Women’s Knowledge and Perceptions of the Risks of Excess Weight in Pregnancy

A thesis submitted for the degree of
Master of Health Sciences
of the University of Otago,
Dunedin, New Zealand

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February 2013
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Abstract

Aims:
The primary aim of this study was to describe pregnant women’s perception of increased risk due to excess weight in pregnancy.

The secondary aims were:
- To describe pregnant women’s knowledge of weight gain recommendations.
- To assess the weight of pregnant women and to examine women’s knowledge of their own weight.

Methods:
A cross-sectional, self-administered survey of 411 pregnant women attending a nuchal translucency scan at 11 to 13+6 weeks gestation in four community radiology units in Christchurch during a four month period in 2012. The main outcome measure was knowledge regarding the risks of excess weight in pregnancy. Knowledge related to the risks of smoking in pregnancy was also considered. Following a literature search, nine events/complications of pregnancy were included in the questionnaire: stillbirth, small for gestational age, macrosomia, complicated vaginal delivery, structural anomaly, caesarean section, high blood pressure, gestational diabetes mellitus and shoulder dystocia. Statements related to knowledge of risks were posed as: smoking/excess weight in pregnancy increases your risk of: for example, gestational diabetes. Participants were asked to rate their level of agreement of increased risk on a seven-point likert scale from ‘strongly agree’ to ‘strongly disagree’ The option ‘I don’t know’ was also given. For analysis, a panel of three specialist obstetricians identified the answers they considered ‘ideal’ for each question, i.e. the appropriate level of agreement or disagreement. Sociodemographic data were collected. Participants were asked to identify their BMI status (underweight, normal weight, overweight or obese) and target gestational weight gain. Options for gestational weight gain included the 2009 Institute of Medicine weight gain in pregnancy guidelines and the answers ‘I should not gain any weight’ and ‘it does not matter how much weight I gain’. Participants had their height and weight measured using calibrated equipment and their BMI calculated.
Conclusion:
This study indicates a number of areas where knowledge is lacking, including the risks of excess weight in pregnancy and appropriate weight gain for pregnancy. This may be exacerbated by the fact a large number of women are not being weighed in early pregnancy and that many women are not aware of their true body size, with the vast majority of overweight and obese women underestimating their body size.
I would like to express my appreciation to all those who have supported and assisted me in the many aspects of this research.

I offer my gratitude to my three supervisors. To my primary supervisor, Dr Helen Paterson, Senior Lecturer, Department of Women’s and Children’s Health, Dunedin School of Medicine, who provided advice and guidance at each stage of this thesis and who helped inspire my interest in research throughout the period of study. To Dr Joanna Gullam, Joint Clinical Senior Lecturer, Department of Obstetrics and Gynaecology, University of Otago, Christchurch, who was available to offer valuable guidance at all times – and lectures on the evils of refined sugar (whilst I consumed vast quantities of lollies). To Mr. Ben Sharp, Consultant Obstetrician & Gynaecologist, Christchurch Women’s Hospital, whose support led me to this piece of research, who has patiently educated me on the nuances of the English language and who constantly challenged me to find a better way. I am very fortunate to have been able to work with you all.

This research received considerable backing from each of our recruitment centres. I would like to acknowledge the significant contribution of Reflect Ultrasound Specialists, and Christchurch Radiology Group, encompassing St Georges Radiology, Cashmere Radiology and Hagley Radiology. I would particularly like to acknowledge Julie Beaumont, Clinical Specialist Sonographer at Christchurch Radiology Group, for her valuable insight into this research.

I would like to thank Professor Elisabeth Wells, Biostatistician, University of Otago, Christchurch, for her bio-statistical expertise, Raymond Jones, Research Coordinator, Kahungunu Infant Safe Sleep (KISS) Study, University of Otago, Dunedin, for his help with the technical aspects of the survey and for his patience when explaining the technical aspects of the survey to me, and Kathy Simmons, Kaiāwhina Whaea me ngā Peepi and Māori, Christchurch Women’s Hospital, for her insight into Māori Consultation and for always being such a positive and welcoming sounding board.
### Glossary

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<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ASM</td>
<td>Annual Scientific Meeting</td>
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<tr>
<td>BMI</td>
<td>Body mass index (weight [kg] / height$^2$ [m])</td>
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<tr>
<td>CI</td>
<td>Confidence interval (e.g. 95% CI)</td>
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<tr>
<td>CMACE</td>
<td>Centre for Maternal and Child Enquiries</td>
</tr>
<tr>
<td>CRG</td>
<td>Christchurch Radiology Group</td>
</tr>
<tr>
<td>CWH</td>
<td>Christchurch Women’s Hospital</td>
</tr>
<tr>
<td>CVD</td>
<td>Cardiovascular disease</td>
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<tr>
<td>GDM</td>
<td>Gestational diabetes mellitus</td>
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<tr>
<td>GWG</td>
<td>Gestational weight gain</td>
</tr>
<tr>
<td>IOM</td>
<td>Institute of Medicine</td>
</tr>
<tr>
<td>LMC</td>
<td>Lead Maternity Carer</td>
</tr>
<tr>
<td>MoH</td>
<td>Ministry of Health (New Zealand)</td>
</tr>
<tr>
<td>NHI</td>
<td>National Health Index number</td>
</tr>
<tr>
<td>NT (scan)</td>
<td>Nuchal translucency scan (11 to 13+6 weeks gestation)</td>
</tr>
<tr>
<td>NTD</td>
<td>Neural Tube Defect</td>
</tr>
<tr>
<td>PET</td>
<td>Pre-eclampsia</td>
</tr>
<tr>
<td>RANZCOG</td>
<td>Royal Australian and New Zealand College of Obstetricians and Gynaecologists</td>
</tr>
<tr>
<td>RCOG</td>
<td>Royal College of Obstetricians and Gynaecologists</td>
</tr>
<tr>
<td>SGA</td>
<td>Small for gestational age infant</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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CHAPTER ONE
INTRODUCTION

The worldwide prevalence of overweight and obesity has more than doubled since 1980, and continues to increase unabated [1]. Overweight and obesity, defined as a body mass index (BMI = weight [kg] / height$^2$ [m$^2$]) of 25 – 29.9 and >30kg/m$^2$ respectively, describe body size whereby ‘abnormal or excessive fat accumulation may impair health’ [1]. In 2008 the World Health Organisation (WHO) reported that more than 1.5 billion adults over the age of 20 years were overweight: of these, greater than 500 million individuals were estimated to be obese [1]. The rise in overweight and obesity prevalence, described by the WHO as ‘one of the greatest health challenges of the 21st century’ [2] and ‘the most blatantly visible - but most neglected - public health problem worldwide’ [3] now sees 65% of the world’s population living in countries where overweight and obesity and their associated comorbidities kill more people than the comorbidities associated with underweight (BMI <18.5) and under nutrition [1].

The increase in overweight and obesity prevalence is proportionately affecting women of childbearing age. Increases in average BMI are being observed among female populations in both developed countries and urban settings of developing countries [4-8]. New Zealand is no exception to this international trend. Data from 2008/09 suggests 33% of women over the age of 15 years in New Zealand are overweight, and a further 28% are obese [7]. In the period from 1997 to 2008/09 the total prevalence of overweight increased by three percent and the prevalence of obesity by 7.2% [7], indicating both an increase in average BMI and an accelerated shift in the highest levels of BMI. These are concerning observations as they indicate that amelioration of the rise in overweight and obesity is not imminent. Those of Māori and Pacific Island descent are at higher risk of being overweight or obese due to a range of social and economic inequalities [9], and are over represented in overweight and obesity statistics in New Zealand [10]. Estimates of obesity are 1.5 times higher for Māori children and 2.5 times higher for Pacific Island children when compared to the total population, highlighting these as population groups warranting particular consideration [5].

In New Zealand, as in the rest of the world, the higher prevalence of overweight and obesity is leading to increased numbers of women being overweight or obese when presenting for obstetric care in pregnancy, an observation that has concerning consequences for obstetric
practice. Observational data show women who are overweight or obese when entering pregnancy are more likely to have ill health and poorer pregnancy outcomes than those of normal BMI [11, 12]. Consequently, this population represents a significant and increasing problem encountered in obstetric practice.

A wide spectrum of adverse pregnancy outcomes associated with maternal overweight and obesity have been reported. These can occur throughout pregnancy and the postpartum period. Well-documented complications include gestational diabetes (GDM) [13-19], pregnancy induced hypertension and the hypertensive disorders of pregnancy [13, 14, 16, 18, 20, 21], pre-eclampsia (PET) [15, 19, 22, 23], post-dates pregnancy [17, 24], a need for the induction of labour [13, 18, 19, 21, 22, 24, 25], delivery by caesarean section [13-18, 21-24], infection [19, 21], and haemorrhage [15, 18, 19, 22, 24]. Risk associated with maternal excess weight typically occurs as a continuum: there is increased likelihood of negative health outcome as maternal excess weight increases [4]. Such risks have implications for both the provision and funding of obstetric and neonatal services.

Risk of complication is not confined to maternal health. Infants born to women who are overweight and obese in pregnancy are at increased risk of structural anomaly [26-33], macrosomia (described variously as a birth weight >4000g, >4500g, or >90th percentile) [13-15, 23, 34], stillbirth [17, 23], traumatic delivery [24], shoulder dystocia [23, 24], a need for neonatal resuscitation [13, 16, 18], and requiring neonatal intensive care [16]. Moreover, research considering the role that the fetal environment plays in the longer-term health of the offspring suggests obese mothers are more likely to have obese children, a worrying observation due to the potential to perpetuate the obesity epidemic [35-37]. Other factors present in the fetal-neonatal period that have also been correlated with increased later-life obesity risk include large birth weight, GDM, maternal diabetes mellitus, excessive maternal gestational weight gain [4] and failure to breastfeed [38], all of which more commonly occur in the overweight and obese mother, further compounding risk for future obesity.

Maternal excess weight, therefore, has the potential to have significant consequences for population health, obstetric services, and the resources required for the continuation of current standards in obstetric care. While there is a plethora of published research describing complications and giving quantification of risk related to excess weight, there remains only a small number of intervention studies designed to mitigate the impact of excess weight in pregnancy, despite the obvious need.
Current guidelines from both the American College of Obstetricians and Gynecologists [39] and the American Dietetic Association [40] recommend that women who are overweight or obese be counselled prior to conception and encouraged to adopt lifestyle changes to minimise the risk of developing complications during pregnancy related to being overweight or obese. For many women this is not achieved, not least as it is estimated in excess of 50% of pregnancies are unplanned [41], therefore the focus moves to minimising risk during pregnancy via restriction of gestational weight gain (GWG) [11, 40, 42].

There is evidence that limited GWG in overweight and obese women is associated with a reduction in risk of pre-eclampsia, and trends towards a reduction in risk of gestational diabetes, gestational hypertension, preterm delivery, intrauterine death and macrosomia [43]. GWG is also a strong predictor of infant outcomes at birth [11, 44]. The 2009 Institute of Medicine (IOM) guidelines for healthy weight gain in pregnancy give estimates of weight gain most likely to optimise maternal and child health outcomes that are based upon observational evidence (TABLE 1) [11]. These guidelines recommend smaller weight gains for women with a higher pre-pregnancy BMI. It is recommended women who are overweight restrict weight gained to 7 - 11kg, and obese women to 5 - 9kg [11]. GWG in excess of IOM recommendations is a determinant of high postpartum weight retention and long-term obesity, even in the normal weight woman [11, 45, 46]. Despite guidelines being available, too few women of all pre-pregnancy BMI categories gain weight within recommended ranges [47-50] and consequently interventions aiming to support optimal weight gains in pregnancy are increasingly being sought.

**TABLE 1:** A comparison of the 1999 and 2009 Institute of Medicine weight gain in pregnancy recommendations [11].

<table>
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<tr>
<th>IOM 1990</th>
<th>IOM 2009</th>
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<tr>
<td>BMI (kg/m²)</td>
<td>Recommended weight gain (kg)</td>
</tr>
<tr>
<td>Underweight (&lt;19.8)</td>
<td>12.5 – 18</td>
</tr>
<tr>
<td>Normal weight (19.8 – 26.0)</td>
<td>11.5 – 16</td>
</tr>
<tr>
<td>Overweight (26.1 – 29.0)</td>
<td>7 – 11.5</td>
</tr>
<tr>
<td>Obese (≥29.0)</td>
<td>At least 6</td>
</tr>
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</table>
Pregnancy is identified as a ‘powerful life event’ for the promotion of healthy eating and physical activity behaviours, as women are likely to be motivated by concern for the health of their babies during pregnancy and are in frequent contact with their healthcare providers [51]. However, to date intervention studies to control weight gained during pregnancy that focus on lifestyle modification targeting dietary change and/or physical activity behaviours in overweight and obese subjects have shown limited success. Review papers seeking to examine published interventions generally agree that there is a lack of good quality interventions upon which to recommend standard procedures for the management of overweight and obese women in pregnancy, due largely to the considerable heterogeneity among interventions and inconsistencies in outcome reporting [42, 43, 52].

Whilst no overriding recommendations for intervention can be drawn from current research, there is a consensus that it is beneficial to educate pregnant women on healthy eating, physical activity and appropriate weight gain [43]. Interventions targeting healthy eating alone [53, 54], or in combination with lifestyle advice (including physical activity education) [55], and/or weight gain education [55, 56] have shown favourable results in limiting total weight gain [53-56] and reducing weight retention following delivery [53, 55]. As yet, there is limited consistency in findings across interventional studies, and further research seeking more consistent findings is required.

Regardless of the clear benefits to both mother and baby of intervening to restrict GWG, intervention can be problematic for a number of reasons. Overweight and obese individuals today are more likely to consider themselves to be of normal weight than overweight and obese individuals 20 years ago [57], and individuals of all BMI groups are more likely to identify increased body size as normal [58], indicating an upward shift in the social norms of body weight. Women of childbearing age are particularly susceptible to misperception of their own body weight, with estimates suggesting nearly 25% of overweight women underestimate their own weight [59]. Individuals who underestimate their weight are more likely to have a decreased perception of health risk related to their body size and are consequently less likely to desire weight change and to participate in healthy behaviours, such as physical activity [58]. Furthermore, overweight and obesity are conditions associated with negative attitudes, demeaning social connotations and discrimination [60]. Ambivalence among overweight and obese patients relating to medical intervention concerning body size is well described [60, 61]. Although evidence that education from a healthcare professional can be of benefit in increasing the likelihood of accurate perception of weight and in setting goals for healthy
lifestyle change [58], from the perspective of the medical professional the topic of overweight and obesity can be difficult to address, requiring an empathetic approach, diplomacy and time [58]. Wadden and Didie, in reference to the use of the terms ‘overweight’ and ‘obesity’, note ‘such terms may well be hurtful or offensive to obese individuals because of their pejorative connotations in everyday use’ [62]. This has led to such recommendations that patient-preferred terms such as ‘excess weight’ and ‘weight problem’ be used in place of ‘overweight’ and ‘obesity’ when addressing weight with patients [63]. Despite the plethora of barriers to intervention, the development of successful intervention strategies has never been of such paramount importance. To increase the likelihood of successful intervention, it is recommended that the views and perceptions of this population should be considered when planning services for the treatment of overweight and obesity, and that health should not only be viewed from a ‘somatic’ perspective [61, 64].

As discussed, obesity is a significant public health issue. Smoking cessation campaigns have been shown to reduce the incidence of smoking during pregnancy and it is therefore plausible that obesity in pregnancy could become one of the most important modifiable risks during pregnancy for both mother and child. Pregnancy has been proposed as a teachable moment, an opportunity to inform women about the important public health message of the risks of both excess weight on pregnancy and excess weight gain during pregnancy [51]. In order to assess the extent to which knowledge is lacking regarding risks associated with excess weight and appropriate weight gain, it is advantageous to explore the perceptions that pregnant women have regarding these issues. This line of investigation may give rise to a wider perspective for informing more effective intervention studies, as well as indicating where future education strategies are required: important factors in the increasing need to temper the effect of excess weight in pregnancy.
CHAPTER TWO
LITERATURE REVIEW

2.1 Literature search

A literature search was conducted using the Ovid MEDLINE ® search engine. The following search strategy was used:

1. Obesity
2. obes*.tw.
3. 1 or 2
4. Pregnancy
5. pregnan*.tw.
6. 4 or 5
7. Health Knowledge, Attitudes, Practice
8. Attitude to Health
9. perception*.tw.
10. 7 or 8 or 9
11. 3 and 6 and 10
12. limit 11 to English language

The initial literature search was carried out on 28th August 2011. Due to the prediction that there would be a limited body of research in this topic area, the initial search considered literature in the period January 1948 to August 2011. In total, 106 articles were obtained from this search (APPENDIX A).

2.1.1 Criteria for selecting literature

All abstracts identified in the initial search were read to establish relevance to the present study. Abstracts of relevance were followed up and the full articles were reviewed. The following criteria were used to determine whether a paper should be included for review:
- Peer reviewed
- Relating to knowledge and / or perceptions of the risk of overweight and / or obesity in pregnancy, not to attitude to, and knowledge of, pregnancy itself
- Reporting on knowledge of weight gain in pregnancy. No restriction on weight gain guidelines used to establish knowledge of appropriate weight gain was imposed
- Reporting on knowledge of own body size in pregnancy

Papers did not have to consider multiple factors for inclusion in review.

Following application of selection criteria, four papers were identified: Gaudet, Gruslin and Magee [65], Groth and Kearney [66], Kominiarek, Vonderheid and Endres [67], and Tovar, Chasan-Taber, Bermudez, Hyatt and Must [68].

Gaudet et al. [65] and Tovar et al. [68] reported on knowledge of risks of obesity in pregnancy. Gaudet et al. [65], Groth et al. [66] and Tovar et al. [68] reported on knowledge of weight gain recommendations. Gaudet et al. [65] reported on knowledge of BMI.

At the conception of this research project in June 2011 there were two papers that were published that related to the primary aim of this research: Gaudet et al. [65] and Kominiarek et al. [67].

