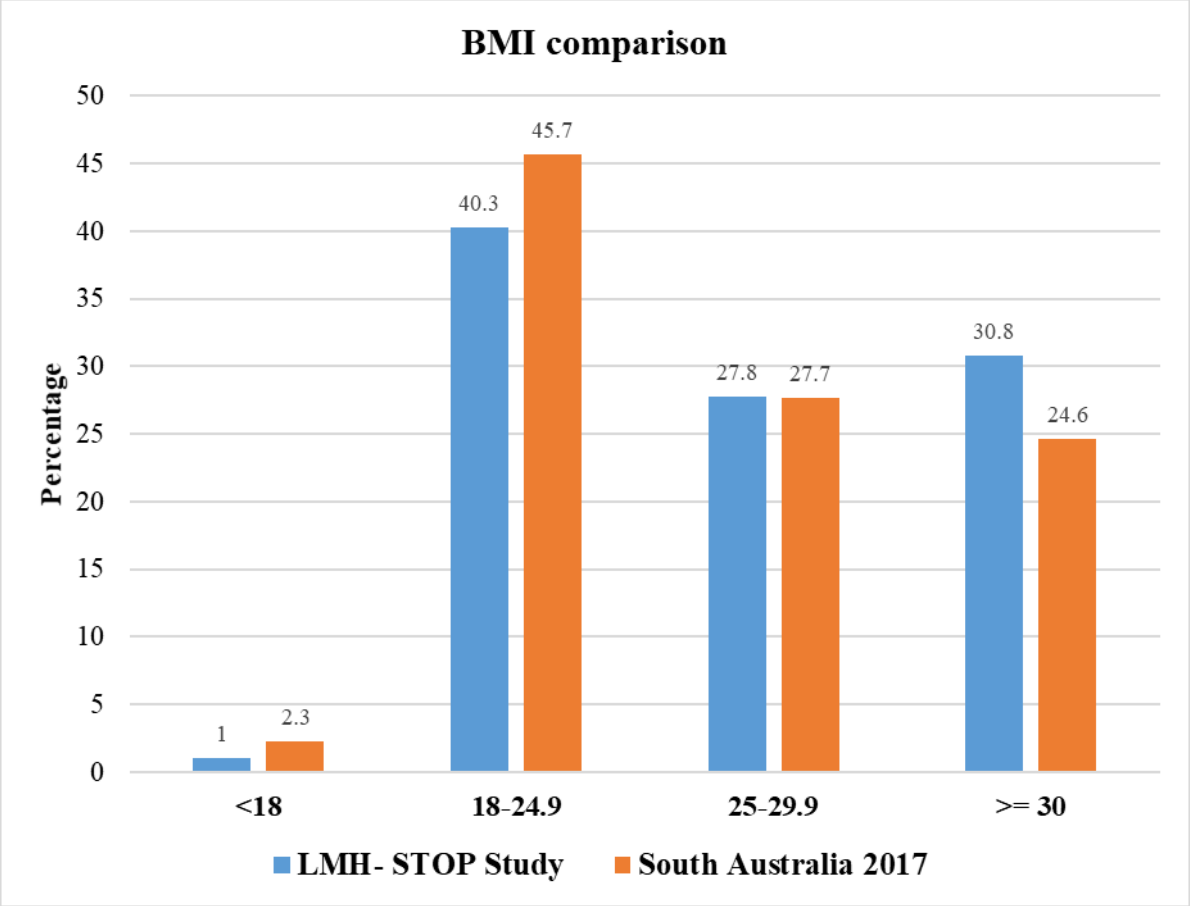
At recruitment, the Body Mass Index (BMI) of 1,299 participants showed 58.6% (n=762) of participants were overweight (BMI 25-29.99) or obese (BMI ≥30) with a mean BMI of 27.96 (Range 15.8-61.4, SD 7.15) for the cohort (Table 2.5).

Table 2.5 Body Mass Index (BMI) in the STOP Cohort

	n (%)	Range	Mean	Standard Deviation
BMI	1300 (100)	15.8 - 61.4	27.96	7.15
<18	13 (1)			
18-24.99	524 (40.3)			
25- 29.99	361 (27.8)			
≥30	401 (30.8)			
Missing	1 (0.1)			

Compared to the South Australian Perinatal Outcomes data for 2017, the BMI for women at their initial antenatal appointment shows the STOP Study cohort to be more overweight and obese than the total South Australian population of pregnant women who had their BMI calculated at their initial appointment before 20 weeks' gestation (n= 16,879) (Figure 2.1).

Figure 2.1 BMI comparison



2.3.4 BMI and Lifestyle Factors

There was no significant difference between the BMI groups in relation to the pre-pregnancy consumption of fruit (p= 0.321), leafy green vegetables (p= 0.460), dairy (p= 0.878) or fast foods (p= 0.761) (Table 2.6).

Table 2.6 BMI and Dietary intake

	BMI <18	BMI 18-24.99	BMI 25-29.99	BMI ≥30	Total	Pearson Chi-square
	n (%)	n (%)	n (%)	n (%)	n (%)	*P*
Fruit						0.321
< 1/day	5 (0.4)	202 (16.9)	151 (12.6)	183 (15.3)	541(45.3)	
≥1/day	6 (0.5)	274 (22.9)	186 (15.6)	187 (15.7)	653 (54.6)	
Total	11 (0.9)	476 (39.8)	337 (28.2)	370 (30.9)	1194 (100)	
Green leafy Vegetables						0.460
< 1/day	5 (0.4)	238 (21.4)	185 (16.6)	203 (18.2)	631 (56.9)	
≥1/day	5 (0.4)	207 (18.6)	136 (12.2)	134 (12.0)	482 (43.1)	
Total	10 (0.8)	445 (40)	321 (28.8)	337 (30.3)	1113 (100)	
Dairy						0.878
< 1/day	3 (0.2)	117 (9.7)	82 (6.8)	98 (8.1)	300 (24.9)	
≥1/day	10 (0.8)	370 (30.7)	253 (21.0)	270 (22.4)	903 (75.1)	
Total	13 (1.0)	487 (40.4)	335 (27.8)	368 (30.5)	1203 (100)	
Burgers						0.412
< 1/wk	1 (0.1)	9 (0.9)	8 (0.77)	8 (0.77)	26 (2.5)	
≥1/wk	8 (0.77)	396 (38.4)	272 (26.4)	328 (31.8)	1004 (97.5)	
Total	9 (0.87)	405 (39.3)	280 (27.2)	336(32.6)	1030 (100)	
Pizza						0.778
< 1/wk	0 (0)	1 (0.1)	1 (0.1)	2 (1.9)	4 (0.4)	
≥1/wk	12 (1.1)	412 (39.7)	289 (27.9)	319 (30.8)	1032 (99.6)	
Total	12 (1.1)	413 (39.8)	290 (28.0)	321 (32.7)	1036 (100)	
Hot Chips						0.737
< 1/wk	1 (0.1)	15 (1.4)	8 (7.3)	10 (9.1)	34 (3.1)	
≥1/wk	11 (1.0)	428 (39.1)	294 (26.9)	327 (29.8)	1060 (96.9)	
Total	12 (1.1)	443 (40.5)	302 (27.6)	337 (38.9)	1094 (100)	
Fried Chicken						0.800
< 1/wk	0 (0)	5 (0.7)	4 (5.6)	2 (0.3)	11 (1.4)	
≥1/wk	6 (8.3)	284 (39.6)	185 (25.8)	231 (32.2)	706 (98.6)	
Total	6 (8.3)	289 (40.3)	189 (26.3)	233 (32.5)	717 (100)	
All Fast Food						0.382
<1/wk	3 (0.27)	75 (6.64)	47 (4.15)	46 (4.1)	171 (15.1)	
≥1/wk	9 (0.79)	372 (32.9)	272 (24.1)	306 (27.1)	959 (84.9)	
Total	12 (1)	447 (39.5)	319 (28.2)	352 (31.2)	1130 (100)	

2.3.5 Mental Health Status

At the initial appointment, the ANRQ score ranged from 5 to 62 with a mean of 18.37 (SD 11.96), (Table 2.7) with 32% percent (n=416) of participants responding in the high risk range for total ANRQ scores (Table 2.8). In addition to this, the EPDS showed medium to high risk of depression and anxiety for 16.2% (n=210) of participants (Range 0-28, Mean 5.46, SD 4.55).

The level of anxiety reflected medium to high scores for 30.1% (n= 382) with the STAI (Range 6-36, Mean 10.3, SD 3.36) and 46.9% (n= 590) with the PSS in their current daily life (Range 0-38, Mean 13.10, SD 0.657) (Table 2.7).

Table 2.7 Mental Health Status

	n	(%)	Mean	Range	Standard Deviation
ANRQ	1290	(99.2)	18.37	5-62	11.96
EPDS	1287	(99.1)	5.46	0-28	4.55
STAI	1269	(97.6)	10.3	6-23	3.36
PSS	1259	(96.8)	13.1	0-38	6.57

ANRQ = Antenatal Risk Questionnaire (possible score range 5-62)
EPDS = Edinburgh Postnatal Depression Score (possible score range 0-30)
STAI = State Trait Inventory Score (possible score range 6-36)
PSS = Perceived Stress Score (possible score range 0-40)

Table 2.8 Mental Health Risk

	Low Risk		Medium Risk		High Risk	
	n	(%)	n	(%)	n	(%)
ANRQ n = 1290	876	(67.9)			414	(32.1)
EPDS n = 1288	1080	(83.9)	100	(7.8)	108	(8.4)
STAI n = 1269	887	(69.9)	181	(14.3)	201	(15.8)
PSS n = 1259	669	(53.1)	551	(43.8)	39	(3.1)

ANRQ = Antenatal Risk Questionnaire (Low risk = < 23, High risk = ≥23)
EPDS = Edinburgh Postnatal Depression Score (Low risk = 0-9, Medium risk = 10-12, High risk = ≥13)
STAI = State Trait Inventory Score (Low risk = 6-11, Medium risk = 12-18, High risk = 19-36)
PSS = Perceived Stress Score (Low risk = 1-14, Medium risk = 15-26, High risk = 27-50)

Question 2 of the ANRQ assessment, asks if the participant has a history of depression or other mental health disorders. Those who '*had experienced 2 weeks or more feeling particularly worried, anxious or depressed'* comprised 38.1% (n= 494) of participants. In addition, 16.1% (n= 208) reported having a history of mental health issues such as schizophrenia, bipolar disorder, eating disorders and psychosis. The specific mental health issues were not collected

for this study. Of these participants, 73.6% (n=364; 28.2% of all participants) had sought professional help.

In relation to stresses, changes and/or losses in the previous 12 months, 27.9% (n= 360) participants had responded with 'yes'. In addition, the mean response to the level of effect these stressors had on their life, was 1.13 (Range 0-5, SD 1.74).

Question 10 of the EPDS assessment, asks how often they have thought about self-harm during the last week (Scores 0= never, 1= hardly ever, 2= sometimes, 3= yes, often). At the initial appointment (n=1,293), three (0.23%) participants responded with 'yes, often', 13 (1%) responded with 'sometimes' and 26 (2.01%) responded with 'hardly ever'. The mean score was 0.5 for this question (Range 0-3, SD 0.281).

2.3.6 Emotional and Social Support

Question 1 on the ANRQ asked the participant *"When you were growing up, did you feel emotionally supported by your mother?"* (Score 1= Very much, to 5= Not at all and 6 = had no mother). Twelve participants responded with a score of 6 (0.926%) and 21 (1.62%) scored 5 (n=1296, Range 1-6, Mean 1.63, SD 1.11).

Question 7 on the ANRQ asked the participant *"Do you feel that you have people you can depend on for support with your baby?"* On a scale of 1-5, with 1 being 'very much' and 5 being 'not at all', eight (0.62%) of respondents scored 5, 'not at all' (n= 1296, Range 1-5, Mean 1.27, SD 0.722). There was no significant difference (n=1,296, Range 1-6, Mean 1.27, SD

0.722, Wald Chi-square 5.602, df 2, p=0.061) between women who were single or in a defacto/married relationship in their feelings about having practical support with their baby.

2.3.7 Domestic Violence

Responses to the lifestyle questionnaire, showed that 8.12% (n=104) of participants reported physical abuse in the 12 months pre-pregnancy. Sixteen women (1.25%) reported having forced sexual intercourse pre-pregnancy, with 6 women (0.46%) experiencing this abuse during the first trimester. In addition, at the initial 12-16 weeks' gestation visit, 13.4% (n= 173) of women reported having experienced physical and/or sexual abuse (ANRQ Question 9) and 10.7% (n= 139) reported emotional abuse (ANRQ Question 8).

2.3.8 Smoking, Drug and Alcohol Abuse

At the 12-16 weeks' visit 20.3% of participants (n=264) reported that they had been smoking in the 3 months prior to their pregnancy, with 46.6% (n=123) of these participants quitting just prior to their pregnancy (Table 2.9). A further 22.7% (n=60) quit within the first trimester of pregnancy. Sixty women continued to smoke into the 3rd trimester. Five of these 60 women reported smoking between 15-20 cigarettes/day. Of all participants, 28.1% (n=360) lived in the same household as someone who smoked.

Women's consumption of alcohol pre-pregnancy ranged from 0.02 to 100 standard drinks per week (calculated over the 3 month pre-pregnancy period). Whilst 94.3% (n=550) of the women who were consuming alcohol pre-pregnancy continued to drink during the first trimester of pregnancy, the volume of alcohol reduced, ranging from 0.04-40 standard drinks per week. Fifteen women (2.73%) who completed the 34 weeks' survey (n=548) consumed between 0.01 and 3 standard drinks per week in the 3 months leading up to 34 weeks' gestation.

Around fourteen percent of women (n=183, 14.1%) reported binge drinking and/or illicit drug taking in the 3 months pre-pregnancy. Binge drinking was categorised as 6 or more standard drinks at one sitting. The use of illicit drugs pre-pregnancy was reported by 12.6% (n=165) of participants ranging from once to 1,800 times during the 3 month period. By the 1st trimester, 93.93% (n= 155) of women who had been using drugs, stopped using. However, those who continued (n=10), increased their drug taking (Range 0.01-1,800 times to 2-2,800 times) over the 3 month period. It should be noted that some women reported 'chain smoking' cannabis daily, hence the exceptionally high number. In the 3 months up to 34 weeks' gestation, eleven women (0.85%) reported using drugs. Data on the number of times drugs were used was not collected at 34 weeks' gestation.

Table 2.9 Smoking, Drugs and Alcohol use in pregnancy

n=1300	**n**	**(%)**	**Range**	**Mean**	**Standard Deviation**
Smoking:					
Cigarettes/day					
- Pre-pregnancy	264	(20.3)	0.01-50	11.55	8.74
- 1st trimester	141	(10.8)	0.04-40	6.56	5.58
- 3 months up to 34 weeks'	60	(4.6)	0.05-20	5.57	4.95
Quit smoking in the 1st trimester	60	(4.6)			
Drugs and Alcohol Consumption:					
Standard alcoholic drinks/ week					
- Pre-pregnancy	583	(44.8)	0.02-100	6.58	9.60
- 1st trimester	550	(42.3)	0.01-49	5.44	7.33
- 3 months up to 34 weeks	15	(1.15)	0.01-3	0.54	0.96
Binge alcohol and/or drugs					
- 3 months pre-pregnancy	183	(14.1)			
- 1st trimester	95	(7.3)			
- 3 months up to 34 weeks'	11	(0.85)			
Number of times taken drugs					
- 3 months pre-pregnancy	165	(12.6)	0.01-1800	111.48	307.21
- 1st trimester	10	(0.76)	2-2800	322.5	872.08
- 3 months up to 34 weeks'	11	(0.85)	No data	No data	No data

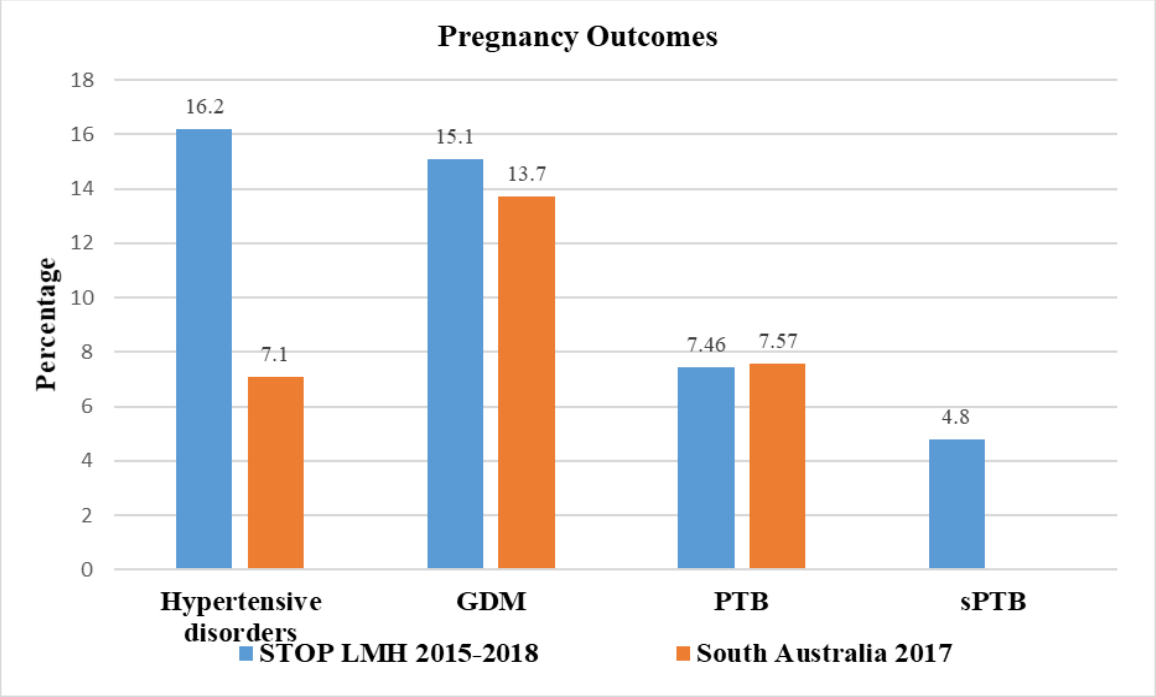
Percentages are of the total cohort

2.3.9 Pregnancy Outcomes

Hypertension in pregnancy (preeclampsia and gestational hypertension), gestational diabetes (GDM), small for gestational age (SGA) and spontaneous preterm birth (sPTB) were the main pregnancy complications investigated for the STOP Study (Figure 2.2). Just over forty-four percent of participants (44.3%, n=576) experienced at least one of these complications.

Of the hypertensive disorders, incidence of preeclampsia was 9.4% (n=120 of 1283 participants) and gestational hypertension was 6.7% (n=86 of 1283 participants). In all categories, the STOP Study participants (nulliparous) had a higher level of hypertensive disorders in pregnancy (16.2% vs 7.1%) and GDM (15.1% vs 13.7%) when compared to the total South Australian births in 2017. The preterm birth (PTB) rate was 7.46% (n= 96 of 1286 participants, Range 20- 41.86 gestational week, Mean 39.29, SD 1.98). This is comparable to the total PTB rate for South Australia in 2017 of 7.57% (n= 1,434 for all singleton preterm births). Recorded preterm births in the South Australian Perinatal Outcomes data do not differentiate between spontaneous and induced preterm births for medical reasons. The STOP Study's spontaneous PTB rate was 4.8% (n=61).

Figure 2.2 Pregnancy Outcomes



2.4 Discussion

This study has shown that women attending the LMH for their antenatal care are generally more disadvantaged compared to the rest of Australia, demonstrated by a low median SEI. In Australia, the average annual income for a fulltime employed adult is currently around $89,000 and in South Australia it is approximately $79,000 (www.abs.gov.au). When seasonally adjusted for all employees (including part-time), the single adult income is at $67,844.40 per annum in Australia (May 2020). The caveat here is that this is for all adult age groups. The STOP Study data reported on the combined income of the woman and her partner, with nearly half (n=592, 45.5%) earning less than $70,000 per annum combined. With 88.7% of women being in a partnered relationship, the combined income could be interpreted as being less than half of the Australian adult annual income for at least 71% of the STOP cohort. In other words, if the household had 2 average Australian seasonally adjusted incomes ($67,850 x 2 = $135,700 /year), then only 29% of the STOP cohort would have earned the Australian average annual income for couples.

With 79% (n=1028) of participants not having received tertiary education, their capacity for achieving employment that attracts a higher income is low. Vocational certificates attained do not indicate extensive education, as the completion of years 11 and 12 at high school are not pre-requisites and certificate training is often of short duration. Around 21% of STOP women achieved year 10 or less at high school, suggesting that literacy and health literacy levels may be low for this group attending the LMH [23].

2.4.1 Healthy Lifestyle

2.4.1.a Nutrition

The examination of some important dietary components such as fruit, vegetables, fish, dairy and fast foods was achieved, providing a generalised view of the eating habits and diet quality of this cohort.

The STOP Study data shows that diet was not optimal according to the Australian Dietary Guidelines 2013 (https://www.nhmrc.gov.au/guidelines-publications/n55). The consumption of fish was low amongst participants with most (n= 770, 60.1%) never consuming oily fish and 42.7% (n= 551) never eating other fish. Oily fish in particular, is beneficial for neurodevelopment of the fetus [26] and yet it seems to be either unaffordable or lack palatability in our cohort. In Australia, 2-3 serves of fish per week is recommended, but this is generally not achieved throughout the country [27], not just within our cohort.

Green leafy vegetables are an important inclusion in the daily diet due to their micronutrient content (such as iron, magnesium, calcium, folate and other vitamins) but consumption was overall less than optimal for our cohort. Therefore it is highly likely that the low quality diet of suboptimal green leafy vegetables and high fast food consumption in STOP women, contributed to the high GDM rate [28] although this analysis has not been undertaken herein. With over 30% (n= 401) of the STOP Study cohort being obese, the consumption of energy dense, fatty foods needs to change to ensure healthier outcomes, not just during pregnancy but into the future of mothers and babies. Pregnant women who receive lifestyle advice have been found to significantly increase their daily fruit and vegetable consumption [29]. A focus on the nutritional benefits of healthy eating in health promotion interventions is necessary [30].

However, with many of the STOP cohort having anxiety related mental health issues, they may lack the ability to alter their dietary habits.

The lack of compliance by women with the Australian Dietary Guidelines raises questions as to the reasons for this which may include lack of knowledge, unable to cook, insufficient income to buy quality food, easier to buy junk food or other priorities preventing purchase. However, the latest report from the Australian Bureau of Statistics (2017-2018, www.aihw.gov.au) shows that even though people living in lower socio-economic circumstances are less likely to meet the recommended fruit and vegetable requirements, the average diet of most Australians does not meet them either. These statistics have barely changed over the last 10 years.

2.4.1.b Obesity

Obesity in pregnancy has remained stable in South Australia at around 28% between 2007 and 2014 [31] but the STOP cohort is in excess of this. This suggests that the STOP cohort has a much lower quality diet than the state average. Educational interventions need to address this issue.

2.4.1.c Socio-economics and Diet

The low income for this cohort brings into question their ability to afford a healthy diet and lifestyle. Purchase of a wide variety of fruit and vegetables is often considered impossible for disadvantaged communities due to a lack of affordability [32]. It has been estimated that a family of 2 adults and 2 children following the Australian Dietary Guidelines would need to spend $239 per week [32]. A family with 2 children on welfare payments had a disposable income of $544 per week. Therefore, families would need to set aside half of their disposable

income just to meet their dietary requirements. It was recognised that the purchase of generic brands of some foods would assist in the affordability for those with low income [32] but this may not assist with the purchase of fresh produce. However, it can be argued that a modified Mediterranean-style diet, rich in vegetables, fruit, red meat, fish, nuts and pulses, can cost the same as a nutritionally poor diet [33]. Both information on how to shop for affordable healthy foods and how to cook them should be areas of focus in health education.

2.4.1.d Domestic Violence

Exposure to psychological, physical and sexual abuse at any time in life can increase the likelihood of mental health issues such as anxiety, depression and post-traumatic stress disorder (PTSD) [24]. Perceived stress and mental health concerns, particularly anxiety related disorders, were observed in the STOP Study. In Australia, it has been reported that 14.6% of women have been physically and/or sexually assaulted by their current partner and 23% of women have suffered emotional abuse by their previous and/or current partner in 2016 (http://www.aihw.gov.au/reports/australias-welfare/family-domestic-and-sexual-violence#women). In addition, the incidence of reported domestic violence is increasing annually and across all socio-economic groups. This does not account for the unreported violence. Whilst it can be argued that the level of domestic violence is small for the STOP cohort, it is comparable to the national data. It also needs to be recognised that STOP study data may not be an accurate representation of domestic violence as many participants had their partners present at the initial appointment and may not have accurately answered the questionnaire. Therefore, the degree of domestic violence may be under-reported [25].

2.4.1.e Substance Abuse

A healthy lifestyle, particularly during pregnancy includes, not using tobacco, drugs and alcohol (https://ranzcog.edu.au). Whilst some women continued smoking (4.6%, n=60) and consumed alcohol and drugs (1.15%, n=15) throughout pregnancy, there was a clear indication that this cohort sought to reduce their consumption early in the pregnancy. However, it is also recognised that if someone living in the same household also smokes or uses drugs and alcohol, then this can create difficulties for ongoing cessation of these substances in pregnancy and in the postnatal period [34]. With 28% of participants living with a smoker, this places the smoking participant at greater disadvantage.

There is also a relationship between substance abuse, negative life events and low self-esteem [35], thus those women with a high ANRQ score are more likely to be trapped in this triad. The association between drug and alcohol addiction and mental health problems is well documented in the non-pregnant population [36, 37]. Social issues such as domestic violence, child abuse and unstable relationships may have influenced drug and alcohol abuse and mental health status for the STOP cohort [8]. Therefore, when developing educational interventions there needs to be an understanding of the relationship between these issues, how they may affect women in their ability to engage in antenatal education and how they can achieve a healthy lifestyle.

2.4.2 Pregnancy Outcomes

The effects of lifestyle factors such as diet, tobacco, alcohol and drug consumption on pregnancy outcome have been well documented [29, 38-46] but it is unclear as to their specific effects on the STOP cohort at present. Further examination is required and beyond the aims of this thesis. High BMI increases the risk of GDM and hypertensive disorders [38] and this was evident with the STOP cohort with the high rate of both pregnancy complications.

2.5 Limitations

The exclusion criteria in the STOP Study, such as women with essential hypertension (medicated) and type 1 or 2 diabetes, limited the sample population thereby failing to include an analysis of this group's psycho-social determinants.

The STOP Study data relating to dietary intake is limited and unable to provide an in depth analysis of the nutritional status of the STOP cohort. This is because measuring participants' complete dietary intake was not one of the main aims of the study. Administration of a reliable and tested food frequency questionnaire would have enabled a complete dietary assessment of participants.

2.6 Conclusion

The STOP Study has provided support for the hypothesis that disadvantaged women have a significant number of social and lifestyle issues that can affect their health and pregnancy outcomes. In addition, these factors could affect their ability to engage effectively with antenatal education [47, 48]. Women attending the LMH for their antenatal care have been shown to be significantly disadvantaged within the Australian context, with many social, medical and psychological complexities. The examination of pregnancy outcomes such as hypertensive disorders and gestational diabetes has highlighted the need to address obesity for this cohort. In addition, SGA and sPTB rates may indicate a need to focus on substance abuse pre-pregnancy and during pregnancy.

This cohort needs assistance to increase their health literacy to enable behaviour change and improve their health status. Dietary information is a necessity in antenatal care but the delivery

of this information may need to include nutritional information as well as instructing women on how to budget and prepare meals incorporating the recommended guidelines [49, 50].

The STOP Study participants have experienced stressors, trying to cope with many difficulties in life such as low income, unemployment, single marital status, social isolation and domestic violence. Physical violence is known to increase stress during pregnancy leading to poorer health outcomes [51, 52]. The degree to which mental health issues and domestic violence affects engagement with health professionals and antenatal education is important to understand as they may become barriers to learning and education. Thus, innovative ways to engage and educate disadvantaged women and their families is necessary to stop the cycle of disadvantage and its associated poorer health outcomes.

If social issues can affect engagement, then perhaps these need to be addressed to enable engagement with antenatal education. The provision of information regarding social and mental health support in conjunction with their antenatal education may assist. Women can be embarrassed or feel stigmatised about their social and mental health situation [53], thus more sympathetic approaches may be necessary to inform them of support systems.

As discussed in Chapter 1, waiting room education is a subtle, opportunistic approach to inform and educate. Chapter 4 explores this.

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CHAPTER 3

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By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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3.1 Abstract

Background

Usage rates for information and communication technologies (ICTs) in healthcare have been increasing in recent years, but often lag behind general usage rates for populations as a whole. Research into such differential rates of ICT use across different segments of the population has identified a number of possible causal factors that limit usage.

Aim

The research investigated midwives' attitudes and experiences of ICT use to identify potential causal factors that encourage or inhibit their usage in antenatal care.

Methods

Semi-structured interviews, focus groups and short surveys were conducted with midwives who provide antenatal education at an Australian metropolitan hospital. Thematic and statistical analyses were used to interpret the data.

Findings

Although midwives recognised the potential benefits of using ICTs to deliver pregnancy-related health information many had reservations about their use in everyday work. These reservations centred on lack of training in use of ICTs, the perceived legal risks associated with social media, potential violations of patient privacy, misdiagnosis and misunderstandings between midwife and client.

Conclusion

Midwives face a number of barriers to effective use of ICTs in healthcare including material access, skills access, usage access and motivational access. Motivational access appears to be a key concern due to the high perception of risk associated with social media in particular. Reducing the motivational barriers through a range of interventions with midwifery staff may assist in overcoming other barriers to ICT use in antenatal care. Further research is required to determine whether these findings are generalizable to other healthcare contexts.

3.2 Introduction

Some health professionals already utilise information and communication technologies (ICTs) in regular practice, including social media, blogs, phone apps and sending health messages via text and emails to consumers [1]. Such practices are, however by no means widespread [2], and understanding how to best use ICTs for health communication remains an important research priority. In this paper we explore the use of ICTs by midwives at a public tertiary hospital located in Adelaide, South Australia, and their perception of the use of ICTs in healthcare [1]. We hypothesise that active engagement of midwives is required if ICTs are to be effectively utilised for health communication. Sympathetic understanding of midwives' concerns regarding ICT use as part of healthcare practice is essential if they are to adopt communication strategies that employ ICTs for pregnancy-related health communication [2].

3.3 Literature Review

Rapid increase in the use of ICTs throughout the developed world has led to dramatic changes in the way people communicate in their everyday lives. Hospitals' and professionals' utilisation of ICTs has expanded significantly throughout the world enabling new forms of interaction between patients and health professionals, as well as increased involvement of consumers in their care [1]. The integration of ICTs, especially social media, into the delivery of healthcare and health communication is argued to have several potential benefits [3]. Social media can be used to facilitate doctor-patient communication, provide an avenue for peer-to-peer social support and information sharing, improve efficiency in the work place and as an important resource for increasing consumer health knowledge [1].

Yet, with the increasing use of social media for healthcare have come warnings of potential problems. These include: the need for specific guidelines to govern social media use, particularly in relation to duty of care [4]; concerns for both staff and patient confidentiality and privacy issues [5]; and cautions regarding the potential for harm to professional reputation [6]. This has led various health organisations in Australia to address these concerns. The Australian Health Practitioner Regulation Agency and the 14 National Boards representing the various healthcare providers, released a proposed social media policy for public consultation and the Australian Medical Association Council of Doctors-in-Training, the New Zealand Medical Association Doctors-in-Training Council, the New Zealand Medical Students' Association and the Australian Medical Students' Association produced a social media guideline for medical practitioners and medical students.

These are legitimate concerns and such responses reflect the strongly established ethical practices that protect the interests and wellbeing of both patients and healthcare professionals. Nevertheless, they also represent one potential barrier to increasing adoption of ICTs for health communication. Van Dijk [7] notes that four major barriers inhibit access to ICT use:

- material access, i.e. the availability of affordable ICT infrastructure and resources,
- skills access, i.e. the availability of the technical skills required to use ICTs,
- usage access, i.e. the availability of opportunities for ICT use,
- motivational access, i.e. the desire and willingness to use ICTs.

These access barriers are obviously interconnected and individuals and organisations may experience each simultaneously. Material access is obviously a necessary condition for ICT use and along with skill access and has garnered most attention in research examining so-called 'digital divides' in various social contexts. However, Van Dijk [7] notes that the usage and

motivational barriers may be of greater concern now that the availability of ICTs has become increasingly prevalent, not to say ubiquitous, in developed countries. Lack of motivational access in particular may inhibit the degree and effectiveness of ICT usage even when other access barriers have been overcome, thus leading to wasted investment in resources.

This research aims to establish the extent to which these various barriers, but especially motivational access, may be a factor inhibiting ICT use by midwives in an Australian metropolitan hospital. It was undertaken for formative research purposes as part of a wider project investigating strategies for improving antenatal health communication, especially in relation to the needs of low socio-economic status (SES) and culturally and linguistically diverse (CALD) populations. Findings relating to a parallel study with antenatal patients have been reported in a separate paper [8].

3.4 Participants and Methods

Semi-structured, face-to-face interviews (n=8) and two focus groups (n=4 and n=9) were conducted with hospital-employed midwives to obtain qualitative data regarding their attitudes to the use of ICTs in antenatal care (Appendix 3.1). All interviews were conducted on-site at the hospital by DR, a qualitative researcher with a PhD in anthropology and/or JD, a practicing RN, RM trained in qualitative research techniques. The eight midwives interviewed individually were approached face-to-face to participate in the study and were selected because of their specific roles in providing antenatal information and education. No-one declined to participate in the study. Individual interviews were typically one hour in duration and were audio recorded and transcribed verbatim. One focus group was conducted with four midwives working within the antenatal clinic where much of the antenatal care, health information and education are conducted. The other focus group included nine midwives working within

women's health division of the hospital. The first focus group was recorded however because of the recording environment it was of poor quality. As such, the research team decided not to record the second focus group. Field notes were taken by DR during the second focus group and written up afterwards. The duration of each focus group was approximately half an hour. Repeat interviews/focus groups were not conducted because of time restraints. The questions used in both the individual and group interviews were developed by the research team and related to participants' perceptions of antenatal women's healthcare needs and use of ICTs, as well as the participants' own understanding of the use of ICTs to deliver health messages and antenatal education.

Research conformed to the 'Statement on Human Experimentation' by the National Health and Medical Research Council of Australia and was approved by the Adelaide Health Service Human Research Ethics Committee (The Queen Elizabeth Hospital, Lyell McEwin Hospital, Modbury Hospital). All subjects gave informed consent. The COREQ checklist guided the production of this manuscript [9].

Van Manen [10] describes phenomenological research as a way to find meaning or sense of the 'lived experience', identifying threads of an experience to gain further depth of understanding. In this study, the recordings and their transcriptions and field notes were thematically analysed by JD, identifying and reflecting on phrases and words used by the participants, resulting in the identification of common themes, noting repetitious use of some words by different participants. Re-reading the transcripts and notes, and re-listening to the recordings provided a clearer interpretation of not just the words said but the feelings behind them. An example of this is when the suggestion of the use of Facebook as a means to communicate with patients was made; the response of 'no' was not a meek 'no' but one reflecting a degree of horror and dismay at the very thought of using Facebook as a medium of

communication. So, in this instance, words alone did not provide the depth of feeling and fear that existed amongst participants.

A questionnaire was also administered to the interview participants and other midwives (n=19) to gather quantitative and further qualitative data about the demographic characteristics of the participants, their own personal use of ICTs, difficulties or barriers they experienced in educating pregnant women, and their thoughts on the use of ICTs in healthcare (Appendix 3.2).[1] The survey questions were developed after analysis of the 8 individual midwife interviews and based on their responses. Questions gave numerous answers to choose from and provided tick boxes for positive responses. Respondents could tick more than one box for each question. Quantitative data from the questionnaire was collated on an Excel spreadsheet. Participants were also given the opportunity to write their own answers, opinions and suggestions, and these responses were thematically analysed alongside the data generated from individual interviews and focus groups.

3.4.1 Participant Demographics

All midwives who completed the questionnaire were female.[2] The age of the 19 midwives who completed the questionnaire ranged from 23 to 60 years with an average age of 42.8 years. The number of years as a registered midwife ranged from 13 months to 36 years with a mean of 16 years. Their years of employment at the study hospital ranged from 13 months to 22 years, averaging 7 years.

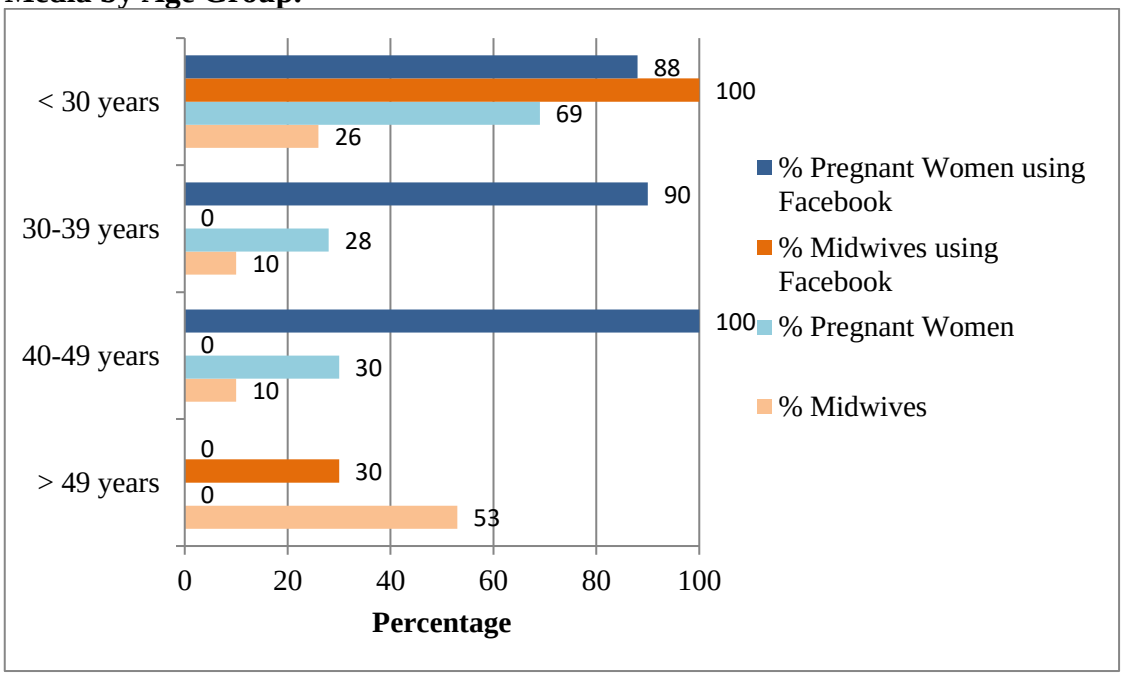
[1] Some respondents of the questionnaire also participated in the focus groups. The questionnaires did not identify individual personnel.

[2] This is reflective of gender ratios in antenatal care at the study hospital and not a bias in the sample.

3.5 Findings

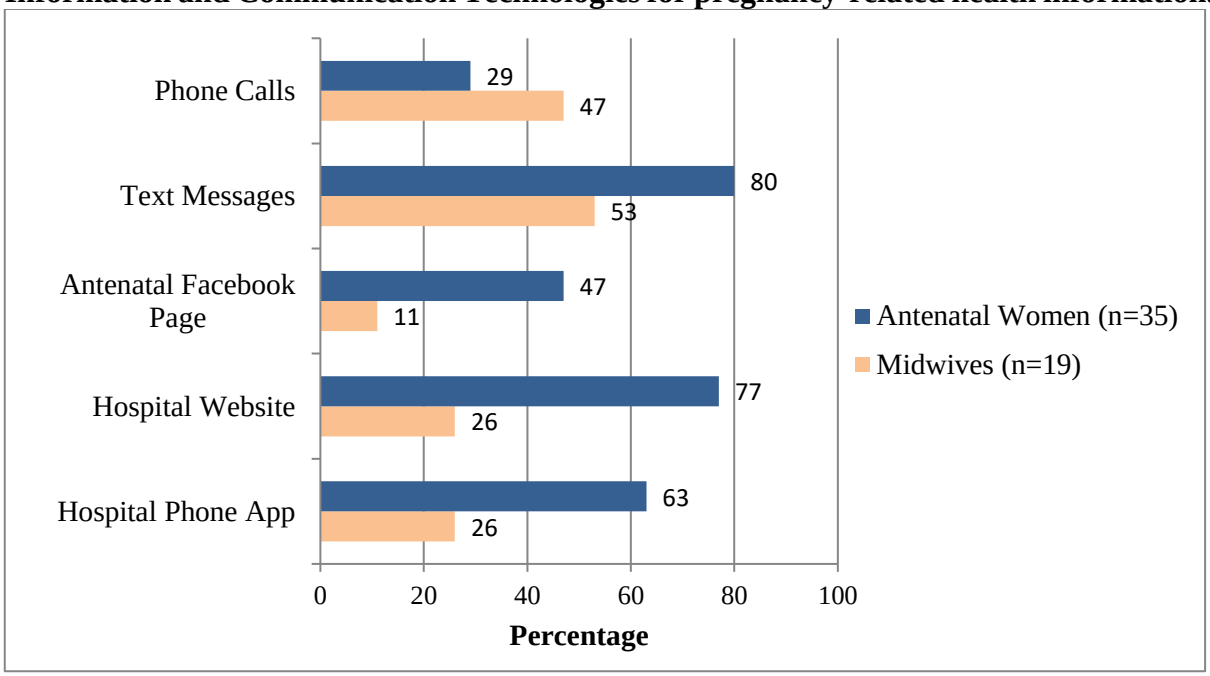
Our research found differences in personal ICT usage rates between midwives and clients. Eynesbach [11] argues that the age of the population may be a key contributing factor that influences the effectiveness of social media use in healthcare. The age of midwives in this study compared to antenatal women may explain their differing attitudes to ICTs. The average age of midwives who completed the questionnaire was 42.8 years (range 23-60 yrs), whilst antenatal women participating in the study were 26 years old on average (range 18-41 yrs). Whilst many of the midwives in our study did access the Internet for personal use, only 3 of the 14 (21%) midwives aged 30 years or over used Facebook, compared to the 5 midwives under the age of 30 years who all used Facebook. This suggests that the older midwives may be less likely to embrace social media professionally if they do not use it personally. Chou, Hunt [12] also identified disparities in social media use by age of the Internet user, highlighting that 18-24 year old Internet users are more likely to use social media than older Internet users [13]. Figure 3.1 shows prevalence of private use of social media by midwives compared to pregnant women with differences possibly attributable to age variations.

Figure 3.1. A Comparison of Midwives and Pregnant Women's personal use of Social Media by Age Group.



Our study did not examine midwives reasons for not using social media in their personal life. However, we did identify a clear unwillingness to use social media to converse with clients. Thus, although pregnant women participating in the study wanted to use ICTs to communicate with the hospital, this enthusiasm was not matched by the majority of participating hospital staff. Figure 3.2 comparing midwives and patients suggestions for the best means of communicating pregnancy-related health information highlights these disparities.

Figure 3.2. A Comparison of Midwives and Pregnant Women's preferences in the use of Information and Communication Technologies for pregnancy-related health information.



Nevertheless, age alone cannot account for this difference because some younger midwives are reluctant users of ICTs in clinical practice. In the following section we use the analytical framework suggested by Van Dijk [7] to examine the facilitators and barriers that influence the adoption of ICTs in antenatal care.

3.5.1 Material Access

Until recently material access to ICTs has been the predominant focus of digital divide research [7]. Whether or not hospital staff can physically access ICTs is clearly an important factor that contributes to their use or non-use. In the study hospital desktop computers are provided for use by staff. However, these computers are primarily used to access patient's medical records and are not typically used for interactive health communication with patients. Some midwives do search for resources on the Internet to provide patients with information, but newer forms of technology are not available to enable staff to utilise the full interactive potential of contemporary ICTs.

Midwives recognised that the Internet and mobile technologies are fast becoming tools widely used by pregnant women for seeking pregnancy-related health information, including low SES women [13-15]. Participants did not have concerns about the ability of patients to materially access ICTs, one midwife said with regard to clients' use of mobile phones, "They all have them," and another said, "[the Internet] appeals to the techno people and visual learners. Even the poorest of women have a mobile phone." Another added, "I can say that I have not seen anyone without a phone and they are always on it." Our research confirms that material access to ICTs was not an issue for the majority of pregnant women[8], but for staff, material access to ICTs remains a barrier that restricts their application in the antenatal healthcare context.

3.5.2 Skills access

Many participants expressed a lack of confidence in their own ability to converse effectively with patients via social media or other ICTs, and claimed they needed additional training, social support and guidance to be able to confidently utilise ICTs for antenatal care. It is notable that these concerns related both to technical skills required for ICT use (e.g. use of hardware or

software), but related most frequently to understanding how to best communicate with patients online (e.g. selecting the appropriate 'tone' or knowing how to express ideas non-verbally). It is sufficient to note here that midwives' concerns regarding their comparative lack of skills and experience in mediated communication via different ICTs contrasts markedly with their expressions of confidence and demonstrable ability in face-to-face communication with patients [3].

3.5.3 Usage access

Time pressures appeared to be the greatest factor in the opinion of participants that lead to problems in usage access. 95% (n=18) of survey respondents identified time constraints as a barrier that limited their ability to effectively educate antenatal women. Concerns about the impact of time pressures were expressed by a survey respondent who wrote, "If you don't have the time to provide the necessary information or don't have the appropriate resources such as in the right language, then this results in poorly informed decisions". Another wrote, *"Time constraints are very difficult as we cannot give all the information required. I often have to rush a lot of information in a small space of time, limiting the amount they can take in."* The use of ICTs to compliment the information given personally at antenatal appointments was accepted by midwives, but concerns about time constraints remained an issue because they believed the development and use of ICTs, such as regular updating of a Facebook page, would take up as much, if not more time than one-to-one discussions with clients. Midwives may, therefore be reluctant to add new communication strategies to established health communication procedures if these cannot be easily integrated into existing antenatal care practices.

3.5.4 Motivational access

Following Van Dijk [7]we hypothesise that the motivation of hospital staff must be considered if new technologies are to be introduced successfully into health care settings, even if ICT use has been mandated as part of standard practice. Our research clearly shows that midwives perceptions of risk inhibit the adoption of ICTs in clinical practice. Social media, in particular, were perceived by participants as 'dangerous' media that had no place in healthcare or required strict control. As a result, the majority of participants lacked the motivation to champion the use of these media in regular antenatal care.

When we asked members of the second focus group (n=9) if they would feel comfortable 'speaking' to women online, the response was a unanimous *'no'*. Participants noted several issues, such as fear of being taken out of context, the potential blurring of professional and personal roles, and the legal implications of having your name identified with information that could be misused. As one interviewee said, *"The written word can be misconstrued in so many ways that you've gotta be pretty careful. I don't want my name misused, basically"*. For this group the benefits of communicating online were outweighed by the possibility of negative interactions, such as cyber-bullying. In particular, staff were concerned that utilising social media could threaten their authority or control by providing a communication forum that was multi-directional and difficult to regulate: *"You'd be opening it [communication] up too wide".* One participant stated that these technologies would provide *"an avenue for raving nutters"*, highlighting fears that patients would misuse these mediums by making frivolous enquiries that could be time consuming to monitor and difficult to respond to. As explored in this research project and published elsewhere the specific characteristics of a medium can have clear implications for the control of message and the location of expertise [16]. Despite the risks, this aspect of social and multi-directional media can (with proper resourcing) be managed and offer the benefits of peer exchange and community participation and support.

The issue of greatest concern to participants when discussing use of online communication channels were the sensory limitations of online communication, particularly the inability to observe bodily and vocal cues to assess women's condition. Midwives preferred to see women in person to assess their condition and worried that missed vital non-verbal signs could lead to misdiagnoses and potentially life threatening situations. For example, one midwife stated that it was difficult to *"pick up on their tone"* when interacting online. The inability to visually confirm who you are talking to online also troubled midwives who were concerned about the anonymity of many online mediums: *"You don't know who you are talking to"*. Our research found that staff had a clear preference for media that could be used for one-to-one communication. Where multi-directional media were discussed positively they tended to be communication mediums that could be strictly regulated and which did not engage clients in a feedback loop by inviting them to 'talk back' or connecting them with other patients. For example, while participants noted that their clients already sought information online, they expressed concern about the inaccuracy of information on the Internet and indicated that antenatal patients should be cautious about the quality of information available online. One midwife stated, *"A lot of the information they get comes from chat rooms unfortunately...and forums and things which is not helpful."* Another said, *"You have to be a bit careful with [social media] because how can you regulate that? It's the same with the Internet sites...a lot of the information that you get on the Internet is not 100% accurate. It can be written by anyone."*

These quotes reflect the commonly held opinion that pregnant women's personal use of ICTs created problems (i.e. misinformation) that needed to be resolved by health professionals [17, 18]. Despite these concerns about the inability of pregnant women to discern between accurate and inaccurate information online, midwives did not consistently inform women about evidence-based pregnancy-related websites. While 58% (n=11) of midwives surveyed did

discuss websites with pregnant women, 42% (n=8) stated that they did not and all of the participants in the second focus group 47% (n=9) said that they did not refer women to websites [4].

Concerns raised in the focus groups were mirrored in midwives' survey responses. Participating midwives were asked about the forms of media that they believed should be employed by the hospital to improve antenatal health communication and education. More than one response could be given per participant. Social media did not rate highly with just 11% (n=2) believing Facebook had a place in healthcare, 26% (n=5) were interested in a phone app, 26% (n=5) indicated that improving the hospital website was important, and 6% (n=1) mentioned interactive technology (not defined). Telephone reminders (47% n=9) and text messages (53% n=10) were identified as valuable for improved attendance at appointments and for the delivery of positive health messages.

3.6 Discussion

3.6.1 Limitations of the study

The participants of this study were limited to midwives working at a single hospital. The total number of participants in the study represented approximately 20% of midwives employed within the hospital. Participants in individual and focus group interviews were selected based on their specific role in antenatal education. Midwives completing the survey were self-selecting, but not all midwives who worked at the hospital were given the opportunity to be involved in the study, thus creating a possibility of biased results. Further research will be required to determine whether these results can be generalized to midwives working in other locations or to other healthcare professionals.

Our study demonstrates that the attitudes of health professionals to the implementation of ICTs in healthcare must be addressed if ICTs are to be successfully used in health communication [19]. ICTs can be used to compliment and assist health professionals in their practice [20], but the inhibitions felt by many must be taken seriously. Health professionals' can be assisted in this through education and training [21], but these must encompass more than just basic skills training, because usage and motivational access may still form significant barriers to effective ICT use [4, 22]. Innovative methods should be devised to foster positive attitudes to ICT use amongst healthcare professionals and to mitigate the potential risks in ICT usage identified by staff.

Pregnant women and their supporters want to be listened to and recognised for their opinions and feelings and will seek opportunities to do so of their own volition if this is not possible through formal antenatal care [17, 22]. Social media may be an effective way to achieve this engagement, because of the opportunities it offers for two-way communication between clients and health professionals. It need not be considered as an alternative to the one-to-one consultation between patient and healthcare provider, but can be used as an educational and informational tool to compliment information given at appointments and to encourage further learning and interaction with their healthcare provider [19].

3.7 Conclusion

Midwives recognise both the potential benefits and possible risks in the use of ICTs in the delivery of pregnancy-related health information. However, our research suggests that at the present time the latter contributes to the construction of usage and motivational access barriers typical of those described by [7]. Therefore, we consider that for the development and use of new ICTs it is imperative that midwives' training should include learning skills in the handling

of online issues, such as cyber bullying and the management of inappropriate language by patients, as well as basic skills training.

Healthcare organisations should consider developing information and educational ICTs to assist health professionals in their delivery of health information and education. This can assist them with time efficiency and consequently become cost effective. If midwives and other health professionals want to facilitate effective behavioural change for the health and wellbeing of their patients then they must listen to their clients, understand their educational needs, and meet those needs using appropriate media and communication channels [23]. It is strongly recommended that further studies be conducted to identify the effectiveness of ICTs in healthcare in terms of user (both professional and consumer) response, behaviour change, health outcomes and cost-benefit analysis. Addressing the fears of health professionals is important if we are to implement ICTs into healthcare successfully. We must give professionals the tools, training and, most importantly the confidence to use ICTs responsibly in their clinical practice.

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CHAPTER 4

Waiting Room Education

4.1 Introduction

The standard practice for relaying information about pregnancy and childbirth at the Lyell McEwin Hospital (LMH) is by the distribution of many different brochures/pamphlets at the first antenatal appointment. These pamphlets include the 'Healthy Eating' booklet about dietary requirements and food portions, warnings about *Listeria* growth in food, weight gain in pregnancy and alcohol avoidance; 'Exercise' sheet that briefly discusses the need to incorporate gentle exercise during pregnancy and back care to prevent back injury; 'Beyond Blue' booklet on emotional and psychological support during pregnancy and postnatal depression; Hospital booklet that explains options of healthcare and services provided; Immunisation during pregnancy pamphlets.

A brief discussion of pertinent information in the pamphlets is initiated by the midwife, face-to-face, as a means to encourage the woman to read them to discover more. However, each midwife has their own way of presenting the information [1] and it is unclear as to the effectiveness of their individual approaches. It is also dependent on the midwife's knowledge and experience in counselling women about the content of the pamphlets. In a South Australian study, some midwives were reported to have little knowledge of the standard dietary recommendations [2].

Counselling and education sessions on nutritional requirements and diet during pregnancy are often recommended as the standard intervention [3-5]. However, midwives have difficulty doing this due to limited time, as well as not having the opportunity to assess the effectiveness of the education [2]. Thus referral to dietitians is often offered. However, these referrals are generally for obesity and weight management during pregnancy [6] or diabetes management rather than to promote general nutritional wellbeing. Counselling and education sessions require more time for the educator/counsellor and pregnant woman in addition to the usual

antenatal appointments. Therefore, the pregnant woman would need to be motivated and have the time to attend these extra appointments.

McGee, Cignetti [7] reported that health professionals complain about having insufficient time to discuss exercise during antenatal appointments and suggest that leaflets and posters or video in the waiting room could provide that information.

Prior to this thesis, we examined pregnant women's (n=56) preferences to seeking pregnancy related health information through survey (n=56) and individual face-to-face interviews (n=35, all completed the survey). Our research found that whilst seven participants (12.5%) reported not reading the Hospital supplied pamphlets and discarding them, most (n=42, 75%) sought what they considered to be the relevant information only. Seven (12.5%) claimed to have read all of the pamphlets throughout. In addition, not all women (n=7, 12.5%) were confident or interested in using digital media to receive health information.

The clinic waiting room also provides an opportunity for education with pamphlets and posters displayed. However, during observation of the clinic waiting room during the Health-e Baby Study (Stage 1), most people attending the clinic were either looking at their phone, reading a magazine or watching the TV that had commercial television programs played (Health-e Baby Study -Unpublished report 2015).

In this earlier research, we found that women reported varying levels of engagement with the posters displayed in the clinic. Some women we interviewed found it difficult to identify any key messages and the information was not always relevant, such as the cessation of smoking poster. Conversely, a Canadian report showed that 82% of patients stated being aware of waiting room posters and 95% of them actually read them [8]. However, this was just one general practice and not indicative of a large population, nor any specialised care such as

obstetrics. Maskell, McDonald [9] found over 67% of patients in their UK study considered posters and leaflets useful, but negatively associated for those with tertiary degrees.

This study concurred with Coathup, Finlay [10], finding that the use of written material (eg pamphlets) displayed in the waiting room were rarely utilised. One study reported that the lack of privacy in a waiting room prevented them from picking up a leaflet [11]. This suggests that some consumers may be too embarrassed to pick up a pamphlet that may reveal certain health issues to others in the waiting room.

Other studies on waiting room education have reported the use of television screens having been well received [9, 11]. Williams, Elliott [11] reported that 44% (n=33) of their study participants stated having watched a television health program in the waiting room, with around half acknowledging that they received a 'take home' message. This implies that they understood the information and could potentially implement what they had learned. However Williams, Elliott [11] reported that there is little evidence that behaviour change and discussion with the healthcare provider about these messages were achieved. Therefore, the effectiveness of this media is variable. It is dependent on the needs of the consumer in the waiting room, as well as the motivation of the time poor healthcare provider to discuss the content [12].

In the Health-e Baby study, clinic staff and pregnant women considered the use of the television in the waiting room as a good medium for antenatal education, recognising that this was a missed opportunity. They presumed that a TV based presentation would be effective in providing healthy pregnancy and lifestyle messages that would be relevant to the consumer. Based on this information and other research [11-13], an antenatal health educational PowerPoint presentation for the clinic TV screen was created.

4.2 Hypothesis

It was hypothesised that the utilisation of an educational TV presentation in the clinic waiting room would provide important health information in a subtle way that would assist behaviour change and engagement with healthcare services.

4.3 Aim

1) To develop an Antenatal Education PowerPoint presentation

2) To evaluate the usefulness and effectiveness of the presentation as an educational tool.

4.4 Methodology

Following the receipt of ethics approval by the CALHN Human Ethics Research Committee (Appendix 4.1), a questionnaire was provided for anyone visiting the clinic (Appendix 4.2). This included pregnant women, their partners and anyone else in the waiting room. People in the waiting room were either asked if they would like to complete the questionnaire, or self-initiated completing the questionnaire but they were not obliged to do so.

A sealed box with a letter sized opening was available for participants to place the completed survey. Some demographic data was collected relating to whether they were pregnant or a support person, age, employment and highest level of education achieved. The remaining questions related to their preferred media for antenatal information/education, whether or not they had brought anything with them to entertain themselves whilst waiting and the length of time they were waiting. In relation to the TV PowerPoint presentation, questions included enquiry into its usefulness, with a yes, no or unsure response asked and open ended questions to explore if they learned anything and what they liked and didn't like.

4.5 The Intervention

The PowerPoint presentation was a slide show that included information specific to the LMH's antenatal services, a healthy lifestyle through diet and exercise, issues such as mental health, smoking, alcohol and drugs in pregnancy and their associated support services (Appendix 4.3). Presenting localised content and support services was to show relevance to the viewer and to assist their engagement with hospital services. The utilisation of pictures, arrows and signs was to enable non-English speaking women and those with poor literacy skills to understand the health messages. Short sentences and simple words were also used as recommended in the Nine Dimensions of Health Literacy [14] and the EDUCATE Model [15]. There was no sound, music or videos attached to the presentation. The duration of the presentation was 28 minutes for 81 slides. Whilst the presentation was lengthy, it was assumed that viewers would have the opportunity to see snippets of information at various appointments, such as they would from other media (eg social media or apps). If the woman was required to sit in the waiting room for 30 minutes, then she would have the opportunity to view the whole slide show, picking up personally relevant information.

The development of the Antenatal PowerPoint presentation included a review and verbal approval by the Lyell McEwin Hospital, Women's and Children's Division Nursing/Midwifery Operational Committee and the Consumer Advisory Committee.

4.6 Results

One hundred and two questionnaires were completed. Eighty six (84.3%) participants were pregnant women, twelve (11.7%) participants were male partners and three (2.9%) were other women attending the clinic (Table 4.1). Most of the participants were aged between 18 and 30

years of age (69.5%), Caucasian (n=75, 73.5%) and employed (n=53, 51.9%). Of the pregnant women, 38.4% (n=33) were in the second trimester and 61.6% (n=53) were in the third trimester of pregnancy. Around one third (n= 34, 33.3%) of participants completed years 10 or 11 at high school.

Table 4.1 Demographics- PowerPoint evaluation questionnaire

Characteristic	n (%)	Range	Mean	Standard Deviation
Gender:				
Female	90 (88.2%)			
Male	12 (11.8%)			
Age:				
<18	1 (0.98%)			
18-25	23 (22.5%)			
26-30	48 (47.0%)			
31-35	15 (14.7%)			
36-40	12 (11.7%)			
>40	3 (2.94%)			
Reason for attending:				
Pregnant	86 (84.3%)			
Family/Friend	15 (14.7%)			
Other appointment	1 (0.98%)			
Gestation:	n=86	18-39	31.015	5.1825
18-27 wks	33 (38.4)			
28-39 wks	53 (61.6)			
Marital Status:				
Single/never married	10 (9.8)			
Defacto/Married	92 (90.2)			
Ethnicity:				
Indigenous	4 (3.9)			
Caucasian	75 (73.5)			
Indian	12 (11.7)			
Asian	7 (6.8)			
African	2 (1.9)			
Turkish	1 (0.98)			
Missing	1 (0.98)			
Employment:				
Student	1 (0.98)			
Unemployed	20 (19.6)			
Home duties	27 (26.5)			
Employed	53 (51.9)			
Missing	1 (0.98)			

Education:	
Year 10	5 (4.9)
Year 11	29 (28.4)
Year 12	38 (37.3)
TAFE/Certificate	19 (18.6)
Tertiary	10 (9.8)
Missing	1 (0.98)

Participants responded on how they accessed pregnancy related information (Table 4.2). More than one response could be made by participants. Just 38.2% (n=39) reported that they used pamphlets supplied by the clinic, 80.3% (n=82) used websites, 65.7% (n=67) used a mobile phone app and 17.6% (n=18) had attended antenatal classes.

Of their preferred method of receiving pregnancy-related health information, more than one response could be made. Doctors and midwives (n=95, 93.1%), family/friends (n=77, 75.5%), phone apps (n=69, 67.6%) and websites (n=57, 55.6%) rated the highest. The TV presentation rated 6th preferred method at 20.5% (n=21).

Table 4.2 Access to pregnancy related health information

Accessed pregnancy related information	**n (%)**
Antenatal clinic pamphlet	39 (38.2)
Books	0 (0)
Websites	82 (80.3)
Phone Apps	67 (65.7)
Antenatal classes	18 (17.6)
Preferred method of receiving pregnancy related health information	
Antenatal Clinic pamphlets	24 (23.5)
Books	8 (7.8)
Websites	57 (55.6)
Phone apps	69 (67.6)
Antenatal Classes	14(13.7)
TV presentation in clinic	21 (20.5)
Doctors and Midwives	95 (93.1)
Family and Friends	77 (75.5)

The time spent in the waiting room and activities performed waiting for the participant's antenatal appointment varied with 68.6% (n= 70) waiting for 20 minutes or more (Table 4.3). With the PowerPoint's 28 minute duration, these participants had the potential to view the whole presentation.