### 2.1.2 Secondary search

References of potential relevance from the papers identified in the initial search were hand-checked. These were references cited in the body of the text. Some of these references were outside the original search criteria. The secondary search also included checking New Zealand Government publications, e.g. those produced by the New Zealand Ministry of Health.

One further paper was identified from Groth et al. [66] as appropriate for inclusion in review. This paper, Stotland et al. [69], reported on knowledge of weight gain in pregnancy.

No studies conducted in New Zealand were identified.
2.1.3 Continuing literature search

Subsequent to the commencement of this research project, two relevant papers were published: Nitert et al. [70] and Thompson, Nassar, Robertson and Shand [71].

Nitert et al. [70] reported on knowledge of the risks of obesity in pregnancy [70]. Thompson et al. [71] reported on knowledge of weight gain recommendations and knowledge of BMI. These papers were accessed via OVID Medline ® using the same search strategy used for the initial literature search.

Attendance at The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) Annual Scientific Meeting (ASM) in Melbourne in November 2011 allowed access to a poster presentation by Huning, McCarthy and Shub [72], ‘Pregnant Women’s Knowledge of Optimal Gestational Weight Gain and Complications of Excess Weight Gain’. This reported on knowledge of the risks of obesity in pregnancy and of appropriate weight gain for pregnancy. The abstract of this poster presentation was accessed via Dr Helen Paterson, primary supervisor.

In total, seven papers and one poster presentation were reviewed.
2.2 Literature review

2.2.1 Knowledge of pregnancy and childbirth complications

Research considering pregnant women’s knowledge of the risks of overweight and obesity in pregnancy is an area of investigation that has only recently begun to emerge, with all studies reviewed having been published within the last two years. To date, four relevant studies have been published [65, 67, 70, 72].

Gaudet et al. carried out a cross-sectional survey of 117 women attending a routine ultrasound assessment between 11 to 24 weeks gestation in Canada [65]. Participants were asked if they believed that overweight and obesity were related to a series of 35 complications of pregnancy, labour, delivery and the postpartum period. Participants were required to indicate if they thought each of the complications were related to overweight and / or obesity. Knowledge of risks was a secondary outcome of this study. Data related to knowledge of complications was not published. The authors of this study concluded that ‘most women were unable to identify obesity-related complications for themselves or their baby…’ [65]. Specifically, ‘most women were unable to identify… increased risks of pre-eclampsia, excessive weight gain, caesarean section, neural tube defects, macrosomia and shoulder dystocia’ [65]. The authors also made comment that overweight and obese women, 25.5% (n=30) of their population, did not appear to have levels of knowledge that were significantly different to those of normal weight women. This study had a small sample size, particularly of obese participants (n=10), and was powered to assess the proportion of women who could correctly classify their BMI (the primary aim of this study). Therefore, there was limited power to detect findings in relation to knowledge of risks.

Kominiarek et al. report results from their cross-sectional study of women from Chicago, Illinois which involved a multiple-choice questionnaire that asked 105 participants, who were 14.9±6.6 weeks gestation and attending their first prenatal visit, to indicate if they were aware, in general, of the risks of obesity in pregnancy [67]. Seven ‘true / false / I don’t know’ questions representing the risks of obesity measured the participants knowledge of obesity-related pregnancy risks, which was the primary outcome of this study. Complications for which knowledge was assessed included: hypertension, diabetes, caesarean delivery, infectious morbidity, fetal growth problems, birth defects and stillbirth. This study compared knowledge between non-obese (BMI <30; 54% n=56) and obese (BMI ≥30; 46%, n=47) participants.
Overall, 49% of participants indicated that obesity increases risks in pregnancy. Knowledge of the specific risks was similar in the non-obese (60% correct) and obese (64% correct) groups. Obese participants were significantly more likely to be aware of the risk for diabetes (68% vs. 96%, P<0.001). Less than 50% of obese participants were aware of the risks for stillbirth, fetal growth problems and caesarean section delivery. In total 80% of non-obese and 83% of obese participants were aware of the risk of high blood pressure. The question regarding stillbirth received the most ‘don’t know’ responses, in which this response was nearly 50% in both BMI groups. As with Gaudet et al. [65] this study had a small sample size. Participants were drawn from a convenience sample based on interviewer availability. This study also had low power to detect the observed differences in overall and specific knowledge (approximately 10%) [67].

Huning, McCarthy and Shub [72] interviewed 296 pregnant women in Victoria, Australia to assess awareness of obstetric and neonatal complications of obesity. The study concluded that women have limited awareness of the potential adverse effects of obesity in pregnancy. This study reported that, while many participants stated that obesity was associated with increased pregnancy complications, knowledge of the nature of these risks was limited. Only 25% of participants were aware of the risk of pre-eclampsia, and 52.7% of the risk of gestational diabetes. Less than 5% were aware of the association with caesarean section delivery, breastfeeding difficulties and neonatal trauma [72].

Only one of the four studies reviewed, Nitert et al., reported their study population had ‘good knowledge’ of the risks of obesity in pregnancy [70]. This study concluded that ‘many’ women, referred to as ‘over 75%’, could identify that overweight and obesity increase overall risk for complications in pregnancy. This study was a cross-sectional survey of 412 women from Brisbane, Australia who were less than 20 weeks gestation. Complications assessed included: gestational diabetes, hypertension, caesarean section, prematurity, special care nursery admission, and congenital abnormality. Participants were stratified according to pre-pregnancy BMI as <25.0 or ≥25. Over 75% of participants were able to identify that there was increased risk of gestational diabetes and hypertension. Less than 50% of participants identified risk associated with congenital abnormality, caesarean section delivery, prematurity and special care nursery admission. This study noted participants had ‘good knowledge’ of the more commonly associated complications of obesity, such as gestational diabetes mellitus and the hypertensive disorders of pregnancy, but less knowledge about neonatal complications.
Whilst Nitert et al. concluded participants were largely aware of the risks of overweight and obesity, limitations to generalisability and validity exist. This study asked women to rate their understanding of risk for a woman who was ‘very obese’ and reported data from this questioning, yet reported women had ‘good knowledge’ of the risks of both overweight and obesity. In only questioning for a ‘very obese’ individual, Nitert et al. may have unintentionally created a bias towards the negative, as the term ‘obesity’ is often imbued with preconceptions that associate it with total poor health [73]. This study did not include a standardising question in order to assess degree of satisficing (a decision making strategy that in which respondents answer questions based on a pattern rather than on identifying an optimal solution) or a ‘false’ question to determine if the relatively widespread portrayal of obesity as a contributor to general ill health contributed to answers given, and therefore comment cannot be made on whether this affected the results of this study.

Caution must be taken when considering and generalising the findings of the studies reviewed in a wider context, as results are likely influenced by a number of factors. Only Nitert et al. made comment on the potential impact of public health messages related to overweight and obesity at the time of the survey. Nitert et al. commented that ‘it is possible that the responses in this survey may have been positively influenced by local media coverage regarding the problems of overweight and obesity which occurred around the time of questionnaire administration’ [70]. None of the other studies made reference to the effect of education or public health strategies at the time of study completion. While it is positive to note that the only study which did note that there had been media coverage found more favourable results regarding knowledge than the other studies which did not comment, this is an important factor for consideration. As discussed, all sample populations were small, but particularly for two of the studies [65, 67] where sample size was less than 120 participants. This may limit generalisability. All studies employed convenience sampling and therefore may have been susceptible to selection bias, for example, higher education levels [65, 70] and lower average BMI [65]. As such, it is important to ensure studies such as this are conducted in wide groups of individuals and that if generalisations are to be made, that they are made based on research in a comparable population.

In summary, the studies considered indicate that women have limited awareness of the risks of overweight and obesity in pregnancy. While Nitert et al. reported their population had good overall knowledge, knowledge regarding the nature of specific risks was limited. Studies to date are limited by small sample sizes, inconsistencies in study design and limited target populations
(including gestation and socio-demographic factors). Differences in the pregnancy events for which knowledge was assessed, and differences in the standards for which knowledge was considered ‘good’ or ‘lacking’ makes comparison difficult. As such, it would be inappropriate to generalise pregnant women’s knowledge of obesity in pregnancy based on findings of current studies and further research is required.
2.2.2 Knowledge of appropriate gestational weight gain

Six studies have considered the knowledge pregnant women have regarding appropriate gestational weight gain in pregnancy [65, 66, 68, 69, 71, 72]. Huning et al. [72] aimed to establish knowledge of the 2009 IOM guidelines for weight gain in pregnancy (TABLE 1). The authors concluded that they identified misconceptions about optimal gestational weight gain. Women who were overweight or obese were least accurate, such that 65% of obese women overestimated the recommended guidelines for gestational weight gain [72]. Thompson et al. who also compared knowledge with the 2009 IOM guidelines in their survey of 149 women at <23 weeks gestation, noted less than one third (29.5%) of participants were able to identify recommended weight gain in pregnancy [71]. Gaudet et al. [65] using the then Canadian guidelines for weight gain reported overweight and obese women were significantly more likely to overestimate appropriate minimum gestational weight gain (60% and 40%, respectively, p= 0.02), and to overestimate maximal gestational weight gain (85% and 100%, respectively, p= 0.002) [65]. Stotland et al. who conducted telephone interviews in a population of 1,198 women less than 20 weeks gestation, concluded that women’s belief about the proper amount of weight gain according to the 1990 IOM guidelines varied significantly by maternal pre-pregnancy BMI [69]. Nearly one quarter (24.1%) of overweight participants (BMI 26.1-29.0) overestimated weight gain recommendations, compared to 4.3% of normal weight participants (p<0.001) in this study [69].

Two studies have assessed knowledge of weight gain guidelines via qualitative methodology. Groth and Kearney [66] in their small study of 23 participants whereby women, who were all of a low socio-economic demographic, participated in a semi structured interview, reported nearly half of participants estimated their appropriate weight gain to be within the guidelines for a normal weight woman. Eight women estimated above that for a normal weight BMI, 10 below, two did not know, and six participants said weight gain varied by pre-pregnancy BMI. This study used the 1990 IOM guidelines as their reference (TABLE 1). Unlike the previous studies, this study considered women who had birthed within the last year and aimed to gain insight into education received during pregnancy. Tovar et al. [68] reported results from focus groups conducted to evaluate knowledge regarding weight gain during pregnancy in line with the 1990 IOM recommendations. This small study of 29 women who were between 11 and 28 weeks gestation reported that attitudes to weight gain recommendations differed by weight status. The normal weight groups reported more knowledge about weight gain.
recommendations as compared to the overweight and obese groups, although the estimate of actual appropriate weight gain varied [68]. The majority of study participants did not consider weight gain guidelines to be important [68].

Overall, studies report inconsistencies in knowledge of guidelines for weight gain in pregnancy. Studies reviewed suggest that overweight and obese women are more likely to overestimate appropriate weight gain than normal weight women.
2.2.3 Knowledge of BMI

Three studies were identified which have considered the knowledge women have of their own BMI [65, 71, 72].

Thompson et al. [71] asked participants to estimate their pre-pregnancy weight, to measure their height and weight and to indicate if they thought they were underweight, normal weight, overweight or obese. Over two thirds (70%) of obese women underestimated their true weight category. Similar results were found by Huning et al. [72] who reported that among overweight participants, 36.8% underestimated their BMI and among obese participants, 74.6% underestimated their BMI. Gaudet [65] asked participants to estimate their pre-pregnancy height and weight and then to classify the BMI category they believed this to be within. Women of normal weight were largely able to classify their BMI correctly (93.8%). As for the previous two studies underestimation of BMI was more common among overweight and obese participants (50% and 90%, respectively).

Results are consistent among the three studies reviewed and suggest overweight and obese women are more likely to misinterpret their body size than normal weight women.
2.3 Literature review summary

This literature review identified that there are no studies of the NZ population that report on women's knowledge of the risks of obesity in pregnancy, on knowledge of weight gain guidelines or on knowledge of own BMI. It also identified that there is limited international literature that has considered these factors.

The studies described suggest that women have limited knowledge of the risks of overweight and obesity in pregnancy and of weight gain guidelines. Furthermore results suggest that overweight and obese women are more likely to overestimate appropriate weight gain for pregnancy and to misinterpret their body size.

Studies are limited in both the populations assessed and also in their description of knowledge and thus it would be inappropriate to make generalisations of women’s knowledge of both the risks of obesity in pregnancy and also of weight gain guidelines based on present research and further research is therefore required.
CHAPTER THREE

AIMS

The primary aim of this study was to describe pregnant women’s perception of increased risk due to excess weight in pregnancy.

The secondary aims were:

- To describe pregnant women’s knowledge of weight gain recommendations.
- To assess the weight of pregnant women and to examine women’s knowledge of their own weight.
CHAPTER FOUR

METHODS

4.1 Questionnaire development

A cross-sectional questionnaire (APPENDIX B) intended for self-administered use by pregnant women was developed.

The first phase of questionnaire development involved establishing pregnancy events / complications that were to be included in the questionnaire. This was a two-step process:

Step one:
A literature search to identify antepartum, intrapartum and postpartum complications associated with maternal, pre-pregnancy overweight and obesity was carried out. This literature search was conducted using the Ovid MEDLINE ® search engine (1996 – present) and the search terms: overweight, obesity, pregnancy, complications, antepartum, intrapartum, postpartum and morbidity.

A total of 21 studies were reviewed that provided data for a range of maternal, fetal and neonatal complications, including: gestational diabetes (GDM), stillbirth, small for gestational age infant (SGA), macrosomia, fetal structural anomaly, caesarean section delivery, hypertensive disorders of pregnancy (including pregnancy induced hypertension and pre-eclampsia), postpartum infection and postpartum haemorrhage. A summary of results relevant to this review are presented in TABLE 2.
### TABLE 2: Prevalence and odds ratios for pregnancy and birth complications related to overweight and obesity in pregnancy.

<table>
<thead>
<tr>
<th>Pregnancy and birth complications</th>
<th>Prevalence in normal weight women (%)</th>
<th>Prevalence in overweight / obese women (%)</th>
<th>Range of odds ratios in overweight / obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stillbirth</td>
<td>0.5 - 0.6</td>
<td>0.6 - 1.9</td>
<td>1.97 – 2.9</td>
</tr>
<tr>
<td>Stillbirth</td>
<td>[16, 22]</td>
<td>[16, 22]</td>
<td>[14, 19, 23, 74]</td>
</tr>
<tr>
<td>Small for gestational age infant</td>
<td>5.45</td>
<td>4.58</td>
<td>0.8 – 1.57</td>
</tr>
<tr>
<td>Small for gestational age infant</td>
<td>[19]</td>
<td>[19]</td>
<td>[19, 75]</td>
</tr>
<tr>
<td>Macrosomic infant</td>
<td>6.5 – 9.03</td>
<td>12.3 – 13.41</td>
<td>2.36</td>
</tr>
<tr>
<td>Macrosomic infant</td>
<td>[19, 76, 77]</td>
<td>[19, 76, 77]</td>
<td>[19, 77]</td>
</tr>
<tr>
<td>Structural anomaly</td>
<td>1.2 – 4.5</td>
<td>2.2 – 5.5</td>
<td>1.1 – 2.6</td>
</tr>
<tr>
<td>Structural anomaly</td>
<td>[26-28, 30]</td>
<td>[26-29, 31-33]</td>
<td>[26-29]</td>
</tr>
<tr>
<td>Caesarean section delivery</td>
<td>7.7 - 22.3</td>
<td>10.4 – 36.2</td>
<td>1.7 – 2.9</td>
</tr>
<tr>
<td>Caesarean section delivery</td>
<td>[19, 78, 79]</td>
<td>[78-80]</td>
<td>[19, 30, 78, 80]</td>
</tr>
<tr>
<td>Hypertensive disorders of pregnancy (including pre-eclampsia)</td>
<td>0.7 – 4.8</td>
<td>1.4 – 13.5</td>
<td>2.1 – 5.2</td>
</tr>
<tr>
<td>Hypertensive disorders of pregnancy (including pre-eclampsia)</td>
<td>[78, 79, 81]</td>
<td>[78-81]</td>
<td>[19, 30, 79, 82]</td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>1.2 – 4.1</td>
<td>3.5 – 9.5</td>
<td>4.0 – 7.8</td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>[78-80, 83]</td>
<td>[27, 78-81, 83]</td>
<td>[19, 27, 30, 80, 81, 83]</td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>0.1</td>
<td>0.4</td>
<td>0.9 – 2.6</td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>[23]</td>
<td>[23]</td>
<td>[15, 21, 23]</td>
</tr>
</tbody>
</table>

Modified version of Dekker-Nitert et al., BMC Pregnancy and Childbirth 2011;11:96

**Step Two:**

An expert panel consisting of three specialist obstetricians, two working at Christchurch Women’s Hospital and one at Dunedin Public Hospital, were consulted to review results obtained from the literature search to help decide which pregnancy events / complications should be included in the final questionnaire.

The consultation process involved distributing relevant data from the literature search (TABLE 2) to all three members of the review panel prior to a review meeting that was held with all members of the review panel present. The brief given to each member of the panel was to identify clinically relevant complications for inclusion in the questionnaire (i.e. ascertaining levels of knowledge of a risk or complication relevant to a medical professional working in obstetrics) and to ensure complications for which knowledge was assessed be
suitable for a pregnant woman in the first trimester of her pregnancy to answer. Other factors considered included: total prevalence of complications, i.e. rare complications were not included; and strength of association between each complication and overweight and obesity, i.e. complications were not considered if they were not clinically relevant and without a convincing association with excess weight.

Six complications were confirmed for inclusion in the questionnaire: stillbirth, SGA, macrosomia, structural anomaly, caesarean section delivery, high blood pressure and GDM. Additionally, two further options not considered in the original literature search were included at the recommendation of the consultation panel: shoulder dystocia and ‘normal and uncomplicated vaginal delivery’.