Table 4.3 Waiting room activities

Time spent in the waiting room	
	N (%)
0-5 min	0 (0)
5-10 min	12 (11.7)
10-20 min	20 (19.6)
20-30 min	32 (31.4)
30-60 min	33 (32.4)
>60 min	4 (3.9)
Missing	1 (0.98)
Entertainment brought to the waiting room	
Yes	63 (61.8)
No	31 (30.4)
Missing	8 (7.8)
Type of entertainment brought	
Book or Magazine	0 (0)
Mobile phone	68 (66.7)
Tablet	0 (0)
Other	0 (0)
Activities performed in the waiting room	
Browsing the internet	27 (26.5)
Playing games on mobile device	23 (22.5)
Text or messaging family/friends	63 (61.8)
Reading a book or magazine	1 (0.98)
Talking to partner or friend	35 (34.3)
Caring for children	7 (6.9)
Filling out medical paperwork	0 (0)
None of the above	3 (2.9)
Read any pregnancy related pamphlets while in the waiting room	
Yes	0 (0)
No	102 (100)
Read any pregnancy related posters while in the waiting room	
Yes	33 (32.4)
No	69 (67.6)

Aware of the TV presentation for pregnant women	
Yes	95 (93.1)
No	7 (6.9)
Watched the TV presentation	
Yes	88 (86.3)
No	14 (13.7)
Learnt something new from the TV presentation for pregnancy women	
Yes	61 (59.8)
No	41 (40.2)
Intend to contact a service or seek out further information about a topic discussed in the TV presentation for pregnant women	
Yes	4 (3.9)
No	54 (52.9)
Not sure	42 (41.2)
Missing	2 (1.9)
The TV presentation in this clinic provided useful information about anxiety and depression	
Yes	69 (67.6)
No	0 (0)
Not sure	25 (24.5)
Missing	8 (7.8)
The TV presentation in this clinic provided useful information about how I can reduce my stress	
Yes	63 (61.8)
No	0 (0)
Not sure	38 (37.3)
Missing	1 (0.98)
I think the TV in the Clinic is a good way to learn about pregnancy:	
Yes	72 (70.6)
No	0 (0)
Not sure	25 (24.5)
Missing	5 (4.9)

Whilst waiting for their appointment in the clinic, most participants used their mobile phone to text message (n= 63, 61.8%), browse the internet (n= 27, 26.5%) or talked to the person that they were with (n= 35, 34.3%).

None of the participants looked at a pamphlet or brochure that was on display in the waiting room. Engagement with the posters on display was made with just 32.4% (n=33) of participants but 93.1% (n= 95) were aware of the TV presentation. However 86.3% (n= 88) reported watching the presentation.

Of the eighty-eight (86.3%) participants who watched the presentation, 59.8% (n= 61) stated that they learnt something from the presentation. Forty participants (45.4%) reported the information learned was regarding diet and vitamins important for pregnancy (n=20 22.7%), exercise (n=2, 1.9%), depression, anxiety and relaxation (n=11, 12.5%), drugs and alcohol (n=8, 9.1%) and where to get help (n=2, 1.9%).

In relation to the usefulness of the depression and anxiety information, 61.8% (n=63) said yes, it was useful. Two (2.3%) participants were unsure, making comment that they did not see the part of the presentation regarding the topic. Comments made were, "*it depends on how much time you have to wait for your appointment', "I had to go to see the doctor so I didn't see it all" and "What I saw of it , it was good"*, indicating limitations of the presentation by way of time spent in the waiting room.

The information about stress management was considered useful by 61.8% (n= 63) of participants who watched the presentation. The remainder of participants were unsure of its usefulness. However 70.6% (n= 72) of participants considered the use of the presentation was a good way to learn, with the remainder unsure.

The relevance of the presentation was recognised by one participant who wrote, "*Sure, it's good to see something relevant to my pregnancy on the TV"* and another participant saying, *"For new mothers- excellent. Also provides up to date info".*

In relation to the overall usefulness of the presentation, participants wrote, *"Excellent idea. Very informative, lovely unobtrusive way to learn. Easily digested"* and "*It will grab the attention while waiting for the appointment and finding useful information in the presentation is good".* One non-pregnant woman wrote, *"Didn't have this much information in my day. Glad my daughter has it."* Another participant reported, *"Not sure if I actually learnt anything but it was a good distraction while I waited."*

Four (4.5%) participants stated that they would like either speaking or music during the presentation, by commenting, *"Did not like no sound", "video or someone talking would be useful if you didn't want to read it all"*, *"would like some music or someone talking" and "maybe some music attached".* Also the multicultural needs were identified by two (2.3%) participants stating *"Maybe could have in other languages as I see foreign people here a lot"* and *"Sound and other languages, otherwise excellent".*

4.7 Discussion

In this study, participants preferred to receive health information from health professionals. This is congruent with a UK study that reported 80.4% (n= 447) preferred face-to-face information by a health professional [16]. Face-to-face, one-on-one education by a health professional is the best method of education because the information can be tailored to the individual's health and learning needs [17]. However face-to-face education is not always accessible and time is often limited for the health professional [18, 19]. Pregnant women don't always know what they should be asking, therefore they may not receive important information that they may need [20]. Health professionals require educational tools to assist them to educate pregnant women by reinforcing the health messages they give [21].

A significant number of participants in our study had used websites (80.3%, n=82) and mobile phone apps (65.7%, n=67) to access information. This could be due to the ease of access of the internet compared to the availability and access to a healthcare provider [22, 23]. Also participants used more than one medium to access information. This was perhaps to compare information in search of the 'truth' [24].

Whilst not the first preference, the Antenatal PowerPoint presentation evaluation showed that the presentation was a "good distraction" whilst waiting for an appointment and provided relevant health information. However, the intent of the TV presentation was to inform and educate, not just be a distraction. Comments by participants recommending the use of videos may improve engagement and its effectiveness as an educational tool.

A systematic review of the use and effectiveness of a 'video-assisted' education intervention, found a difference between the types of video presentations [25]. 'Didactic' video provides verbal instruction that may or may not have figures to demonstrate or describe. 'Practice' videos involves actual people being filmed, demonstrating how to do a particular task such as using an inhaler or performing a finger prick for blood glucose testing. Thirdly, the 'Narrative' video has people acting scenarios as a means to educate and change behaviour. Abed, Himmel [25] reported 7 out of 10 studies reviewed showed the 'Practice' and 'Narrative' videos as significantly affecting behaviour change. However, the 'Didactic' method did not have the same effect. It was considered that the persuasiveness of the 'Narrative' video had greater ability to provide a sense of connectedness for the viewer, with the characters and events. This would assist in enabling information to be processed, provide "surrogate social connections" and reduce resistance to change.

Similarly, Denny, Vahidy [26] reported that a video presented in a question/answer format with someone acting as a patient asking questions and answers being given by a health

professional (Narrative method), increased participant knowledge and self-efficacy. The question and answer format placed the viewer in the position of patient, thereby helping them to relate to what they were watching. However, Abed, Himmel [25], reported there was no decisive evidence that video-assisted education provided self-efficacy in behaviour modification.

A study in the US compared the use of an interactive video and booklet (n= 190) versus a booklet only (n=203) for patients with the potential for back surgery [27]. The video utilised animated graphics and verbal explanations (Didactic method) that could be specific to the individual's circumstances by having them clicking onto their health issue (e.g. herniated disc, spinal stenosis). They found a significant difference (p= 0.04) in the severity of back pain experienced by participants, with those in the video/booklet group reporting less pain. This showed that the instructive video information on back care and pain management was more effective than the booklet. Whilst not significantly different, the booklet only group had a higher surgical intervention rate (33% vs 26%, relative difference 22%, p= 0.08). It was suggested that the information provided on the video was better understood by participants than just the booklet alone. Participants had a distinct preference for the video than the booklet due to its ability to engage and create more interest for users. The authors also considered that the video assisted in improving the process of informed consent for surgery [27].

Goodman, Mossad [28] conducted a randomised controlled trial (n=105) to assess the persuasiveness and impact of a video intervention ('Narrative' method) in regards to women's beliefs surrounding the health benefits of the influenza vaccination in pregnancy and the uptake of the vaccination. It was reported that whilst the video positively influenced participant's beliefs, it failed to positively impact on the rate of vaccination. Participants were four times more likely to have a vaccination if the doctor had recommended it face-

to-face. This is perhaps similar to our study that showed participants preferred face-to-face education with a health professional.

A randomised controlled study in Korea compared the effectiveness of face-to-face education and video education in relation to the use of a Ventolin inhaler [29]. They reported that both methods were equally safe and effective. However, the cost of the video was less than the cost of appointments with a health professional, they could be played numerous times over, reduced the degree of embarrassment for the patient, particularly for the elderly who may need more time to learn.

In a waiting room setting, the amount of information received from TV education can depend on how long the participant was sitting in there [30]. However, this may also depend on the relevance and interest level the viewer has on the presentation [12].

One study reported only 25.1% (n= 140) of respondents to a survey often watched TV presentations in the waiting room with 68.7% (n= 382) considering posters and pamphlets to be useful [16]. This was not the case in our study, with no participant claiming to look at the pamphlets displayed.

A study conducted in rural Victoria, Australia reported 44.6% (n= 33) of respondents viewed a health promotion video on a waiting room TV. However, of those 51.5% (n= 17) watched for a few minutes, 36.4% (n=12) watched for 10 minutes and 12.1% (n= 4) watched for more than 20 minutes [30]. In the Health-e Baby study, the time spent in the waiting room did not necessarily equate to the time spent actually watching the TV presentation. This highlights a limitation of our study as we did not ask how long they watched the TV presentation.

It should be noted that the Victorian study was conducted in a GP's rooms and the topic content may not have been relevant to all respondents. Topics included healthy diet, exercise and fitness, diabetes, wound dressings and skin cancer. Respondents who were able to recall what they observed had spent more time watching the TV than others [30]. In our study, those who commented on what they learned spent at least 20 minutes waiting for their appointment.

Participant's recognition of the use of video or sound to improve our presentation reflects the possibility for improved engagement. However, sound can have negative effects, such as being too noisy (hence annoying) or too quiet (too difficult to hear), depending on where the person sits in the room [13].

Participants who suggested the presentation to be more culturally and linguistically inclusive were similar to those in a UK based study within a migrant rich community [13]. Whilst the Health-e Baby study included participants of different ethnicity, non-English speaking people were not included. Thus assessment of the presentation's ability to inform the culturally and linguistically diverse with its pictures and symbols could not be made. An interpreter to help people to complete the survey was not available for our study.

In retrospect, the development of the TV presentation should have involved the consumer, particularly in relation to the style and content. It was developed with consideration as to what information was already being given to women in a paper-based format, through the eyes of a health professional and not as a consumer. Consumer engagement is important in all stages of the development and implementation of an education intervention [31].

Nevertheless, whilst health literacy was not examined, studies have suggested that health information in the waiting room was valuable for improving health literacy [11, 16, 30] and utilisation of the TV had the potential to change behaviour [13].

4.8 Conclusion

Waiting room educational tools, whether they be paper-based or digital are valuable assets [15] to help pregnant women think about topics they may need to discuss with a health professional or prompt further information seeking behaviour [32, 33]. Our Antenatal PowerPoint presentation was considered by participants to be useful for antenatal education in the waiting room, however a video utilising a 'Narrative' or 'Practice' method of presentation could have been more effective for engagement and educating [25]. In addition, the recall of information from the TV presentation was dependent on the time participants spent waiting for their appointment.

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CHAPTER 5

The Development of the Health-e Babies App

5.1 Introduction

Mobile health apps are ubiquitous and they have been developed to assist consumers, as well as health professionals, in many different areas of health, including for mental health [1-3], weight management [4, 5], medication management [6], fitness [7-9], cardiac monitoring [10], cancer [11] and many other chronic diseases [12] and lifestyle issues [13]. Pregnancy related apps provide content that may include information about physical changes in pregnancy, fetal development, diet and exercise, tracking fetal movements and uterine contractions [14, 15]. Many women also like to make diary entries about their pregnancy using an app [16]. Whilst apps are most often used by women having their first baby [17] they provide a means of reassurance and guidance for all pregnant women [15]. However, the content is largely dependent on the focus of the app development team regarding who they want to target and what they want to promote. Pregnancy apps are not always consumer focussed, with many being profit driven evidenced by the sponsorship and promotion of commercial baby products within the app [18].

The advantages of mobile pregnancy apps compared to other pregnancy media include their accessibility anywhere at any time that suits the user. Apps can also provide a broad spectrum of generic information with or without internet access once they have been downloaded. Despite some reports of less uptake due to financial barriers (including costs of hardware, mobile phone plans, including data) [19], it has been suggested that the use of digital technology is not restrictive for socio-economically disadvantaged pregnant women [20]. Potential barriers to access and use include the purchase price of some apps which can be too costly or that some apps can take up too much space on a mobile phone [21]. Despite these possible limitations, pregnancy apps are still well utilised within this group [20, 22] and our earlier research was congruent with other studies that reported many women having more than one pregnancy app on their phone [23]. While some studies have speculated that if someone has a mobile phone,

then they can navigate a digital app with little confusion [24], additional research is needed to explore whether or not a lack of digital literacy skills are prohibitive for some potential users.

There is much broader consensus in the literature regarding concerns about the identified failure to regulate apps [25, 26]. The accuracy of information validated by research is often neglected and app developers generally do not involve healthcare providers in the app development process [26]. In addition to this, if the content of the app fails to engage with the user due to its lack of localised or culturally specific content or a failure to provide information that is appropriate for their language and literacy skills, the app user may be less likely to trust the information or continue to engage with an app [27-29]. Other studies have reported that continued engagement is difficult to maintain, with high drop off rates following initial usage. Therefore, the app needs to not just provide accurate and useful content but should have some tactical methods within the app to encourage ongoing engagement [30].

With the knowledge of these concepts, advantages and potential pitfalls, we considered that a mobile pregnancy app for disadvantaged women should be developed and trialled.
Information about what to expect during pregnancy, how to achieve health and wellbeing, enabling easier access to reliable and accurate health information with specific referencing of localised healthcare and community support services would provide relevance.

The design and content of the Health-e Babies App was specific to women attending the trial hospital (Lyell McEwin Hospital, Elizabeth Vale, South Australia) whose catchment area encompasses the lowest socio-economic region in metropolitan Australia, with a high level of domestic violence, depression, anxiety and financial hardship [31]. This meant that our team would ensure there was a focus on these issues within the app content. The content of the app

would include the transformation of the paper-based information in the booklets that were already provided using a different medium.

5.2 Hypothesis

We hypothesised that a pregnancy app that contained research based information, specific to South Australian health policies and procedures, the services within the trial hospital and community resources, would better meet the antenatal educational needs of disadvantaged pregnant women.

5.3 Aim

Our aim was to develop and test a pregnancy app that would effectively engage disadvantaged pregnant women to improve their health literacy.

5.4 Assumptions made about the target cohort

Due to the low socio-economic status (SES) of the study setting, assumptions were made regarding the target group. These were that the pregnant women attending the study hospital had a low income, low literacy and/or limited education, low health literacy, had minimal social support such as single marital status, few parental role models and/or limited emotional support (http://data.sa.gov.au). Also women had a high level of mental health issues and/or domestic violence [31]. These issues were a priority to ensure that the messages that we wanted to convey to the participants would be presented in an appropriate way.

5.4.1 Low income

The SA Health Atlas has shown that around 20% of families within the catchment area of the Hospital are dependent on welfare payments with 26.7% - 36% of families being single parent families with children under 15 years of age (http://data.sa.gov.au). This led the research team to assure that the Health-e Babies App would be free of charge. Participants in the study would ideally have the app downloaded via free 'wifi'. Whilst it was evident in our early research that all women attending the antenatal clinic at the trial hospital had access to a mobile phone [22, 32] or tablet, their poor ability to afford storage data and internet access was concerning. We did not want the Health-e Babies App to be a costly app by way of data usage as this would limit access to the women who needed the information the most. However, we chose to provide instant access to reputable websites if the user wanted to seek further information. For example, if a woman wanted to know more about drug and alcohol use in pregnancy than the information provided in the app, then she could click on the relevant icon asking if she wanted more information and it would bring up the website for the 'Drug and Alcohol Service of South Australia'. Participants would be advised to go to a 'free wifi hot spot' such as the local library, to access the websites.

5.4.2 Low literacy

With around 26% of mothers with children under the age of 15 years reporting that the highest level of education completed was year 10 (http://data.sa.gov.au), it was considered important that the language used in the app was at a basic level. Congruent with Barton, Allen [33] 'Health Literacy Tapestry Model', language used in the text included common English words that 10-12 year olds would be able to understand and medical jargon was limited. Medical terms, when used, were explained in common language to teach users the medical terminology that may be used at antenatal appointments. Also the information was presented in short sentences or dot points for easy reading. For those with extremely limited reading

ability, all text was audio recorded in English to enable users to listen to what was written instead of having to read it. Regretably, languages other than English were not recorded in this initial study because of time and economic limitations. However, it was recognised that this could be done in a future version of the app.

5.4.3 Low Health Literacy

Limited schooling was assumed to equate to limited knowledge about health and healthy lifestyles [34]. A health literacy assessment was considered by the research team prior to the trial but it was seen to be beyond the scope of the project. Whilst this would have been an important inclusion, time and financial constraints prevented this. However, the Health-e Babies App was intended to provide information to improve health literacy and be an easy and reliable resource for users.

5.4.4 Minimal Social Support

Supportive family and role models for the target group are limited [31], with 30% of the population being single mothers (http://data.sa.gov.au). Access to information to improve users' social support network and community resources such as parenting groups for young parents/single mothers and financial advice services were included to help meet these needs.

5.4.5 High level of mental health issues and/or domestic violence

Mental health, drug and alcohol abuse and domestic violence were a priority concern during the development of the Health-e Babies App. Edwards, Galletly [31] reported that there was a high prevalence of these issues amongst women attending the study hospital. The daily struggle these women experienced impacted heavily on their lives. Thus providing support

service information and tools to assist in managing psycho-social problems were recognised as ways to help women focus on managing these issues as well as their physical health.

One midwife's perception of many young pregnant women attending the study hospital was that their social issues were so great that these women had trouble focusing on their pregnancy and therefore had difficulty changing poor diet and lifestyle [32]. If the Health-e Babies App could attempt to help these women with some of these problems, then it was considered a way of also encouraging healthy behaviour change. Depression and anxiety would then be addressed by providing information about how to reduce their anxiety through relaxation techniques and motivational messages. Hospital and community contact phone numbers and websites to assist them in a crisis were important inclusions in the app.

All of these assumptions were addressed throughout the development of the Health-e Babies App as they were deemed vitally important in meeting the needs of this cohort. It also had the potential to promote engagement with the app.

5.5 Development team

The development of the Health-e Babies App was achieved with the collaboration of a small team of app developers (Holopoint Interactive, Adelaide, South Australia) for the digital technology development, the Health-e Baby Study research team and consumers by way of three focus groups. The consumer focus groups were conducted at different stages of the app's development to assess its useability, readability, content, design and identify any issues before the trial commenced. Maintaining a consumer focus and relevance to the target audience was of significant importance because we wanted women to engage with it.

5.6 Health-e Babies App Intervention Framework

An intervention framework was developed to ensure that the team was focused on what we wanted to achieve (Table 5.1). The app development process required us to recognize and answer important questions necessary to keep on track.

Table 5.1 Health-e Babies App Intervention Framework

Component	Activities	Questions
1. Mobile device	• Develop and assess a smartphone application that supports improved maternal health.	• Does the app target appropriate aspects of maternal health? • Does the app focus on improvement to maternal health?
2. Literacy	• Content of the app is provided in short sentences, diagrammatic for low literacy and health literacy levels. • Content includes all aspects of antenatal care, fetal development, health information relevant to the 2nd trimester of pregnancy.	• Does the app work within existing levels of health literacy? Is it easy to read, comprehend? • Does the app assist in improving health literacy? • Does the app reinforce messages delivered via printed media? • Does the app make appropriate connections to printed media?
3. Internet	• Develop a list of high quality Internet resources that LMH recommends to clients.	• Does the app provide access to an archive of appropriate content without the need for internet access? • Is it easy to access the internet via the app?
4. Communication	• Develop a list of hospital and community contacts for the app.	• Does the app provide clear opportunities to contact appropriate healthcare services? • Does the app assist in providing continuity of care?

The first two focus groups (n= 2, n=4) were presented with paper prototypes of the app to assist in their understanding of what the app would look like. Discussions were made

regarding every aspect of the proposed content and appearance of the app, utilising our Intervention Framework. The third focus group (n=5) members were given the app to view on a tablet and mobile phone. This enabled them to test the appearance and useability, as well as review the content of the app. This was an opportunity to 'fine tune' the app prior to the trial.

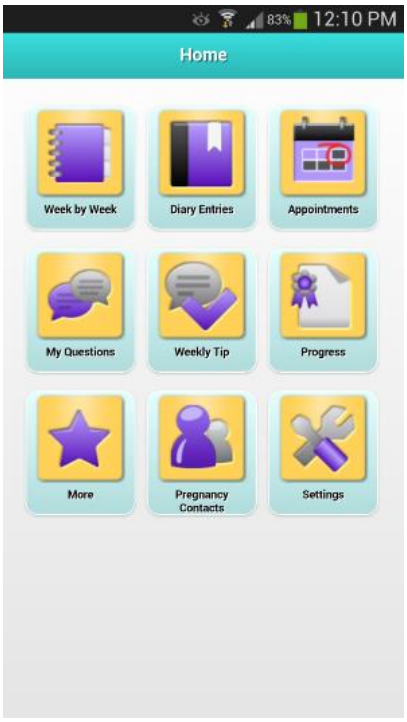
Key hospital staff were also given a demonstration of the app before the trial to ensure the content was accurate, research based and appropriate. The key personnel were midwifery and obstetric staff and the hospital's Consumer Advisory Committee.

5.7 Health-e Babies App Content

5.7.1 'Home' page

The 'Home' page offered icons for the user to choose depending on their interest at that time. Icons were labelled 'Week by Week', 'Diary Entries', 'Appointments', 'My Questions', 'Weekly Tip', 'Progress', 'More', 'Pregnancy Contacts' and 'Settings' (Figure 5.1).

Figure 5.1 Home Page

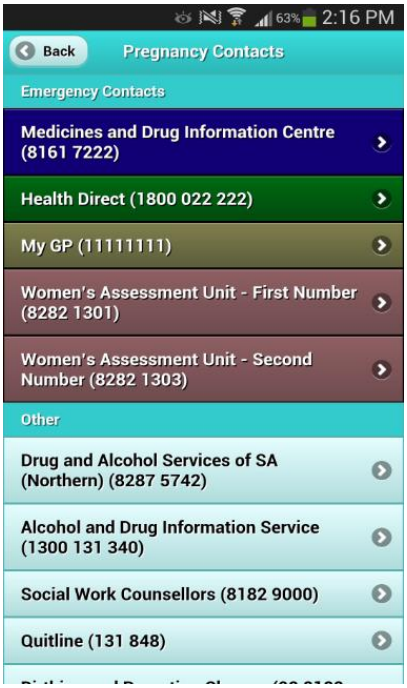


‘Diary Entries’ enabled the user to document anything they wanted about their pregnancy or how they were feeling. Appointments for ultrasounds, midwife or doctor could be entered in the ‘Appointments’ section and reminder notifications of the appointments would be sent to the phone by a text message. This could also serve to remind the app-user to view the app and look at more information within the app. Thus maintaining engagement was considered important for the apps success.

‘My Questions’ gives an opportunity for the app-user to write questions that they want to ask their healthcare provider at their next appointment. This way they would not forget what they wanted to ask. A ‘Weekly Tip’ is a short message to inform the user of helpful ideas or healthy reminders. The ‘Progress’ icon did not have any content for the pilot app and provided space for more information if the app was further developed.

‘Pregnancy Contacts’ provided access to phone numbers for a variety of hospital and community resources, including emergency phone numbers, mental health services, parenting groups, multiple births association, charity organisations and their personal GP (general practitioner) could have their phone number entered into this section for quick and easy access (Figure 5.2). When a phone number was selected by the user, they would be asked if they wanted to dial this number and if they clicked ‘yes’ then the phone number would be automatically dialled.

Figure 5.2 Contacts

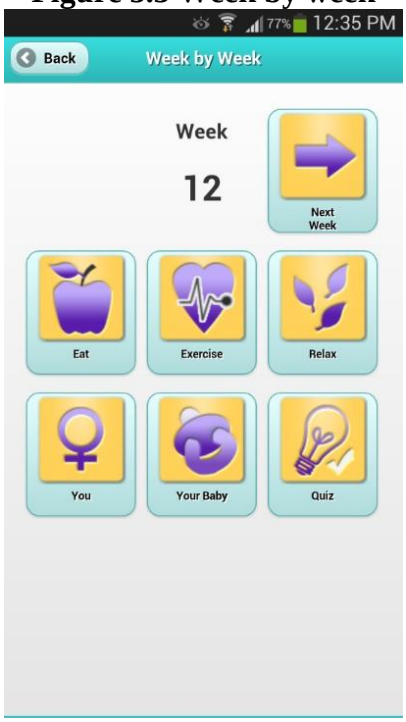


The 'Settings' icon would allow the app-user to disable the app to stop reminder notifications of coming appointments. It was decided by the research team that there was contact and supportive information within the app if an app-user had suffered a miscarriage, therefore it may be more helpful not to delete the app completely from the mobile phone. App-users were given written and verbal instructions about this. The remainder of the 'Settings' section was for use by the research team to enable information from the app to be downloaded onto a computer to collate actual use data.

5.7.2 'Week by Week' section

Our earlier research reported that pregnant women were most interested in keeping track of fetal development during the pregnancy and knowing what physical changes they may be likely to experience [22]. In response to this, the 'Week by Week' section was developed. (Figure 5.3).

Figure 5.3 Week by week



Each week from week 12 through to week 22, information about baby would be provided as to the physical development of the fetus, including an ultrasound picture (Figure 5.4).

Figure 5.4 Fetal development

Maternal physical and emotional changes that may occur were also mentioned with suggestions on how to resolve any problems such as ‘morning sickness’, constipation, abdominal pain and bleeding (Figure 5.5).

Figure 5.5 Tips

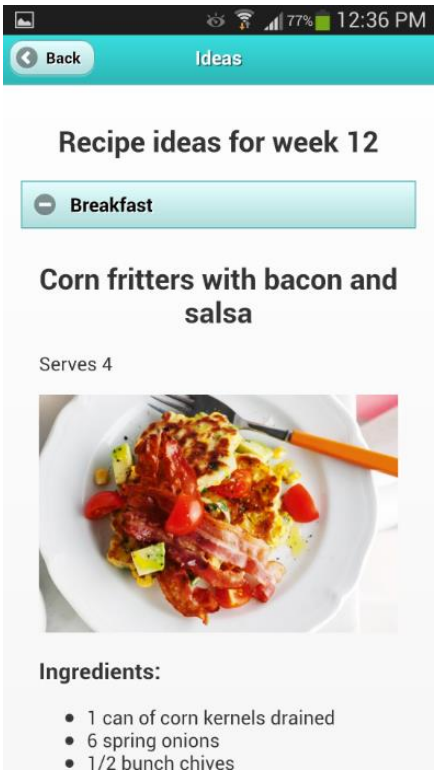
At the appropriate gestation week, diagnostic tests such as the nuchal translucency and morphology ultrasounds, and glucose testing were discussed. This included an explanation of the reason for the test, preparation for the procedures and any associated risks that may be involved. Contact information on where to seek further information about these procedures was provided.

With a focus on health promotion, each week provided information to healthy eating, exercise and relaxation. Dietary recommendations were according to the Australian Dietary Guidelines 2013 (https://www.nhmrc.gov.au/**guidelines**-publications/n55), the ‘Go for 2 and 5’ campaign (2 fruits and 5 vegetables per day) (http://www.gofor2and5.com.au), the ‘Rainbow diet plan’

that recommends eating foods of the colours of the rainbow to provide a broad spectrum of nutrients per day (https://www.naturalbalancefoods.co.uk) and the National Heart Foundation recommendations (https://www.heartfoundation.org.au). The information provided was also reflective of the paper-based information already given to women attending the antenatal clinic. The dietary information was reviewed by the trial hospital's senior dietitian before being added to the app content.

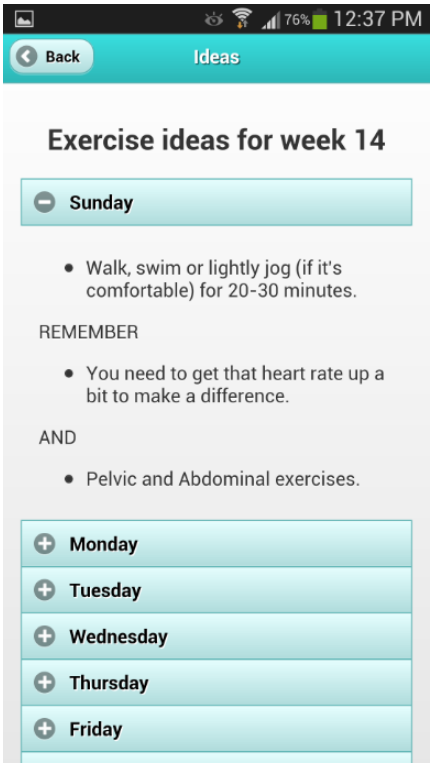
The 'Eat' icon provided ideas on how to manage morning sickness, foods to avoid due to risk of *Listeria* and recipes to promote the dietary recommendations. Recipes were provided weekly for breakfast, morning tea, lunch, afternoon tea, dinner, supper with references to the source (Figure 5.6). This was to assist women who had little knowledge of cooking, on how to prepare meals that would incorporate all food groups into their diet every day. Portion sizes were also mentioned. The term 'diet' was deliberately not used so as to normalise healthy eating and avoid any negative connotations.

Figure 5.6 Recipes



The ‘Exercise’ icon aimed to encourage women to do some form of physical activity that would not interfere with busy lifestyles. During pregnancy, regular exercise is thought to assist with flexibility and endurance for labour and birthing, mental wellness, weight management and overall physical health [35]. However, some studies have shown that there is often confusion as to how much exercise and the type of exercise that is safe during pregnancy with many health professionals failing to provide correct information [35, 36]. For the Health-e Babies App, exercises were described with diagrams, as recommended by the hospital’s physiotherapists and endorsed by the Australian Physiotherapists Association. Again the same information that is given in paper form at physiotherapy appointments was replicated for the app (Figure 5.7).