In discussion during the consultation panel meeting it was decided that identical questions related to smoking during pregnancy should be included to allow comparison between a well-educated negative health behaviour in pregnancy (smoking) and a less well educated negative health factor (overweight and obesity). The results from the literature search are presented in TABLE 3.
TABLE 3: Prevalence and odds ratios for pregnancy and birth complications related to smoking during pregnancy

<table>
<thead>
<tr>
<th>Pregnancy and birth complications</th>
<th>Prevalence in non-smokers</th>
<th>Prevalence in smokers</th>
<th>Range of odds ratios in smokers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stillbirth</td>
<td>3.8/1,000</td>
<td>6.7/1,000</td>
<td>1.4 – 2.1</td>
</tr>
<tr>
<td>[38]</td>
<td>[38]</td>
<td>[84-87]</td>
<td></td>
</tr>
<tr>
<td>Small for gestational age infant</td>
<td></td>
<td></td>
<td>1.5 - 2.9</td>
</tr>
<tr>
<td>[88]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macrosomic infant</td>
<td>12.0% – 38.9%</td>
<td>7.1% – 28.7%</td>
<td>0.48 – 0.73</td>
</tr>
<tr>
<td>[89-91]</td>
<td>[89-91]</td>
<td>[89-91]</td>
<td></td>
</tr>
<tr>
<td>Structural anomaly</td>
<td></td>
<td></td>
<td>0.90 – 1.5</td>
</tr>
<tr>
<td>[92]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caesarean section delivery</td>
<td>No reported association identified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertensive disorders of pregnancy</td>
<td></td>
<td></td>
<td>0.5 – 0.6</td>
</tr>
<tr>
<td>[93]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>No reported association identified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>No reported association identified</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ideal responses for each of the included pregnancy events / complications were established. For each question the evidence presented in TABLE 2 and TABLE 3 was reviewed by the expert panel and ‘ideal answer(s)’ identified. Where a strong association, or clear evidence of increased or decreased risk was apparent, a narrow range of ‘ideal responses’ was awarded, for example excess weight and gestational diabetes. Where a less-strong/weaker association was identified, or where limited or discordant research was available, a wider range of ‘ideal responses’ was awarded, for example excess weight and shoulder dystocia. Where there was a lack of available evidence the expert panel discussed the impact of each variable (weight/smoking) and agreed upon ‘ideal responses’. Where all three of the expert panel could not agree, the majority vote was used.

The ideal responses are described in the figures and text as ‘expert opinion’.

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The term ‘excess weight’ was used to describe overweight and obesity, accompanied by the statement: 'Excess weight is defined as being overweight or obese (i.e. BMI >25). Excess weight can also be thought of as ‘weighing more than is healthy’'. This was used to reduce possible ambiguity around the terms ‘overweight’ and ‘obesity’ and to provide a range of definitions that could apply to the term ‘excess weight’. Ten staff members at Christchurch Women’s Hospital were consulted and deemed this terminology to be acceptable.

During the second phase of questionnaire development further questions were written to ascertain demographic information, knowledge of appropriate weight gain for pregnancy, and whether participants could correctly classify their own BMI.

In total, the questionnaire consisted of two separate, single-sided, A4 pages covering six sections (APPENDIX B):

- **Section one:** demographic information, including date of birth, parity, gestation, smoking status, education level, and ethnicity. Participants were also asked if they had been weighed in this pregnancy. The options for education were chosen as they outline the major levels of qualifications available in New Zealand. The options for ethnicity were chosen to correspond with the ethnicity question in the New Zealand census. Questions related to age, parity, ethnicity and education level were included as, a priori, we thought that they may be associated with knowledge and would therefore be useful for analysis to delineate specific groups requiring further education.

- **Section two:** appropriate weight gain for pregnancy. Six options were listed, including the 2009 Institute of Medicine weight gain in pregnancy guidelines [12] (TABLE 1) and the options ‘I should not gain any weight in my pregnancy’ plus ‘It does not matter how much weight I gain’. The 2009 IOM guidelines were chosen as these are the most commonly used guidelines for weight gain in pregnancy [11].

- **Section three and four:** knowledge of the risks of smoking (section three) and excess weight (section four). Participants were asked to rate agreement with statements posed on a seven-point Likert scale from ‘strongly disagree’ through ‘no difference’ to ‘strongly agree’. The option of ‘I don’t know’ was also given. The statement ‘having a baby with green eyes’ was included to estimate the degree of satisficing (a decision-making strategy
in which respondents answer questions based on a pattern rather than on identifying an optimal solution [66]).

Following consultation the following wording was decided upon for each complication:

i. Stillbirth: a baby dying before delivery (stillbirth)
ii. Small for gestational infant: giving birth to a small baby (weighing less than 2.5kg/5.5lbs)
iii. Macrosomia: giving birth to a big baby (weighing more than 4kg/8.8lbs)
iv. Vaginal delivery: having a normal, uncomplicated vaginal delivery
v. Structural anomaly: having a baby with a structural abnormality
vi. Caesarean section: needing a caesarean section (when you don’t deliver vaginally)
vii. Blood pressure anomaly: having high blood pressure (including pre-eclampsia / toxemia)
viii. Gestational diabetes: developing diabetes in pregnancy (gestational diabetes)
ix. Shoulder dystocia: having problems with the baby’s shoulders getting “stuck” during a vaginal delivery (shoulder dystocia)

This wording was tested with ten staff members at Christchurch Women’s Hospital (four medical secretaries, two dietitians, two midwives, one nurse aid and one receptionist).

- Section five: perception of own BMI. Participants were asked to choose the weight category they considered themselves: underweight, normal weight, overweight or obese.

- Section six: The last section of the questionnaire asked participants to list the long-term health problems that they were aware of that are related to smoking and excess weight in pregnancy for both mother and child. The option ‘I don’t know’ was also given.

The questionnaire was called the ‘Pregnancy Health Survey’ to steer the focus from the questionnaire just being about overweight and obesity.

Throughout the initial questionnaire development a number of medical professionals were consulted with, these included obstetricians, lead maternity carers (LMCs), dietitians, midwives and sonographers working at Christchurch Women’s Hospital and Dunedin Hospital.
The questionnaire was formatted in order to be compatible for use with the Autonomy TeleForm™ 10.5 system (Autonomy Systems Ltd, Cambridge, UK).

4.2 Information and Consent

A single page information and consent form was written to accompany the questionnaire (APPENDIX C).

The information section was intended to outline the main aim of the questionnaire, as well as the requirements for participant participation. In accordance with guidelines for ethical approval, paragraphs reassuring participants of privacy guidelines, outlining compensation in the case of harm caused by participating in the questionnaire, and explaining ethical approval were also included.

The consent section involved the participant ticking whether they agreed (yes) or disagreed (no) with a number of statements relating to: understanding of the study aim and requirements for participation, satisfaction with support received in the process of deciding whether to participate in the study, participant right to withdraw from the study and confidentiality. Participants were also asked if they agreed to have their height and weight measured. If a participant declined to be measured they were still included in the study.

In line with ethical approval requirements, participants were required to print their full name, signature and the date on the information/consent forms.

4.3 Further information for participants

In accordance with guidelines for ethical approval, information relating to healthy eating in pregnancy (APPENDIX D) and smoking cessation during pregnancy (APPENDIX E) was available for participants.
4.4 Sample size

At the recommendation of the consulting biostatistician, it was advised a 70% recruitment rate for the pilot was required.

A sample size was calculated a priori (APPENDIX F). The primary outcome was a comparison of knowledge between the risks of obesity in pregnancy and the risks of smoking in pregnancy. No literature was available during bio-statistical consultation to guide an expected size of effect so we postulated a feasible sample size of 400 and considered what could be detected in that sample with $\alpha_2$ and power of 80%.

4.5 Piloting

The questionnaire was piloted over a five-day period from 10-14 October 2011 at St Georges Radiology, a private radiology centre in Christchurch. All women (n= 34) who presented for a nuchal translucency (NT) ultrasound (10 – 13+6 weeks gestation) during the piloting period were eligible for inclusion in the pilot and were asked by radiology centre staff (either reception staff or a radiographer) to participate in the questionnaire. Request for participation was at the discretion of recruitment centre staff; for example if a woman stated the scan was to query an early pregnancy loss then participation was not sought.

Consent and information forms and questionnaires were provided in English only. The exclusion criterion was inability to complete the questionnaire in English, because of either insufficient skill in English, or lack of literacy.

Questionnaires were either completed whilst women were waiting for their scan appointment, or in the interim between having their scan and obtaining the results from their scan. Questionnaires were completed using a black, ballpoint pen. Responses required participants to both shade the corresponding box for their answer, or to handwrite answers.

All women who participated in the pilot (n= 29) were asked to have their weight and height measured. If this was declined, women were not excluded from the study. Recruitment centre staff (sonographers, practice nurses, reception staff) carried out the weighing and measuring of participants. Women were weighed using recruitment centre’s own scales which were
calibrated. Height measurements were taken using SECA 213 stadiometers. Instruction on the correct use of both the scales and stadiometers was provided by research staff according to instructions given in the 2008/09 Adult Nutrition Survey (APPENDIX G).

In addition to individually completing the questionnaire and information and consent form, participants were asked to record on the questionnaire any questions they had and whether they found any question ambiguous or confusing. Recruitment centre employees were requested to make note of any concerns or questions they had and also any verbal feedback they had received from participants.

At the end of the piloting period a meeting was held with the charge sonographer at the recruitment site used. During this meeting, feedback from the pilot week was shared (transcript APPENDIX H). Data from all completed questionnaires was reviewed and collated. Questionnaires were checked to ensure questionnaires were completed according to directions given, to ensure logical responses were given and that questionnaire responses were in agreement with expected responses.

No changes were made to the questionnaire at the end of the piloting phase. Questionnaires collected during piloting were included in the final data.

The overall recruitment rate for the pilot was 86.0%

4.6 Recruitment

The questionnaire was administered to a self-selected sample of pregnant women at five recruitment centres located in Christchurch, New Zealand:

- Christchurch Women’s Hospital Radiology Department
- St Georges Radiology (Christchurch Radiology Group [CRG])
- Hagley Radiology (CRG)
- Cashmere Radiology (CRG)
- Reflect Ultrasound Specialists.
One of the recruitment centres was in a tertiary care hospital, and four were at private ultrasound facilities. Participants were recruited when attending their NT scan between 11 and 13+6 weeks' gestation. Women were asked to participate in this study by either reception staff or sonographers. Request for participation was at the discretion of recruitment centre staff; for example, if the scan was to query an early pregnancy loss then participation was not sought.

4.7 Data collection

Data collection was performed in the same manner as for the pilot study (see above), except participants were not asked to record their thoughts and feedback regarding the questionnaire as they were during the pilot.

All questionnaires were returned prior to participants leaving the recruitment centres. In accordance with guidelines for ethical approval, completed questionnaires and information/consent forms were stored in separate piles by the recruitment centres to reduce the likelihood that questionnaire could be matched with the information/consent forms as these had participants’ full name recorded on them.

4.8 Data exclusion

There were no questionnaires returned from Christchurch Women’s Hospital Radiology. This recruitment centre was subsequently excluded from study analysis.

4.9 Data collation

Data from all completed questionnaires was collated using TeleForm™ 10.5 system (Autonomy Systems Ltd, Cambridge, UK). This involved individually scanning all completed questionnaires using a Fujitsu SCANSNAP S500 scanner. Data were uploaded to the TeleForm® computer programme following scanning. All data were checked according to the standard operating procedure (APPENDIX I). Data were then transferred to Microsoft Excel (2011) for analysis.
4.10 Recruitment rate

At the conception of this research project when recruitment centres were approached to participate in this study it was requested that the total number of NT scans performed during the recruitment period at each of the recruitment centres would be provided. All recruitment centres agreed they would provide this data.

Due to methods for data recording at the Christchurch Radiology Group recruitment centres (St Georges Radiology, Hagley Radiology and Cashmere Radiology) there were inconsistencies in the data returned from these recruitment centres. In light of this, the National Health Index numbers (NHIs) for all women who were reported to have had an NT scan during the recruitment period were requested. All NHIs were checked by research staff using ‘InteleViewer’ (InteleViewer version 3-3-1-P100, Intelerad Medical Systems Incorporated, Copyright 2002-2006). Each scan was checked to verify that NT measurement was performed and the scan was used in the calculation of recruitment rate. Scans were excluded if their estimated gestation from the scan was <10 weeks or >14 weeks or if no scan related to the NHI provided was found.

Recruitment rate was calculated as:

\[
\frac{\text{Total questionnaires returned during the recruitment period}}{\text{Total scans during the recruitment period}} \times 100
\]

4.11 Statistical analysis

Data analysis was carried out with the advice of a bio-statistician (APPENDIX F).

BMI was calculated as:

\[
\text{BMI} = \frac{\text{Weight (kg)}}{\text{(height)}^2 \text{ (m)}}
\]

BMI was classified according to BMI classification guidelines used in the 2009 IOM guidelines for recommended weight gain during pregnancy [11] (TABLE 4).

<table>
<thead>
<tr>
<th>BMI classification</th>
<th>kg.m$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5 – 24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>25 – 29.9</td>
</tr>
<tr>
<td>Obese</td>
<td>≥30</td>
</tr>
</tbody>
</table>

Ethnicity was analysed via prioritised ethnicity [94]. Demographics and nominal data were described as numbers and percentages (which were rounded to 1 decimal point [dp]). Analysis was performed in Microsoft Excel 2011.

Statistical comparisons were made between groups for binomial responses using a chi-squared test. The chi-squared test was performed at:
http://openepi.com/OE2.3/Menu/OpenEpiMenu.htm

McNemar's test of significance was used to compare responses to the two statements related to excess weight and smoking from the same participant for each of the researched events [94]. What matters are the discrepant responses, not when a participant responds the same way to both questions. If there were no difference in the response to both questions in the population then 50% of the population discrepancies would be that smoking was a risk and 50% would be that excess weight was a risk. To test this null hypothesis, the observed percentage is compared to the expected 50%. If the confidence interval does not include 50%, then the null hypothesis is rejected and the result is considered statistically significant.

Bowker's test for symmetry is an extension of McNemar's test and is used when there are more than two ordered categories [94]. It is used when a categorical variable is observed twice. This test was used to examine data in matched pairs, i.e. to assess symmetry in a square cross-tabulation. This test has been used to assess if respondents rated excess weight or smoking as a greater risk factor for each of the assessed complications. An example is provided in TABLE 5 (adapted from ‘Standard and nonstandard log-linear symmetry models for measuring change in categorical variables’ [95]).
TABLE 5: Cross-tabulation of responses to a survey to establish feelings about cats and dogs

<table>
<thead>
<tr>
<th></th>
<th>‘How do you feel about dogs?’</th>
<th>‘How do you feel about cats?’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hate (1)</td>
<td>Like (2)</td>
</tr>
<tr>
<td>‘How do you feel about cats?’</td>
<td>11 b</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Like (2)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Love (3)</td>
<td>1</td>
</tr>
</tbody>
</table>

Matching colours represent corresponding pairs

Notes:

a) Denotes pair coordinates
b) Numbers in bold indicate the line of axial symmetry

Each of the numbers in the table above represents the intersection of the two responses to each of the questions posed. Inspection of the table shows more responses in the upper triangle (highlighted in grey) than the in lower triangle (22 vs. 18). This shows participants rated their love of dogs more highly than their love of cats. For example pair 1,3 (row 1, column 3) indicates that 8 participants who indicated they ‘love’ dogs but hate cats, only one participant gave the response loved cats but hated dogs (pair 3,1). In contrast, for pair 2,1, two participants indicated they ‘like’ dogs but hate cats whereas four participants indicated they ‘like’ cats but hate dogs.

Inserting the frequencies from TABLE 5 for each symmetric pair yields the following equation:

$$X^2 = \frac{(4 - 2)^2}{(4 + 2)} + \frac{(1 - 8)^2}{(1 + 8)} + \frac{(13 - 12)^2}{(13 + 12)} = 6.15$$

This value had a ‘degrees of freedom’ of 3 and a tail probability to p=0.104, thus the null hypothesis of axial symmetry can be retained [95].

4.12 Ethics approval

Ethical approval under expedited review was obtained from the Upper South Island B, Regional Ethics Committee. Ethics reference number URB/11/EXP/032 (APPENDIX J).
4.13 Cultural consultation

This research project was reviewed and accepted by the Ngāi Tahu Research Consultation Committee (Te Komiti Rakahau Ki Kai Tahu) (APPENDIX K). Kathy Simmons, Kaiāwhina Whaea Me Ngā Peepi (Māori Health Worker) at Christchurch Women’s Hospital was consulted regarding Māori health and cultural inclusion during questionnaire development and throughout the process of data collection and analysis.
CHAPTER FIVE

RESULTS

5.1 Data exclusion and recruitment rate

There were 660 women eligible for inclusion in this study (FIGURE 1). A total of 420 questionnaires were returned during the recruitment period of 10 October 2011 to 23 December 2011, representing a recruitment rate of 63.6%

Of the 420 questionnaires that were returned, two were excluded for no date of birth recorded, one for gestation <10 weeks, three for gestation >14 weeks and three for gestation not recorded.

FIGURE 1: Flow chart for data exclusion
5.2 Characteristics of participants

TABLE 6: Age of participants

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>11</td>
<td>2.7</td>
</tr>
<tr>
<td>20 to 24</td>
<td>43</td>
<td>10.5</td>
</tr>
<tr>
<td>25 to 29</td>
<td>104</td>
<td>25.3</td>
</tr>
<tr>
<td>30 to 34</td>
<td>140</td>
<td>34.1</td>
</tr>
<tr>
<td>35 to 39</td>
<td>92</td>
<td>22.4</td>
</tr>
<tr>
<td>≥40</td>
<td>21</td>
<td>5.1</td>
</tr>
<tr>
<td>Total</td>
<td>411</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes:

a) Calculated age of participants at 20 November 2011, the median date in the recruitment period
b) Age rounded to the nearest year (0 decimal places)

Mean age of participants was 31 years (range: 17 – 50 years).

TABLE 7: Number of children

<table>
<thead>
<tr>
<th>Number</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>202</td>
<td>49.1</td>
</tr>
<tr>
<td>1</td>
<td>128</td>
<td>31.1</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>13.4</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>2.7</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>1.9</td>
</tr>
<tr>
<td>5 – 7</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Missing</td>
<td>5</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Notes:

a) Number of children reported by participants
b) No response provided for this question by participant

Response rate for this question was 98.8% (n=406).

49% (n=202) of participants were nulliparous and 50% (n=204) were multiparous. Women who were multiparous most commonly had one child (mode = 1).
**TABLE 8:** Gestation at time of questionnaire participation

<table>
<thead>
<tr>
<th>Gestation (weeks)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>11</td>
<td>47</td>
<td>11.4</td>
</tr>
<tr>
<td>12</td>
<td>306</td>
<td>74.5</td>
</tr>
<tr>
<td>13</td>
<td>52</td>
<td>12.7</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>411</td>
<td>100</td>
</tr>
</tbody>
</table>

Note:
a) Participants’ concept of gestation

The majority (mode) of participants (74.5%) were 12 weeks pregnant at time of questionnaire participation.

**TABLE 9:** Highest level of education

<table>
<thead>
<tr>
<th>Education level</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended high school</td>
<td>111</td>
<td>27.0</td>
</tr>
<tr>
<td>Completed NCEA level 3 / Bursary, or equivalent</td>
<td>29</td>
<td>7.1</td>
</tr>
<tr>
<td>Trade certificate</td>
<td>47</td>
<td>11.4</td>
</tr>
<tr>
<td>University qualification</td>
<td>218</td>
<td>53.0</td>
</tr>
<tr>
<td>Missing b</td>
<td>6</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Notes:
a) Highest level of education reported by participants
b) No response provided for this question by participant

Response rate for this question was 98.5% (n=405). Over half (53%) of participants had a university qualification.
TABLE 10: Ethnicity

<table>
<thead>
<tr>
<th>Ethnicity a</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand European</td>
<td>310</td>
<td>75.4</td>
</tr>
<tr>
<td>Māori</td>
<td>18</td>
<td>4.4</td>
</tr>
<tr>
<td>Samoan</td>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>Cook Island Māori</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Tongan</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Niuean</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Chinese</td>
<td>14</td>
<td>3.4</td>
</tr>
<tr>
<td>Indian</td>
<td>7</td>
<td>1.7</td>
</tr>
<tr>
<td>Other</td>
<td>48</td>
<td>11.7</td>
</tr>
<tr>
<td>Missing b</td>
<td>9</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Notes:
- a) Ethnicity stratified by prioritised ethnicity
- b) No response provided for this question by participant

Response rate for this question was 97.8% (n=402).

Only 4.4% (n=18) of participants identified as Māori and 1.2% (n=5) as being of Pacific Island descent.

TABLE 11: Smoking during pregnancy

<table>
<thead>
<tr>
<th>Smoking</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>42</td>
<td>10.2</td>
</tr>
<tr>
<td>No</td>
<td>366</td>
<td>89.1</td>
</tr>
<tr>
<td>Missing a</td>
<td>3</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Notes:
- a) No response provided for this question by participant

Response rate for this question was 99.3% (n=408).

The majority of participants (89.1%) were non-smokers at the time of questionnaire participation.
TABLE 12: Weighed during pregnancy

<table>
<thead>
<tr>
<th>Weighed</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>252</td>
<td>61.3</td>
</tr>
<tr>
<td>No</td>
<td>152</td>
<td>37.0</td>
</tr>
<tr>
<td>Missing *</td>
<td>7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Notes:
- a) No response provided for this question by participant

Response rate for this question was 98.3% (n=404).

TABLE 13: Measured BMI of participants

<table>
<thead>
<tr>
<th>BMI</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>6</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5 – 24.9</td>
<td>200</td>
</tr>
<tr>
<td>Overweight</td>
<td>25 – 29.9</td>
<td>112</td>
</tr>
<tr>
<td>Obese</td>
<td>≥30</td>
<td>70</td>
</tr>
<tr>
<td>Missing b</td>
<td>23</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Notes:
- a) BMI categorised according to the IOM guidelines for weight gain during pregnancy
- b) No response provided for this question by participant

Consent for height and weight measurement was given by 94.4% (n=388) of participants. Of the 23 participants who did not consent, all 23 (5.6%) did not consent to having their weight measured and 22 (5.4%) did not consent to having their height measured.

Mean weight of participants was 70.2kg (range: 39.8 – 123.0kg). Mean height was 1.65m (range: 1.49 – 1.87m).

Mean BMI was 25.7 (range: 17.2 – 46.7). Overall, 44% (n=182) percent of women were overweight or obese.
5.3 Participant characteristics by measured BMI category

TABLE 14: Age distribution of participants for each measured BMI category

<table>
<thead>
<tr>
<th>Age (years) a,b</th>
<th>n</th>
<th>Underweight</th>
<th>Normal weight</th>
<th>Overweight</th>
<th>Obese</th>
<th>No BMI c</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>11</td>
<td>0.0</td>
<td>72.7</td>
<td>18.2</td>
<td>0.0</td>
<td>9.1</td>
</tr>
<tr>
<td>20 – 24</td>
<td>43</td>
<td>7.0</td>
<td>34.9</td>
<td>27.9</td>
<td>25.6</td>
<td>4.7</td>
</tr>
<tr>
<td>25 – 29</td>
<td>104</td>
<td>1.0</td>
<td>48.1</td>
<td>25.0</td>
<td>19.2</td>
<td>6.7</td>
</tr>
<tr>
<td>30 – 34</td>
<td>140</td>
<td>1.4</td>
<td>49.3</td>
<td>27.1</td>
<td>17.9</td>
<td>4.3</td>
</tr>
<tr>
<td>35 – 39</td>
<td>92</td>
<td>0.0</td>
<td>52.2</td>
<td>31.5</td>
<td>9.8</td>
<td>6.5</td>
</tr>
<tr>
<td>≥40</td>
<td>21</td>
<td>0.0</td>
<td>47.6</td>
<td>23.8</td>
<td>23.8</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Notes:
- a) Calculated age of participants at 20 November 2011, the median date in the recruitment period
- b) Age rounded to the nearest year (0 decimal places)
- c) BMI not calculated as no height and/or weight data available

The mean age and age range of participants for each measured BMI group was: underweight, 27 years (range: 21-32 years); normal weight, 31 (range: 17-50); overweight, 31 (range: 18-41); obese, 30 (range: 20-42); missing, 31 (range: 18-40).

TABLE 15: Distribution of highest level of education of participants for each measured BMI category

<table>
<thead>
<tr>
<th>Education level a</th>
<th>n</th>
<th>Underweight</th>
<th>Normal weight</th>
<th>Overweight</th>
<th>Obese</th>
<th>No BMI b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended high school</td>
<td>111</td>
<td>1.8</td>
<td>32.4</td>
<td>27.0</td>
<td>27.9</td>
<td>10.8</td>
</tr>
<tr>
<td>Completed NCEA level 3 / Bursary, or equivalent</td>
<td>29</td>
<td>0.0</td>
<td>62.1</td>
<td>17.2</td>
<td>17.2</td>
<td>3.4</td>
</tr>
<tr>
<td>Trade certificate</td>
<td>47</td>
<td>0.0</td>
<td>44.7</td>
<td>36.2</td>
<td>12.8</td>
<td>6.4</td>
</tr>
<tr>
<td>University qualification</td>
<td>218</td>
<td>1.8</td>
<td>55.5</td>
<td>26.6</td>
<td>12.8</td>
<td>3.2</td>
</tr>
<tr>
<td>Missing c</td>
<td>6</td>
<td>0.0</td>
<td>66.7</td>
<td>33.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Notes:
- a) Highest level of education reported by participants
- b) BMI not calculated as no height and/or weight data available
- c) No response provided for this question by participant

For analysis, underweight participants were combined with normal weight participants.

Normal weight participants were significantly more likely to indicate a university qualification as their highest level of education compared to overweight and obese participants: $\chi^2 = 21.86$, df = 6 (NB: degrees of freedom = 6 means there are 6 pairs), p <0.05.
TABLE 16: Number of children for each measured BMI category

<table>
<thead>
<tr>
<th>Number a</th>
<th>n</th>
<th>Underweight</th>
<th>Normal weight</th>
<th>Overweight</th>
<th>Obese</th>
<th>No BMI b</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>202</td>
<td>2.0</td>
<td>53.0</td>
<td>22.3</td>
<td>18.8</td>
<td>4.0</td>
</tr>
<tr>
<td>1</td>
<td>128</td>
<td>1.6</td>
<td>45.3</td>
<td>32.8</td>
<td>15.6</td>
<td>4.7</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>0.0</td>
<td>47.3</td>
<td>32.7</td>
<td>9.1</td>
<td>10.9</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>0.0</td>
<td>18.2</td>
<td>18.2</td>
<td>54.5</td>
<td>9.1</td>
</tr>
<tr>
<td>4-7</td>
<td>10</td>
<td>0.0</td>
<td>50.0</td>
<td>30.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Missing c</td>
<td>5</td>
<td>0.0</td>
<td>0.0</td>
<td>40.0</td>
<td>0.0</td>
<td>20.0</td>
</tr>
</tbody>
</table>

For analysis, underweight participants were combined with normal weight participants

Notes:

a) Number of children reported by participants
b) BMI not calculated as no height and/or weight data available
c) No response provided for this question by participant

There was no relationship between BMI category and how many children participants indicated they had: $\chi^2 = 12.27$, df = 6, p=0.06.

Mean number of children for each BMI category was: underweight, 0.3; normal weight, 0.7; overweight, 0.9; obese, 0.7; no BMI, 1.12.

TABLE 17: Distribution of ethnicity for each BMI group

<table>
<thead>
<tr>
<th>Ethnicity a</th>
<th>n</th>
<th>Underweight</th>
<th>Normal weight</th>
<th>Overweight</th>
<th>Obese</th>
<th>No BMI b</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZ European</td>
<td>310</td>
<td>0.6</td>
<td>47.7</td>
<td>28.7</td>
<td>17.1</td>
<td>5.8</td>
</tr>
<tr>
<td>Māori</td>
<td>18</td>
<td>0.0</td>
<td>22.2</td>
<td>38.9</td>
<td>33.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Samoan</td>
<td>4</td>
<td>0.0</td>
<td>0.0</td>
<td>25.0</td>
<td>75.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Cook Island Māori</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Tongan</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Niuean</td>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Chinese</td>
<td>14</td>
<td>14.3</td>
<td>57.1</td>
<td>7.1</td>
<td>7.1</td>
<td>14.3</td>
</tr>
<tr>
<td>Indian</td>
<td>7</td>
<td>0.0</td>
<td>14.3</td>
<td>71.4</td>
<td>14.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Other</td>
<td>48</td>
<td>4.2</td>
<td>68.8</td>
<td>14.6</td>
<td>8.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Missing c</td>
<td>9</td>
<td>0.0</td>
<td>66.7</td>
<td>22.2</td>
<td>11.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Notes:

a) Ethnicity stratified by prioritised ethnicity
b) BMI not calculated as no height and/or weight data available
c) No response provided for this question by participant
5.4 Knowledge of weight gain in pregnancy guidelines

TABLE 18: Questionnaire response ‘what do you consider a healthy weight gain for you in this pregnancy?’

<table>
<thead>
<tr>
<th>Response</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I should not gain any weight in my pregnancy</td>
<td>3</td>
<td>0.7</td>
</tr>
<tr>
<td>It does not matter how much weight I gain in my pregnancy</td>
<td>50</td>
<td>12.2</td>
</tr>
<tr>
<td>5 - 9kg (11 – 20lbs)</td>
<td>87</td>
<td>21.2</td>
</tr>
<tr>
<td>7 – 11.5kg (15 – 25lbs)</td>
<td>140</td>
<td>34.1</td>
</tr>
<tr>
<td>11.5 – 16kg (25 – 35lbs)</td>
<td>72</td>
<td>17.5</td>
</tr>
<tr>
<td>12.5 – 18kg (28 – 40lbs)</td>
<td>50</td>
<td>12.2</td>
</tr>
<tr>
<td>Missing</td>
<td>9</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Notes:

a) No response provided for this question by participant

Response rate for this question was 97.8% (n=402)

TABLE 19: Questionnaire response ‘it does not matter how much weight I gain in this pregnancy’ for each BMI group

<table>
<thead>
<tr>
<th>% in each BMI category</th>
<th>'It does not matter how much weight I gain’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Underweight &amp; normal weight</td>
<td>203</td>
</tr>
<tr>
<td>Overweight</td>
<td>108</td>
</tr>
<tr>
<td>Obese</td>
<td>69</td>
</tr>
</tbody>
</table>

Exclusion for the purpose of analysis made if: data missing (n=8), data missing & no BMI (n=1) and no BMI (n=22)

Notes:

a) For analysis, underweight participants were combined with normal weight participants

The response ‘it does not matter how much weight I gain in my pregnancy’ was chosen by 12.1% (n=46) of participants. There was no relationship between BMI and response to this question: $\chi^2 = 0.09$, df = 2, p = 0.96.
**TABLE 20**: Outline of responses considered underestimation, correct estimation and overestimation of appropriate weight gain for pregnancy according to the IOM guidelines for weight gain during pregnancy [11].

<table>
<thead>
<tr>
<th>Measured BMI</th>
<th>Response given for recommended weight gain (kg) *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12.5 - 18</td>
</tr>
<tr>
<td>Underweight</td>
<td>Correct</td>
</tr>
<tr>
<td>Normal weight</td>
<td>Correct</td>
</tr>
<tr>
<td>Overweight</td>
<td>Overestimation</td>
</tr>
<tr>
<td>Obese</td>
<td>Correct</td>
</tr>
</tbody>
</table>

Notes:

a) IOM guidelines for weight gain during pregnancy (TABLE1, [11])

**TABLE 21**: Measured BMI and underestimation, correct answer and overestimation of weight gain for pregnancy guidelines.

<table>
<thead>
<tr>
<th>% in each BMI category</th>
<th>Over-estimation</th>
<th>Correct response</th>
<th>Under-estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight &amp; normal weight *</td>
<td>175</td>
<td>15.4</td>
<td>24.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>94</td>
<td>33.0</td>
<td>44.7</td>
</tr>
<tr>
<td>Obese</td>
<td>61</td>
<td>72.1</td>
<td>27.9</td>
</tr>
</tbody>
</table>

Participants excluded from analysis for responding: ‘I should not gain any weight during my pregnancy’, ‘It does not matter how much weight I gain’, if no measured BMI available and if no response to this question provided.

Notes:

a) For analysis, underweight participants were combined with normal weight participants

There was a relationship between BMI and estimation of appropriate weight gain for pregnancy with participants with excess weight significantly overestimating appropriate weight gain for pregnancy compared with underweight and normal weight participants: $\chi^2 = 108$, df = 4, P= <0.0001.
5.5 Women's Knowledge of Risk

5.5.1 Women's knowledge of the risk of stillbirth

FIGURE 2A: Response to statement: Excess weight in pregnancy increases the chance of a baby dying before delivery (stillbirth)

FIGURE 2B: Response to statement: Smoking during pregnancy increases the chance of a baby dying before delivery (stillbirth)
McNemar’s test of significance was used to compare responses to the two statements related to excess weight and smoking from the same participant for each of the researched events. What matters is the discrepant response, not when a participant responds the same way to both questions. If there were no difference then it would be expected that discrepancies would be approximately 50% thinking smoking was a risk and 50% thinking excess weight was a risk. If the confidence interval does not include 50%, the result is considered statistically significant.

17.7% (n=73) of participants indicated they did not agree that there is any degree of increased risk associated with excess weight and risk for stillbirth, with 8.5% (n=35) indicating they ‘strongly disagree’ there is any increased risk. 24.3% (n=100) of participants chose the option ‘no difference’, indicating they did not perceive a difference in risk of stillbirth in women with excess weight and women who are normal weight. Overall, more participants chose the option ‘I don’t know’ (29.9%) than responded in accordance with expert opinion (26.0%) respectively.

68.4% (n=281) of participants agreed there is some degree of increased risk of stillbirth associated with smoking during pregnancy. 10.7% (n=44) of participants did not agree that there is any degree of increased risk, and 6.3% (n=26) of participants indicated that there is no difference in risk of stillbirth for those who smoke in pregnancy compared to those who do not smoke.

Risk of stillbirth according to expert opinion was identified correctly by 26% of participants (95% CI [Confidence interval] 22, 30; n=107) for excess weight and 50.4% (95% CI 50, 50.8; n=207) for smoking.

**TABLE 22:** An example of the McNemar’s test used to analyse response for stillbirth in accordance with expert opinion

<table>
<thead>
<tr>
<th>Smoking</th>
<th>Excess Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>Incorrect</td>
</tr>
<tr>
<td>169</td>
<td>35</td>
</tr>
<tr>
<td>Correct</td>
<td>135</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
</tr>
</tbody>
</table>

Note:
This includes ‘don’t know’ answers as incorrect

Those who did estimate risk for both excess weight and smoking were compared to see what risk factor was most likely to be judged correct in accordance with expert opinion. McNemar’s test was used to compare those who were correct for excess weight but wrong for smoking with those who were wrong for excess weight but correct for smoking (TABLE 22). It showed that 46% were correct for excess weight but wrong for smoking (95% CI 40, 52), indicating no significant difference in the percentage correct for smoking and excess weight.

McNemar’s test was also used to compare the number of participants who answered ‘I don’t know’ for smoking and for excess weight for stillbirth. Of the discrepant responses, 79.8% answered ‘I don’t know’ for excess weight (95% CI 72, 86), indicating significantly more pregnant women were not aware of the risk for excess weight than for smoking.

Bowker’s test for symmetry is an extension of McNemar’s test and is used when there are more than two ordered categories. It is used when a categorical variable is observed twice. This test was used to examine data in matched pairs, i.e. to assess symmetry in a square cross-tabulation. This test has been used to assess if respondents rated excess weight or smoking as a greater risk factor for each of the assessed complications.