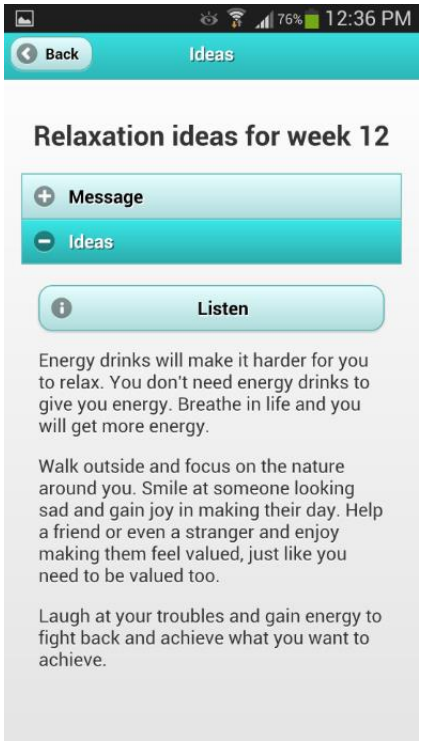
Figure 5.7 Exercise



Due to the perceived high levels of anxiety and stress of the target group, the ‘Relaxation’ icon provided positive affirmations and tips on how to relax and to take the time to do this.

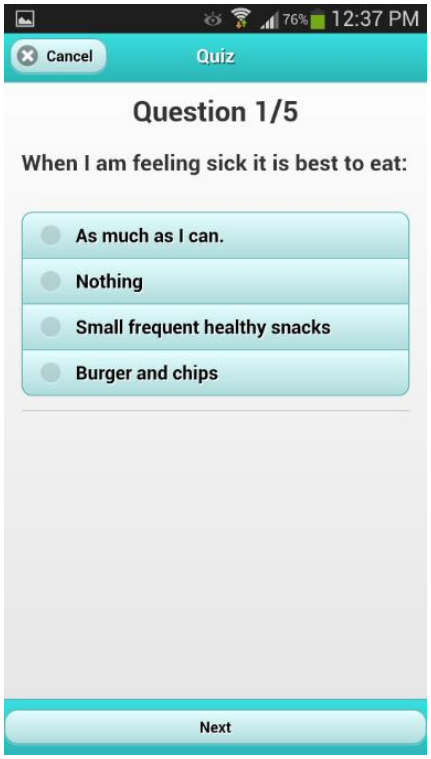
Meditations were audio recorded to allow the user to get comfortable and drift into a meditative state (Figure 5.8).

Figure 5.8 Relaxation



The ‘Quiz’ icon was developed as a means of promoting engagement and fun, as well as providing a means of educating women on the app content. Whilst the multiple choice questions were relatively simplistic and some answers were silly, the focus was to have them think about a healthy lifestyle and problems in pregnancy and how to resolve them themselves (Figure 5.9).

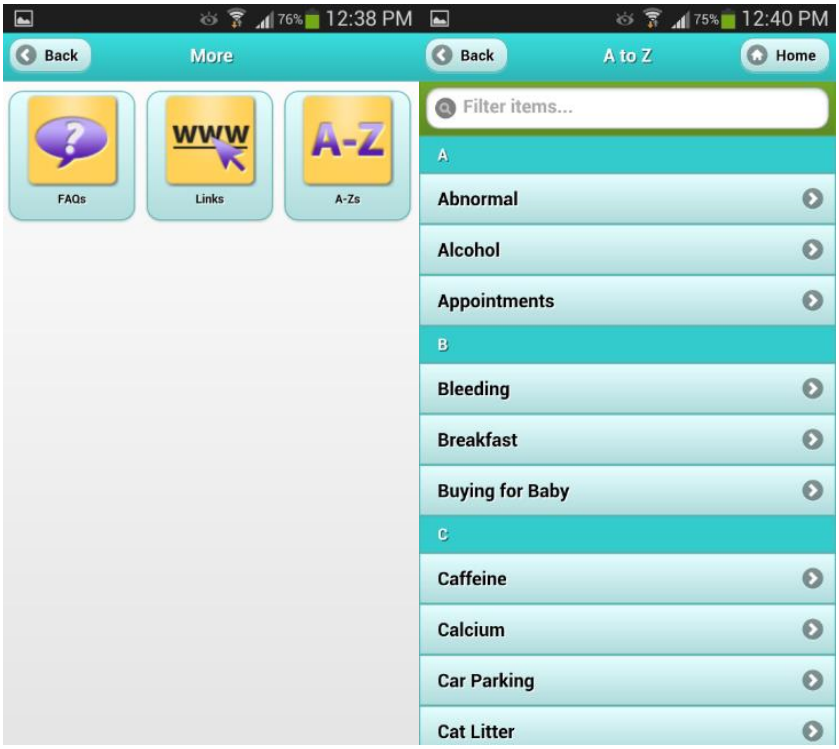
Figure 5.9 Quiz



5.7.3 'More' section

The 'A-Z' icon listed in alphabetical order, topics that may be of interest or a problem during pregnancy (Figures 5.10 and 5.11). These included topics such as bleeding, ultrasounds, *Listeria*, infections, social and mental health services, what is needed for baby (e.g. clothes, furniture, car safety seats) and advice on where to get these items cheaply. Knowing that limited finances prevented the purchase of new baby items, opportunity shops and similar organisations were suggested with contact details provided.

Figure 5.10 More **Figure 5.11 A to Z**

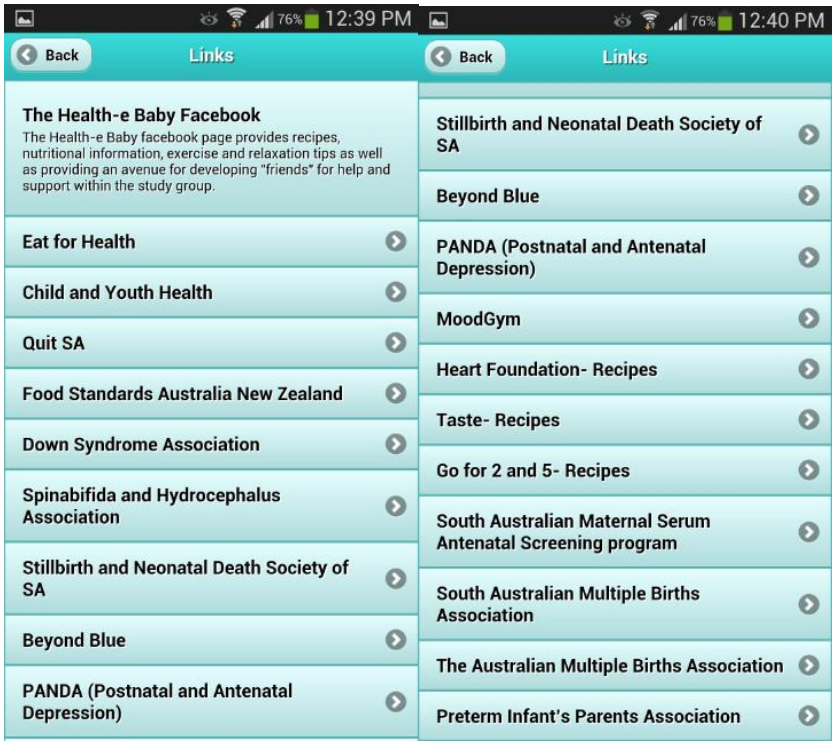


The 'FAQ' (Frequently Asked Questions) icon answered specific questions that pregnant women often asked midwives at the trial hospital but was also in line with the 'A-Z' content (Figure 5.12).

Figure 5.12 FAQ

The ‘WWW’ icon (‘Links’ section) provided users with relevant websites, such as government and government endorsed organisation websites that provided pregnancy-related information. It was considered important to provide websites that contained up to date research based information as this was a major concern for midwives and pregnant women [32] (Figure 5.13).

Figure 5.13 Links



5.8 Downloading the Health-e Babies App

The Health-e Babies App could be downloaded via a link by way of a text message or email address sent to the participant. The link was: http://tiny.cc/healthebaby . The recipient would then need to go into the ‘settings’ of their mobile device to allow the download. Because the app was ‘unknown’ to an app store and their phone would issue warnings that the app may pose a threat to the mobile device. This warning was to be ignored as there was no threat. Once the app was downloaded, the app-user was required to enter a name (not necessarily

their real name), their date of birth, due date for the baby's birth, General Practitioner's (GP) name and phone number and any future antenatal appointments. Entering the baby's due date, would enable the change of week in the 'week by week' section. By entering their appointments it would initiate a notification of the appointment the day prior to that appointment.

To enable assessment of the ease of use of the app, the only information given to the participants was how to download the app and enter the initial information aforementioned. This was given verbally and in paper form.

Following this, the app-user would be welcomed to the Health-e Babies App and then asked to enter how they were feeling. The task would require them to slide a smiling face from 0-6 (0 was feeling very sad to 6 being very happy). This was to give an indication to the researchers the app-user's current feelings. If the woman reported being very sad, then she would be advised via the app to seek help. The app-user could skip this page if they didn't want to disclose this emotion.

The next page would be the 'Home' page and the app-user could then navigate the app as they chose and for as long as they wanted to. This page then provided the user with access to the whole content of the app.

5.9 Consumer engagement with the Health-e Babies App

To provide depth of understanding of the participant's opinion of the layout, content and usability of the app, three methods were used in the evaluation. I conducted a focus group,

downloaded data from the participant's mobile devices and questionnaires administered (Appendix 5.1) at the completion of their 10 week trial of the app. Results of the surveys conducted are reported in Chapter 6.

5.9.1.a Focus group

In relation to the focus group, informed consents were obtained and the interviews were recorded and transcribed. Because the participants were unknown to each other and the researchers, they were initially shy in discussion but soon became very open with their opinions. The women (n=2) were in their 3rd trimester of pregnancy and had previously birthed one child. The duration of the interview was 40 minutes and questions were in a semi-structured format.

Each section of the app was discussed but some responses were a simple "Okay" or "good" until such time as they relaxed more into the discussion. Comments made were very positive about the Health-e Babies App. One participant saying, *"the diary entries were good"*, as she liked to make frequent entries on how she was feeling and what was going on in her life. When comparing commercial apps to the Health-e Babies App, one said, *"In terms of the types of appointments, there was more relevance"* and the other, *"I think there wasn't a huge difference, pretty similar in telling you what was happening to you and your baby'.* When asked how useful the Health-e Babies App was, they both agreed that *"it was reasonably useful. If it were my first time around I would have found it more useful'.* This was because they had remembered much of the information from their previous experience.

In relation to the contacts information that provided instant access to the hospital and community services, one said *"It's easier to go to without having to flick through the booklet".* One participant commented "*I loved the recipes. I've used one or two of them and they are*

really nice" and "*I used the diary all the time".* Both participants preferred the 'Week by Week' section as their favourite as they liked to know about fetal growth and development. Participants claimed they wanted greater depth of information in this section but added, "*You don't want too much detail cos if you don't go through what might be a sign or symptom you might go, Oh no what's wrong with the baby."* Therefore sometimes too much information can cause worry or anxiety. The A-Z section of the App was noted to provide good information and one participant said *"found the index page that you could click on (A-Z section) ... was quite useful".*

When asked if the second trimester was an appropriate time to commence the app for the trial, one participant said, *"To start off with yes, I think I'd like to see it go a bit further along because that's when a lot of things are happening"* and the other participant added *"because that sort of time period is when you are the most calm in terms of how you feel….. I think if it was my first pregnancy I would have wanted the second trimester information more….some people are more anxious near the end of their pregnancy, worried about every little niggle and pain or something they would worry about".* When asked what time frame a pregnancy app would be most suitable one participant said, *"for a first time mum you would want to know from 12 weeks onwards. For someone who has already done it, (had a previous pregnancy), definitely from like 25 weeks onwards".*

When asked if the App was easy to use, one participant said, *"yeah, you could flick through it and know where it goes".* The only technical problem identified with the App was the sound, in that the 'listen' button did not work for these participants. In relation to the appearance of the App, one participant said, "*I liked it. It was nice and simple and calm. I found it very calm to look at".* When talking about commercial apps, one participant said *"some of them are overloaded in pictures and colours that made it difficult to know where to click into".* Both participants couldn't remember if they accessed any websites from the App. When asked if they

had changed their lifestyle or behaviour in anyway in relation to diet, exercise and relaxation, one participant said "*no it just gave me some information.*" However, they did acknowledge that the Health-e Babies App gave them greater knowledge as to where to seek and access help if needed. When asked if the app prompted them to search for more information about pregnancy, one participant said *"yes, I looked into the A-Z thing and you do check more than one resource, like compare information. That's just a normal thing I do."* The other participant also responded with *"I can't say I really searched for more information but sometimes just being on other sites like Facebook and things, people share links and I would go and read them out of interest. I wouldn't necessarily look for anything extra….I didn't really feel I needed to look for anything."* She explained that this was because the app had what she needed and she had prior knowledge from her previous pregnancy.

5.9.1.b Downloaded app data

To gather quantitative data regarding the actual use of the app required me to meet the participant and download the data from the app on their personal mobile phone onto a laptop computer. Once downloaded onto the laptop, I would show the participant the information downloaded so that they could give verbal consent to use the information for the study and reassure them that no other identifiable information had been downloaded from their phone.

Of the 30 app-users, 14 (46.7%) participants had data downloaded from their mobile phones. Reasons for the inability to download data from their mobile device were as follows; one participant's tablet battery died and was unable to be replaced, two women had lost their phone that contained the app, three participants changed their mobile phones to an iPhone, and were unable to re-download the app which was android only and ten women failed or declined to meet to download the data but completed exit questionnaires via the post. The

demographics of the women who permitted the downloading of data are shown in Table 5.2. These participants mostly self-identified as Caucasian, Australian born, were reasonably well educated and employed, which is on the higher end of SES for the region.

Table 5.2 Demographics

n=14	**Mean**	**Range**
Age (years)	28.5 (5.1248)*	22-38 years
	n (%)	
Ethnicity:		
Caucasian	11 (78.6%)	
Vietnamese	1 (7.1%)	
Asian	1 (7.1%)	
Not specified	1 (7.1%)	
Country of birth:		
Australia	11 (78.6%)	
Canada	1 (7.1%)	
Philippines	1 (7.1%)	
New Zealand	1 (7.1%)	
Highest level of Education:		
Year 11	4 (28.6%)	
Year 12	5 (35.7%)	
TAFE/College	2 (14.3%)	
University	3 (21.4%)	
Employment:		
Employed	10 (71.4%)	
Home duties	3 (21.4%)	
Student	1 (7.1%)	
Unemployed	0 (0%)	

*Standard Deviation

For the 14 women who consented to us downloading their app data, the average number of times the app was accessed was 18 times during the 10 week trial (Table 5.3). The mean time spent looking at the app at each episode was 5.7 minutes. This time may have included time when the app-user was sent to a website via the app but this could not be determined by the data collected. All participants viewed the 'week by week' section that covered maternal changes and fetal development and all except one participant entered the 'Diary' section. This was therefore very popular with some women making notes regularly. The section viewed the least was the 'Exercise' section.

Table 5.3 Downloaded data

App use	**Mean**	**Range**
No. of times App accessed	18	2-63
Time spent per episode	5.7 min	2-13 min

Section of App viewed	**n (%)**
Week by week	14 (100)
Eat	11 (79)
Relax	11 (79)
Exercise	8 (57)
A-Z	10 (71)
Quiz	11 (79)
Diary	13 (93)

5.10 Discussion

The development of the Health-e Babies App was a collaborative approach by health professionals, academics, technology experts and consumers. It was designed to meet the

needs of pregnant women living with socio-economic disadvantage and was closely guided by education models and aligned with health industry guidelines and recommendations. The app sought to assist with mental health issues by the inclusion of meditations, positive affirmations and where to seek assistance. The information provided and contact phone numbers, addresses and websites were localised to women living in the hospital's catchment area, as the research team believed that this would be of greater benefit, relevance and usefulness to the app users.

The participants of the focus group agreed that first time mothers were more likely to use the app or find it more useful. This is congruent with other studies [17, 37-39]. Parity was not questioned for this study and in hindsight would have provided greater insight by comparing use between nulliparous and multiparous women.

Participants also considered that more information would be sought in the 1st and 3rd trimesters of pregnancy rather than the 2nd trimester. So whilst the information on the Health-e Babies App was useful for the 2nd trimester, focussing on the 3rd trimester may have seen higher engagement of the app. Gao, Larsson [40] reported that Chinese women sought information mostly during the 1st trimester due to their antenatal care generally commencing during the 2nd trimester of pregnancy. Thus individualised information could be attained by face-to-face contact with a health professional after this time. Madhavanprabhakaran, D'Souza [41] reported on anxiety during pregnancy and the differing reasons for their anxiety, depending on the trimester of pregnancy they were experiencing. This can influence the type of information sought and its timing. Whilst some women seek information at one time in their pregnancy, their needs change as the pregnancy goes on. Furthermore, each woman is different in their individual informational/educational needs. So over a full

pregnancy, engagement with antenatal education can alter depending on past childbirth experience, previous knowledge and their current social situation.

Topics of interest for our focus group and further evidenced by the downloaded data reflects similar interest as reported in other Australian studies [23, 42]. However, seeking information regarding nutrition for this study was higher than the study by Hearn, Miller [15] where just 15% of the participants using the Ngala app sought information about diet and 13% on exercise. It could be suggested that the participants who permitted their data to be downloaded were of a higher socio-economic status than the Ngala app study but our socio-economic data was unable to be compared with the Ngala data.

Our focus group participants also reported that too much information could be worrying. This was similar to other research that reported anxiety prevented some women wanting to access information [43]. Therefore achieving the right balance of information was suggested. An app that provides sufficient information for one person but enables access to further information for those who want more was recommended and built into the Health-e Babies App.

Participants acknowledged that the ‘contacts’ section of the app provided them with hospital and community resources that were relevant and useful to them as individuals. This was a priority when developing the content for the app and a positive outcome. The two participants in the focus group had previous experience with pregnancy and acknowledged that they did not consider they learnt anything new about achieving a healthy lifestyle. However, the downloaded data shows an interest in nutrition with their high access to this section of the Health-e Babies App.

The limitations of the quantitative data obtained through data download was that it showed the frequency of use but doesn't tell of the quality of its use (e.g. what women learnt, how it made them feel, how it contributed to their confidence, emotions etc). Furthermore, the low participation in the focus group and data downloads has significantly limited the evaluation of the Health-e Babies App. The difficulties in finding participants interested or having the time to be involved in this part of the evaluation were considerable, despite the offer of financial incentives (gift voucher for the focus group participants) and reducing any inconvenience by attempting to meet them at their scheduled antenatal appointments.

5.11 Conclusion

The focus group and downloaded app data reflects similarly with numerous other studies of app and internet use in pregnancy, regarding parity, timing and content. Participants also liked to diarise their pregnancy experiences. However, the women who permitted the downloading of their app data were on the higher spectrum of low socio-economic status than the rest of the participants who used the Health-e Babies App. This may have skewed the results.

The ability to determine the effectiveness of the Health-e Babies App through behaviour change could not be determined by either the focus group nor by downloading their app data. This was because we were targeting a more generalist approach at this time. This part of the study did not seek to ask if the Health-e Babies app enabled behaviour change; rather, how useful the information was considered by the participants.

The following chapter tests the use of the Health-e Babies App for disadvantaged pregnant women.

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CHAPTER 6

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Overall percentage (%)	75%
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.
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ii. permission is granted for the candidate in include the publication in the thesis; and

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6.1 Abstract

Background

The use of mobile technology such as phone applications (apps) has been proposed as an efficient means of providing health and clinical information in a variety of healthcare settings. We developed the Health-e Babies app as an Android smart phone application for pregnant women attending a tertiary hospital in a low socio-economic community, with the objective of providing health information about early pregnancy that would increase maternal confidence and reduce anxiety. Based on our earlier research, this form of health communication was viewed as a preferred source of information for women of reproductive age. However, the pilot study had a poor participation rate with 76% (n=94) not completing the study requirements. These initial findings raised some very important issues in relation to the difficulties of engaging women with a pregnancy app. This paper analyses the characteristics of the participants who did not complete the study requirements in an attempt to identify potential barriers associated with the implementation of a pregnancy app.

Methods

This retrospective review of quantitative and qualitative data collected at the commencement of the Health-e Babies App trial, related to the participant's communication technology use, confidence in knowing where to seek help and mental health status, maternal-fetal attachment and parenting confidence. Engagement and use of the Health-e Babies App was measured by the completion of a questionnaire about the app and downloaded data from participant's phones. Mental health status, confidence and self-efficacy were measured by questionnaires.

Results

All women were similar in terms of age, race, marital status and level of education. Of the 94 women (76%) who did not complete the trial, they were significantly more anxious as indicated

by State Trait Anxiety Inventory (p=0.001 Student T-test) and more likely to be unemployed (50% vs 31%, p=0.012 Student T-Test).

Conclusion

This study provides important information about the challenges associated with the implementation of a pregnancy app in a socially disadvantaged community. The data suggests that factors including social and mental health issues, financial constraints and technological ability can affect women's engagement with a mobile phone app.

6.2 Introduction

In a world of increasing use of information and communication technology, the internet and pregnancy mobile applications (apps) are very popular media for pregnant women seeking pregnancy-related health information [1, 2]. Increased use of these media may potentially improve women's understanding and knowledge of personal health and healthcare options and enhance their ability to make the most appropriate choices for pregnancy. However, barriers still prevent some women from engaging with antenatal educational materials. This is a concern for health professionals given that health literacy during pregnancy is vitally important for maternal and fetal health and wellbeing [3-5]. There is a direct correlation between low health literacy and poor health outcomes [5] and between low socio-economic status (SES) and poor health outcomes [6-8], so it is important to promote health education.

The popularity of mobile pregnancy apps has increased irrespective of socio-economic status [1, 9]. Whilst there are strong advocates for the use of mobile technology in childbirth education [10], few pregnancy apps have undergone scrutiny to evaluate the accuracy of the information they provide and their alignment with current obstetric guidelines [11]. Daniels and Wedler [10] claim that pregnant women are technologically literate and able to navigate the internet and mobile apps for self-education, but fail to offer suggestions as to how to best engage women, particularly if they have literacy issues or lack interest in self-learning.

A randomised controlled trial that consisted of the use of a pregnancy app compared with a paper-based tool, showed that there was increased engagement and active learning by app users [12]. However this study was limited to women with tertiary education and low risk pregnancies. Women living in low socio-economic circumstances and with limited education

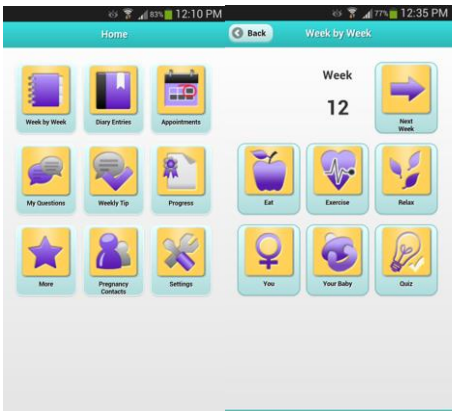
were not included. It may be that engagement with mobile apps may vary between socio-economic status (SES) groups but this is yet to be determined.

Our research focussed on health outcomes in pregnant women from a socially disadvantaged population [13-16]. The level of social deprivation in this pregnant population is significant. For example 36% of pregnant women from this population have reported they were abused as a child, 35% have suffered major life stressors and 30% of these pregnant women were diagnosed with depression during their antenatal care [16]. Population based data reported that 40% of the inhabitants in this community do not finish high school beyond year 10, greater than 22% of the population are unemployed, 27% are housed by the government and 22% of families have a sole female parent [17]. Within this population we found that, despite social disadvantage, all women had a mobile phone and wanted pregnancy related health information that was relevant to their specific needs, was easily understood and accessible at any time [1]. Based on this evidence, we hypothesised that a phone app targeted specifically at a low level of literacy and designed to provide hospital specific information, as well as pregnancy information, would be an effective tool to increase the population's ability to seek information, gain interest in self-learning, increase confidence and reduce anxiety around pregnancy related issues. Consequently, we created an Android mobile app called the 'Health-e Babies App' which was specifically for pregnant women attending a tertiary hospital that was the main provider of antenatal and obstetric care for this population.

The Health-e Babies App provided information regarding fetal development, maternal physical changes, explanations of the tests and procedures they may undergo and problems they may experience during their pregnancy with advice on what to do and where to seek help if needed. It promoted healthy eating, exercise and relaxation during pregnancy with scientifically based information with particular emphasis on relieving anxiety and depression. It was also aimed to

enable easy access to hospital, community health services, support groups and research-based websites, should the participant require further in-depth information or assistance. (Fig 6.1). Notifications were also embedded into the app to remind participants of appointments and also if they had not used the app for a few weeks, it would suggest that they engage with it.

Fig 6.1 The Health-e Babies App



The initial development of the app included consumer participation with focus groups of pregnant women at 3 major stages of the app development to ensure their needs were met in terms of design, literacy, content and useability. The next stage of the research was to test the app in a cohort of pregnant women and this paper will report on the findings from this stage of the project. In particular we will focus on the characteristics of women who used the phone app relative to those who did not.

Participants in the focus groups were from the same socio-economic region and attending the same hospital as the participants who participated in the app trial, however the focus group participants were not included in the trial.

6.3 Method

The study was approved by the hospital's Human Research Ethics Committee (TQEH/LMH/MH), application number 2011026. Pregnant women attending their first antenatal appointment at the trial hospital were invited to participate in the study. Eligibility for recruitment included women aged 18 years or older, pregnant between 10 and 14 weeks gestation at the time of recruitment and those who had an Android mobile phone or tablet. Women could be nulliparous or multiparous. Exclusion criteria included greater than 14 weeks gestation because it was considered that participants may potentially be limited by time because the app focused on a 10 week, second trimester period. As this study was a pilot for the possible development of a full pregnancy app, the research team decided not to conduct a randomised control trial at this stage of the project.

Immediately after attaining an informed signed consent, participants were sent a text message to their mobile phones or an email that contained a link to enable the Health-e Babies App to be downloaded. Verbal and written information about how to download the app was given at the time of recruitment. Participants were only given information on how to download the app and the initial set-up data entry requirements, such as name, date of birth, due date for the baby's birth, their own local general practitioner's name and phone number and future appointment dates. Participants were expected to download and navigate the app without further encouragement by the researcher to use any particular aspect of the app. The purpose of this approach forms part of the initial assessment of the app in relation to determining how easy it was for participants to use the app and how many women were motivated to explore and learn from it. Most participants did not download the app in the presence of the researcher but did so after the appointment.

Qualitative and quantitative methodologies were used for the evaluation of the Health-e Babies App. Participants were given questionnaires at the time of commencement and completion of the trial. Questionnaires given at recruitment consisted of demographic information and their use of the internet and other mobile pregnancy applications. This was to identify the socio-economic status of the trial participants and their level of information and communication technology (ICT) use for pregnancy-related health information. This survey included a 7 point self-efficacy scale (0-6), to determine their level of confidence in knowing where to get health information and/or help if needed.

The evaluation of depression, anxiety, maternal-fetal attachment and parenting confidence was focussed on assessing any effects the app may have had during the course of pregnancy. Questionnaires at recruitment consisted of depression and anxiety evaluation; Edinburgh Postnatal Depression Score- EPDS, Antenatal Risk Questionnaire- ANRQ, State Trait Anxiety Inventory-STAI, Generalised Anxiety Disorder – GAD-7, Maternal Antenatal Attachment Score- MAAS for maternal and fetal attachment [18] and Parenting Sense of Competence PSoC [19, 20]. These questionnaires were included in the study to assist in identifying the participants' mental health status before and after the trial period because maternal mental health status can significantly affect confidence levels [21]. Each of these evaluation tools has been validated by previous research [22-26]. ANRQ reflects life and social experience and its effect on depression and anxiety [22]. The EDPS examines the level of anxiety, depression and ability to cope over the last 7 days [23, 27]. The GAD-7 and STAI assesses current anxiety levels. The MAAS is used to evaluate maternal and fetal attachment, recognizing the factors of tolerance, acceptance, pleasure of interaction and competence of parenting [28]. The Maternal Antenatal Attachment Survey indicated that the higher the score, the closer the maternal-fetal attachment. The PSoC is a 17 point assessment of self-confidence in competence of parenting that comprises of sub sections relating to satisfaction, efficacy, interest and control [19, 20, 26].

Scoring for the Parenting Sense of Competence questionnaire indicated that the lower the score, the more confident the participant felt at parenting.

Questionnaires related to app usage and opinions about the Health-e Babies App were administered at the end of the trial. The self-efficacy scale, level of anxiety, maternal and fetal attachment and confidence in parenting questionnaires were also administered at the end of the trial.

6.3.1 Statistical analysis

Participants who completed the study requirements and used the Health-e Babies App were named the 'App users'. Those who did not complete the study requirements were named the 'Non-app users', however, it could not be determined whether or not these women used the Health-e Babies App. The inability to remotely monitor participant's app usage is examined in the limitations section of this paper. The differences between App users and Non-app users were examined using unpaired t-tests for parametric continuous variables, and Chi-Square test for categorical variables, following stratification compliance. All reported *P* values were two-tailed, and a *P* value of <0.05 was considered to be statistically significant. All statistical procedures were carried out using SPSS version 24 (SPSS Inc., Chicago, IL, USA).

6.4 Results

One hundred and fifty pregnant women consented to participate in the study. Nine women (6 %) suffered a miscarriage and 11% (n=17) did not complete all of the initial questionnaires resulting in exclusion from the study. This left a cohort of 124 women who went forward in the study. Difficulties arose with 9% (n=11) of women failing to report problems in downloading

the app, despite being given contact phone numbers for technological support. Few women reported any problems prior to the trial period ending. In addition to this, when contacted at the end of the trial period, several women reported that they had changed mobile phones or lost their phones thereby losing access to the app (6%, n= 8). Sixty percent (n= 75) of participants failed to complete the exit questionnaires, therefore 30 women (24%) from the 124 participants completed the trial (Appendix 6.1).

6.4.1 Demographics

Of the thirty App user participants, the average age was 25 years (range 19-41 years). Most women identified themselves as Caucasian Australian (83%, n=24) and 55% (n=16) were nulliparous. Non-app users were predominantly nulliparous women (n=85, 89%). This was due to the researcher's access to more nulliparous women during the recruitment period and not associated with a more profound interest in the study than multiparous women.

There was no significant difference in relation to parity within the App-user group (nulliparous n=17 and multiparous n=13 (Student t-test, p= 0.856).

As indicated in Table 6.1, comparing the demographics of App user participants with the Non-app user participants, there was no significant difference between the two cohorts in relation to age, race, marital status, education and the possession of a government Healthcare Card (reflecting low income). However there were significant differences in relation to employment status (Student t-test, p= 0.012) indicating a higher rate of unemployment in the Non-app user group.

Table 6.1 Demographics

	App User	Non-App User	*p* value
Age			
Mean	26.9667	25.7340	.289
N	30	94	
Standard Error	1.03888	0.48594	
Range	19-41 yrs	18-41 yrs	
Parity			
Nulliparous (n, %)	17 (57%)	84 (89%)	**.002***
Multiparous (n, %)	13 (43%)	10 (11%)	
Marital Status			
Never Married (n, %)	3 (10%)	23 (24%)	.183
Married/Defacto (n, %)	27 (90%)	67 (72%)	
Separated (n, %)	0 (0%)	2 (2%)	
Divorced (n, %)	0 (0%)	1 (1%)	
Education			
Year 9 (n, %)	0 (0%)	3 (3%)	.639
Year 10 (n, %)	2 (7%)	20 (21%)	
Year 11 (n, %)	7 (23%)	15 (16%)	
Year 12 (n, %)	12 (40%)	24 (25%)	
Certificate (n, %)	4 (13%)	20 (21%)	
University degree (n, %)	5 (17%)	12 (13%)	
Employment Status			
Unemployed (n, %)	1 (3%)	15 (16%)	**.012 ***
Home duties (n, %)	6 (20%)	22 (23%)	
Student (n, %)	0 (0%)	10 (11%)	
Employed (n, %)	23 (77%)	47 (50%)	
Healthcare Card			
Yes (n, %)	8 (28%)	42 (44%)	.060
No (n, %)	22 (72%)	52 (56%)	

*= P=<0.05 Significant difference

6.4.2 Information and Communication Technology (ICT) use prior to recruitment

At the time of recruitment participants were asked about their current communication technology use. As indicated in Table 6.2, 83% of both App user (n=25) and Non-app user (n=59) groups had accessed the internet for pregnancy related information prior to their first hospital appointment. There was also no significant difference between the two groups in relation to the websites they accessed (Student t-test, p= 0.311, Fig 6.2).

Fig 6.2 Website use for pregnancy-related health information prior to the trial

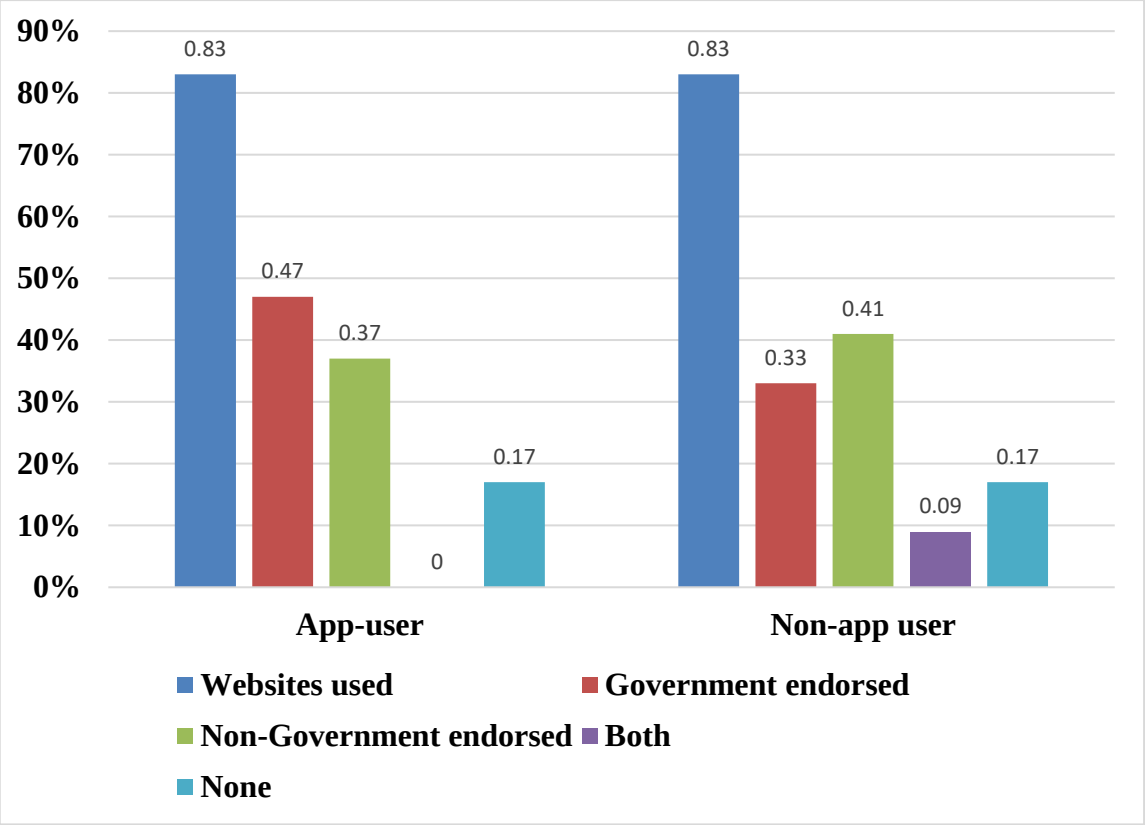
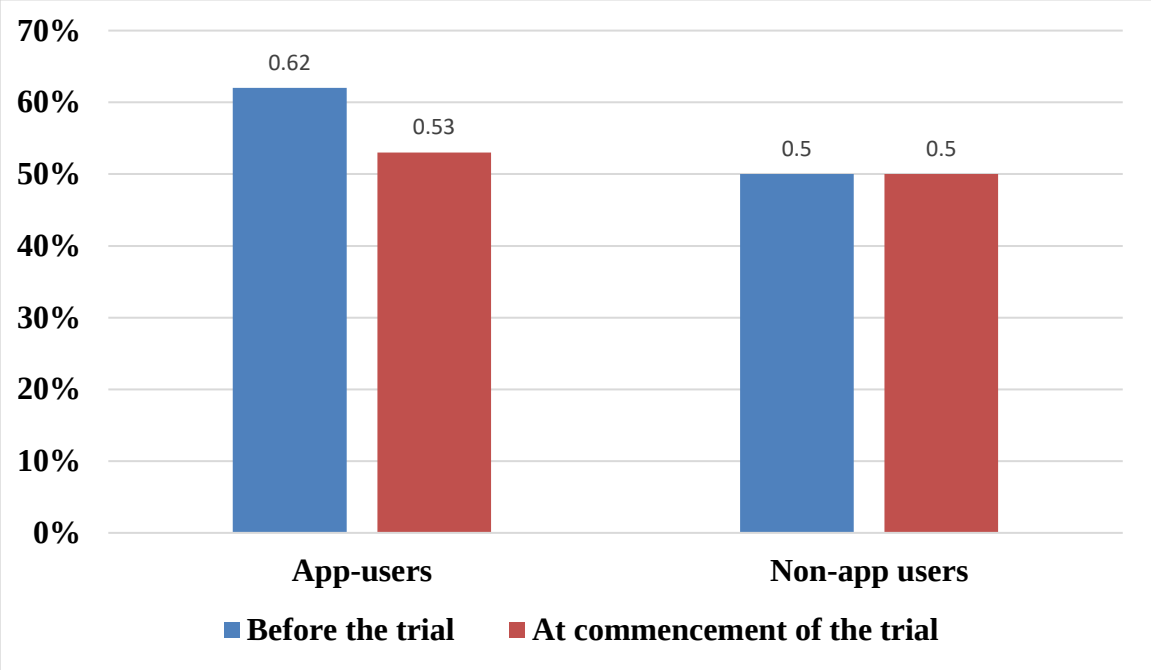


Table 6.2 Information and communication technology use for App-user vs Non-App user participants.

	App User	Non-App User	*p* value
Pregnancy Websites			
Number users (%)	25 (83%)	59 (83%)	.311
Government endorsed			
Non-Government	14 (47%)	31 (33%)	
Both Govt & Non-Govt	11 (37%)	39 (41%)	
None	0 (0%)	8 (9%)	
	5 (17%)	16 (17%)	
Mobile Apps Used Before trial			
Number users (%)	19 (62%)	50 (53%)	.331
Mobile Apps Used At commencement of Trial			
Number users (%)	15 (50%)	47 (50%)	1.000

Sixty two percent (n=19) of the App user group had sought other pregnancy apps before the study to obtain pregnancy information, compared to 56% (n=53) of the Non-app user group. Half of the women in both groups were continuing to use at least one pregnancy app at commencement of the trial (Fig 6.3).

Figure 6.3 Mobile app use during the first trimester and at commencement of the trial



6.4.2 Confidence

The participants' level of confidence in knowing where to access information and help was explored using a self-efficacy scale, self-rating from 0 (no confidence at all) to a rating of 6 (extremely confident). The App users had a confidence score of 4.53 ± 0.23 and Non-App users had a score of 4.6 ± 0.12 and were not significantly different (Student t-test p=0.73).

6.4.3 Mental Health Status

The assessment of mental health status at the commencement of the trial, showed no significant differences between the App user and Non-app user in the ANRQ, EPDS, GAD-7 scores, however the STAI showed a significant difference (Fig 6.3). The STAI for the Non-app users reflected a higher level of anxiety (Student t-test, p=0.001). The mental health status of the App-user group did not change from the commencement and completion of the trial (Table 6.4).

Fig 6.4 Mental health status of App-user and Non-App user participants.

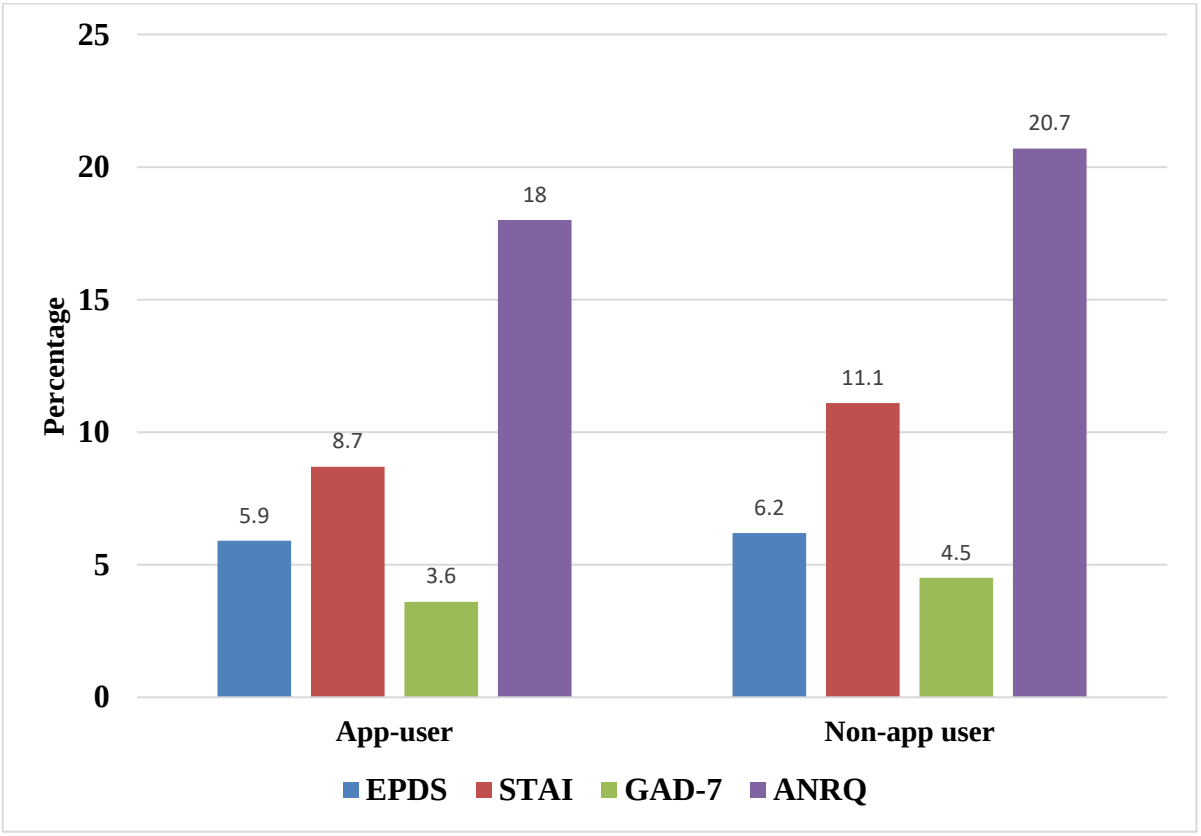


Table 6.3 Mental health status at commencement and completion of the trial for App-users

	Commencement	Completion	*p* value
	EPDS	**EPDS 2**	.635
Mean	6.0769	5.6538	
N	26 (87%)	26 (87%)	
Standard Error	1.29487	1.26606	
Range	0-28	0-28	
	GAD-7	**GAD-7 2**	.782
Mean	3.6552	3.4828	
Standard Error	0.67553	0.87469	
N	29 (97%)	29 (97%)	
Range	0-12	0-18	
	STAI	**STAI 2**	.581
Mean	8.7586	9.1724	
N	29 (97%)	29 (97%)	
Standard Error	0.53373	0.59981	
Range	6-16	6-22	

6.4.4 Maternal Antenatal Attachment

The Maternal Antenatal Attachment Scale scores for both groups were not statistically different (App users: 75.6 ±1.79 vs Non App users: 76.6 ±1.1).

6.4.5 Parenting Confidence

The Parenting Sense of Competence scores for both groups were not statistically different (App users: 39.4 ±1.9 vs Non App users: 39.9 ±1.1)

6.5 Discussion

Our research prior to and during the development of the Health-e Babies App combined with the analysis of the data from the App-user group demonstrated that use of a mobile phone pregnancy app by a specific group of women derived from a socially disadvantaged community has the potential to inform, educate and change behaviour [1]. However, the high rate in non-completion of the study requirements is concerning. The design of the pilot study and the limitations of the Health-e Babies App itself (i.e. no way to remotely monitor app usage) meant that the researchers were not able to determine if women in the 'Non-app' user group used the App, and if so, how, when and why. Nevertheless, from the data we have collected it appears women with a high level of anxiety and financial impairment may have had major barriers to engaging with the mobile phone app. This relationship would be better examined by a randomised control trial in the future. The lack of participation in research has previously been attributed to cultural differences, language barriers, socio-economic status, lower financial constraints and time constraints [29, 30]. Whilst cultural and language barriers should not have been an issue in this group, the other factors may well have contributed to the low rate of completion of the study.

Socially disadvantaged populations have been shown to be less likely to comply with health interventions [31], whether this be due to lack of education, interest or motivation due to poor health literacy [32]. Bender, Choi [33] and Krebs [32] reported that those who have limited education are less likely to download a health app than those with tertiary qualifications. A recent characterisation of medical apps [34] indicated poor instruction on how to use an app was a barrier to their uptake. In our study we intentionally left subjects to manage the app on their own for the purpose of defining its useability and this may have been one of the issues affecting the high dropout rate in the study.

Published reports on mobile app research rarely mention the drop-out rate of participants but simply the outcome of data collated by those completing the studies [35, 36]. Numerous studies focus on levels of engagement, interactivity and interest [37] as a means of evaluating the effectiveness of mobile health apps and others gauge the success of apps by their ability to remain in the top of the 'Top 300 Chart' of the mobile app stores, the scope of their market and period of time the apps were used by consumers [38]. However, when it comes to health apps, few consider those who would benefit from the use of health apps but choose not to download the app. A national survey on health app use in the United States of America reported the main reasons for non-use of apps include disinterest, cost and the fear of data collection by unknown persons via the app [32]. It was also reported that those more likely to download an app were younger and tertiary educated.

The factor of non-participation is important in relation to health outcomes and community health. The 'best app' may show improved health outcomes but if the people who need it the most cannot get it or do not know how to use it, then it is of limited value.

Commercial apps downloaded from app stores such as 'Google Play' (Android) and the 'App Store' (iOS) are easily downloaded and data can be remotely collected about the purchaser's use of the app [39]. These app users choose to download the app for their own personal reasons and motivation. There is often no clear recognition that the apps have reached their targeted population [39]. There have been few randomised controlled trials where participants are given the app as an intervention of care [40] and some simply report on the estimate of effectiveness of the app made by those using it [39, 41]. In addition, even when attempting to employ a more sophisticated methodology, studies still tend to report only on the participants who completed the study and not those who failed to complete it [36]. Whilst they may reach part of their target cohort, they are not recognising any gaps within it.

6.5.1 The effects of socio-economic factors

Differences between socio-economic groups and their adoption of the use of mobile health applications have rarely been reported and studies have not explored ways to address any incongruities [38-40, 42]. Brusse, Gardner [43] identified language, cultural issues, socio-economics and remoteness of community as potential barriers to mobile technology use for Indigenous Australian communities but failed to suggest any specific means to resolve them.

In this study, both the App-user and the Non-app user groups showed no significant difference in socio-economic status except for their employment status. Despite this, the high level of single marital status in the most disadvantaged region in metropolitan Australia, could still play a strong part in the lack of participation. Cairney, Boyle [44] reported a close relationship between single-parent status and anxiety and depression. Single parents, particularly young mothers, often have less contact with family and friends, thus limiting their support network, reducing self-confidence and increasing the likelihood of developing depression [45]. Further to this, women who live in poverty and experience its associated stresses, have more difficulty in developing coping mechanisms [46]. Consequently, this affects their focus on important aspects of their life such as pregnancy [47]. This belief was congruent with a study conducted at the trial hospital which revealed that pregnant women attending this hospital were extremely vulnerable due to a high level of exposure to domestic violence, particularly during pregnancy, and previous physical and emotional abuse during their own childhood [16]. Competing priorities can therefore affect pregnant women's ability to engage with the app or result in a lack of interest for research. It is therefore argued that addressing barriers such as these are imperative to improve engagement and health education for women living in such circumstances. Strategies to increase engagement based on the findings of this pilot trial are provided below.

Health consciousness (understanding one's own health status and health needs) has been reported to be an indicator of higher health app use [48] and suggested that the acceptance and use of mobile apps is influenced by an individual's belief of its usefulness, thoughts of risk of the use and the degree to which they are focussed on their own health [35]. Therefore the value of downloading and use of a pregnancy app may need to be strongly emphasised to the target group, to enable them to understand why it is important and how it would benefit them.

This study has demonstrated that mobile apps are frequently used, with 50% of both groups of women claiming to be using at least one other pregnancy app before the trial. This suggests that apps are a popular medium for receiving pregnancy-related health information. However the additional charges associated with the use of data on a mobile phone or tablet device such as extra data [49] and access to external websites plus an inability to purchase new data immediately when needed may limit app use. Also the more familiar and efficient a person is with using a health app, the less likely they are to replace it with a different health app [48]. Therefore, if women were satisfied with an existing pregnancy app that they used prior to the introduction of the Health-e Babies App, they may have been less interested in downloading and trialling this new app.

There is also evidence from this study that Non-app users have a limited understanding of mobile technology, given that eleven women (7%) reported problems downloading the app. This is in contrast to Daniels and Wedler's [8] view that all women are technologically savvy. Our study suggests that greater attention needs to be paid to women's level of technological literacy in order to ensure that apps are accessible. Some women may need further instruction outlining how to download the app successfully and how to use it. Therefore technological literacy must be addressed to ensure participant's optimal use and confidence in using the app

[50]. As with most educational technologies, there is a need for complementary methods to support the app such as social reinforcement by others, rather than assuming that it will work effectively all by itself [51] [52].

6.5.2 Strategies for engagement

Various strategies have been suggested to promote use and engagement with the pregnancy apps. These include:

1. Downloading the app for the participant at the time of recruitment, to ensure compatibility with their mobile device. However, this may not be practical given the time constraints experienced by antenatal healthcare providers.
2. Showing how the contents of the App are relevant to the individual by explaining the features that would help them with their specific needs and existing media habits.
3. Minimising the need for access to websites externally from the app by having sufficient information on the app itself. This would reduce the financial costs associated with data usage that may have been a factor that shaped women's app use.
4. Meeting the needs of participants with low literacy by providing them with audio recordings of information that is also given in written format in the app and providing audio-visual displays and diagrams. Where these are features of an app (as in the Health-e Babies App) it is important that researchers ensure participants are aware of these capabilities.
5. Sending a follow-up text message to the participant one week after the initial recruitment consultation to determine if they are having any problems with the app. This will also act as a reminder to look at the app.
6. Embedding notifications and text messages to promote engagement [53-55]. Enable a means of two-way communication via the App between the woman and health professional [11, 56].

7. Educating midwives and doctors about how they can utilise the app at the point of consultation (i.e. using app content as an education tool in antenatal appointments). The use of the app at consultations can provide greater confidence in the app as an informational tool for women, thereby promoting its use [12, 57].
8. Countering the trend of frequent changing of mobile phones by ensuring easy access to the acquisition of the app through an online app store or website optimised for both iOS and Android mobile technology.

6.5.3 App design

The design of the Health-e Babies App was considered to be good by the App-user group but this could not be determined by the Non-app users. Whether or not the App was appealing to the Non-app user group will never be known nor if this was a factor in their non-participation with the study. Had this group been contactable and willing to respond, interviews could have been conducted to better evaluate the App design.

The design of the App provided audio-recorded relaxation meditations and tips for reducing anxiety but without remote access to data use, it was impossible to determine the effectiveness of this tool. Future research into the effectiveness of mental health tools within the app could be implemented if remote access could be achieved.

6.6 Limitations

A limitation of the study was that women with non-Android mobile phones were excluded due to the app having been developed only for Android smart phones. This resulted in approximately 50% of women who otherwise met the inclusion criteria, were unable to trial the

Health-e Babies App. Free wifi was unavailable at the time of recruitment, thus many participants were unable to download the app in the presence of the researcher. This meant that any difficulties downloading the app could not be addressed immediately.

As previously mentioned, the limited capabilities of the app resulted in the inability to identify the Non-app user group member's actual use of the app during the study period (i.e. analysing app data usage was reliant on downloading material from women's phones in person). Whilst it might be assumed that women who did not continue in the trial did not use the app, this may not be correct. A randomised control trial would have given more definitive results. The use of telephone interviews and/or face-to-face focus groups would also have been appropriate methods to utilise in order to further examine how pregnant women experienced the app (i.e. perceived effectiveness, everyday routines informing use, likes/dislikes, etc.). However, this was a pilot study that was designed to assist in decision-making for the development of a full pregnancy app. Future research in this area should carefully consider how women's access and use of pregnancy apps will be measured and what strategies could be implemented if there is a high drop-out rate.

Further to this, women experiencing domestic violence was not explored in the initial questionnaires. This limited the ability to better understand the circumstances that these women were living in, particularly as this community has been previously characterised as having a high level of domestic violence [16]. This variable could have had had an impact on the use of the App and participation in the research. In future this could be explored when evaluating the use of a pregnancy app for socio-economically disadvantaged women.

6.7 Conclusion

Research into mobile app use has predominately focused on how app usage affects participant behaviour, modification of lifestyle, and effectiveness in disease management and prevention [36, 39, 58-60]. However, inaccurate assumptions are often made about people's ability to access and use mobile technology [10]. This study highlights the importance of understanding the difficulties that women living in socio-economically disadvantaged communities may face and how these challenges can impact their ability to engage with health professionals, educational apps and research projects more broadly. It is imperative that these factors are considered if mobile phone apps are to become a viable medium of health communication for disadvantaged populations.

6.8 Ethics Approval and Consent to participate

The study was ethically approved by the hospital Human Research Ethics Committee (The Queen Elizabeth Hospital/Lyell McEwin Hospital/Modbury Hospital), application number 2011026. Consents to participate were provided on a voluntary basis.

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CHAPTER 7

FINAL DISCUSSION

7.1 Introduction

This thesis has examined the health, lifestyle and circumstances of women attending the Lyell McEwin Hospital (LMH) for their antenatal care. It has been observed that within Australia, this hospital provides healthcare for the some of the most disadvantaged women in a metropolitan area of the country plus northern South Australian rural communities. Socio-economic disadvantage is associated with lower levels of literacy and health literacy that requires targeted health promotional interventions that meet the needs of the intended audience [1].

Whilst some research reports on differences in socio-economics and its effect on education and engagement with health education interventions [2-6], little has been done to address these differences in the form of new educational interventions, specifically for the disadvantaged. This is why this research is very important to the body of knowledge that currently exists.

The literature review (Chapter 1) has examined socio-economic disadvantage, health literacy and education models plus a variety of educational interventions to assist in the exploration of antenatal education. Using a mixed methods approach, health and lifestyle information, focusing on the needs of women attending the LMH, have been explored for the development of antenatal education interventions (Chapters 2 and 3). Two interventions were developed and trialled, each demonstrating the importance of understanding the limitations of participant engagement and the utility of each intervention as an educational tool (Chapters 4, 5 and 6).

In addition, LMH staff were interviewed to understand their views regarding the use of digital media in antenatal education, as well as enablers and barriers for pregnant women to engage with antenatal education (Chapter 3). A thematic analysis of these qualitative interviews

generated new insights into how digital media can best be integrated into healthcare into the future and what needs to be done to better reach the most disadvantaged.

7.2 The Population

A characterisation of nulliparous pregnant women attending the LMH, through research in the STOP Study, reported on demographics, health status and pregnancy outcomes to assist in understanding their life experience (Chapter 2). How socio-economic factors can impact on pregnant women's health, wellbeing and ability to engage with antenatal education and change behaviour, was examined. It was discovered that over half of the STOP cohort were either in the overweight or obese categories, being a significant factor in the high incidence of hypertensive disorders and gestational diabetes (GDM). Hence, diet and weight management should be an important inclusion in a health promotion strategy for this cohort. Addressing the high fast food consumption and improving their green leafy vegetable and fruit intake would also reduce their risks of having a small for gestational age (SGA) baby, GDM and a spontaneous preterm birth (sPTB).

7.3 Effects of Socio-Economic Disadvantage

Unemployment, domestic violence, mental health problems, drug and alcohol abuse have been highlighted through my research, as barriers to accessing healthcare and antenatal education [7, 8]. Disadvantaged women are often just trying to live their life one day at a time; seeking a safe environment to live in, trying to feel safe, having enough money to eat or pay the rent and managing their stress and anxiety. This makes it very challenging to include health education as part of their lives [7]. In addition, poor literacy and the shame associated with it, often limits their ability to access information and understand it.

This cohort's high level of anxiety and depression, often associated with social disadvantage, is a major barrier for pregnant women to engage with antenatal education. If anxiety and other mental health issues can affect memory [9] and cognitive ability [10], then these issues need to be addressed to assist in developing health literacy. The 'Nine Dimensions of Health Literacy' explained that a lack of competency in any of the dimensions would affect the ability of the individual to understand what is required to implement these changes [11]. Therefore, if an individual does not feel like they are being listened to or supported, are unable to engage effectively with a health professional, can't access healthcare or don't have enough knowledge, ability or resources to help them make positive choices, then they can't improve their health and wellbeing [11].

Mental health is a morbidity that can reduce the ability to engage with education and health information during pregnancy [10, 12]. Therefore, strategies that assist in managing mental health in pregnancy, are likely to improve health education and behaviour change which includes the use of a pregnancy app. The Health-e Babies App combined meditations and positive affirmations with pregnancy information as a means of reducing anxiety and depression whilst improving health literacy. Whilst assessment of the impact of this aspect of the app in this cohort could not be made, due to small study numbers, these are important issues that should be assessed in future studies.

There are numerous commercially available apps that monitor and provide self-help guidance for mental health problems, including the management of substance abuse [13-15]. Some apps utilise games to help teach breathing techniques to reduce anxiety and panic attacks [16] and mood assessment tools, using rating scales and diary entries on how a person is feeling [17]. Whilst some apps have reported to be very effective, most have not been clinically validated [14, 18], nor were any specifically relating to pregnant women or the disadvantaged.

Nevertheless, features that teach breathing techniques, evaluate mood by rating scales and provide self-help techniques could be easily incorporated into a future pregnancy app. For those with limited income, having two apps (one for mental health and one for pregnancy) may be prohibitive, depending on their mobile phone plan and data storage capability. Thus, incorporating mental health support into one educational pregnancy app could be more acceptable.

Despite other studies reporting that the disadvantaged had difficulties in accessing and using digital media [6], this study found that all women had access to these technologies but socio-economic factors were a limitation of their use. Participants in the Health-e Baby study accessed the internet easily via their mobile phone, their computer at home or public library. This could suggest that if a disadvantaged woman was sufficiently motivated to access online information, she could do so. Cost free mobile apps that did not require internet connection once downloaded, would be less expensive for women with low income to gain information rather than websites. Some Health-e Baby study participants could only afford pre-paid data on their phone, so if they ran out of internet data before they could pay for more, then they would not be able to access any information via this medium. This highlights one pitfall in the use of digital media for disadvantaged women but does not totally exclude its use. In addition, some women who lacked technological literacy were less able to download and navigate the app.

7.4 Preferred media

The preferred method of learning is very individual. It was identified that pregnant women attending the trial Hospital preferred to receive pregnancy-related health information from both digital media and the health professionals caring for them.

Women's need or desire for answers at any time meant that the use of digital media was important and whilst some women checked and compared information between websites, phone apps and social media, they wanted instant answers that health professionals could not always provide as quickly. However, not knowing where to access accurate information online was a concern [19] as many participants were unaware of the government endorsed websites that would provide relevant, local information. One study reported that most women looked at the first 2-5 websites on search engines such as 'Google search'[20]. This could account for the participants in the Health-e Baby study having difficulties accessing the government endorsed websites if the first 5 listed were commercially based. Health professionals need to actively show women the list of recommended websites that is on the back page of the South Australian Pregnancy Record. This booklet is given to pregnant women at all state public hospitals at their first antenatal appointment. However, women would not have this list of websites prior to their first appointment.

Health professionals are time poor and it was found that they were reluctant to engage with pregnant women via digital media and use it for antenatal education [7]. This was largely because they themselves were unsure of the best websites or apps to recommend to women. This highlights the need for health professionals to be more aware of the list on the Pregnancy Record, explore it themselves to know what information is there and refer women to it or seek out other appropriate sites (if necessary) to meet individual needs.

Traditional forms of antenatal education such as paper-based literature and antenatal classes remain viable media. However, the introduction of the internet, mobile phone applications and social media have enabled a more immediate response to questions. Some women still prefer paper-based literature and class settings, suggesting that there is no wrong or outdated medium; just new emerging media that health professionals and organisations can work

towards developing and integrating into a multi-layered approach to education. In addition, my utilisation of the clinic waiting room TV by way of a PowerPoint presentation was also considered to be a valuable resource for health information by both pregnant women and health professionals, highlighting women's acceptance of a variety of media.

One theme that became evident during the interviews with pregnant participants was that they trusted the doctors and midwives at the study hospital. If they had a question to ask, then they believed they would be given a reliable and accurate answer. Thus, if the women could engage with the health professional, they would most likely trust them. This theme is evident in other studies [21-24] and yet not all of the health professionals interviewed were fully aware of this level of trust. The ability to build a relationship with the pregnant woman assists to develop trust and a feeling of support [25]. Health professionals need to recognise this trust and the importance of relationship building through continuity of care. This may require obstetric training programs and midwifery services to adopt better models of care, especially in socially disadvantaged communities where most women use public health and do not have access to a private obstetrician.

Short appointment times make it challenging for health professionals to understand an individual's level of health literacy, their cognitive and socio-economic ability to care for themselves. However, if they can show women how to access and use digital technology and other educational forms of media, women will become more empowered and able to make appropriate choices and decisions in their healthcare and lifestyle [26, 27]. A study in Brazil reported that the social networking functionality of the 'Kangaroo' app created a great sense of empowerment for the pregnant women who used it [28]. Other studies also have reported success in achieving empowerment via digital apps, particularly within disadvantaged groups

[27]. However, assessment of empowerment is not always consistent [29] in research but there are some validated measurement tools [30, 31].

Importantly, the health professional's own perception of the effectiveness of digital media and overcoming their own concerns about accuracy of information will affect their approach to encouraging women's engagement with digital media [7].

7.5 Evaluating the Interventions: What has been learned from the Antenatal PowerPoint Presentation and the Health-e Babies App

Two interventions were trialled and evaluated with quantitative and qualitative methods; the Antenatal PowerPoint presentation in the antenatal clinic waiting room and the android digital 'Health-e Babies App'. Both interventions aimed to provide meaningful information regarding nutrition, exercise, smoking, drug and alcohol consumption, mental health support with hospital specific information and local community resources.