**TABLE 23:** Responses for excess weight vs. smoking for stillbirth

<table>
<thead>
<tr>
<th>Smoking</th>
<th>Excess weight</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

The shaded boxes denote the correct response according to expert opinion.

Note:
a) 1 = strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
b) n_missing included in ‘I don’t know’ category (category 8): excess weight n=8, smoking n=3
c) Category 8 not included in \( \chi^2 \) calculation
Participants were significantly more likely to rate smoking as a higher risk for stillbirth than excess weight (Bowker’s test: $\chi^2 = 120.58$, df 21, $p<0.0001$).

Inspection of TABLE 23 shows many more responses in the lower triangle. This shows participants rated smoking as a higher risk for stillbirth than excess weight. For example, smoking was judged a ‘7’ (strongly agree) by 12 participants for pair 7,1 in contrast to pair 1,7 where only one respondent rated excess weight a ‘7’. Similarly, 29 participants rated smoking a ‘6’ (pair 6,4) compared to only one participant who rated excess weight a ‘6’ (pair 4,6).
5.5.2 Women's knowledge of the risk of small for gestational age infant (SGA)

**FIGURE 3A:** Response to statement: Excess weight in pregnancy increases the chance of giving birth to a small baby (weighing less than 2.5kg/5.5lbs)

**FIGURE 3B:** Response to statement: Smoking during pregnancy increases the chance of giving birth to a small baby (weighing less than 2.5kg/5.5lbs)
36.2% (149) participants indicated they did not agree that there is risk associated with excess weight and having an SGA infant. 11.9% (49) of participants agreed that there is some degree of increased risk. 25.1% (103) of participants did not believe that there is any difference in risk of having an SGA infant associated with excess weight compared to those who are normal weight.

83.6% (344) of participants agreed there is some degree of risk of having an SGA infant associated with smoking during pregnancy. Only 6.2% (26) of participants did not agree that there is any increased risk associated with smoking.

Risk of a small for gestational age infant according to expert opinion was identified by 14.4% (95% CI 11.2, 18.0; n=59) of participants for excess weight and 73.9% (95% CI 71.5, 76.3; n=304) for smoking. For those who did estimate risks for both excess weight and smoking McNemar’s test showed 17.0% were correct for excess weight but not for smoking (95% CI 13.2, 21.4).

Of the discrepant responses, 85.9% answered ‘I don’t know’ for excess weight (McNemar’s test: 95% CI 78.7, 91.5).

**TABLE 24:** Responses for excess weight vs. smoking for small for gestational age infant

<table>
<thead>
<tr>
<th>Smoking</th>
<th>Excess weight</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 1 1 1 4 1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1 1 2 2 3</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>1 1 1 1 1</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>3 7</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>4 4 5 11 5 1 1</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>4 8 18 24 11 2</td>
<td>24</td>
</tr>
<tr>
<td>7</td>
<td>30 26 30 51 12 5 6</td>
<td>53 213</td>
</tr>
<tr>
<td>8</td>
<td>2 4 5 3 2</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>45 45 59 103 32 9 8</td>
<td>110 411</td>
</tr>
</tbody>
</table>

The shaded boxes denote the correct response according to expert opinion

Notes:

a) 1= strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
b) n missing included in ‘I don’t know’ category (category 8): excess weight n=11, smoking n=3
c) Category 8 not included in \( \chi^2 \) calculation
Participants were significantly more likely to rate smoking as a higher risk for small for gestational age infant than excess weight: Bowker’s test, $\chi^2 = 233.79$, df=21, $p<0.0001$.

Inspection of TABLE 24 indicates 30 women strongly agreed that smoking was a risk whereas only one strongly agreed that excess weight was a risk but strongly disagreed that smoking was a risk.
5.5.3 Women's knowledge of the risk of macrosomia

**FIGURE 4A:** Response to statement: Excess weight in pregnancy increases the chance of giving birth to a big baby (weighing more than 4kg/8.8lbs)

**FIGURE 4B:** Response to statement: Smoking during pregnancy increases the chance of giving birth to a big baby (weighing more than 4kg/8.8lbs)
48.2% (n=198) of participants agreed there is some degree of increased risk associated with excess weight and risk of a macrosomic infant. 12.4% (n=51) did not agree that there is any degree of increased risk. 17.3% (n=71) of participants indicated they did not agree there is any difference in risk between a woman who is of excess weight and a woman who is normal weight.

63.7% (n=262) of participants did not agree there is increased risk associated with smoking and macrosomia. 6.3% (n=26) of participants agreed there is some degree of increased risk.

Risk of a macrosomic infant according to expert opinion was identified by 10.2% (95% CI 7.6, 13.4; n=42) of participants for excess weight and 34.1% (95% CI 33.3, 34.8; n=140) for smoking. For those who did estimate risks for both excess weight and smoking, McNemar’s test showed 24.0% were correct for excess weight but not for smoking (95% CI 17.7, 31.3).

Of the discrepant responses, 58.9% answered ‘I don’t know’ for excess weight (McNemar’s test: 95% CI 49.6, 67.8).

| TABLE 25: Responses for excess weight vs. smoking for macrosomic infant |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Smoking                                       | Excess weight   |                  |                  |                  |                  |                  |                  |                  |
| 1 9 5 4 28 16 21 15 24                         | 122             |
| 2 1 3 4 28 16 18 18 8 19 83                    |
| 3 3 2 2 9 14 13 5 7 57                         |
| 4 1 5 16 9 7 4 10 52                         |
| 5 2 1 4 2 3 12  |
| 6 2 1 2 4 2 10 4 |
| 7 2 1 2 2 3 10                                     |
| 8 2 4 6 14 14 6 25 66                             |
| Total 18 14 19 71 73 83 42 91 411               |

The shaded boxes denote the correct response according to expert opinion
Note:
a) 1= strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
b) n missing included in ‘I don’t know’ category (category 8): excess weight n=11, smoking n=5
c) Category 8 not included in \( \chi^2 \) calculation

Participants were significantly more likely to rate excess weight as a higher risk for macrosomia than smoking: Bowkers test: \( \chi^2 = 186.03, df=21, p<0.0001 \).
5.5.4 Women's knowledge of the likelihood of a normal, uncomplicated vaginal delivery

**FIGURE 5A:** Response to statement: Excess weight in pregnancy increases the chance of having a normal, uncomplicated vaginal delivery

**FIGURE 5B:** Response to statement: Smoking during pregnancy increases the chance of having a normal, uncomplicated vaginal delivery
21.1% (n=87) of participants agreed to some extent that excess weight increases your chance of a normal, uncomplicated vaginal delivery. 44.8% (n=184) of participants did not agree that excess weight increases your chances.

10.7% (n=44) of participants agreed to some extent that smoking during pregnancy increases your chance of a normal, uncomplicated vaginal delivery. 44.8% (n=184) of participants disagreed that there is any degree of increased chance.

Chance of a normal and uncomplicated vaginal delivery according to expert opinion was identified by 26.0% (95% CI 22, 30.4; n= 107) of participants for excess weight and 50.4% (n=207) of participants for smoking. For those who did estimate risks for both excess weight and smoking, McNemar’s test showed 51.8% were correct for excess weight but not for smoking (95% CI 46.4, 57.1).

Of the discrepant responses, 53.3% answered ‘I don’t know’ for excess weight (McNemar’s test: 95% CI 41.0, 64.8).

**TABLE 26:** Responses for smoking and excess weight for normal and uncomplicated vaginal delivery

<table>
<thead>
<tr>
<th>Smoking</th>
<th>Excess weight</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>62</td>
<td>56</td>
</tr>
</tbody>
</table>

The shaded boxes denote the correct response according to expert opinion
Note:
- a) 1= strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
- b) n_missing included in ‘I don’t know’ category (category 8): excess weight n=1, smoking n=1
- c) Category 8 not included in $\chi^2$ calculation
Participants were significantly more likely to rate women who are of excess weight as being of a higher likelihood of successfully having a normal and uncomplicated vaginal delivery than women who smoke: Bowker’s test: $\chi^2 = 61.13$, df=21, p<0.0001.

5.5.5 Women’s knowledge of the risk of structural anomaly

**FIGURE 6A:** Response to statement: Excess weight in pregnancy increases the chance of having a baby with a structural anomaly (e.g. spina bifida, neural tube defect)
FIGURE 6B: Response to statement: Smoking during pregnancy increases the chance of having a baby with a structural anomaly (e.g. spina bifida, neural tube defect)

19% (n=78) of participants disagreed to some extent that there is any increase in risk associated with excess weight and structural anomaly. 40.6% (n=167) of participants indicated they that there is no difference in chance of structural anomaly for a woman who is of excess weight compared to a normal weight woman.

17.1% (70) of participants disagreed to some extent that smoking increases risk of structural anomaly. 20.0% (82) indicated that they do not believe that there is any difference in risk between smokers and non-smokers, and 20.4% (84) chose the option ‘I don’t know’.

Risk of structural anomaly according to expert opinion was identified by 14.1% (95% CI 11, 17.7; n= 58) of participants for excess weight and 41.9% (95% CI 41.4, 42.4; n=172) of participants for smoking. For those who did estimate risks for both excess weight and smoking, McNemar’s test showed 30.1% were correct for excess weight but not for smoking (95% CI 23.8, 37.0).

Of the discrepant responses, 60.6% answered ‘I don’t know’ for excess weight (McNemar’s test: 95% CI 50.7, 69.9).

TABLE 27: Responses for excess weight vs. smoking for structural anomaly
The shaded boxes denote the correct response according to expert opinion

Note:

a) 1 = strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
b) n_missing included in ‘I don’t know’ category (category 8): excess weight n=10, smoking n=3
c) Category 8 not included in \( \chi^2 \) calculation

It was not possible to analyse this data using Bowker’s test as some pairs were 0, 0. In light of this, McNemar’s test of significance was used. Of the discrepant responses 28.8% thought excess weight was a risk for structural anomaly (95% CI 21.6, 36.5).
5.5.6 Women's knowledge of the risk of caesarean section delivery

![Graph A](image)

**FIGURE 7A:** Response to statement: Excess weight in pregnancy increases the chance of needing a caesarean section (when you don’t delivery vaginally)

![Graph B](image)

**FIGURE 7B:** Response to statement: Smoking during pregnancy increases the chance of needing a caesarean section (when you don’t delivery vaginally)
52.6% (n=216) of participants agreed there is some degree of increased risk associated with excess weight and risk for caesarean section delivery. 11% (n=45) disagreed to some extent that there is any increased risk.

20.2% (n=83) of participants agreed to some degree that smoking during pregnancy increases your risk of needing a caesarean section delivery, compared to 18.2% (n=75) who disagreed to some extent. 37.2% (n=153) indicated they did not believe that there was any difference in risk in those who smoke during pregnancy compared to those who do not smoke.

Risk of caesarean section delivery according to expert opinion was identified by 32.4% (95% CI 28, 37.1; n=133) of participants for excess weight and 50.3% (95% CI 47.9, 52.7; n=207) for smoking. For those who did estimate risks for both excess weight and smoking, McNemar’s test showed 36.8% were correct for excess weight but not for smoking (95% CI 31.4, 42.4).

Of the discrepant responses, 60.0% answered ‘I don’t know’ for excess weight (McNemar’s test: 95% CI 50.2, 69.3).

**TABLE 28: Responses for excess weight vs. smoking for caesarean section delivery**

<table>
<thead>
<tr>
<th>Excess weight</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8 be</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>43</td>
<td>37</td>
<td>26</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1</td>
<td></td>
<td>6</td>
<td>12</td>
<td>10</td>
<td>6</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>11</td>
<td>7</td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>11</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>16</td>
<td>18</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>13</td>
<td>12</td>
<td>20</td>
<td>70</td>
<td>83</td>
<td>78</td>
<td>55</td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>

The shaded boxes denote the correct response according to expert opinion.

Note:
- a) 1= strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
- b) n missing included in ‘I don’t know’ category (category 8): excess weight n=10, smoking n=2
- c) Category 8 not included in $\chi^2$ calculation
It was not possible to analyse this data using Bowker’s test as some pairs were 0,0. In light of this McNemar’s test was used. Of the discrepant responses 19.4% thought excess weight was a risk for caesarean section delivery (95% CI 14.2, 25.7).
5.5.7 Women's knowledge of the risk of high blood pressure

**FIGURE 8A:** Response to statement: Excess weight in pregnancy increases the chance of having high blood pressure (including pre-eclampsia / toxemia)

**FIGURE 8B:** Response to statement: Smoking during pregnancy increases the chance of having high blood pressure (including pre-eclampsia / toxemia)
86.4% (n=311) of participants agreed that excess weight in pregnancy increases the risk of high blood pressure with the majority (35.8%) ‘strongly’ agreeing. 6.4% (n=26) of participants disagreed that excess weight increases risk.

63.5% (n=261) participants agreed to some extent that smoking during pregnancy increases the risk of high blood pressure.

Risk of high blood pressure according to expert opinion was identified by 35.8% (95% CI 31.2, 40.5; n=147) of participants for excess weight and 9.8% (95% CI 9.4, 10.2; n=40) for smoking. For those who did estimate risks for both excess weight and smoking McNemar’s test showed 79.1% were correct for excess weight but not for smoking (95% CI 72.4, 84.9).

Of the discrepant responses, 32.3% answered ‘I don’t know’ for excess weight (McNemar’s test: 95% CI 26.3, 47.2).

TABLE 29: Response for excess weight vs. smoking for high blood pressure

<table>
<thead>
<tr>
<th>Excess weight</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>12</td>
<td>6</td>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>1</td>
<td>14</td>
<td>29</td>
<td>26</td>
<td>6</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>40</td>
<td>44</td>
<td>11</td>
<td>108</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>20</td>
<td>3</td>
<td>77</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>2</td>
<td>12</td>
<td>11</td>
<td>18</td>
<td>25</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>13</td>
<td>7</td>
<td>20</td>
<td>44</td>
<td>147</td>
<td>54</td>
<td>411</td>
</tr>
</tbody>
</table>

The shaded boxes denote the correct response according to expert opinion
Note:

a) 1= strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
b) n_missing included in ‘I don’t know’ category (category 8): excess weight n=9, smoking n=1
c) Category 8 not included in $\chi^2$ calculation

It was not possible to analyse this data using Bowker’s test as some pairs were 0,0. In light of this McNemar’s test was used. Of the discrepant responses 23.7% thought excess weight was a risk for high blood pressure (95% CI 18.1, 30.1).
5.5.8 Women’s knowledge of the risk of gestational diabetes

**FIGURE 9A:** Response to statement: Excess weight in pregnancy increases the chance of developing diabetes during pregnancy (gestational diabetes)

**FIGURE 9B:** Response to statement: Smoking during pregnancy increases the chance of developing diabetes during pregnancy (gestational diabetes)
76.6% (n=321) of participants agreed that excess weight in pregnancy increases the risk of gestational diabetes (GDM), with the majority (48.7%) ‘strongly’ agreeing. Only 6.2% (n=26) of participants disagreed that excess weight increases risk for GDM.

31.4% (n=129) of participants agreed to some degree that smoking during pregnancy increases risk of GDM compared to 12.3% (n=51) who disagreed it increases risk. 29.2% (n=120) of participants answered ‘I don’t know’.

Risk of gestational diabetes according to expert opinion was identified by 48.7% (95% CI 43.9, 53.5; n=200) of participants for excess weight and 40.8% (95% CI 39, 42.6; n=176) for smoking. For those who did estimate risks for both excess weight and smoking McNemar’s test showed 48.9% were correct for excess weight but not for smoking (95% CI 43.3, 54.5).

Of the discrepant responses, 18.1% answered ‘I don’t know’ for excess weight (McNemar’s test: 95% CI 11.9, 25.9).

**TABLE 30: Responses for excess weight vs. smoking for GDM**

<table>
<thead>
<tr>
<th>Smoking</th>
<th>Excess weight</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 2 3 4 5 6 7 8^c</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>3 2 2 6 11 8</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>4 4 8</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>4 3 6 12 27 45 10</td>
<td>107</td>
</tr>
<tr>
<td>5</td>
<td>3 13 35 2</td>
<td>53</td>
</tr>
<tr>
<td>6</td>
<td>1 1 1 1 15 24 3</td>
<td>46</td>
</tr>
<tr>
<td>7</td>
<td>2 1 2 22 3</td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>2 1 5 2 7 27 51 29</td>
<td>124</td>
</tr>
</tbody>
</table>

The shaded boxes denote the correct response according to expert opinion

Note:

a) 1= strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
b) n missing included in ‘I don’t know’ category (category 8): excess weight n=9, smoking n=3
c) Category 8 not included in \( \chi^2 \) calculation
It was not possible to analyse this data using Bowker’s test as some pairs were 0,0. In light of this McNemar’s test was used. Of the discrepant responses 7.4% thought excess weight was a risk for gestational diabetes (95% CI 4.5, 11.6).
5.5.9 Women's knowledge of the risk of shoulder dystocia

**FIGURE 10A:** Questionnaire response: Excess weight in pregnancy increases the chance of having problems with the baby’s shoulders getting “stuck” during a vaginal delivery (shoulder dystocia)

**FIGURE 10B:** Questionnaire response: Smoking during pregnancy increases the chance of having problems with the baby’s shoulders getting “stuck” during a vaginal delivery (shoulder dystocia)
The majority of participants (31.1%, n=128) chose the option ‘I don’t know’ for excess weight and risk of shoulder dystocia. 11% (n=45) of participants disagreed to some extent that there is any increased risk of shoulder dystocia associated with excess weight. 29.2% (n=120) did not believe there is any difference in risk for those who have excess weight and those who are normal weight.

38.4% (n=158) of participants did not believe there is a difference in risk between smokers and non-smokers for shoulder dystocia and 27% (n=111) chose the option ‘I don’t know’. 7.1% (n=29) indicated there was some degree of increased risk compared with 27.3% (n=112) who indicated they disagree with there being any increased risk.

Risk of shoulder dystocia according to expert opinion was identified by 26.5% (95% CI 22.4, 31; n=109) of participants for excess weight and 41.6% (95% CI 37.9, 45.3; n=171) for smoking. For those who did estimate risks for both excess weight and smoking McNemar’s test showed 42.6% were correct for excess weight but not for smoking (95% CI 36.5, 48.9).