Whilst there were inconclusive results relating to the uptake of the Health-e Babies App, those who were verified as having used the app found it very useful with one participant in a focus group stating that it *"has everything that you need".* Therefore, if the user could navigate the app and was interested in exploring what the app contained, then they would have benefitted more from its content and features. However, the level of engagement and benefits could not be determined for those participants who did not complete the study. Despite this limitation, it was found that those who did not complete the requirements for the Health-e Baby study, had greater anxiety than those who completed the study. This suggests that mental health issues and associated social stressors can be a barrier to engagement with a pregnancy app.

The drop-out rate for the Health-e Baby study highlighted the difficulty in engaging disadvantaged women, suggesting that this cohort may have lacked technological literacy and women needed to understand how the app could benefit them. A greater explanation at the time of downloading the app may have resulted in a higher uptake, however some women chose to download the app at home. The wifi at the place of recruitment was poor, limiting the ability to demonstrate the app to all participants. Some women needed to be assisted to have the app downloaded and then be shown how each feature and information could be accessed within the app. Whilst the research team chose not to provide extensive information about how to navigate the app, it is recognised that the implementation of an app should include demonstrating how to use and navigate the app, highlighting the benefits. It is considered critical for successful engagement initially and important for on-going engagement with the app.

However, it remains unclear as to whether it was the app itself, a lack of digital literacy, socio-economic issues or simply their participation in the research project that explained the high drop-out rate. App studies rarely report on failure rates, but focus more on the successes of interventions [32]. Others report on estimated effectiveness by users and fail to include analysis of why some dropped out [33, 34]. Perhaps this was unachievable, as with the Health-e Babies App trial.

Interactive apps have the potential to enhance the relationship between the woman and health professional [35, 36] and have the potential to be a positive educational tool [36]. There can be passive (automated information such as text messages) and/or two-way interactive features (that enable personalisation and treatment). The Health-e Baby study showed that women liked

having passive interactive features, such as a diary in which they can enter their own story about their pregnancy and reminder notifications. The option to complete a sliding scale of how the user was feeling, with the intention to notify the user to access mental healthcare (following three consecutive poor scores), was not tested for effectiveness in the participants due to budget and technical limitations. Despite this, those who used this feature reflected on how they were feeling and some added explanations as to why they felt the way that they did to their diary entries. This feature could be tested in further research into mental health apps, with the use of the Edinburgh Postnatal Depression Score (EPDS) and 'short message services' (SMS) on how to self-help or seek professional support. Algorithm-driven screening and feedback mechanisms have shown positive signs [37-39]. However, studies into the effectiveness of these features, in the form of behaviour change outcome measures, have been poorly examined [39].

The examination of waiting room information via a rotating PowerPoint presentation found this medium has the potential to provide information and promote discussion with a health professional but there is limited effectiveness without other means to support its content. For example, information about mental health issues and support services on the TV presentation may require supporting paper-based literature with available contact numbers for the woman to take home. The individual observer of the presentation needs the motivation to act upon what is observed and may require health professional and/or family or community support to enact further discussion and behaviour change [40, 41].

Furthermore, the Antenatal PowerPoint presentation required attendance at the antenatal clinic with sufficient time spent watching the TV presentation, to 'take in' the information. The inclusion of consumer opinion in the initial development of the presentation may have influenced the visual effectiveness to improve engagement and understanding of the information presented. A presentation in a 'Narrative' or 'Practice' video format would have

provided greater interest for optimal impact [42], as suggested by participants in the evaluation of the presentation. On further reflection, perhaps specific topics should have been 'discussed' over a few minutes with video and slides to provide a more comprehensive mini educational session. A health promotion strategy that includes budgeting and setting a healthy eating plan could assist disadvantaged communities greatly [43]. This could be included in a waiting room TV presentation or within a pregnancy app. The Health-e Babies app provided recipes that were focussed on healthy meal options. These recipes were referenced to enable users to go to the website if they needed further assistance in cooking. This would require greater motivation to seek website information about how to cook.

7.6 What strategies are effective?

Effective strategies are interventions that can defy barriers to enable engagement. Once engagement occurs, the intervention needs to not only promote behaviour change but also enable the user to utilise the information, achieve and sustain the behaviour change. Furthermore, it can provide them with greater insight and ability to make the right choices in their pregnancy. Given the many barriers disadvantaged women experience to engage with antenatal education, I suggest that every point of contact between a pregnant woman and a health professional should be an opportunity for education.

This thesis has demonstrated that the main aspects of an effective education intervention involve easy access, engagement, relevance to the target audience, quality and accuracy of information and support and ongoing encouragement. The TV PowerPoint intervention was easy to access by those attending the clinic but was limited by being only written in English. Pictures and symbols were used to demonstrate what was written for non-English readers, thus attempting to reduce the language barrier. The Health-e Babies App was cost free for

users, thus catering well for those with limited income. Engagement was dependent on the motivation of the individuals in the waiting room and those who had the app on their mobile phone. Movement of slides and animations within the PowerPoint presentation plus notifications and interactive features within the app assisted with engagement, in addition to the relevance of the content. Both interventions ensured localised, accurate and evidence-based information that was central to the target audience, providing information that was the same as the paper-based literature routinely given to women attending the trial hospital.

7.7 Adaptation to a changing environment

Traditional methods of education remain relevant but emerging technologies need to continue to be explored to assist pregnant women and health professionals to reach everyone and complement a health professional's face-to-face interactions. With the Covid-19 pandemic affecting the world with lockdown restrictions, face-to-face antenatal education has been affected, particularly in relation to group settings. This has forced the introduction of education programs being conducted via digital teleconferences utilising systems such as "Zoom" and "Microsoft Teams", where numerous people can 'dial in' to an education class. Thus, adaptation to the changing world is a necessity, but its effectiveness is yet to be determined.

There is an increase in women seeking digital technology to access health information [26] so this media should not be ignored. The evaluation of digital technology's effectiveness to educate and improve physical and mental health outcomes is increasing. However, they are time consuming for researchers and sometimes the technology becomes outdated before the research has been completed [44]. This was highlighted when the further development of the Health-e Babies App was found to be unachievable, as the technology initially used had become

incompatible with newer mobile phone technology. So sustainability of technology is an issue for app developers.

It was found that women used social media to gain emotional support and source information on pregnancy and birthing but it's effectiveness on reducing pregnancy anxiety and the fear of birthing has not been fully examined. One positive consideration, particularly for disadvantaged women, is that social media has been seen to cross socio-economic barriers, thus income is not restrictive [45] assuming women have a smart phone. Social media is therefore a medium worth considering for health professionals to become involved, to provide up to date health information, moderate conversation to ensure accuracy of information, as well as support women on an emotional level. A web-based intervention that enabled a 'chat room' feature for postnatal women and community health nurses along with child development and health information, reported a high level of interaction between women and nurses and consistent engagement and a low drop-out rate (around 11%) over the 9 month period [46].

7.8 Limitations

The LMH provides antenatal care for the largest proportion of the Aboriginal and Torres Strait Islander women in the metropolitan and northern areas of South Australia and yet participation in these studies was disproportionate to their presence at the Hospital. The recruitment of Aboriginal and/or Torres Strait Islander women was unattainable at the time. Higher rates of reported psycho-social issues [47], as well as more medical co-morbidities than other cultural groups (http://sahealth.sa.gov.au), have impacted on their ability to engage with mainstream healthcare. The ability of Indigenous women to engage effectively in antenatal care, education and seeking pregnancy-related health information can be more difficult than for non-indigenous

Australians due to fears of racism and not feeling culturally safe [48]. This project would have benefited from consultation and collaboration with Indigenous women and their communities to enable their participation in the study but it was beyond the scope of the research project. Similarly, other cultural groups, particularly refugee migrants, were poorly represented due to language barriers, thus these groups need to be examined to enable the development of culturally sensitive educational strategies.

The focus on the 2nd trimester of pregnancy with the Health-e Babies App limited the longevity of its use. It was also the period of time that some women felt that they were less likely to seek information about pregnancy.

A health literacy assessment was not administered to assess the effectiveness of the Antenatal PowerPoint intervention and Health-e Babies App intervention. This would have provided greater insight into the effectiveness of the two interventions. There are a number of validated health literacy tools available, such as the 'Health Literacy Questionnaire' (HLQ) [49] and the 'European Health Literacy Survey' (HLS-EU) [50].

The Health-e Babies App could only be used on android devices, thus limiting the ability to recruit participants. The use of android technology was due to the protracted and unrealistic process of having to send each participant's IP address to Apple to enable access to the app. Furthermore, the technology used for this pilot study had a limited lifetime as the advancement of mobile digital technology superseded the technology used for the Health-e Babies App. Hence the app could no longer be accessed on newer mobile devices to enable downloading of a newer version of the app. This is one pitfall in the development of mobile apps [44].

7.9 Recommendations

The best approach to improving health literacy for pregnant women is to ask them what their needs are and the way they prefer to learn. Each individual woman should be asked about what they see as barriers and discuss a plan to eliminate or reduce those barriers. In addition, health professionals should use every contact point as an opportunity to educate, utilising paper-based literature and waiting room television screens.

All media should be utilised to engage disadvantaged women in antenatal education as everyone has their own specific needs and abilities. In relation to digital media, they must be easy to access and navigate, therefore some women need to become more technologically literate, needing the support of health professionals to guide them.

Social issues need to be understood and addressed to improve the effectiveness of any educational tool. Incorporating support and health information simultaneously within an intervention is an option worth considering.

Health professionals need to become involved in the development of digital media so that they can trust the information provided on these sites. Following state-wide health department procedures, protocols and guidelines when creating digital and non-digital content will ensure accuracy and consistency of information across health sites. In addition to the same basic pregnancy-related health information, each healthcare facility within the state should provide its own local content to assist women's engagement with the relevant healthcare facility and local community resources. This would particularly assist the disadvantaged.

7.10 Future Research

Understanding Indigenous, migrant and refugee groups is necessary to ensure they engage with antenatal education in a culturally appropriate manner and that is easily understood by these groups to promote healthy behaviours and behaviour change. In addition, they need to have the knowledge of the Australian health system, be able to access healthcare and make informed choices.

A randomised control trial (RCT) with an app encompassing the whole pregnancy (not just the 2nd trimester) should be conducted to assess its effectiveness to improve health literacy and behaviour change. An RCT would provide greater understanding of how the app performs compared to the usual educational methods. A mixed methods approach would gain good insight into women's views, preferences and actual use. Access to remote digital data would enable analysis of actual use of the app. Furthermore, it requires an examination of the effects of socio-economic disadvantage to understand the specific issues preventing the use of an app and the cognitive ability to change behaviour. Applying the 'Nine Dimensions of Health Literacy' model [11] could assist in assessing the individual's ability to understand and respond to the information.

A social media site could be developed and trialled within a continuity of care model of healthcare. The creation of a social media site moderated by the midwife caring for a caseload of pregnant women can assist to develop a support network within the midwife's caseload. This group could then continue to provide support for each other away from social media, after the birth of their babies.

An evaluation of teleconferencing antenatal education classes should be considered, especially for women living in regional areas but who will birth in a metropolitan hospital.

The term 'family' has also expanded from 'traditional' Euro-centric or 'Western' understandings about the heteronormative 'nuclear' family unit, based on biological ties and comprised of a man, woman and child/children to include diverse kinship forms such as same sex relationships, transgender relationships (www.family.lovetoknow.com), where children are conceived via procedures such as *in vitro* fertilisation, artificial insemination and surrogacy. Antenatal education fails to acknowledge these kinds of family relationships by not recognising and meeting their specific needs. Fathers and their stereotypical role in pregnancy are sometimes included [51] but there is little guidance and support that recognises 'kinship' families and their pregnancies and transition to parenthood. This area needs to be explored to enable greater support for these families.

7.11 Conclusion

This thesis provides a valuable insight within the realm of antenatal education, recognising that disadvantaged populations can have difficulties engaging with many educational interventions.

New technologies have been reviewed with varying claims of improving health and wellbeing and assisting with behaviour change. However, there is no single intervention that has been able to reach those who need it the most and effect positive behavioural change for all.

Without recognising the barriers and enablers for this cohort, educational interventions are impotent. A lifestyle that comes from being financially and socially disadvantaged can have a

generational flow on effect, where lack of role models, poor diet and lifestyle behaviours are passed from one generation to the next. Therefore, effective interventions are vitally important.

Better ways to communicate health information to improve health literacy needs to be constantly explored. This may also require improving the digital technological skill set of health professionals to provide them with the confidence to readily access digital information for the purposes of relaying and disseminating information to pregnant women.

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Appendices

Appendix 1.1: Health Literacy Tapestry Model (adapted Barton, A.J et al, 2018)

Health Literacy- Domain	Health Literacy Practice Competency
Verbal Communication	• Use interpreter for non-English speaking patients • Speak slowly, clearly and concisely • Utilise non-verbal listening skills • Avoid medical terminology- speak in lay terms to explain medical jargon • Answer patient's questions • Obtain feedback to ensure their level of understanding
Written Communication	• Use subject headings • Use easy to read format such as dot points, short sentences • Use language that is written for 5th and 6th grade children • Minimise the use of medical terminology
Environmental Communication	• Share the responsibility of understanding and accessing healthcare system and processes with the patient- encourage their accountability • Refer patient to relevant community resources that will also assist in developing their health literacy skills
Engagement, empowerment and activation	• Identify patient's concerns and needs • Identify patient's preferred method of learning • Make instructions/education interactive to promote engagement and retention of information • Identify reasons/causes for non-adherence to instructions in a non-judgemental way • Focus on a "patient-centred" approach of questioning to identify patient needs • Utilise the "teach back" style of education to ensure the patient understands the information/instructions

Appendix 1.2: Nine Dimensions of Health Literacy (Adapted Batterham, Hawkins et al, 2016)

Dimension	Explanation
Feeling understood and supported by healthcare providers	Communicates and trusts healthcare provider/ has a good relationship with healthcare provider
Having sufficient information to manage own health	Has verbal, written, diagrammatic information that is understood by the individual
Actively managing own health	Motivated and has the cognitive ability to manage own health
Social support for health	Engages family, friend and community supports
Appraisal of health information	Has the ability to understand health information
Ability to actively engage with health care providers	Ease of access and engagement with healthcare providers
Navigating the health system	Understands how the health system works and how to access healthcare easily
Ability to find good health information	Knows how to access reliable, research based information and be discerning of health information
Understanding health information well enough to know what to do	Has the cognitive ability to change behaviour from information received

Appendix 1.3: EDUCATE Model (adapted from Marcus, 2014)

EDUCATE Model	Actions
Enhanced comprehension and retention	Make a list of questions for the learner to ask the teacher Use repetition to reinforce the information Have the learner repeat the information to further reinforcement
Deliver patient-centred education	Talk with and not 'at' the learner Show empathy Ask them about their life experiences to enable relevant use of examples/metaphors
Understand the learner	Find out the learners current level of knowledge Be aware of non-verbal messages Determine the learners barriers to learning
Communicate clearly and effectively	Use effective communication skills State the most important information first Emphasise key points Focus on one key message at a time Use a logical sequence of information Use lay terms- not medical jargon
Address health literacy and cultural competence	Ask about their ability to understand the language Use interpreters if necessary Use diagrams and literature in the appropriate language Use lay terms- not medical jargon especially if there is no word in their language that is used in English
Teaching and Education goals	Ensure adequate preparation is made for learning and teaching Utilise good teaching methodologies Overcome barriers to learning

Appendix 1.4: COM-B Model
(adapted from Michie, et al 2011 and Grant, Morgan et al, 2019)

	Domain	Examples
Capability	**Physical**	Skills, strength, stamina
	Psychological	Knowledge, confidence, memory
Opportunity	Social	Social norms, interpersonal influences
	Environmental	Resources, physical environment
Motivation	Automatic	Impulses, desires, addiction
	Reflective	Beliefs, intentions

Appendix 1.5 Gamification App Pathway (Periera, P. et al, 2014)

App Capability	Action
Progress pathways	Progresses the user through gradually more difficult tasks- increasing their learning
Feedback	Rewards for achievement
Social connection	Able to communicate with other players and/or healthcare providers - Provides support
Interface and user experience that can provide cross-platform integration	Internet connection, links to data bases, aesthetics etc

Appendix 2.1 STOP Study Ethics Approval

Women's & Children's Hospital

Research Secretariat
Level 2, Samuel Way Building
72 King William Road
Tel 08 8161 6390
Tel 08 8161 6521
www.wch.sa.gov.au

16th October 2014

Prof C Roberts
School of Paediatrics & Reproductive Health
University of Adelaide SA 5005

Dear Prof Roberts

Re: Screening Tests to identify poor Outcomes in Pregnancy (STOP) Study. HREC/14/WCHN/90. Ethics expiry date: 31/10/17

Lead HREC for the above study for the following public health units/sites:
Women's & Children's Health Network
Lyell McEwin Hospital

I refer to your letter dated 19th September 2014 in which you responded to matters raised by the WCHN Human Research Ethics Committee at its August 2014 meeting. I am pleased to advise that your protocol has been granted full ethics approval and meets the requirements of the *National Statement on Ethical Conduct in Human Research.*

Specifically, the following documents have been noted/approved:

Document	*Version*	*Date*
NEAF	AU/1/F7F9111	08 August 2014
Protocol	1	09 July 2014
Lifestyle Questionnaire	1	08 July 2014
Participant Information Sheet - Mother	1	08 July 2014 (revised 19/9/14)
Patient Information Sheet - Partner	1	08 July 2014 (revised 19/9/14)
Forms for withdrawal of participation	1	08 July 2014
Master Consent Form	1	08 July 2014

In future, in submitting revised documents (for example information sheets), please revise the date of the document in the footer.

Before proceeding with the study, on page two of the *Participant information sheet – mother,* under *How and why I have been chosen ...,* please replace the symbol '<' with the words 'less than'.

This letter constitutes advice on ethical consideration only. You must not commence this research project at a site until you have obtained separate research governance approval from the site concerned. A copy of this letter should be forwarded to all site investigators for submission to the relevant Research Governance Officer.

At the WCHN, or any other SA Health site, separate authorisation from the Chief Executive or delegate of that site must be obtained through a Site Specific Assessment (SSA) request. For information on this process at the WCHN, please contact the WCHN Research Governance Officer, Ms Angelika Lipinski (telephone 8161 6688, email angelika.lipinski@health.sa.gov.au).

I remind you approval is given subject to:
•immediate notification of any serious or unexpected adverse events to participants;
•immediate notification of any unforeseen events that might affect continued ethical acceptability of the project;
•submission of any proposed changes to the original protocol. Changes must be approved by the Committee before they are implemented;

Government of South Australia
SA Health

•immediate advice, giving reasons, if the protocol is discontinued before its completion;
•submission of an annual report on the progress of the study, and a final report when it is completed to the WCHN Research Governance Officer. It is your responsibility to provide these reports, without reminder. The proforma for the report may be found on the WCHN Research Governance and Ethics website.

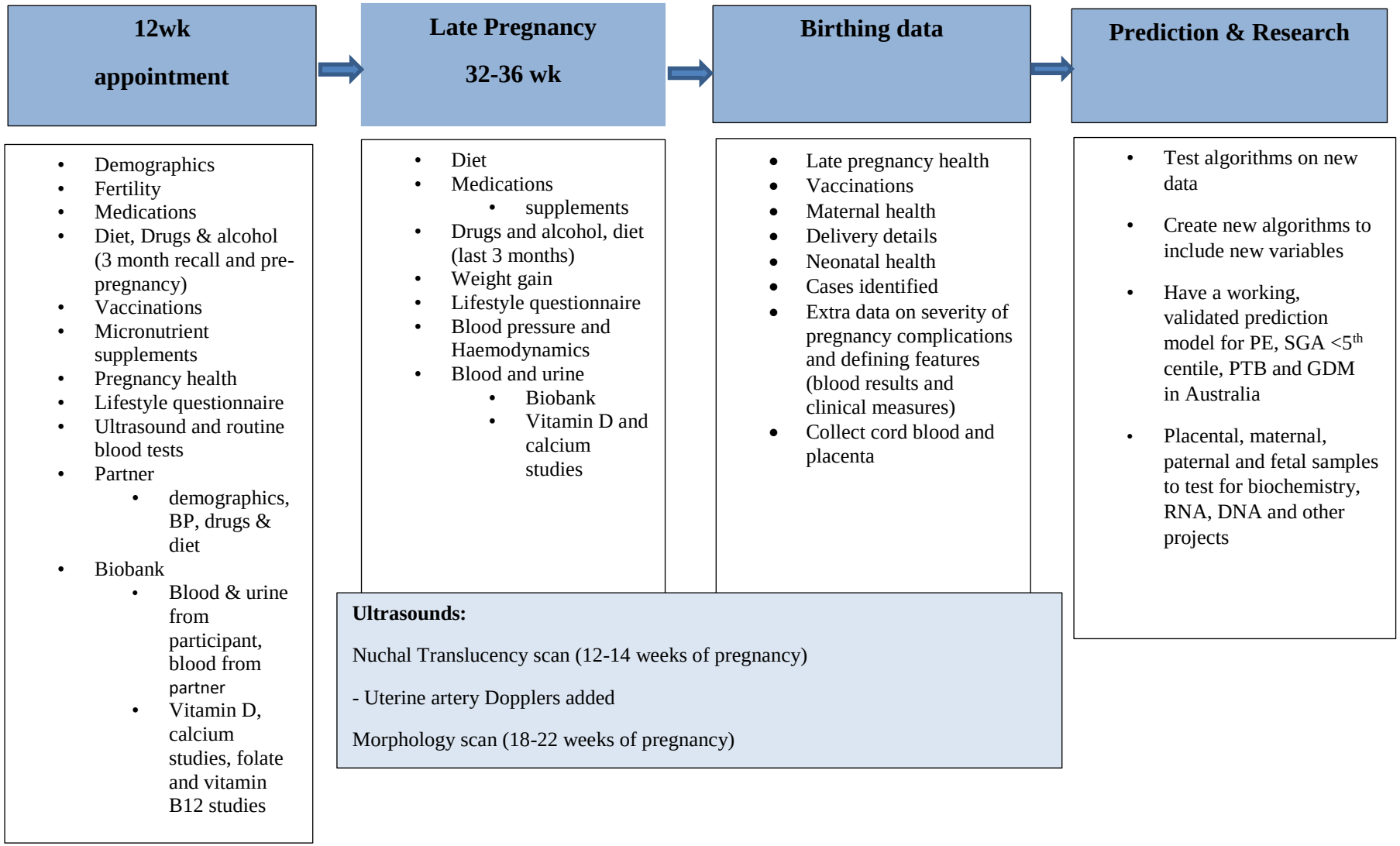
Approval is given for three years only. If the study is more prolonged than this, an extension request should be submitted unless there are significant modifications, in which case a new submission may be required. Please note the expiry date in the title above and include it in any future communications.

Yours sincerely

TAMARA ZUTLEVICS (DR)
CHAIR
WCHN HUMAN RESEARCH ETHICS COMMITTEE

Cc: Dr P Andraweera

Appendix 2.2 STOP Study Process



Appendix 2.3 STOP Study Questionnaires

STOP study

Screening **T**ests to identify poor **O**utcomes in **P**regnancy

STOP study - 12wk data

Form 1 – Registration

Participant ID	
Participant's initials	
D.O.B	
Age	
Midwife/Researcher	
Recruiting Centre	1. LMH/ 2.WCH
Patient consent obtained	1. No/ 2. Yes
Reason if not consented	1. Exclusion criteria/2. Declined/ 3. Withdrew from study
Date of consent	
Participant's E.D.D.	
E.D.D.	
E.D.D. based on	1. LMP/2. Dating scan/3. NT scan
Calculated LMP	
Personal details	
Email address	
Primary phone number	
Secondary phone number	

Form 2 – Consent

Consent to	Mum	Baby	Dad
Taking part in STOP study	1. No/ 2. Yes/ 3. unk	1. No/ 2. Yes/ 3. unk	1. No/ 2. Yes/ 3. unk
Collaborative research (q 8b)	1. No/ 2. Yes/ 3. unk	1. No/ 2. Yes/ 3. unk	1. No/ 2. Yes/ 3. unk
Medical record audit (q 10)	1. No/ 2. Yes/ 3. unk	1. No/ 2. Yes/ 3. unk	n/a
Follow-up studies contact (q 13)	1. No/ 2. Yes/ 3. unk	1. No/ 2. Yes/ 3. unk	1. No/ 2. Yes/ 3. unk
Baby follow-up to 18 months	n/a	1. No/ 2. Yes/ 3. unk	n/a
Partner being contacted	n/a	n/a	1. No/ 2. Yes/ 3. unk

Form 3 – Exclusion criteria & other trials

1. Inclusion criteria (must be yes)

	No	Yes
Singleton		
Nulliparous		

2. Exclusion criteria (must be no)

	No	Yes
≥ 3 terminations		
Multiple pregnancy		
Major fetal anomalies		
Hypertension pre-pregnancy on medication		
Type I or II diabetes		
Renal disease		
Systemic lupus erythematosus		
Anti-phospholipid syndrome		
Known major uterine anomaly		
Cervical cone biopsy		
Enrolled in a trial of:		
low dose aspirin		
calcium >1g/24h		
heparin		
low molecular weight heparin		
antioxidants (vitamin C and E)		

3. Other Trials enrolled in:

Trial Name (e.g. ORIP)	Gestation at entry (w+d)

Form 4 – Demographics

Marital status	1. Single; 2. Married; 3. De facto (stable relationship, not married); 4. Separated or divorced; 5. Same sex partner; 6. Widow
Country of birth	
Ethnicity	1. Caucasian; 2. Maori; 3. Pacific Islander; 4.South East & Far East; 5. Indian subcontinent; 6. African subcontinent; 7. Middle-eastern; 8. Hispanic; 9. Aboriginal; 10. China and Japan; 11. other
Ethnicity - other	
Level of education (completed)	1. Yr. 10; 2. Yr. 12; 3. Certificate; 4. Bachelor; 5. Higher degree; 6. not completed yr. 10
Total years of education (not including reception/prep)	
Tertiary education (university)	1. No; 2. Attending; 3. Graduated; 4.Dropped out
Tertiary education (other)	1. No; 2. Attending; 3. Graduated; 4.Dropped out
Have you been employed for the last 12 months?	1. No; 2. Yes
Current employment	1. None; 2. Student; 3. Casual; 4. Part time; 5. Full-time
Current Occupation	
Household Income (participant + partner)	1. ≤$20,000 2. $20,001 - $40,000 3. $40,001-$70,000 4. $70,001-$105,000 5. $105,001-$205,000 6. >$205,000
NZ SEI (major group)	0. Armed forces 1. Legislators, administrators, managers 2. Professionals 3. Associate professional/technical 4. Clerks 5. Service, sales 6. Agriculture, fishery 7. Trade workers 8. Plant or machine operators 9. Elementary occupations
NZ SEI (minor group)	
Post code	
SEIFA score - IRSAD	
SEIFA score – IRSD SEIFA score – IER	
SEIFA score - IEO	

Form 5 – Maternal history

1. In Utero

Participant's birth weight (g)		Confirmed?	1. No/2. Yes
Participant's partner's birth weight (g)		Confirmed?	1. No/2. Yes
Participant born preterm	1. No; 2. Yes; 3. Unknown		
Participant's gestation at delivery (wks)		Confirmed?	1. No/2. Yes
Participant's position in family			
Participant from a multiple pregnancy	1. No; 2. Yes; 3. Unknown		

2. Obstetric History

Previous gravidities	
Months to conceive	

Previous gravidities – not including current pregnancy; for months to conceive 1 day = 0.03 months

No.	Pregnancy Outcome	G.A. (wks)	D&C	Partner Number.	Month and Year
1			1. No/2. Yes		
2			1. No/2. Yes		
3			1. No/2. Yes		
4			1. No/2. Yes		
5			1. No/2. Yes		

For pregnancy outcome choose one of:

1. Miscarriage ≤10wks, details unknown; 2. Miscarriage ≤10wks, blighted ovum;

3. Miscarriage ≤10wks, fetal loss; 4. Miscarriage 11-19wks;

5. Termination ≤10wks; 6. Termination 11-19wks; 7. Ectopic pregnancy

Partner number of current pregnancy*	

** first pregnancy: partner #1, if miscarriage/termination partner #>1, don't include if no pregnancy from partner*

3. History of infertility

History of infertility	1. No; 2. Yes (>12 months or partner infertile)
Fertility treatment for this pregnancy	1. No; 2. Yes

If yes to fertility treatment:

Hormonal treatment	1. No; 2. Clomiphene; 3. Other
Artificial insemination (AI)	1. No; 2. Yes, partner sperm; 3. Yes, donor sperm
In vitro fertilization (IVF)	1. No; 2. Yes, partner sperm; 3. Yes, donor sperm
Intra-cytoplasmic sperm injection (ICSI)	1. No; 2. Yes, partner sperm-seminal fluid; 3. Yes, partner sperm-transcutaneous
Donor oocyte for this conception	1. No; 2. Familial; 3. Non-familial

4. Gynaecological History

Age at menarche (yrs.)	

a) Pap Smear

Abnormal smear or CIN leading to colposcopy?	1. No/2. Yes

If yes, treatment for CIN:

No.	Treatment	Last treatment time (months)	No. of treatments
1			
2			
3			

Note: for table above - Treatment: 1.colposcopy alone; 2. Lletz; 3. Laser; 4. Cryotherapy; 5. Other and for last treatment time: 1. <6 months; 2. 6-12 months; 3. >12 months

b) Polycystic Ovaries

PCO	1. no/2. unsure/3. Yes – by blood/4. Yes – by scan/5. Yes – by blood and scan

If yes:

Treatment at conception	1. No 2. Yes- fertility drugs 3. Yes – metformin 4. Yes – fertility drugs and metformin 5. Other treatment
Treatment in 1st trimester	1. No 2. Yes- fertility drugs 3. Yes – metformin 4. Yes – fertility drugs and metformin 5. Other treatment

5. Sexual history *

Father of baby known		1. Yes / 2. No
Pregnancy by donor sperm		1. Yes / 2. No
Months of sexual relationship (pre-pregnancy with biological father)	(A)	
Condom/diaphragm use (months)	(B)	
Sex without barrier contraception (months)	(A-B)	
Sex per month with biological father (in the 3 months pre-pregnancy)		
Sex per month with biological father (last 3 months)		
Sex per month with anyone (last 3 months)		

**this has been included in the lifestyle questionnaire if completed electronically, data is entered on form 10*

Form 6 – Family history

1. Obstetric history (mother & sisters (full sister/maternal half-sister or paternal half-sister)

Family member	MC	PIH	GH	PE	Ecl	LBW baby	PTB All	PTB Spont	GDM	Stillbirth	NND
Mother											
e.g. sister											

Fill in each section the above table with one of these options: 1. No; 2. 1x; 3. >1x; 4. Unknown; 5. n/a

2. Medical history (don't record family with no medical history)

Family member	High BP	VTE	IHD	CVA	T1D	T2D	Diabetes NS	Deceased with disease
Mother								
Father								
Any sibling								

Fill in each section with: 1. No; 2. Yes; 3. Unknown; 4. n/a (alive)

If the family member has died indicate whether it was due to the indicated disease, if still alive put n/a.