Of the discrepant responses, 63.4% answered ‘I don’t know’ for excess weight (McNemar’s test: 95% CI 53.3, 72.8).

TABLE 31: Responses for excess weight vs. smoking for shoulder dystocia

<table>
<thead>
<tr>
<th>Smoking</th>
<th>Excess weight</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18 2 2 17 2 6 5</td>
<td>15 67</td>
</tr>
<tr>
<td>2</td>
<td>3 2 2 10 1 4 1</td>
<td>9 32</td>
</tr>
<tr>
<td>3</td>
<td>1 2 3 3 2</td>
<td>2 13</td>
</tr>
<tr>
<td>4</td>
<td>1 1 6 68 30 11 12 29</td>
<td>158</td>
</tr>
<tr>
<td>5</td>
<td>6 3 1 1</td>
<td>2 13</td>
</tr>
<tr>
<td>6</td>
<td>2 2 2</td>
<td>1 7</td>
</tr>
<tr>
<td>7</td>
<td>2 2 4</td>
<td>1 9</td>
</tr>
<tr>
<td>8</td>
<td>1 4 12 7 4 6</td>
<td>78 112</td>
</tr>
<tr>
<td>Total</td>
<td>22 7 16 120 48 30 31</td>
<td>137 411</td>
</tr>
</tbody>
</table>

The shaded boxes denote the correct response according to expert opinion
Note:
- a) 1= strongly disagree, 4 = no difference, 7 = strongly agree, 8 = ‘I don’t know’ and missing
- b) n_missing included in ‘I don’t know’ category (category 8): excess weight n=9, smoking n=1
- c) Category 8 not included in χ² calculation
It was not possible to analyse this data using Bowker’s test as some pairs were 0,0. In light of this McNemar’s test was used. Of the discrepant responses 18.2% thought excess weight was a risk for shoulder dystocia (95% CI 12.5, 25.1).
5.5.10  Women’s knowledge of the risk of having a baby with green eyes (standardising questions to assess degree of satisficing)

**FIGURE 11A:** Questionnaire response: Excess weight in pregnancy increases the chance of having a baby with green eyes

**FIGURE 11B:** Questionnaire response: Smoking in pregnancy increases the chance of having a baby with green eyes
5.6 Measured and perceived BMI

TABLE 32: Perceived BMI

<table>
<thead>
<tr>
<th>BMI</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>7</td>
<td>1.7</td>
</tr>
<tr>
<td>Normal weight</td>
<td>285</td>
<td>69.3</td>
</tr>
<tr>
<td>Overweight</td>
<td>107</td>
<td>26.0</td>
</tr>
<tr>
<td>Obese</td>
<td>8</td>
<td>1.9</td>
</tr>
<tr>
<td>No perceived BMI</td>
<td>4</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Response rate for this question was 99.0% (n=407).

TABLE 33: Comparison of measured and perceived BMI

<table>
<thead>
<tr>
<th>Perceived BMI</th>
<th>Measured BMI</th>
<th>Measured BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Underweight</td>
<td>Normal weight</td>
</tr>
<tr>
<td>Underweight</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Normal weight</td>
<td>3</td>
<td>194</td>
</tr>
<tr>
<td>Overweight</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Obese</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Overweight and obese participants were significantly more likely to underestimate their own BMI than underweight and normal weight participants ($\chi^2 = 191.3$, df = 2, p < 0.0000001).
### 5.7 Long-term risks

**TABLE 34:** Excess weight and long-term risks for the child

<table>
<thead>
<tr>
<th>Condition</th>
<th>Responses accepted</th>
<th>Number of responses a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overweight</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Obesity</td>
<td>Could be fat</td>
<td>21</td>
</tr>
<tr>
<td>Excess weight</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Long-term weight issues</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td>45</td>
</tr>
<tr>
<td>Type I Diabetes</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Type II Diabetes</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>GDM</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Increased blood pressure</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Big baby/child</td>
<td>Increased birth weight</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Fat baby</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased fetal size</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Macrosomia</td>
<td></td>
</tr>
<tr>
<td>Low birth weight</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Birth problems</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Premature death</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Baby sick / poor growth</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>General poor health</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Heart problems</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Early periods</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Premature birth</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Jaundice</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Circulation problems</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Stillbirth</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Birth defects</td>
<td>Neural tube defects</td>
<td>2</td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Note:
a) Some participants provided more than one answer

There were a total of 152 written responses
### TABLE 35: Excess weight and long term risks for the mother

<table>
<thead>
<tr>
<th>Responses accepted</th>
<th>Number of responses a</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDM</td>
<td>46</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Type II Diabetes</td>
</tr>
<tr>
<td>Aches and pains</td>
<td>Tired</td>
</tr>
<tr>
<td></td>
<td>Lethargic</td>
</tr>
<tr>
<td></td>
<td>Joint damage</td>
</tr>
<tr>
<td></td>
<td>Back pain</td>
</tr>
<tr>
<td></td>
<td>Fatigue</td>
</tr>
<tr>
<td></td>
<td>Limited mobility</td>
</tr>
<tr>
<td>Increased blood pressure</td>
<td>Blood pressure</td>
</tr>
<tr>
<td></td>
<td>High blood pressure</td>
</tr>
<tr>
<td></td>
<td>PET</td>
</tr>
<tr>
<td></td>
<td>Toxemia</td>
</tr>
<tr>
<td>Extended recovery time</td>
<td>Long recovery</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>CS</td>
</tr>
<tr>
<td>Problems with birth and delivery</td>
<td>Pregnancy problems</td>
</tr>
<tr>
<td>Asthma</td>
<td>1</td>
</tr>
<tr>
<td>Early mortality</td>
<td>Early death</td>
</tr>
<tr>
<td>Pelvic floor problems</td>
<td></td>
</tr>
<tr>
<td>Require feeding intervention</td>
<td>1</td>
</tr>
<tr>
<td>Increased complications in general</td>
<td>4</td>
</tr>
<tr>
<td>Cancer</td>
<td>2</td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>1</td>
</tr>
<tr>
<td>Heart disease</td>
<td>Heart issues</td>
</tr>
<tr>
<td></td>
<td>Heart problems</td>
</tr>
<tr>
<td></td>
<td>Heart conditions</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>1</td>
</tr>
<tr>
<td>Overweight/Obesity</td>
<td>Problems with weight loss</td>
</tr>
<tr>
<td>Poor circulation</td>
<td>1</td>
</tr>
<tr>
<td>Infertility</td>
<td>1</td>
</tr>
<tr>
<td>Increased cholesterol</td>
<td>2</td>
</tr>
</tbody>
</table>

Note:

a) Some participants provided more than one answer

There were a total of 244 written responses
TABLE 36: Smoking during pregnancy and long-term risk for the child

<table>
<thead>
<tr>
<th>Responses accepted</th>
<th>Number of responses</th>
<th>Note:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicotine addiction</td>
<td>Addiction</td>
<td>a) Some participants provided more than one answer</td>
</tr>
<tr>
<td></td>
<td>Addicted to cigars</td>
<td>There were a total of 244 written responses.</td>
</tr>
<tr>
<td>Premature</td>
<td>Born early</td>
<td></td>
</tr>
<tr>
<td>Stillbirth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lung cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lung problems</td>
<td>Lung concerns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lung disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bronchitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Respiratory problems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Breathing problems</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allergies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glue ear</td>
<td>Ear infection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hearing problems</td>
<td></td>
</tr>
<tr>
<td>Cot death / Sudden infant death syndrome</td>
<td>SIDS</td>
<td></td>
</tr>
<tr>
<td>Intrauterine growth restriction</td>
<td>IUGR</td>
<td></td>
</tr>
<tr>
<td>Small baby</td>
<td>Low birth weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stunted at birth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Underweight (child)</td>
<td></td>
</tr>
<tr>
<td>Development/learning difficulty</td>
<td>Attention deficit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>hyperactivity disorder</td>
<td></td>
</tr>
<tr>
<td>Heart problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall poor health for life</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth defects / deformities</td>
<td>Neural tube defects</td>
<td></td>
</tr>
<tr>
<td>Blindness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth problems and stunted growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscarriage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malnourished</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**TABLE 37: Smoking during pregnancy and long term risk for the mother**

<table>
<thead>
<tr>
<th>Responses accepted</th>
<th>Number of responses a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>12</td>
</tr>
<tr>
<td>Allergies</td>
<td>2</td>
</tr>
<tr>
<td>Poor overall health</td>
<td>19</td>
</tr>
<tr>
<td>- Bad health</td>
<td></td>
</tr>
<tr>
<td>- Generally unhealthy</td>
<td></td>
</tr>
<tr>
<td>Birth complications</td>
<td>5</td>
</tr>
<tr>
<td>- Labour complications</td>
<td></td>
</tr>
<tr>
<td>- Problems with delivery</td>
<td></td>
</tr>
<tr>
<td>Difficult pregnancy</td>
<td>1</td>
</tr>
<tr>
<td>Blood clots</td>
<td>1</td>
</tr>
<tr>
<td>Respiratory problems</td>
<td>38</td>
</tr>
<tr>
<td>- Breathing problems</td>
<td></td>
</tr>
<tr>
<td>- SOB/ Shortness of breath</td>
<td></td>
</tr>
<tr>
<td>- Emphysema</td>
<td></td>
</tr>
<tr>
<td>- Lung problems/damage/disease</td>
<td></td>
</tr>
<tr>
<td>- Chronic obstructive pulmonary disease (COPD)</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>48</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>25</td>
</tr>
<tr>
<td>Cardiovascular disease (CVD)</td>
<td>57</td>
</tr>
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<td>- Stroke</td>
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<td>- Increased blood pressure</td>
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<td>- BP problems</td>
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<td>- High blood pressure</td>
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<td>- Hypertension</td>
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<td>- Circulation problems</td>
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<td>Stillbirth</td>
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<td>Miscarriage</td>
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<td>Guilt</td>
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<td>Heart problems</td>
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<td>- Ischemic heart disease</td>
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<td>Respiratory problems</td>
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<td>Bad breath</td>
<td>1</td>
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<tr>
<td>Caesarean section</td>
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<tr>
<td>Premature infant</td>
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<tr>
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<td>1</td>
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<td>Malnourished</td>
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<tr>
<td>Slow healing</td>
<td>1</td>
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<tr>
<td>Problems breastfeeding</td>
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Note:
a) Some participants provided more than one answer

There were a total of 203 written responses.
CHAPTER SIX

DISCUSSION

This study aimed to describe pregnant women’s perception of increased risk due to excess weight in pregnancy. The secondary aims of this research were to describe pregnant women’s knowledge of weight gain recommendations, and to examine women’s knowledge of their own weight. The cohort was a group of 411 pregnant women in Christchurch, New Zealand in 2011.

The main findings of this study were: alarming deficiencies in participants’ knowledge regarding the potential adverse impact of excess weight on maternal and fetal health outcomes, the lack of participants’ knowledge of recommended weight gain in pregnancy, and participants’ underestimation of their weight status. As noted in Chapter One, there is limited international literature that considers the knowledge women have of both the risks of overweight and obesity in pregnancy and also of recommended weight gain in pregnancy. To our knowledge this is the first reported study to be undertaken to consider these factors in a population of women in New Zealand.
6.1 Knowledge of the risks of excess weight in pregnancy

6.1.1 Fetal structural anomaly

One of the most concerning findings of this study was the lack of participants’ knowledge of the risk of excess maternal weight on fetal structural anomaly (FIGURE 6A). Only 14% (95% CI 11, 17.7) of participants identified that there is an increased risk of structural anomaly if a woman has a BMI >25. The correct answer, according to expert opinion, was considered to be any answer that was equivalent to agreement, regardless of how strong this agreement was, e.g. agree to strongly agree. Nineteen percent of participants disagreed that there is any increase in risk and 41% of respondents identified no change to risk due to maternal weight. In comparison, the risk of structural anomaly according to expert opinion was identified by 14.1% (95% CI 11, 17.7; n= 58) of participants for excess weight and 41.9% (n=172) of participants for smoking.

Risk of fetal structural anomaly is reported in the literature as being 1.1 - 2.6 times higher in overweight / obese women compared to normal weight women (TABLE 2). Three studies have considered women’s knowledge of the risk of fetal structural anomaly associated with excess weight. Nitert et al. reported 58% of respondents with a BMI <25, and 62.7% of respondents with a BMI ≥25, were aware of the increased risk for congenital anomaly in a ‘very’ obese woman [70]. Gaudet et al. stated ‘most women were unable to identify obesity-related complications for themselves or their baby, including... neural tube defects’ [65]. Kominiarek et al. reported <70% of respondents were able to identify the risk for birth defects. It is apparent that women are uninformed about the risk for structural anomaly associated with excess weight [67]. In comparison, risk of structural anomaly according to expert opinion was identified by 14.1% (95% CI 11, 17.7; n= 58) of participants for excess weight and 41.9% (n=172) of participants for smoking. (FIGURE 6B).

This lack of knowledge regarding fetal structural anomaly is a concerning finding because the risk for neural tube defects in high-risk women can be reduced by taking the higher dose of 5 mg of folic acid per day prior to conception and for the first trimester [96]. Uninformed women, being unaware of their increased risk secondary to their excess weight for a NTD, would be more likely to believe the standard over the counter preparation would be adequate for their needs.
6.1.2 Stillbirth

Just over one quarter of participants (26%) identified an increased risk of stillbirth (95% CI 22, 30) (FIGURE 2A). Any level of agreement of increased risk was considered correct according to expert opinion. Of concern, 72% of participant responses were discrepant to expert opinion: 18% disagreed that there is any increased risk (8.5% ‘strongly’ disagreed), 24% stated there is no difference in risk, and 30% of participants indicated that they did not know if there was any increased risk. It is clear from these findings that our study population was unaware of the increased risk for stillbirth due to excess weight. In comparison, the risk of stillbirth according to expert opinion was identified by 26% of participants (95% CI 22, 30; n=107) for excess weight and 50.4% (n=207) for smoking (FIGURE 2B).

Komijiiarek et al. [67] the only other study to consider knowledge of the risk for stillbirth, reported 50% of non-obese respondents and 40% of obese respondents were aware of the association between obesity and having a stillborn child. The prevalence of stillbirth in the literature is reported as 0.5 - 0.6% in normal weight women and 0.6 - 1.9% in overweight / obese women (TABLE 2). A large cohort study of 24,505 pregnancies in Denmark found pre-pregnancy obesity was associated with an almost tripled risk of stillbirth (OR=2.9, 95% CI: 1.5 - 5.3), and that this risk existed after adjustment for factors including maternal smoking, alcohol intake, maternal age and parity [74]. This association remained after exclusion of women with diabetes mellitus or hypertensive disorders of pregnancy [74]. No single cause of death explained the higher risk of stillbirth among the obese women [74]. Risk of stillbirth rises with increasing obesity in a ‘dose-dependent’ fashion [97]. The findings of a large Swedish study examining inter-pregnancy weight changes and adverse pregnancy outcomes reported the adjusted odds of stillbirth were 63% greater in women with weight gains of ≥3 BMI units between pregnancies than in those whose weight changed by less than one BMI unit (p=0.002) [98]. The association was linear, with risk of stillbirth increasing significantly as category of weight gain increased (p=0.03). Again, the association remained even after adjustments for maternal diabetes or hypertension during the second pregnancy were made [98]. It is conceivable therefore that weight loss prior to pregnancy may decrease the risk for stillbirth, particularly in obese women. Our finding is concerning as knowledge of the considerable increased risk for stillbirth and the potential effect of weight loss pre-conceptually on risk reduction may be a motivating factor for weight loss prior to conception.
6.1.3 Macrosomia

Nearly half (48.2%) of participants agreed there is some increase in risk of macrosomia associated with excess weight in pregnancy (FIGURE 4A). Expert opinion considered the correct response to be ‘strongly agree’, and thus only 10.2% (95% CI 7.6, 13.4) of participants were correct according to expert opinion. While it was positive to note that 48.2% of participants identified there is some degree of increased risk, a greater percentage of participants (49.2%) were incorrect, either disagreeing there is any increased risk (12.4%), choosing the option ‘no difference’ (17.3%), or the option ‘I don’t know’ (19.5%). In comparison, the risk of macrosomia according to expert opinion was identified by 10.2% (95% CI 7.6, 13.4; n= 42) of participants for excess weight and 34.1% (n=140) of participants for smoking (FIGURE 4B).

Only one other study has considered knowledge of the risks of macrosomia. Gaudet et al. [65] stated ‘most women were unable to identify obesity-related complications for themselves or their baby, including... macrosomia’ [65]. Prevalence of macrosomia in the literature is reported as 6.5 – 9% in normal weight women and 12.3 - 13.4% in overweight / obese women. While 48.2% of participants were aware of the increased risk for macrosomia, a large number of participants underestimated magnitude of increased risk compared to expert opinion (38%), and an even greater percentage of participants were incorrect (30%). This finding is of concern since risk for macrosomia is strongly associated with overweight and obesity in pregnancy (TABLE 2). There is evidence that limited gestational weight gain in pregnancy is associated with a reduced risk of macrosomia [99]. Knowledge of the risk for macrosomia and its attendant complications may be a motivating factor for appropriate weight gain in pregnancy.

6.1.4 Shoulder dystocia

The expert panel suggested that any agreement of increased risk for shoulder dystocia was correct. Consequently, 26.5% (95% CI 22, 31) of participants were considered to correctly identify risk for shoulder dystocia (FIGURE 10A). Only one other study has considered knowledge of the risk of shoulder dystocia. Gaudet et al. [65] reported ‘most women were unable to identify obesity-related complications for themselves or their baby, including... shoulder dystocia’ [65]. The prevalence of shoulder dystocia in the literature is reported as 0.1% for normal weight women and 0.4% for overweight / obese women (TABLE 2).
Findings suggest that women are unaware of the risk for shoulder dystocia associated with excess weight. Other pre-labour factors associated with shoulder dystocia include maternal diabetes mellitus and macrosomia >4.5kg [100], both of which occur more commonly in overweight and obese women further compounding risk. Knowledge of the risk of shoulder dystocia may be a motivating factor for appropriate weight gain in pregnancy. In comparison, the risk of shoulder dystocia according to expert opinion was identified by 26.5% (95% CI 22.4, 31; n= 109) of participants for excess weight and 41.6% (n=171) of participants for smoking (FIGURE 10B).

6.1.5 Caesarean section delivery

Over half (52.6%) of participants identified an increased risk of requiring a caesarean section delivery with excess weight in pregnancy (FIGURE 7A). Expert opinion considered the responses ‘strongly agree’ and the agreement between strongly agree and agree (i.e. two responses overall) to be correct. Therefore, 32.4% (95% CI 28, 37.1) of women were considered to correctly identify risk according to expert opinion. In comparison, the risk of caesarean section delivery according to expert opinion was identified by 32.4% (95% CI 28, 37.1; n= 133) of participants for excess weight and 50.3% (n=207) of participants for smoking (FIGURE 7B).

Risk for caesarean section delivery is reported as 1.7 - 2.9 times higher in overweight / obese women compared with normal weight women (TABLE 2). Huning et al. report that less than 5% of their study respondents were aware of the risk of caesarean section associated with obesity [72]. Similarly, Gaudet et al. reported ‘most women were unable to identify obesity-related complications for themselves or their baby, including... caesarean section’ [65]. Nitert et al. reported 53.6% of participants with a BMI <25 and 50.7% of participants with a BMI ≥25 were aware of risk for caesarean section delivery in a ‘very obese’ woman [70]. Kominiarek et al. reported 46% of non-obese and 55% of obese participants correctly identified risk for caesarean section delivery [67].

There is evidence that limited gestational weight gain in overweight and obese women is associated with a reduced risk for caesarean section delivery [44, 101]. Limited gestational weight gain also reduces risk for macrosomia, a strong predictor of caesarean section delivery in overweight and obese women [102]. It is clear that women are largely unaware of the degree
of increased risk for caesarean section delivery. This is a concerning finding as knowledge of the risk of caesarean section delivery may be a motivating factor for appropriate weight gain in pregnancy.

### 6.1.6 Normal and uncomplicated vaginal delivery

Nearly half (45%) of participants disagreed that excess weight increases the chance of having a normal and uncomplicated vaginal delivery (95% CI 22, 30.4). Expert opinion was that any disagreement was correct (FIGURE 5A). Over one fifth of participants (21.1%) agreed that excess weight in pregnancy increases the chance of having a normal and uncomplicated vaginal delivery. In comparison, the chance of normal and uncomplicated vaginal delivery according to expert opinion was identified by 26.0% (95% CI 22, 30.4; n= 107) of participants for excess weight and 50.4% (n=207) of participants for smoking (FIGURE 5B).

There is no literature that describes knowledge of likelihood for vaginal delivery. In considering this, factors linked to overweight and obesity, such as risk for macrosomia [102], shoulder dystocia [100], diabetes [103], and GDM [103] need consideration as all may increase risk of a caesarean section delivery. As women may prefer to deliver vaginally, they need to be aware that due to risk factors associated with their excess weight, a vaginal delivery may be less attainable.

### 6.1.7 Gestational diabetes

Nearly 80% of participants identified there is an increased risk for gestational diabetes associated with excess weight (FIGURE 9A). Expert opinion was the response ‘strongly agree’ and 48.7% of participants correctly identified risk according to expert opinion (95% CI 43.9, 53.5). Huning et al. [73] reported 52.7% of women were aware of the risk association between obesity and gestational diabetes. In comparison, the risk of gestational diabetes according to expert opinion was identified by 40.8% (95% CI 39, 42.6) of participants for smoking (FIGURE 9B). Nitert et al. reported over 87.8% of respondents with a BMI <25 and 86.5% of respondents with a BMI >25 identified increased risk for gestational diabetes in a ‘very obese’ woman [71]. Komiarek et al. reported 68% of non-obese and 96% of obese participants correctly identified risk for diabetes (not gestational diabetes) [68]. Our findings support those
of others that GDM is one of the better recognised complications associated with excess weight.

In a population-based study of 151,025 women, Villamore et al. considered the association between change in pre-pregnancy BMI from the first to the second pregnancy and risk for GDM [98]. This study reported a weight change of more than three BMI units compared to a change of -1.0 and 0.9 units resulted in a more than two-fold increase in the risk for the development of GDM in the study participants' second pregnancy (adjusted odds ratio 2.09, 85% CI 1.68-2.61). Similarly, Glazer et al. [104] concluded that a weight gain as little as 4.5kg in obese women between pregnancies resulted in a 1.46-fold increase in the risk of GDM. Knowledge of the risk for GDM may be a motivating factor for weight loss prior to pregnancy.

6.1.8 High blood pressure

Over 75% of participants identified an increased risk of high blood pressure (including pre-eclampsia and toxemia) associated with excess weight (FIGURE 8A). Expert opinion was ‘strongly agree’, and as such 35.8% (95% CI 31.2, 40.5) of participants responded in accordance with expert opinion. In comparison, the risk of high blood pressure according to expert opinion was identified by 35.8% (95% CI 31.2, 40.5; n= 147) of participants for excess weight and 9.8% (n=40) of participants for smoking (FIGURE 8B). Huning et al. reported in their study that 25% of their study participants were aware of the association between obesity and pre-eclampsia [72]. Nitert et al. reported 88.2% of participants with a BMI <25 were aware of the risk of blood pressure problems as were 88.3% of participants with a BMI >25 in a ‘very obese’ woman [70]. Gaudet et al. stated ‘most women were unable to identify obesity-related complications for themselves or their baby, including increased risks of pre-eclampsia’ [65]. Kominarek et al. reported 80% of non-obese and 83% of obese respondents correctly identified risk for high blood pressure [67]. Our finding suggests that, while a large percentage of our population was aware of the increased risk for high blood pressure, many underestimated the magnitude of risk. There is evidence that limited gestational weight gain in overweight and obese women is associated with a reduction in risk for pre-eclampsia [26, 27]. Knowledge of the risk for high blood pressure and also knowledge of magnitude of increased risk may be powerful motivating factors for appropriate weight gain in pregnancy.
6.1.9 Small for gestational age infant

In total, 36% of participants disagreed that there is any increased risk for a small for gestational age infant for a women with excess weight (FIGURE 3A). Expert opinion was considered to be disagreement by one point to the left of ‘no difference’ and thus 14.4% of participants were considered correct according to expert opinion. In comparison, the risk of small for gestational age infant according to expert opinion was identified by 14.4% (95% CI 11.2, 18.0; n= 59) of participants for excess weight and 73.9% (n=304) of participants for smoking (FIGURE 3B).

There are no studies that have considered knowledge of the risk of small for gestational age infant for women who have excess weight in pregnancy. The reported prevalence for SGA in normal weight women is 5.45% and in overweight / obese women it is reported as 4.58%. The odds ratio is 0.8 (TABLE 2). Therefore the literature indicates there is a decreased risk for SGA. Of note, nearly half (49.2%) of participants responded ‘no difference’ (25.1%) or ‘I don’t know’ (24.1%) for this question. Because of difficulties in clinically assessing the size of the baby (fundal height) and also increased likelihood for poor scan quality, there is potential for under recognition of SGA in obese women. In addition there is anecdotal evidence that customised GROW charts (available at: https://www.gestation.net/fetal_growth/download_grow.htm) are not being used.

6.1.10 Knowledge of obesity and excess weight in comparison to smoking

Smoking was used as a comparator to excess weight as we were interested to compare knowledge of excess weight to knowledge of a well publicised negative health behavior in pregnancy. Education strategies to convey the negative impact of smoking in pregnancy, and to promote the benefits of smoking cessation prior to pregnancy, or during pregnancy, have been available in New Zealand for approximately the last 20 years [105]. During this time a number of intervention strategies promoting the benefits of smoking cessation and the negative health outcomes associated with smoking in the general population have also been available [105]. To our knowledge, there are no other published papers that compare women’s knowledge of the risks of smoking in pregnancy with their knowledge of the risks of overweight and / or obesity in pregnancy.

Participants were more aware of the risks of smoking in pregnancy than they were of the risks of excess weight. A higher percentage of participants correctly identified the risk for smoking
in pregnancy in accordance with expert opinion for all events of pregnancy for which knowledge was assessed, except for gestational diabetes and high blood pressure. Participants were more likely to respond ‘I don’t know’ for excess weight than they were for smoking for all pregnancy events, apart from high blood pressure and gestational diabetes. Participants were also more likely to rate smoking as a more significant risk factor for all events of pregnancy for which knowledge was assessed, apart from that of gestational diabetes and macrosomia.

These findings, related to knowledge of the risks of smoking in pregnancy are similar to those of Gilligan et al. [106]. In an interviewer-administered questionnaire of 145 pregnant Aboriginal and Torres Strait women in Australia, Gilligan et al. reported that knowledge of the ‘harm’s’ of smoking was generally high [106]. Knowledge of the risk for caesarean section delivery was similar to our study; 46% (n=27) of smokers and 47% of non-smokers correctly identified risk, compared with 50.3% (n=207) of all participants in our study. Compared to the present study, Gilligan et al. reported higher levels of knowledge for low birth weight infants (smokers 92% (n=54), non-smokers 92% (n=78)), maternal diabetes (smokers 68% (n=40), non-smokers 52% (n=44)), and high blood pressure / high heart rate (smokers 90% (n=53), non-smokers 86% (n=73)). Other studies to make comment on women’s knowledge have reported varied degrees of overall awareness. Walsh et al. in a study of 2,577 pregnant Australian women noted ‘most (61%) women said they believed smoking was definitely harmful to the unborn child’ but that ‘awareness and acceptance of specific risks were inadequate’ [107]. Similarly, Glover [108] in a study to consider the attitudes of Māori women who smoke found that while there was a varied degree of awareness about the risks among participants, there was little understanding of the risks.

A lack of statistical data makes it difficult to comment on whether there has been a decrease in smoking rates among pregnant women associated with interventions aimed at encouraging smoking cessation in pregnancy and prior to pregnancy via the educating of risks. A Christchurch study compared the prevalence of smoking in a cross-section of pregnant women from 1994 to 1997 via analysis of blood samples from 3,082 women [109].

This study noted a statistically significant reduction in smoking rates from 26.8% (95% CI 24.5-29.2%) to 25.0% (95% CI 22.3-27.8%) and then 23.0% (95% CI 20.8-25.2%) in the first, second and third trimesters of pregnancy, respectively [109]. This represents an absolute reduction in smoking rates of 4.7% (p = 0.02), 6.6% (p = 0.04) and 3.8% (p = 0.04). In the
period from 1999 – 2007 smoking rates among girls decreased from 32.4% to 14.9% [110]. Evidence of a reduction in the prevalence of smoking both during and outside pregnancy in the time in which education strategies have been available may suggest education has had an impact. It is therefore possible that we can educate women about the risks of excess weight in pregnancy, particularly if there is the benefit of additional motivation in pregnancy.

6.1.11 Knowledge of risks summary

Overall, there were less than 50% of participants who identified risk for each of the assessed pregnancy events with excess weight in line with expert opinion. These results were statistically significant for all events of pregnancy assessed, apart from gestational diabetes. Results suggest that while some participants were aware of risks of excess weight in pregnancy, the vast majority were not aware of the magnitude of risk, with the bulk of participants underestimating risk. Our study demonstrates notable and alarming deficiencies in participants’ knowledge regarding the impact of excess weight on both maternal and fetal health outcomes. This lack of knowledge may be remedied by education.
6.2 Knowledge of long-term risks of excess weight and smoking for mother and child

In assessment of women’s knowledge of the long-term risks for the child that are associated with maternal excess weight during pregnancy, women appear to have knowledge regarding diabetes (n=45), big baby/child (n=35) and obesity (n=21) (TABLE 34). Pregnant women stated that the long-term complications for the mother of maternal excess weight included diabetes (n=112), increased blood pressure (n=75), gestational diabetes (n=46), aches and pains (n=19) and heart disease (n=16) (TABLE 35). The most commonly indicated responses for smoking and long-term risk for the child (TABLE 36) included: small baby (n=111), asthma (n=51), premature (n=21), lung problems (n=21), development/learning difficulties (n=19), birth defects / deformities (n=19), overall poor health for life (n=18) and cot death/sudden infant death syndrome (n=16). For the mother (TABLE 37), common responses included: cardiovascular disease (n=57), respiratory problems (n=56), cancer (n=48), lung cancer (n=25), heart problems (n=21), and poor overall health (n=19). In general, women were less likely to be aware of long-term risks associated with excess weight than they were with smoking, in terms of both the health of mother and child. This may provide a good basis from which to educate further.
6.3 Knowledge of weight gain in pregnancy guidelines

Our results indicate women are unaware of how much weight it is appropriate to gain in pregnancy (TABLE 18). Over two thirds (69.4%) of respondents incorrectly identified appropriate weight gain in accordance with the 2009 Institute of Medicine guidelines for weight gain during pregnancy [11]. Of particular concern, overweight and obese participants were significantly (p<0.0001) more likely to overestimate appropriate weight gain when compared to normal weight participants (TABLE 20).

Three other studies have considered women’s knowledge of appropriate weight gain in pregnancy. Huning et al. reported that women who were overweight or obese were least accurate when estimating correct weight gain, such that 65% of obese women overestimated recommended gestational weight gain [72]. Thompson et al. noted that less than one third (29.5%) of their respondents were able to identify recommended weight gain in pregnancy [71]. Gaudet et al. reported overweight and obese participants were significantly more likely to overestimate appropriate minimum gestational weight gain (60% and 40%, respectively, P=0.02) [65]. Gaudet et al. also reported that appropriate maximum weight gain was overestimated by overweight and obese women (85% and 100%, respectively) [65]. It is evident that women are unaware of appropriate weight gain for pregnancy. It is also apparent that overweight and obese women are more likely to overestimate appropriate weight gain in pregnancy.

A study of 2,237 pregnant women in the United States showed targeted weight gain advice was strongly associated with actual weight gain in pregnancy [47], therefore it is important to educate women on appropriate weight gain. As described previously, weight gains within the IOM guidelines are associated with a reduction in risk for pre-eclampsia [13], caesarean section delivery [28, 29] and macrosomia [13]. Weight gains that exceed the IOM guidelines have been connected to complications including hypertension, diabetes mellitus, pre-eclampsia, caesarean section delivery, macrosomia and obesity in the offspring at three years’ [51]. Weight gains outside IOM recommendations are also associated with greater postpartum weight retention and increased risk for future overweight. The multiple risks that are associated with excess GWG may be compounded by risks that are associated with high pre-pregnancy BMI [51]. Therefore, weight gains within recommendations can positively influence not only obstetric outcomes in a current pregnancy, but also long term health for both mother and child.
6.4 Body size and perception of body size

This study’s findings reveal that 44% of pregnant women were either overweight (27%) or obese (17%) (TABLE 13), and that the vast majority (88.6%) of obese women were not aware that they were obese (32). Results also highlight that over one-third (38.7%) of the cohort had not yet been weighed in this pregnancy (TABLE 12), despite Section 88 requirements [111].

Our finding of inaccurate perception of body size is similar to four other studies that have reported on perception of body size in women in early pregnancy. Huning et al. reported that among their obese respondents, 74.6% underestimated BMI [72]. Similarly Thompson et al. reported 70% of their obese women underestimated their BMI [71]. Gaudet et al. reported that underestimation of BMI was significantly more common in overweight and obese women, such that 50% of overweight participants and 90% of obese participants underestimated their BMI [65]. Callaway et al. (2009) reported 35% of overweight participants and 84% of obese participants underestimated their BMI [112].

There are several concerning aspects of our findings. The inaccurate categorisation of BMI indicates that our participants may not appreciate how overweight or obese they are. Perception of true health risk related to body size is decreased in individuals who underestimate their weight [58]. This may lead to a reduction in desire to both seek knowledge related to, and to participate in, healthy behaviours that reduce health risk, such as physical activity [58]. This may also result in an inaccurate perception of the potential impact of weight on future pregnancies [39, 113, 114]. Furthermore, underestimation of body size may lead to excess gestational weight gain. Herring et al. in a study of 1537 women, found that overweight and obese women who underestimated their weight had a four-fold increase in the likelihood of excess gestational weight gain compared with overweight and obese women who correctly assessed their weight [115]. In the non-pregnant individual, education related to true weight status has been shown to be of benefit in increasing the likelihood of accurate perception of weight and in setting goals for healthy lifestyle change [58].

Our findings highlight that many women had not been weighed in this pregnancy at the time of questionnaire completion. This is a concerning finding as LMCs are required to weight all women at booking in accordance with guidelines outlined in the Maternity Services Notice, Section 88 of the Public Health and Disability Act 2000 [111]. While this study did not aim to assess who had weighed participants (medical clinician, LMC, General Practitioner, midwife
etc.) this is a worrying finding as it highlights a large percentage of women are not being weighed. Participants were attending their nuchal translucency scan and therefore should also have an MSS-1 test at the same time. Accurate weight is a pre-requisite for calculation of the correct risk category for MSS-1 screening. If this pivotal information is incorrect, there is a real possibility that the women’s risk of the conditions screened for could be falsely high or low.

Our findings suggest women are not being weighed nor are they having their height measured and their BMI accurately calculated. They also appear largely uninformed of the risk of adverse pregnancy outcomes associated with their excess weight.
6.5 Education

Given that a healthy baby is a highly valued outcome of pregnancy for most women [70, 116], increasing women’s knowledge of the risks of excess weight in pregnancy may be a powerful motivating factor for both weight loss prior to pregnancy and also appropriate weight gain in pregnancy [51]. “A meta-analysis of Leventhal’s common-sense models as a theoretical basis for intervention programs identified moderate to strong relationships between knowledge of disease, coping behaviours and outcomes” [70, 117]. Educating women about the risks associated with overweight and obesity may therefore help to improve pregnancy outcomes in individuals with excess weight. A recent meta-analysis of antenatal interventions suggest that the diet approach may be the most effective approach to limiting gestational weight gain [43].