Form 7 – Current pregnancy I

1. Hyperemesis

Diagnosed hyperemesis	1. No/2. yes

Hyperemesis = vomiting resulting in admission, IV fluids, nasogastric feeding or weight loss >5%

If hyperemesis = yes:

G.A. at onset (wks.)	
G.A. ceased (wks)	
Weight loss (kg)	

2. Vaginal bleeding

Vaginal bleeding	1. No/2. yes

If yes:

No.	G.A. (wks)	Duration (days)	Amount
1.			1. Spotting/2. Light/3. Like a period/4. Heavy and/or clots
2.			1. Spotting/2. Light/3. Like a period/4. Heavy and/or clots
3.			1. Spotting/2. Light/3. Like a period/4. Heavy and/or clots
4.			1. Spotting/2. Light/3. Like a period/4. Heavy and/or clots

3. Infection in pregnancy

Infection	1. No/2. yes

If yes:

Type	1. Flu/respiratory tract infection 2. Pyelonephritis 3. Vaginal candida 4. Suspected vaginal candida	5. Gastroenteritis 6. Urinary tract infection (lower) 7. Other
Infection comment		
Treatment	1. None; 2. Antibiotics; 3. Antifungal; 4. other	
Treatment comment		

4. Dental health

Do you have regular dental check-ups	1. No/2. Yes
Dental problems (comment)	
Do you have your teeth professionally cleaned regularly?	1. No/2. Yes

Have your...	Pre-pregnancy (3 months)	1st trimester
...gums bled?	1. No/2. Yes/3. unknown	1. No/2. Yes/3. unknown
...teeth been sore when chewing?	1. No/2. Yes/3. unknown	1. No/2. Yes/3. unknown
...gums been swollen?	1. No/2. Yes/3. unknown	1. No/2. Yes/3. unknown

5. Asthma

Dr diagnosed asthma	1. No/2. Yes

If yes: (Otherwise skip to 6)

Asthma flare-up in past year		1. No/2. Yes
Asthma medication use in the past year		1. No/2. yes
Currently using a short action B2-agonist inhaler (e.g. Ventolin)		1. No/2. Yes
Treatment in addition to B2-inhaler (in pregnancy):	inhaled steroids	1. No/2. Yes
	long action B2-agonist inhaler	1. No/2. Yes
	oral steroids	1. No/2. Yes
Other treatment (comment)		
Oral steroids in pregnancy (duration in wks)		

6. Maternal medical history

Medical condition	Y / N	Year diagnosed	If yes, is medication required?
HT on oral contraception	Y / N		
Mild HT not on antihypertensives	Y / N		
Anaemia	Y / N		
UTIs	Y / N		
Urinary incontinence	Y / N		
Inflammatory bowel disease	Y / N		
Coeliac disease	Y / N		
Irritable bowel syndrome	Y / N		
Rheumatoid arthritis	Y / N		
Epilepsy	Y / N		
Thromboembolism - proven diagnosis	Y / N		
Thromboembolism – clinical diagnosis	Y / N		
History of depression	Y / N		
Documented thrombophilia	Y / N		
Name of thrombophilia			
Thyroid disease (current)	1. No; 2. Hypothyroid; 3. Thyrotoxicosis; 4. Past thyrotoxicosis		
If thyroid disease, current treatment?	1. None; 2. Thyroxine; 3. Thioamides;		
Other medical conditions (comment)			

7. Hospital admissions

Hospital admission in pregnancy	1. No/2. yes

If yes: (Otherwise skip to form 8)

No.	Reason
1	1. Hyperemesis; 2. Vaginal bleeding; 3. Other obstetric; 4. Asthma; 5. Other medical; 6. Surgical; 7. Trauma; 8. other
2	

Form 8 – Current pregnancy II

1. Diet

Are you vegetarian?	1. No; 2. Yes, lacto-ovo-vegetarian; 3. Yes, lacto-vegetarian; 4. Yes, vegan; 5. Yes, fruitarian; 6. Yes, demi-vegetarian, 7. Pescatarian

Pre-pregnancy - How often have you eaten:

	1 1-3/m	2 1-2/wk	3 3-4/wk	4 5-6/wk	5 1-2/d	6 3-4/d	7 >5/d	8 Never	
Oily fish									Salmon, sardines, anchovies
Other fish									White fish, prawns, canned tuna
Fruit									
Green leafy vegetables									Spinach, lettuce, broccoli, bok choi
Burgers									
Pizza									
Hot chips									
Curry									
Dairy									
Fried Chicken									KFC, Schnitzels (not grilled chicken)

Last 3 months / First trimester - How often have you eaten:

	1 1-3/m	2 1-2/wk	3 3-4/wk	4 5-6/wk	5 1-2/d	6 3-4/d	7 >5/d	8 Never	
Oily fish									Salmon, sardines, anchovies
Other fish									White fish, prawns, canned tuna
Fruit									
Green leafy vegetables									Spinach, lettuce, broccoli, bok choi
Burgers									
Pizza									
Hot chips									
Curry									
Dairy									
Fried Chicken									KFC, Schnitzels (not grilled chicken)

1. Medications in pregnancy

(This includes prescriptions, OTC/non-prescription and asthma medications, if unsure please add)

a. Prescription

Medication (name, brand)	Dose	Freq	Pre-preg use?	Date commenced	Gestation started (w)	Gestation stopped (w)
Expl: Citalopram /Thyroxine	100 g	P.R.N.	Yes / No		4	10

b. Non-prescription

Medication (name, brand)	Dose	Freq	Gestation started (wks)	Gestation stopped (wks)
Example: Panadol	1000mg	P.R.N.	2	9

2. Multivitamin and supplements in pregnancy

a. Pregnancy & women's multivitamins (assume recommended dose)

Multivitamin (name, brand)	Dose	Pre-pregnancy		First trimester	
		Freq	No months taken	Freq	No weeks taken
Example: Elevit, BM BFG	1 tablet	1/day	12	1/day	

Note: Enter the brand and name of multivitamin then indicate frequency (Frequency: 1. Daily; 2. Less than daily; 3. Unknown; 4 N/A).

b. Other supplements, herbal and alternative medicines

Other supplements (name, brand)	Dose	Pre-pregnancy		First trimester	
		Freq	No months taken	Freq	No weeks taken
Example: I-folic / Ferrograd C	1 tablet	1/day	12	1/day	12

Note: Enter the brand and name of supplement/herbal/alternative medicine then indicate frequency (Frequency: 1. Daily; 2. Less than daily; 3. Unknown; 4 N/A).

3. Alternative therapies (circle all that apply)

1. Homeopathy; 2. Naturopathy; 3. Herbal; 4. Chinese; 5. Acupuncture; 6. Massage; 7. Chiropractor; 8. Skeletal osteopathy; 9. Cranial osteopathy; 10. Reflexology; 12. Aromatherapy; 13. Yoga or mediation; 14. Iridology; 15. Other

4. Vaccinations

Have you been vaccinated against influenza or whooping cough (pertussis)?	1. No; 2. Yes
Are you willing to be vaccinated? (n/a if already vaccinated for both)	1. No; 2. Yes; 3. N/a
If not, why not? (comment)	

If you were vaccinated, when? (If not, skip to 6)

Vaccination	Vaccinated?	Date	Gestation (w +d)
Influenza	1. no/2. yes		
Pertussis	1. no/2. yes		

* include vaccinations in pregnancy (gestation) and pre-pregnancy (month/year)

5. Drugs and alcohol

a) Household smoking

Does anyone in your household other than you smoke?	1. No/2. Yes

b) Your smoking, drug and alcohol use

Drug	3 months pre-pregnancy	1st trimester	Gestation ceased (wks.)
Cigarettes (per day)			
Alcohol (per wk.)*			
Other drugs/binge alcohol	1. No/2. yes	1. No/2. yes	

**record this as a total of binge and casual alcohol, record 1st trimester consumption before positive pregnancy test*

If other drugs or binge alcohol are yes: (Otherwise skip to form 9)

Drug/binge alcohol *	3 months pre-pregnancy	1st trimester	Gestation ceased (wks.)
EXAMPLE: marijuana	12 cones / 3 mnths	2 (in first trimester)	6

Note: enter total number of times taken in 3 months pre-pregnancy or in first trimester; Drug options are: 1. Binge alcohol ≥6 drinks per session; 2. Cocaine/crack; 3. Amphetamines (not P/Crystal meth); 4. Substance P/crystal meth; 5. XTC; 6. Opiates; 7. Hallucinogens; 8. Herbal highs; 9. E-cigarettes (with nicotine); 10. E-cigarettes (without nicotine); 11. nicotine replacement (patches, gum, etc.); 12. Shisha (or hookah); 13. marijuana

Form 9 – Routine investigations

1. E.D.D. & early ultrasounds

Date of LMP		Is the date certain?	1. no/2. yes

Scan type	Date	Gestation (w + d)	CRL (mm)
NT scan			
Dating			
Other			

* Ultrasound types: 1. Dating /2. Vaginal bleeding/3. Elective/4. Viability/5. Cervical length/6. Pain/7. Suspected ectopic/8. Unknown/9. Other

Final E.D.D.	
G.A. today (w + d)	
Method of estimation	1. LMP; 2. Dating scan; 3. NT scan

Final EDD –

1. *Based on LMP if date is certain, if uncertain…*
2. *Based on dating scan, if no dating scan…*
3. *Based on NT scan, if dating scan/LMP/NT are out by >7 days use most recent ultrasound <20 wks.*

2. NT ultrasound Doppler

NT scan performed?	1. Yes, Dopplers completed 2. Yes, Dopplers not completed 3. Declined NT Scan
R Uterine RI	
R Uterine PI	
R notch	1. Absent; 2. Present; 3. Indeterminate; 4. Not visualised; 5. No result
L Uterine RI	
L Uterine RI	
L notch	1. Absent; 2. Present; 3. Indeterminate; 4. Not visualised; 5. No result
Risk of trisomy 21 (1 in….)	

3. Routine antenatal blood results

Record all tests completed in pregnancy and date tested

Test	Result	Date
Blood group	A B O AB	
Rh factor	1. Positive; 2. Negative	
Red cell folate (ng/mL)		
Ferritin (ng/ml)		
B12 (pmol/L)		
Vitamin D (nmol/L)		
Haematocrit (PCV)		
Platelets (x109/L)		
Haemoglobin (Hb, g/L)		
Urine Creatinine (PCR test)		
Urine Protein (PCR test)		
Urine Protein:creatinine ratio		
HbA1c (%)		
PAPP-A (MOM)		
B-hCG (MOM)		
Plasma calcium		
Ionised calcium		
Urinary creatinine (CCR test)		
Urinary calcium (CCR test)		
Urinary calcium:creatine ratio		
Random glucose (form 13)		
Risk of trisomy 21 (1 in....)		

4. Routine antenatal screening questionnaires

a) ANRQ - (Scoring: No = 0, Yes = 5)

Question	1	2a	2b	2c	2d	3	4a	4b	5	6	7	8	9	Total
Options	1-6	0 / 5	0 / 5	0-5	0 / 5	1-6	0 / 5	0-5	1-5	1-5	1-5	0 / 5	0 / 5	n/a
Score														

Is the participant considered high risk?
1. No; 2. yes (2a = yes or 2c >3 or 2d = yes or 8 = yes or 9 = yes or total score >22)

b) EPDS (past week)

Question	1	2	3	4	5	6	7	8	9	10	Total	Range
Options	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	n/a	1. 0-9 2. 10-12 3. 13-30
Score												

5. Physical measurements

Pre-pregnancy weight (kg)			
Height (m)			
Weight (kg)			
Waist (cm)			
Hip (cm)			
Blood pressure measurements		**USCOM BP+ readings**	
SBP (mmHg)		pSBP (mmHg)	
DBP (mmHg)		pDBP (mmHg)	
Manual / Automatic		cSBP (mmHg)	
		cDBP (mmHg)	
		PR (bpm)	
		AI (%)	
		Machine #	
		SD #	

6. Sample collection

Sample	Collection date	Collection Time	Time received at lab
EDTA blood – 2 x 6ml			
Serum – 1x8ml			
Heparin (trace metal free) blood – 1x 6ml			
Urine ~ 30ml			
Saliva			

Form 12 – 20wk Ultrasound results

1. Scan details

Scan date		Gestation (w + d)	
Fetal sex	1. Likely male; 2. Likely female; 3. Not seen; Not reported		

2. Anatomy and growth

Fetal abnormality	1. None; 2. Not assessed; 3. CNS; 4. Cardiac; 5. Urogenital; 6. Gastrointestinal; 7. Musculoskeletal; 8. Respiratory; 9. Multiple; 10. Other abnormality; 11. Not visualised
BPD (mm) HC (mm)	
AC (mm)	
FL (mm)	
Liquor volume	1. Normal; 2. Increased; 3. Reduced; 4. Not reported

3. Uterine and umbilical Doppler

Umb RI	
Umb PI	
Umb EDV R Uterine RI	1. Present; 2. Absent; 3. Reversed; 4. No result
R Uterine PI	
R notch	1. Absent; 2. Present; 3. Indeterminate; 4. Not visualised; 5. No result
L Uterine RI	
L Uterine PI L notch	1. Absent; 2. Present; 3. Indeterminate; 4. Not visualised; 5. No result

4. Cervical scan

Cervical scan performed	1. no/2. yes
Shortest trans vaginal cervical length (mm)	
Membranes bulging through cervix	1. no/2. yes
Cervical findings communicated	1. no/2. yes

If yes,

- Rest intervention	1. no / 2. Yes	- Cerclage	1. no / 2. Yes
- Antibiotics	1. no / 2. Yes	- Betamimetics	1. no / 2. Yes
- NSAID	1. no / 2. Yes	- Nifedipine	1. no / 2. Yes
- MgSO4	1. no / 2. Yes	- Progesterone	1. no / 2. Yes
-other treatment			

5. Fetal outcome

On 20wk scan	1. Alive and continuing pregnancy	5. FDIU and induction ≤19w +6d
	2. No scan	6. FDIU and induction ≥20w
	3. Anomaly for TOP ≤19w +6d	7. Anomaly for TOP ≥20w
	4. Other reason for TOP ≤19w +6d	8. Other reason for TOP ≥20w

Form 13 –Glucose & Iron studies

1. Was a glucose test performed?

Test		Results	Date	Gestation (w+d)	
Random Glucose					
Early-gestation GTT – 75g load					
1. no/2. Yes	Fasting				
	1h				
	2h				
OGCT – 50g load					
1. no/2. yes	1h				
Late-gestation GTT – 75g load					
1. no/2. yes	Fasting				
	1h				
	2h				

Outcome:

GDM	GTT: fasting 5.1-6.9 mmol/L or 1h >10.0 mmol/L or 2h 8.5-11.0 mmol/L	1. No / 2. yes
Diabetes in pregnancy	GTT: fasting >7.0 mmol/L or 2h >11.1 mmol/L	1. No / 2. yes
Diabetes intervention	1. Diet only	5. Other oral hypoglycaemic tablets
	2. Insulin (diet continues)	6. Insulin and other oral hypoglycaemic tablets
	3. Metformin oral hypoglycaemic tablet	7. Other
	4. Metformin and insulin	

2. Iron and other studies

Record any routine blood results at 28-34 wks' gestation

Test	Result	Date	Gestation (w+d)	
Ferritin (ng/ml)				
Vitamin D (nmol/L)				
Haematocrit (PCV)				
Haemoglobin (Hb, g/L)				
Platelets ($x10^9$/L)				

STOP study

Screening Tests to identify poor Outcomes in Pregnancy

Lifestyle Questionnaire – First trimester appointment

STUDY ID	
INITIALS	
DATE	

Participant completed questionnaire: Yes, by self____ Yes, with MW____ No____

This questionnaire asks about how you spend your time, your work and exercise, how you manage your pregnancy, about your feelings and relationships.

In an average week, I spend

_____ Hours at paid employment
_____ Hours studying
_____ Hours of household duties
_____ Hours relaxing (reading, hobbies etc)
_____ Hours exercising

Work

If you do paid work, please complete the next questions. If not, turn the page.

How would you describe your activities at work?

Circle **the one that best describes your main activities at work**

1. Administrative/sitting activities
2. Sitting and some walking
3. Standing
4. Standing & walking
5. Standing & walking work plus intermittent strenuous exercise
6. Regular strenuous exercise

This asks you about how you feel at the end of your normal working day. Please answer these questions in relation to how you have been feeling **in THE PAST MONTH by *ticking either* Yes *or* No.**

	NO	YES
I find it hard to relax at the end of a working day		
At the end of a working day I am really feeling worn-out		
My job causes me to feel rather exhausted at the end of a working day		
I have trouble concentrating in the hours off after my working day		
I find it hard to show interest in other people when I just came home from work		
In general, it takes me over an hour to feel fully recovered after work		
When I get home, people should leave me alone for some time		
After a working day I am often too tired to start other activities		
During the last part of the working day I cannot optimally perform my job because of fatigue sometimes		
Generally speaking, I'm still feeling fresh after supper		
Generally speaking, I'm able to relax only on a second day off		

Stress

The next questions ask about your feelings and thoughts during THE LAST MONTH.

In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. Don't try to count up the number of times you felt a particular way, but rather ***circle the answer that you think best fits for you***.

	Never	Almost Never	Some-times	Fairly Often	Very Often
In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
In the last month, how often have you felt nervous and stressed?	0	1	2	3	4
In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
In the last month, how often have you felt that things were going your way?	0	1	2	3	4
In the last month, how often have you found that you could not cope with all the things you had to do?	0	1	2	3	4
In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
In the last month, how often have you been angered because of things that happened that were outside of your control?	0	1	2	3	4
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Exercise and Sleep Now

1. **On average, how many hours do you currently spend each day doing the following? Please fill in the number of hours for each activity.**

	On a week day	On a weekend day
Standing	____ hours	____ hours
Physically resting during the day	____ hours	____ hours
Sleeping during the day	____ hours	____ hours
Sleeping at night	____ hours	____ hours

2. **Has your level of exercise (physical activity) changed since you've been pregnant? (*Circle* the answer)**
   - **A** – Decreased
   - **B** – Unchanged
   - **C** – Increased

For the next questions, please *circle* which fit best with what you have done in THE LAST MONTH.

3. **How many times do you usually wake during a night's sleep.**
   - **A** - Don't usually wake up
   - **B** - Once a night
   - **C** - 2-3 times
   - **D** - 4 or more times

4. **Do you snore most nights?**
   - **A** –Yes
   - **B** - No
   - **C** – Don't know

5. **How often have you engaged in vigorous exercise in the last month (exercise which made you breathe harder or puff or pant such as tennis, jogging, aerobics, heavy gardening, rollerblading, skiing, rowing, rowing/cycling machine)**
   - **A** - Never
   - **B** - Once a week
   - **C** - 2-3 time each week
   - **D** - 4-6 times each week
   - **E** – Daily
   - **F** - More than once a day

6. **How often have you engaged in less vigorous exercise for recreation, sport or health-fitness purposes in the last month which did not make you breathe harder or puff and pant?**

   A - Never

   B - Once a week

   C - 2-3 time each week

   D - 4-6 times each week

   E – Daily

   F - More than once a day

7. **How often have you walked for recreation or exercise in the last month?**

   A - Never

   B - Once a week

   C - 2-3 time each week

   D - 4-6 times each week

   E – Daily

   F - More than once a day

8. **How many days a week in the last month did you walk for a purpose rather than for fun (e.g. walking to bus stop)?**

   A - Never

   B - Once a week

   C - 2-3 time each week

   D - 4-6 times each week

   E – Daily

   F - More than once a day

9. **In the last month, how many kilometres did you walk for a reason each day (for example, to a bus stop)?**

   _____kilometres

10. **How many times a day did you climb a flight of stairs in the last month?** ***(not just a few steps into the house)***

    A – Never

    B - Less than 10 times per day

    C - At least 10 times per day

11. **In the last month, on average, how many hours did you spend watching television in a day?**

    A – None

    B – Less than 2 hours

    C – 2-4 hours

    D – 5-6 hours

    E – more than 6 hours

12.In the last month, on average, how many hours did you spend using a computer in a day?

A – None

B – Less than 2 hours

C – 2-4 hours

D – 5-6 hours

E – more than 6 hours

Your Responses to Your Pregnancy?

The statements below refer to things that you may or may not have done to manage your pregnancy.

How often you have done the following since you found out you were pregnant? Please ***circle the answer that you think best fits for you***

	Not at all	Rarely	Some days	Most days	Every day
I have overdone things, then needed to rest up for a while	0	1	2	3	4
I have avoided physical exercise	0	1	2	3	4
I have put parts of my life on hold	0	1	2	3	4
I have not been able to carry on with my usual level of activity	0	1	2	3	4
I haven't slowed down, I've just carried on as normal	0	1	2	3	4
I have felt better than ever	0	1	2	3	4
I have pushed myself as hard as ever until I can not push myself any more	0	1	2	3	4
I have gone to bed during the day	0	1	2	3	4
I have carried on with things as normal until my body can not cope any longer	0	1	2	3	4
I have felt obliged to carry out all my responsibilities, no matter how bad I feel	0	1	2	3	4
I have avoided my usual activities	0	1	2	3	4
I have tried to do too much and felt even worse as a result	0	1	2	3	4
I find myself rushing to get everything done before I crash	0	1	2	3	4

How are you Feeling?

Please read each of the following statements and circle the most appropriate number to the right of the statement to indicate **how you feel right now**, at this moment. Do not spend too much time on any one statement but ***circle*** the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately	Very Much
I feel calm	0	1	2	3
I feel tense	0	1	2	3
I feel upset	0	1	2	3
I feel relaxed	0	1	2	3
I feel content	0	1	2	3
I feel worried	0	1	2	3

Relationships and Support

The last questions are about your Relationships and Support.

Please *circle* the answer that you think best fits for you

	All of the time	Most of the time	Some of the time	Seldom	Never
Do you have people around you who can help with practical things when you need it?	1	2	3	4	5
Do you have people around you who can help or listen to you when you feel down, upset or worried?	1	2	3	4	5

We know that many women are hurt in their relationships and we are asking all women in the study a few questions about this. If you find the questions upsetting or if you need help/support, we have information about available support services.

Please ask if you would like or need some support.

1. **During the *12 months before this pregnancy* have you been hit, slapped, kicked or physically hurt by anyone? Please *circle* all that apply.**

	Never	Once	2-5 times	More than 5 times
Husband or partner	0	1	2	3
Ex husband or partner	0	1	2	3
Family member other than your husband or partner	0	1	2	3
Friend or acquaintance	0	1	2	3
Stranger	0	1	2	3
Someone else	0	1	2	3

2. **During *this pregnancy* have you been hit, slapped, kicked or physically hurt by anyone? Please *circle* all that apply.**

	Never	Once	2-5 times	More than 5 times
Husband or partner	0	1	2	3
Ex husband or partner	0	1	2	3
Family member other than your husband or partner	0	1	2	3
Friend or acquaintance	0	1	2	3
Stranger	0	1	2	3
Someone else	0	1	2	3

3. **During the *12 months before this pregnancy* were you ever physically forced to have sexual intercourse by anyone? Please circle all that apply.**

	Never	Once	2-5 times	More than 5 times
Husband or partner	0	1	2	3
Ex husband or partner	0	1	2	3
Family member other than your husband or partner	0	1	2	3
Friend or acquaintance	0	1	2	3
Stranger	0	1	2	3
Someone else	0	1	2	3

4. **During *this pregnancy* were you ever physically forced to have sexual intercourse by anyone? Please *circle* all that apply.**

	Never	Once	2-5 times	More than 5 times
Husband or partner	0	1	2	3
Ex husband or partner	0	1	2	3
Family member other than your husband or partner	0	1	2	3
Friend or acquaintance	0	1	2	3
Stranger	0	1	2	3
Someone else	0	1	2	3

5. **During *this pregnancy* have you had sexual intercourse because you were afraid of what any of these people might do to you? Please *circle* all that apply.**

	Never	Once	2-5 times	More than 5 times
Husband or partner	0	1	2	3
Ex husband or partner	0	1	2	3
Family member other than your husband or partner	0	1	2	3
Friend or acquaintance	0	1	2	3
Stranger	0	1	2	3
Someone else	0	1	2	3

If you have been hurt, then ***circle*** the one that applies:

6. **Compared to the *12 months before your pregnancy*, during this pregnancy have you been hurt**

1 - More often	**2** - Less often	**3** - Same	**4.** Never hurt

Form 11 – Partner

1. Consent & demographics

STOP ID	

Consent	1. No/2. Yes/3. Partner unknown

If partner is unknown, partner or participant does not consent, leave the rest of the form blank.

Date of visit	
Initials	
D.O.B. Age	
Ethnicity	1. Caucasian; 2. Maori; 3.Pacific Islander; 4.South East & Far East; 5. Indian subcontinent; 6. African subcontinent; 7. Middle-eastern; 8. Hispanic; 9. Aboriginal; 10. China and Japan; 11. Other
Ethnicity (other) Level of education	1. Yr. 10; 2. Yr. 12; 3. Certificate; 4. Bachelor; 5. Higher degree
Total years of full-time education (not including reception/prep)	
Employment	1. None; 2. Student; 3. Casual; 4. Part-time; 5. Full-time
Occupation Do you live in the same household as your partner?	1. No/ 2. yes
NZ SEI (major group)	0. Armed forces 1. Legislators, administrators, managers 2. Professionals 3. Associate professional/technical 4. Clerks 5. Service, sales 6. Agriculture, fishery 7. Trade workers 8. Plant or machine operators 9. Elementary occupations
NZ SEI (minor group)	
Post code SEIFA - IRSAD	
SEIFA - IRSD	
SEIFA - IER	
SEIFA - IEO	

2. Diet

Are you vegetarian?	1. No; 2. Yes, lacto-ovo-vegetarian; 3. Yes, lacto-vegetarian; 4. Yes, vegan; 5. Yes, fruitarian; 6. Yes, demi-vegetarian, 7. Pescatarian

Pre-pregnancy - How often have you eaten:

	1 1-3/m	2 1-2/wk	3 3-4/wk	4 5-6/wk	5 1-2/d	6 3-4/d	7 >5/d	8 Never	
Oily fish Other fish									Salmon, sardines, anchovies White fish, prawns, canned tuna
Fruit									
Green leafy vegetables									Spinach, lettuce, broccoli, bok choi
Burgers Pizza Hot chips									
Curry									
Dairy Fried Chicken									KFC, Schnitzels (not grilled chicken)

Last 3 months / First trimester - How often have you eaten:

	1 1-3/m	2 1-2/wk	3 3-4/wk	4 5-6/wk	5 1-2/d	6 3-4/d	7 >5/d	8 Never	
Oily fish									Salmon, sardines, anchovies
Other fish									White fish, prawns, canned tuna
Fruit									
Green leafy vegetables									Spinach, lettuce, broccoli, bok choi
Burgers									
Pizza Hot chips									
Curry									
Dairy Fried Chicken									KFC, Schnitzels (not grilled chicken)

3. Supplementation

Multivitamin (Name, Brand)	No. Months taken (pre-conception)	No. months taken (post conception)	Frequency

As in Form 8.3, enter the name and brand, how many months they were taken pre-&post-conception. For frequency: 1. Daily; 2. Less than daily; 3. unknown

4. Paternal health

Do you have any of these conditions?

Diabetes	1. No; 2. Type 1; 3. Type 2; 4. Other; 5. Unknown
Hypertension	1. No; 2. Yes; 3. Unknown
Thromboembolism	1. No; 2. Yes; 3. Unknown
Ischaemic heart disease	1. No; 2. Yes; 3. Unknown
Other diseases	1. No; 2. Yes; 3. Unknown
If other diseases, specify:	

Have you previously fathered other children?

1. No	4. Yes, >1 preeclamptic pregnancy
2. Yes, no preeclampsia	5. Yes, unknown whether it was a preeclamptic pregnancy
3. Yes, one preeclamptic pregnancy	

5. Drugs and alcohol

a) Household smoking

Does anyone in your household other than you smoke?	1. No/2. Yes

b) Your smoking, drug and alcohol use

Drug	3 months pre-conception	Last 3 months (1st trimester)	Gestation ceased
Cigarettes (per day)			
Alcohol (per wk.)			
Other drugs/binge alcohol	1. No/2. Yes	1. No/2. Yes	

If other drugs or binge alcohol are yes: (Otherwise skip to 6)

Drug/binge alcohol	3 months pre-conception	Last 3 months (1st trimester)	Gestation ceased

Note: enter total number of times taken in the 3 months pre-conception or in the last 3 months (first trimester). Drugs: 1. Binge alcohol ≥6 drinks per session; 2. Cocaine/crack; 3. Amphetamines (not P/Crystal meth); 4. Substance P/crystal meth; 5. XTC; 6. Opiates; 7. Hallucinogens; 8. Herbal highs; 9. E-cigarettes (with nicotine); 10. E-cigarettes (without nicotine); 11. nicotine replacement (patches, gum, etc);12. Shisha (or hookah); 13. marijuana

6. Physical measurements

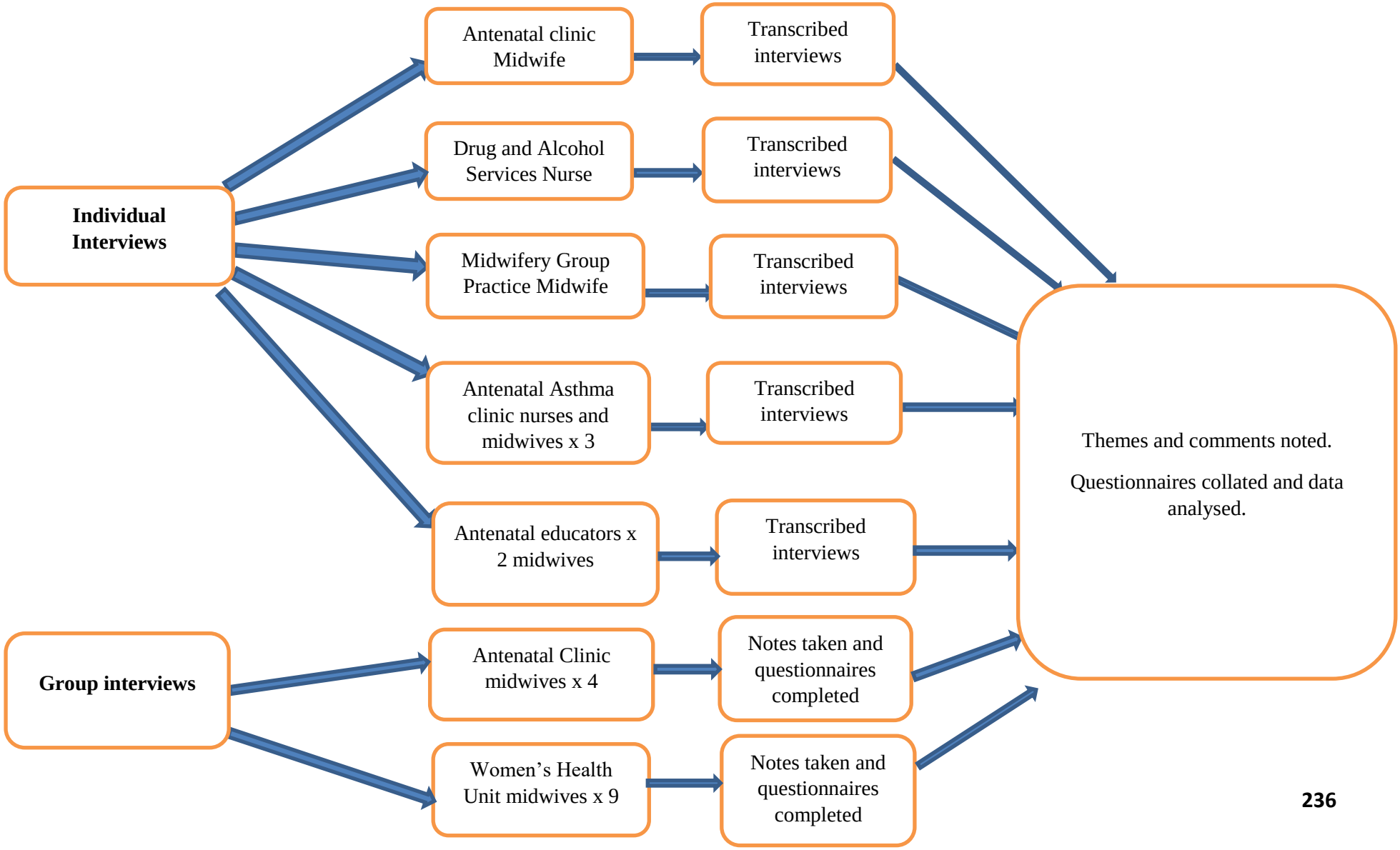
Height (m)			
Weight (kg)			
Waist (cm)			
Hip (cm)			
Blood pressure measurements		**USCOM BP+ readings**	
SBP (mmHg)		pSBP (mmHg)	
DBP (mmHg)		pDBP (mmHg)	
Manual / Automatic		cSBP (mmHg)	
		cDBP (mmHg)	
		PR (bpm)	
		AI (%)	
		Machine #	
		SD #	

7. Sample collection

Sample	Collection date	Collection Time	Time received at lab
EDTA blood – 6ml			
Oragene Saliva			

Only use Oragene saliva as a last resort, better samples are obtained from EDTA

Appendix 3.1 Midwives Interview Process



Appendix 3.2 Staff Questionnaire

1. **Age: _____**

2. **Gender:** □ Female □ Male □ Prefer not to say

3. **Years of practice:**
   - First year
   - 1- 5 years
   - 5-10 years
   - > 10 years

4. Do you use any **forms of social media** as stated below? Please tick all that apply

   - Texting (SMS)
   - Email
   - Twitter
   - Facebook
   - LinkedIn (The world's largest professional network)
   - Mobile apps (for phone and/or tablet)
   - Internet Forums (An online discussion site where people can hold conversations in the form of posted messages)
   - YouTube (Online videos)
   - Other - please state:_____ _____ _

5. How often do you use facebook?
   - At least once / day
   - At least once /week
   - At least once /fortnight
   - At least once/month
   - Less than once/month
   - Never

6. How often do you use Internet Forums? (As defined above)
   - At least once / day
   - At least once /week
   - At least once /fortnight
   - At least once/month
   - Less than once/month
   - Never

7. How often do you use Mobile Apps?
   - At least once / day
   - At least once /week
   - At least once /fortnight

- ☐ At least once/month
- ☐ Less than once/month
- ☐ Never

8. What do you like about social media?

_____
_____
_____
_____

9. What do you dislike about social media?

_____
_____
_____
_____

10. Do you think social media has a place in healthcare/health promotion?

- ☐ Yes
- ☐ No

11. If YES to Qu 11, how do you think the LMH could use social media as part of a healthcare/health promotion strategy?

_____
_____
_____
_____
_____
_____

12. If NO to Qu 11 re: the use social media for healthcare/health promotion, what are your reasons?

_____
_____
_____
_____
_____

13. If the Lyell McEwin Hospital provided an **educational/informational** Facebook page or other similar social media or internet site, how would you **rate your level of comfort** with contributing to it?

1	2	3	4	5
Not at all Comfortable	A little Comfortable	Somewhat Comfortable	Quite Comfortable	Very Comfortable

14. If the Lyell McEwin Hospital provided an **educational/informational** Facebook page or other similar social media or internet site, how would you **rate your level of confidence** with contributing to it?

1	2	3	4	5
Not at all Confident	A little Confident	Somewhat Confident	Quite Confident	Very Confident

15. What **barriers if any**, do you consider would inhibit **your use of social media** in healthcare at the LMH?
Please state:

_____
_____
_____
_____
_____

16. Do you think that your patients would be **willing** to use social media for healthcare?

- ☐ Yes - please state reason
- ☐ No - please state reason

_____
_____
_____
___

17. Do you think that your patients would **be able** to use social media for health care?

- ☐ Yes - Please state reason
- ☐ No - Please state reason

_____
_____
_____
___

If you would be willing to be interviewed to further explore your responses, please leave your name and contact details or contact Julia Dalton in the Family Clinic (ph 82821614) or Robinson Institute (ph 81332128) or text her on – 0409 093 401.

Please place this questionnaire in the envelope and send it to Julia Dalton in the Family Clinic.
Thank you for your assistance and co-operation.

Appendix 4.1 Ethics Approval for Antenatal PowerPoint Presentation

Dear Julia,

Date: 4 July 2018

CALHN Reference number: 2011026

Project title: E-health communication strategy and design: Evaluating the influence of new media interventions on the health of patients from vulnerable populations.

CPI: Prof Vicki Clifton

Please accept this e-mail as **Acknowledgement of Receipt , Review and APPROVAL** of the document(s), on behalf of **Central Adelaide Local Health Network Human Research Ethics Committee (CALHN HREC)** and retain a copy for your records.

For multi-centre studies a copy of this email must be forwarded to Principal Investigators at every site approved by the CALHN HREC for submission to the relevant Research Governance Officer along with a copy of the approved documents.

Document	***Version***	***Date***
Antenatal PowerPoint Questionnaire	2	28 June 2018

This approval is subject to the conditions outlined in the original ethics approval letter.

Should you have any queries about this matter please contact the Executive Officer of the HREC on 08 7117 2229 or 08 8222 6841 or Health.CALHNResearchEthics@sa.gov.au

Yours sincerely,

Eloise Spooner
Research Administration Officer
On behalf of:

Mr Ian Tindall
Chair,
Central Adelaide Local Health Network Human Research Ethics Committee (CALHN HREC)
CALHN Research Office
Phone: 08 7117 2229 or 08 8222 6841 | Email: Health.CALHNResearchEthics@sa.gov.au |

L3 Roma Mitchell House, North Terrace, Adelaide

https://www.rahresearchfund.com.au/rah-research-institute/for-researchers/human-research-ethics/

Ground Floor, Basil Hetzel Institute for Translational Health Research, 28 Woodville Road, Woodville South SA 5011 | DX: 465101
http://www.basilhetzelinstitute.com.au/research/information-for-researchers/human-research-ethics-committee/

Government of South Australia
SA Health
Central Adelaide Local Health Network Inc.

Appendix 4.2

ANTENATAL POWERPOINT QUESTIONNAIRE

You are invited to review the TV presentation about pregnancy and the services at the Family Clinic at the Lyell McEwin Hospital. This review helps us to assess your needs and opinions about the information we provide at the Lyell McEwin Hospital. The questionnaire is part of a project called the Health-e Baby Study with the University of Adelaide. The information you provide us is extremely valuable and will be kept confidential.

Just so we can understand a little about who you are, could you please answer the demographic questions below.

Gender:

- Female
- Male
- Other: please state if comfortable ……
- Prefer not to say

Age:

- < 18
- 18-25
- 26-30
- 31-35
- 36-40
- 41-45
- Over 45

Please tick the circle for the reason that you are at the Clinic today:

- I'm pregnant. Please state how many weeks pregnant you are:……
- I'm here with my partner, relative or a friend who is attending the Clinic for an appointment
- I'm not pregnant and here for a different appointment
- Other reason: please state……
  ……

Are you:

- Single
- Defacto/married
- Separated

What is your Cultural Background?

- Aboriginal Australian
- European/ Caucasian/ Anglo Australian
- African
- Indian Subcontinent
- Asian (Chinese, Japanese, Malaysian, Indonesian etc)
- Maori
- Other: please state……

Are you:

- Employed
- Home-duties
- Unemployed
- Student

What is the highest level of education that you have completed?

- Year 9
- Year 10
- Year 11
- Year 12
- TAFE (or similar) diploma or certificate
- University degree

1. Have you accessed pregnancy related information via any of the following methods?

Please tick as many as required.

- o Antenatal clinic pamphlet
- o books
- o website
- o phone app
- o antenatal classes

2. What is your preferred method of receiving pregnancy related health information?

Please tick as many as required.

- o Antenatal clinic pamphlet
- o books
- o website

- o phone app
- o antenatal classes
- o TV presentation in clinic
- o Doctors and Midwives
- o Friends and family

Please answer these general questions about how you use the waiting room.

1. **How much time did you spend in the waiting room today?**
   - o 0 – 5 minutes
   - o 5 – 10 minutes
   - o 10 – 20 minutes
   - o 20 – 30 minutes
   - o 30 minutes to an hour
   - o Over an hour

2. **Did you bring any entertainment to the waiting room with you?**
   - o Yes
   - o No. Go to question

3. **If yes, what entertainment did you bring? Please tick as many as required.**
   - o Book or magazine
   - o Mobile phone
   - o Tablet
   - o Other: please state:
     ……
     ……

4. **Select the activities that you did in the waiting room:**
   - o Browsing internet
   - o Playing games on phone or other device
   - o Talking, texting or communicating with friends/family etc. via other means (e.g. Facebook Messenger)
   - o Reading book or magazine
   - o Talking to partner, friend, relative or other person
   - o Caring for children
   - o Filling out medical paperwork
   - o None of the above
     (please
     state…….

5. **Did you read any pregnancy related pamphlets while in the waiting room?**

- Yes
- No

6. **Did you read any pregnancy related posters while in the waiting room?**
   - Yes
   - No

Please tell us what you think about the TV presentation for pregnant women by answering the following questions.

1. **I noticed the TV presentation for pregnant women:**
   - Yes
   - No

2. **I watched the TV presentation while in the waiting room:**
   - Yes
   - No

3. **I learnt something new from the TV presentation for pregnancy women (e.g. about my own health / well-being or someone else's health / well-being):**
   - Yes
   - No

If Yes, what did you learn? Please state: Vitamins and diet, where to get help, drugs and smoking, depression and who can help

4. **I intend to contact a service or seek out further information about a topic discussed in the TV presentation for pregnant women:**
   - Yes
   - Not sure
   - No

5. **The TV presentation in this clinic provided useful information about anxiety and depression:**
   - Yes
   - No
   - Unsure

6. **The TV presentation in this clinic provided useful information about how I can reduce my stress.**
   - o Yes
   - o No
   - o Unsure

7. **I think the TV in the Clinic is a good way to learn about pregnancy:**
   - o Yes
   - o No
   - o Unsure

Please explain:

……
……
……
……
……
…….

8. **Was there anything that you <u>did not like</u> about the TV presentation? Please state:**

……
……
……
……
……

9. **Do you have any other <u>suggestions or comments</u> about how the TV presentation could be improved?**

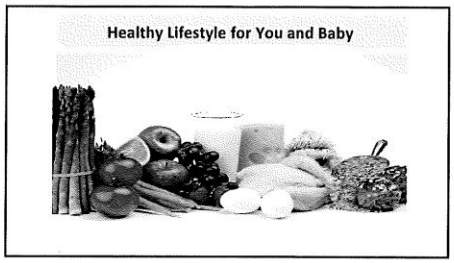
……
……
……
……
……
……
……
……
……
……

Thank you very much for your contribution to this research.

Please return the completed questionnaire in the envelope provided and place it in the box labelled 'ANTENATAL POWERPOINT QUESTIONNAIRE' Thank you.

Appendix 4.3 Antenatal PowerPoint Presentation

Appendix 4.3 Antenatal PowerPoint Presentation



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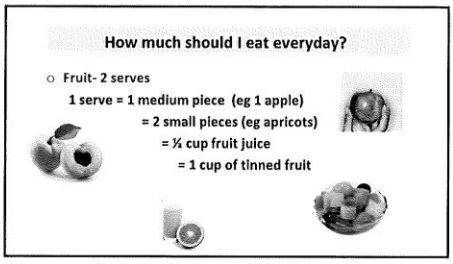

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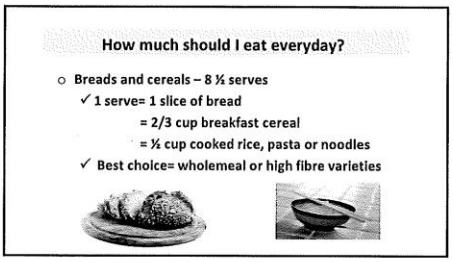

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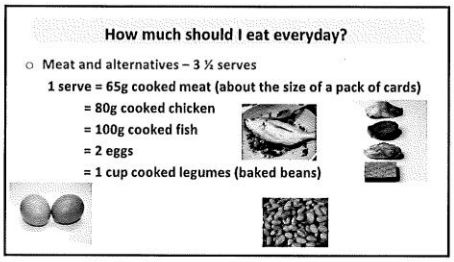

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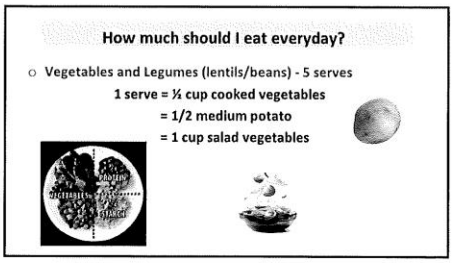

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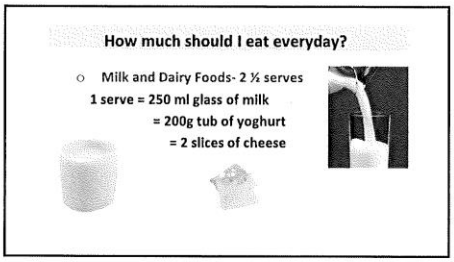


6

Appendix 4.3 Antenatal PowerPoint Presentation

How much should I drink everyday?

Try to drink at least 2 litres of water a day

7

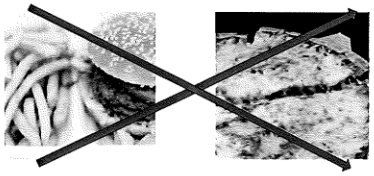
I feel too sick to eat?

TRY:

- Ginger- in a drink, food or tablets
- Vitamin B6 tablets

If you can't keep anything down..... SEE YOUR GP MIDWIFE OR THE WOMEN'S ASSESSMENT UNIT FOR ADVICE

10



8

Do I need to take Vitamins?

The best way to get it is from the foods you eat!

Vitamins & Minerals you need in pregnancy are:

- ✓ Folic Acid
- ✓ Iron
- ✓ Zinc
- ✓ Iodine
- ✓ Vitamin D
- ✓ Calcium

11

I feel too sick to eat?

TRY:

- Lots of healthy snacks
  - Like pieces of apple, nuts, rice crackers

- Keep a little food in your tummy all the time

- Sip small amounts of water rather than lots at once

9

FOLIC ACID (FOLATE) - Extra supplements are recommended before pregnancy and the first 12 wks of pregnancy

- Helps reduce the risk of birth defects such as Spina Bifida

12

Appendix 4.3 Antenatal PowerPoint Presentation

You can get FOLATE by eating:

- Green leafy vegetables
- Grainy breads and cereals
- Nuts, fruits and vegemite

13

IRON

- Needed for carrying oxygen and vital nutrients around your body and to your baby

14

You can get IRON by eating-

- Red Meats, Chicken and Fish
- Green leafy vegetables
- Baked beans
- Nuts
- Grainy breads and cereals

15

ZINC

- Helps with baby's growth and development
- Helps to build your immune system

16

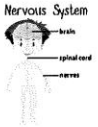
You can get ZINC by eating-

- meat, chicken, seafood
- grainy breads and cereals
- nuts, baked beans

17

IODINE

- Helps the development of the brain and nervous system of your baby



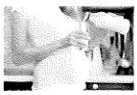
18

Appendix 4.3 Antenatal PowerPoint Presentation

You can get IODINE by eating:

- Fish
- Boiled egg
- Vegetables
- Meat
- Low fat Yoghurt
- Cheddar Cheese

19



Calcium

You can get Calcium by eating:

- Dairy Products
- Calcium fortified soy products
- Sardines
- Tahini (Sesame paste)

22

Vitamin D and Calcium

- Calcium needs Vitamin D to be absorbed by the body
- Both are important for growth of strong bones and teeth for you and your baby

20

How much CAFFEINE can I drink /day?

1 Cup of Espresso Coffee

or

3 Cups of Instant Coffee

or

4 Cups of Tea

ENERGY DRINKS SHOULD BE AVOIDED

23

Vitamin D comes from:

- Sunlight – 90% of Vit D comes from the sun

Try walking in the sun early in the morning or late afternoon without sunscreen for just 10 minutes

- Egg Yolk
- Fish
- Red meat

21

WHAT'S THIS THING CALLED LISTERIA?

- It is a germ that can grow on some foods if they are not stored or made/cooked properly
- Listeria is fairly rare but can cause serious harm to your baby
- Only eat cold meats if you know that it is freshly cut from the supermarket and kept cold in the fridge

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Appendix 4.3 Antenatal PowerPoint Presentation

The best way to prevent Listeria is to:

- Make your food at home
- Wash your hands **before you prepare it**
- **Have a clean kitchen bench and utensils and make sure the food is fresh**
- Keep hot foods hot and cold foods cold before you eat it
- Cook **meat, chicken and seafood** thoroughly
- **Eat it as soon as possible after preparing**

25

Foods to Avoid:

- **Soft cheeses like the ricotta and cream cheese in dips, camembert, brie unless cooked and served hot**
- **Soft Serve ice-cream**
- **Cold deli meats like ham, mettwurst, fritz, salami, cabana**



26

Foods to Avoid:

- **Pate**
- **Pre-prepared or stored salads**
- **Raw, smoked or chilled cooked seafood such as salmon, prawns, oysters etc.**
- **Takeaway Cold cooked chicken**
- **Salad bars and smorgasbords**



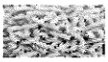
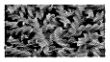
For further information visit www.foodstandards.gov.au

27

Try to:

- **Swap white breads, and refined cereals to Wholemeal or grain breads, and high fibre cereals**



28

Try to:

- **Eat lots of fibre-**
  - **fruits, vegetables, beans, lentils, nuts, seeds,**
  - **wholegrain breads and cereals, brown rice and wholemeal pasta**




29

Try to:

- **Swap High fat foods to Low fat foods**



30

Appendix 4.3 Antenatal PowerPoint Presentation

What foods should you AVOID?

- **Fried Foods**
- **Sugary drinks and lollies**
- **Takeaway/Fast Foods like Pizza, Burgers**

31

Get your portion size right!

32

Eating – can impact on your mood

- If you have trouble preparing food for yourself, have small protein-based snacks like yoghurt and nuts.
- Avoid highly sugared snacks like muesli / fruit bars that may seem healthy but are actually full of sugar.

www.panda.org.au
1300 726 306

33

Eating – can impact on your mood

- Always carry a bottle of water with you as being dehydrated can make you feel irritable and tired.
- Set a weekly meal plan to help you shop and avoid unhealthy snacks. You may also find that you save money by planning your meals in advance.

www.panda.org.au
1300 726 306

34

Exercise- can help you feel less stressed and less tired

- Set achievable goals
- Start off with gentle exercise such as short walks several times a week
- Build up to longer walks
- Meditation and Yoga are also great ways to reduce stress

www.panda.org.au
1300 726 306

35

Try to do some exercise

EVERYDAY

Walking costs nothing!

36

Appendix 4.3 Antenatal PowerPoint Presentation

What Exercise should I do?

- Walking
- Swimming
- Water aerobics
- Stationary bike riding

Always drink plenty of water when exercising

37

Try:

- Yoga, Pilates
- Meditation and relaxation
- Look for a free app for relaxation on your mobile phone app store and take the time to listen

38

When pregnant it is always best to sleep on your side.

This helps the blood flow to the placenta so baby can get as many nutrients and oxygen as it can.

39

- If you find that you are having problems with back pain, use the sleeping on the side position, and try placing a pillow under your abdomen as well
- If you are experiencing heartburn during the night, you may want to try propping your upper body with pillows
- In late pregnancy, you may experience shortness of breath. Try lying on your side or propped up with pillows

40

Urinary Incontinence

1 in 3 women who have had a baby wet themselves

It is caused by weakening of your Pelvic Floor muscles.
Discuss it with a midwife or doctor.
Visit www.bladderbowel.gov.au

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DRUGS IN PREGNANCY

Alcohol, tobacco and drugs can cause your baby to go through withdrawals after birth.

42

Appendix 4.3 Antenatal PowerPoint Presentation

DRUGS IN PREGNANCY

If you WANT HELP to stop or reduce your
drug or alcohol use....
Seek help from the DRUGS and ALCOHOL SERVICE of SA
and learn how you can help yourself and
your baby to a healthier life.
Phone: 08 8287 5742

43

ALCOHOL IN PREGNANCY

THERE IS
NO KNOWN SAFE AMOUNT
OF ALCOHOL TO DRINK IN PREGNANCY.

JUST SAY NO !

44

ALCOHOL IN PREGNANCY

Drinking Alcohol in pregnancy
can cause serious harm to your baby as the alcohol
is passed onto the baby
via the placenta.

45

ALCOHOL IN PREGNANCY

Alcohol can Cause an Increased Risk of:
- MISCARRIAGE
- STILLBIRTH
- FETAL DEFECTS
- EARLY BIRTH
- BLEEDING in pregnancy

46

ALCOHOL IN PREGNANCY

Alcohol can cause serious problems
for baby's
- Growth and physical development
- Brain development

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SMOKING IN PREGNANCY

Smoking Causes an Increased Risk of:
- MISCARRIAGE
- STILLBIRTH
- FETAL DEFECTS
- BLEEDING during your pregnancy
- POOR FETAL GROWTH

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Appendix 4.3 Antenatal PowerPoint Presentation

SMOKING IN PREGNANCY

Smoking Causes an Increased Risk of:

- SIDS- Sudden Infant Death Syndrome
- Asthma for baby
- Developmental and behavioural problems for baby
- Ear and chest Infections for baby

49

SMOKING IN PREGNANCY

Need help to Quit?

Call Quitline -131 848

50

DRUGS, ALCOHOL AND SMOKING

IF YOU CAN'T CUT IT OUT

CUT DOWN

51

DRUGS, ALCOHOL AND SMOKING

Have a problem with drugs
and/or alcohol
and are pregnant?

Ask for an appointment with our DASSA Clinic or
call the Drug and Alcohol Services of SA (Northern)
on

8287 5742

Drug & Alcohol Services South Australia (DASSA)
is a state wide health service that
offers a range of prevention, treatment, education and community-based services
for all South Australians.

52

Pregnancy Hormones can make you
more emotional than usual

53

Do you:

- Have mood changes
- Cry more
- Lose your temper more
- Become more forgetful

Then perhaps you have depression!

54

Appendix 4.3 Antenatal PowerPoint Presentation

Try:
- Talking to a friend
- Going for a walk in the fresh air
- Watching a funny movie
- Having a warm bath and relax
- Reading a book

55

Feeling angry?

Feel like taking it out on someone?
Feel like hurting yourself?

ASK FOR HELP NOW!

If you can't see your mental health counsellor or local doctor, call
Mental Health Emergency: ph 131 465
or go to the Emergency Department

58

Do you feel:
- Unable to cope with everyday life?
- Sadness, guilt, shame, confused, alone?

Then perhaps you have depression!

10% of women have symptoms of Depression during pregnancy.

56

For Telephone and
Online Information
about mental health
Contact:

Pregnancy & Perinatal Helpline- 1800 882 436
Beyond Blue- 1300 224 636 www.beyondblue.org.au
PANDA- 1300 726 306 www.panda.org.au
MoodGym- www.moodgym.anu.edu.au

Mental Health Emergency- 131 465

59

If you're NOT OK
and feel an overwhelming sadness, anxiety, stress, unable to sleep
or a sense of hopelessness,
talk to a Midwife NOW.

You may benefit from a referral to our
Perinatal Mental Health Midwives
or
Social Work Counsellors
ph 8182 9000

We are here to help you.

57

Sleep- is important for your physical and mental wellbeing
- Go to bed at the same time each day
- Avoid exercise before going to bed
- Turn off your mobile phone or TV to avoid unnecessary stimulants in your bedroom
- Avoid caffeine, energy drinks or other stimulants in the evening

www.panda.org.au
1300 726 306

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Appendix 4.3 Antenatal PowerPoint Presentation

Sleep- is important for your physical and mental wellbeing

- Relax in a warm bath or shower 2 hours before bed to regulate your body temperature before sleeping
- Try not to have a nap early in the evening
- If you can't sleep, get up and do something quiet without any stimulation **(no screen time!)**

61

Stay connected and broaden your social network

- Connect with other adults
- Join mother's groups and play groups
- Look online for support groups
- Seek help if you are experiencing mental health issues by talking to community health workers or your GP

www.panda.org.au
1300 726 306

62

Stressed or mentally exhausted?

- **Take Time Out!**
  - Go for a walk
  - Relax in a bath
  - Listen to music
  - Read a book or magazine
  - Watch a movie
  - Meet friends for a coffee

www.panda.org.au
1300 726 306

63

Are you afraid?
Is someone threatening you?
Are you being hurt by someone?
It is time for you and your baby to be safe !
If you need help, call the
Northern Domestic Violence Service- 8255 3622

64

Domestic Violence is not your fault
Safety for you and your children come FIRST
Seek legal advice promptly
Be aware of your rights
Seek help- the Police can provide lots of assistance
Build strong social support from friends & family
Seek counselling and support groups

65

Asthma and pregnancy

Breathing is important for you and baby!
So don't forget to carry your puffer wherever you go and use it when you need to.

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Appendix 4.3 Antenatal PowerPoint Presentation

Asthma and pregnancy

For some women
Asthma can get worse during pregnancy.

See your GP for an Asthma Plan
just in case it happens to you!

67

Asthma and pregnancy

Make sure that your puffers are not out of date.
Check with your GP that you have
the right puffer for you!

68

My baby's movements

After 26 weeks gestation it is good to take notice of baby's movements.

69

My baby's movements

- Lie on your left side and focus on your baby's movements: rolls, kicks or flutters
- Take notice how baby feels when it moves- is it strong, how often and what is the pattern to their movement
- You may like to record this experience with a diary or app
- This is a way of getting to know your baby
- Do this once a day at approximately the same time each day
- If anything feels different to usual, DON'T WAIT- Go to the Women's Assessment Unit

70

BREASTFEEDING

REDUCES BABY'S RISK OF:

- Infection
- Allergies and Asthma
- SIDS (Sudden Infant Death Syndrome)

71

BABY'S FIRST FEED:

- Skin to skin contact between you and your baby for the 1st hour of their life promotes bonding and breastfeeding.
- Breastfeeding baby as soon as possible after birth leads to longer breastfeeding.

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Appendix 4.3 Antenatal PowerPoint Presentation

NEED HELP WITH BREASTFEEDING?

Call the breastfeeding helpline
1800 mum 2 mum
1800 686 2 686
Australian Breastfeeding Association
www.breastfeeding.com.au

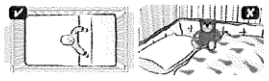
73

Safe sleeping positions

Recommended by the SIDS Council

74

Safe Sleeping



Recommended by the SIDS Council

75

Safe Sleeping

Recommended by the SIDS Council

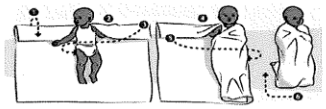
76

Safe wrapping

Recommended by the SIDS Council

77

Wrapping a baby



Recommended by the SIDS Council

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Appendix 4.3 Antenatal PowerPoint Presentation

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Appendix 5.1 Health-e Babies App Questionnaire

THE UNIVERSITY OF ADELAIDE AUSTRALIA

HEALTH-e BABIES APP TRIAL

QUESTIONNAIRE / INTERVIEW QUESTIONS

ID CODE:

DATE:

1. How often did you look at the Health-e Babies phone app provided to you as part of this study?

   Please tick the most appropriate box.
   - ☐ At least once a day
   - ☐ At least once a week
   - ☐ At least once a fortnight
   - ☐ At least once a month
   - ☐ Less than once a month
   - ☐ Only once when it was installed on my phone

The Appearance of the App

2. How much did you like the colours on the Health-e Babies app?
   Please circle your choice on the scale below.

Not at all			OK			Perfect
1	2	3	4	5	6	7

3. If you rated less than 6, what colours would you prefer ? Please state:
   ……
   ……

4. Did the Health-e Babies app use appropriate **icons**?
   Please circle your choice on the scale below

Not at all			OK			Perfect
appropriate						
1	2	3	4	5	6	7

5. If you rated less than 6, how should the icons be changed? Please state:
   ……
   ……

6. Did the Health-e Babies app use appropriate **pictures**?
   Please circle your choice on the scale below

Not at all appropriate			**OK**			**Perfect**
1	**2**	**3**	**4**	**5**	**6**	**7**

7. What other pictures would you like on the Health-e Babies app? Please state:
   ……
   ……

8. Did the Health-e Babies app use appropriate **sound** content?
   Please circle your choice on the scale below

Not at all Appropriate			**OK**			**Perfect**
1	**2**	**3**	**4**	**5**	**6**	**7**

9. How easy or hard was it to use the Health-e Babies app **functions**?
Please circle your choice on the scale below.

Impossible to use any features			**Variable / some difficulty**			**Very easy to use all features**
1	**2**	**3**	**4**	**5**	**6**	**7**

10. How easy or hard was it to find **information** you needed on the Health-e Babies app?
    Please circle your choice on the scale below.

Impossible to find any information I wanted.			**Variable/Some difficulty**			**Very easy to find all the information I wanted**
1	**2**	**3**	**4**	**5**	**6**	**7**

11. How easy or hard was it to understand the **words and phrases** used on the Health-e Babies app?

Please circle your choice on the scale below.

Couldn't understand Any			Understood Some			Understood All
1	2	3	4	5	6	7

12. How useful was the **information** you received from the Health-e Babies app?
Please circle you choice on the scale below.

Not at all Useful			Somewhat Useful			Very Useful
1	2	3	4	5	6	7

13. How confident has the App made you feel in knowing where to get help and/or information about your pregnancy?

Not at all Confident			Somewhat Confident			Very Confident
1	2	3	4	5	6	7

14. Did you use any of the Website Links from the Health-e Babies App?

- ☐ Yes
- ☐ No

If Yes, which websites did you look at?

_____
_____

If No, why not? Please explain:

_____
_____
_____

15. Did you use the Contacts section to find phone numbers?

- ☐ Yes, it worked
- ☐ Yes, I tried but it didn't work
- ☐ No, because I didn't want to
- ☐ No, because I didn't need to

16. Please complete the following sentence:

The most useful information on the Health-e Babies app was_____, because _____.

17. Was there any information **NOT** included on the Health-e Babies app that would have been helpful? Please list below:
    _____
    _____
    _____

If you would like to participate in a Private Telephone Interview or Focus Group to further discuss your opinion of the Health-e Babies app, please leave your name and phone number for Julia (Research Midwife) to call you.

Name: …… Phone Number:…….

Thank you for your participation in the Health-e Baby Study

Appendix 6.1 Health-e Baby Study Process