Participants were more aware of the risks of smoking in pregnancy than they were of excess weight. This finding may suggest education efforts promoting smoking cessation prior to pregnancy and educating on the risks of smoking on pregnancy outcomes are showing some success. Due to the increasing proportion of women who are overweight and obese in the pregnancy, the cost of obesity related complications are likely to increase [118, 119] therefore we need to look to public health education strategies, and increasing women’s knowledge of the risks of overweight and obesity in pregnancy may be a successful first step.
CHAPTER SEVEN

Strengths and Limitations

This study provides information on risk perception related to excess weight in pregnancy with regards to both maternal and fetal complications. We also provide information on knowledge of appropriate weight gain guidelines and provide insight into perceptions of body size in a large cohort of pregnant women. Given the scarcity of previous information in this area, results may help to inform better interventions for pregnant women who are overweight or obese.

Compared to the general population of New Zealand, our study population had a lower BMI: 1.5% were underweight, 48.7% were of normal weight, 27.3% were overweight and 17% were obese (TABLE 13). In comparison, data from the 2008/09 New Zealand Health Survey reported 1.5% of women aged 15 years or older were underweight, 37.9% were normal weight, 32.8% were overweight and 27.8% were obese [7]. Possible explanations for this include: a higher level of interest or willingness to participate in research on the part of women who have a lower BMI, women with a higher BMI may not attend for screening, our population was largely New Zealand European who were of a lower BMI than our Maori and Pacific Island participants (TABLE 17), and reluctance of women with a higher BMI to participate due to the request that they be weighed.

Our study population had a higher education status than that for the general population (TABLE 9). In total 53% of participants reported a university qualification as their highest level of education. The 2006 Census reported 10.5% of residents in Christchurch had a bachelor’s degree and 4.7% had a higher university qualification (Masters Degree, PhD) [120]. This has been previously reported in self-selected surveys and could overestimate the knowledge level of the average woman [65]. Possible explanations for this higher education level in our participants may include the timing of the survey. As this was performed at the time of the first trimester screening scan, it may reflect a greater knowledge and education amongst these women with regards to the importance of screening for Down’s Syndrome and other conditions.
This study observed a low rate of Māori recruitment (TABLE 10). Overall 4.4% of our population identified as Māori. A clinical audit conducted at Christchurch Women’s Hospital in 2010 reported a rate of 7% Māori [121]. Based on 2006 Census data, 8% of the Canterbury population identified as Māori, compared with 15% Māori for the total New Zealand population. This cohort of women were examined by birth data as ethnicity is recorded for both mother and child. Further audit of data held at Christchurch Women’s hospital established that <50% of Māori women who birthed in Canterbury had had a nuchal translucency scan [122]. As such, it is likely our study observed a good uptake of Māori women based on the population who undergo a nuchal translucency scan in Canterbury. However, based on population data, our recruitment is likely to be non-representative. The low Māori recruitment rate could be partly attributable to the recent earthquakes in Christchurch. Post earthquake enrolments at primary schools show the net migration loss from Greater Christchurch for Māori children is at a rate 3-5 times that of Pakeha children in the year to June 2011 [123].

This study relied on the judgments of three consultant obstetricians to decide upon the answers which would be considered ‘correct’ for each of the events of pregnancy assessed. These correct answers were largely based upon clinical experience and knowledge of the literature and were dependent on the knowledge base of the consultants. As all of the consultants are involved in obesity research it was anticipated they would have a reasonable knowledge, and prior to convening they were provided with relevant references for review.

Use of a convenience sample, as was employed by this study, may result in selection bias.

A strength of this study is that the vast majority of women were weighed and measured and thus this study does not rely on self-reported data which is more likely to be systematically underreported [65].

The study employed the use of a ‘false’ question in order to test the degree of satisficing (a decision making strategy whereby respondents answer questions based in a pattern rather than on identifying an optimal solution [65]). Results are presented in FIGURE 11A and FIGURE 11B. The majority of participants responded ‘no difference’ or ‘strongly disagree’ to this question. It appears that women may have misinterpreted this question, by having a strong initial reaction to the statement ‘having a baby with green eyes’ knowing that excess weight has no bearing on eye colour and therefore a proportion of women answered this as ‘strongly
disagree’, instead of the expected response of ‘no difference’. Although it would appear from our results that women did not misinterpret our other questions. Therefore our question did not work as a satisficing question in the way we would have expected it to.

This study observed an overall recruitment rate of 63.6%. There is a general consensus that a response rate of 70% and above is necessary to ensure that the obtained sample of participants is sufficiently representative of the target population from which its members are drawn [123]. This assumes that non-participants are unlikely to have markedly different views than those successfully recruited into the sample [124]. Despite the fact that our response rate fell slightly short of the desired target of 70%, and therefore we cannot generalise that non-responders would have similar views as our study, participants were of higher educational status and were slimmer than the general population. It is therefore more alarming that our respondents were still highly deficient in knowledge. It therefore seems reasonable to extrapolate that the general population know even less on this topic.

Women were weighed in early pregnancy, not pre-pregnancy. This could have had an impact on perceptions of weight. Thompson et al. reported that the pre-pregnancy BMI category of women in their study of women at <23 weeks gestation was strongly associated with their BMI category at the time of recruitment (P < 0.01) [71]. It is doubtful therefore that this would have had too great of an impact on results.
CHAPTER EIGHT

Recommendations for future research

Due to the low recruitment of Māori and Pacific Island individuals in this study, it would be beneficial to repeat this study in a population where a higher recruitment rate of individuals from these ethnic groups could be expected. If repeated, the questionnaire may require modifications, including changes relating to the wording of some questions. It may also be beneficial to increase the number of questions asked that relate to perceptions of body size and to also include questions related to women’s feelings about whether it is important to them to gain weight within recommendations and also who they would be likely to happily receive this advice from. The use of an interviewer or a support person to assist in explaining the questionnaire should also be considered.

It would be interesting to repeat this study in a population of midwives, lead maternity carers and doctors to establish their perceptions of risk and knowledge of weight gain guidelines. As midwives and LMCs have the closest and most ongoing contact with women in pregnancy they are a valuable tool for education.

More education is required for LMCs regarding the importance of weighing women in early pregnancy.

It would be beneficial to conduct research to consider the methods of communication of information that would be acceptable, for example print media vs. a television campaign.

As this study has concluded that women have limited knowledge of the risks of excess weight in pregnancy, it would be interesting to assess the impact of education on knowledge. As such, a randomised controlled trial with an intervention/education group vs. a placebo group could be conducted.
This study indicates a number of areas where knowledge is lacking, including the risks of excess weight in pregnancy and appropriate weight gain for pregnancy. This may be exacerbated by the fact a large number of women are not being weighed in early pregnancy and that many women are not aware of their true body size, with the vast majority of overweight and obese women underestimating their body size.

Pregnancy is an opportune time for women to be educated. Many women will see a health professional both frequently and regularly throughout their pregnancy, each meeting representing an opportunity for education and discussion, support and feedback. Given that the goal of a healthy baby is the case for most women, increasing their knowledge about the impact of overweight and obesity on not only the woman herself but on that of the unborn child may help to encourage women to actively attempt to control their weight during pregnancy. Even better, identifying overweight and obese women pre-pregnancy and educating them would possibly give more time to achieve a healthier weight.

Overweight mothers produce overweight babies who have overweight babies of their own and so, ad infinitum. We cannot afford the consequences of untreated excess weight in pregnancy. Our problem remains, however, as to how to achieve education and implement it in a timely fashion.

‘If it were done when ’tis done, then ’twere well
   it were done quickly’

Macbeth
Act 1, scene 7.
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APPENDIX

APPENDIX A: Literature review search strategy

Ovid Technologies, Inc. Email Service
-----------------------------------------

Search for: limit 11 to English language

Results: 106

Database: Ovid MEDLINE(R) 1948 to Present with Daily Update
Search Strategy:

--------------------------------------------------------------------------------
1 Obesity/ (102472)
2 obes*.tw. (125469)
3 1 or 2 (153968)
4 Pregnancy/ (635720)
5 pregnan*.tw. (311902)
6 4 or 5 (691416)
7 Health Knowledge, Attitudes, Practice/ (57030)
8 Attitude to Health/ (66208)
9 perception*.tw. (110527)
10 7 or 8 or 9 (214901)
11 3 and 6 and 10 (113)
12 limit 11 to english language (106)

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Anonymous.

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APPENDIX B: Pregnancy Health Survey

Pregnancy Health Survey
Thank you for participating in this survey. When answering the following questions please shade the box of your chosen answer or answers, as shown.

E.g.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>No difference</th>
<th>Strongly agree</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
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</table>

Initials

Date of Birth

How many children do you have?

How many weeks pregnant are you?

Have you smoked during this pregnancy?

Yes

No

Have you been weighed during this pregnancy?

Yes

No

How would you describe your highest level of education?

- Attended high school
- Completed NCEA level 3 / Bursary, or equivalent
- Trade Certificate or similar
- University or tertiary institute degree or higher

Which ethnic group do you belong to?
Mark the space or spaces which apply to you

- New Zealand European
- Maori
- Samoan
- Cook Island Maori
- Tongan
- Niuean
- Chinese
- Indian
- Other (such as Eutch, Japanese, Tokelauan)

Please state.

What do you consider to be a healthy weight gain for you in this pregnancy? Please choose ONE answer

- I should not gain any weight during my pregnancy
- 12.5 - 18kg (28 - 40lbs)
- 7 - 11.5kg (15 - 25lbs)
- It does not matter how much weight I gain
- 5 - 9kg (11 - 20lbs)
- 11.5 - 16kg (25 - 35lbs)

Please indicate how much you agree or disagree with the following statements. Please choose ONE answer for each statement

<table>
<thead>
<tr>
<th>Smoking during pregnancy increases the chance of:</th>
<th>Strongly disagree</th>
<th>No difference</th>
<th>Strongly agree</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>A baby dying before delivery (stillbirth)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giving birth to a small baby (weighing less than 2.5kg/5.5lbs)</td>
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</tr>
<tr>
<td>Giving birth to a big baby (weighing more than 4kg/8.8lbs)</td>
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</tr>
<tr>
<td>Having a baby with green eyes</td>
<td></td>
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<tr>
<td>Having a normal, uncomplicated vaginal delivery</td>
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<td></td>
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<tr>
<td>Having a baby with a structural abnormality (e.g. spina bifida, neural tube defects)</td>
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<tr>
<td>Needing a caesarean section (when you don't deliver vaginally)</td>
<td></td>
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<tr>
<td>Having high blood pressure (pre-eclampsia / toxemia)</td>
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<tr>
<td>Developing diabetes in pregnancy (gestational diabetes)</td>
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<tr>
<td>Having problems with the baby's shoulders getting “stuck” during a vaginal delivery (shoulder dystocia)</td>
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</tbody>
</table>
The following questions ask if you think excess maternal weight during pregnancy affects the chances of developing different conditions in pregnancy. Excess weight is defined as being overweight or obese (i.e. a BMI >25). Excess weight can also be thought of as ‘weighing more than is healthy’.

<table>
<thead>
<tr>
<th>Excess weight in pregnancy increases the chance of:</th>
<th>Strongly disagree</th>
<th>No difference</th>
<th>Strongly agree</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>A baby dying before delivery (stillbirth)</td>
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<tr>
<td>Giving birth to a small baby (weighing less than 2.5kg/5.5lbs)</td>
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<tr>
<td>Giving birth to a big baby (weighing more than 4kg/8.8lbs)</td>
<td>○</td>
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<tr>
<td>Having a baby with green eyes</td>
<td>○</td>
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<tr>
<td>Having a normal, uncomplicated vaginal delivery</td>
<td>○</td>
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<tr>
<td>Having a baby with a structural abnormality (e.g. spina bifida, neural tube defect)</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Needing a caesarean section (when you don’t deliver vaginally)</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Having high blood pressure (pre-eclampsia / toxemia)</td>
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<tr>
<td>Developing diabetes in pregnancy (gestational diabetes)</td>
<td>○</td>
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</tr>
<tr>
<td>Having problems with the baby’s shoulders getting &quot;stuck&quot; during a vaginal delivery (shoulder dystocia)</td>
<td>○</td>
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</tbody>
</table>

What weight do you consider yourself? Please choose ONE answer.

- ○ Underweight
- ○ Normal weight
- ○ Overweight
- ○ Obese

Please list the long-term health problems you know of that are associated with smoking or excess weight in pregnancy. Please include complications for mother and child.

Smoking during pregnancy

Mother: [ ]

Child: [ ]  Or I don’t know ○

Excess weight during pregnancy

Mother: [ ]

Child: [ ]  Or I don’t know ○

Please contact a member of our research team if you wish to discuss anything related to this study:

Emma Jeffs - emma.jeffs@otago.ac.nz / (03) 364 4601
Dr Helen Paterson - helen.paterson@otago.ac.nz
Dr Ben Sharp - Christchurch Women’s Hospital
Dr Jo Gullam - Christchurch Women’s Hospital

To be completed by recruitment centre staff: ○ CGM ○ Reflect ○ CW1

<table>
<thead>
<tr>
<th>Measured</th>
<th>MSS1</th>
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<tbody>
<tr>
<td>Weight (kg)</td>
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<tr>
<td>Height (m)</td>
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<tr>
<td>Weight (kg)</td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
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</tbody>
</table>
Pregnancy Health Survey

Information

Aim
You are invited to take part in a study that aims to investigate the perceptions pregnant women have about health in pregnancy.

What is involved?
To participate in this study we ask that you fill out a short survey and have your height and weight measured.

Privacy
We would like to reassure you that we take your privacy seriously. Information gathered by this survey will not be released, passed onto a third party or made public for any reason. No information that could identify you personally will be used in any reports on this study. You are free to withdraw from this study at any time and can choose not to answer any question in the survey.

Compensation
In the unlikely event of a physical injury as a result of your participation in this study you may be entitled to ACC cover under the Injury Prevention, Rehabilitation and Compensation Act. This isn’t automatic and ACC makes the final decision. There is no longer any lump sum compensation. If you have any questions about ACC, you should contact your nearest branch office for further information. These are listed in the blue section at the front of the phone book, or you could phone one of our researchers.

Statement of Approval
This study has received ethical approval from the Upper South Island B Regional Ethics Committee; ethics reference number URB/11/EXP/032.

If you are happy to participate in this study, please read and sign below

Consent

Please read and tick the appropriate box

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have read and I understand the information for participants taking part in this pregnancy health survey</td>
<td></td>
</tr>
<tr>
<td>I have had the opportunity to use whānau support or a friend to help me ask questions and understand the study</td>
<td></td>
</tr>
<tr>
<td>I have had the chance to ask questions, am satisfied with the answers that I have been given and I have had time to consider whether to take part in this study</td>
<td></td>
</tr>
<tr>
<td>I understand that taking part in this study is voluntary (my choice), that I may withdraw from the study at any time and that this will in no way affect my future health care</td>
<td></td>
</tr>
<tr>
<td>I know whom to contact if I have any questions about the study</td>
<td></td>
</tr>
<tr>
<td>I understand that taking part in this study is confidential and no material that could identify me will be used in any reports on this study</td>
<td></td>
</tr>
<tr>
<td>I consent to having my height and weight measured</td>
<td></td>
</tr>
</tbody>
</table>

I __________________________ hereby give consent to take part in this pregnancy health survey.

(Full name)

_________________________ __________________________
Signature Date
APPENDIX D: Information for participants – Ministry of Health, Eating for Healthy Pregnant Women.
Smokechange is free step by step support to change smoking in pregnancy

Smokechange is your programme
It offers you the chance to think about your smoking. Your support person will match their support with your readiness.
Smokechange is for pregnant women and their partners, and we can work with you to support your family or whānau to become smokefree too.

What you can expect
The programme is personalised to meet your needs.
We provide home visits and phone calls, as well as quit cards for subsidised nicotine replacement options (patches, gum and lozenges).

What we can expect of you
We expect you to try and keep appointments and to let us know if plans change. We expect you to tell us if there are any problems. Thank you.

To contact us, please phone
03 379 9947

Smokechange is free step by step support to change smoking in pregnancy

What others say about Smokechange
“I thought that fathers smoking didn’t matter too much, but when I saw the statistics on cot death (SIDS) it really shocked me. We went for totally smokefree around here. When I look at our little fella, I feel like I’ve done something really important, you know, we both have." Jease

“What I like about the programme is that even the small changes are seen as important. They get noticed." Vonnie

“My flatmates all smoked. Everyone I knew smoked and I was scared I’d feel left out if I quit. But I really wanted to do the best I could for this baby. And I don’t feel left out at all. I feel real proud.” Jono

Feedback about the service
To register satisfaction or a complaint about Smokechange, please contact us on:
smokechange
P O Box 13 864, Christchurch 8141
P (03) 379 9947 E info@smokechange.co.nz
W www.smokechange.co.nz

We are looking forward to working with you

A programme of Change for our Children
Funded by the Ministry of Health

**Project:** Women’s knowledge and perceptions of the risks of excess weight in pregnancy  
**Researchers:** Dr Helen Paterson, Emma Jeffs, Dr Joanna Gullam, Dr Benjamin Sharp  
**Department:** Obstetrics and Gynaecology, Christchurch Women’s Hospital  
**Biostatistician:** Elisabeth Wells

This project involves accessing pregnant women through the six radiology clinics in Christchurch when they turn up for their first scan.

The questionnaire covers pregnancy consequences of smoking and pregnancy consequences of obesity.

Smokers will be compared to non-smokers for knowledge of the consequences of smoking. However it is expected that there is widespread knowledge of these consequences so that there will be little difference between these two groups and so what is of value is to look at the precision of estimates within each group.

Similarly, it is of interest to know the precision of estimates for the consequences of obesity in the obese and the non-obese. It is expected that the obese may report less awareness than the non-obese.

The third comparison is between knowledge of smoking risks and knowledge of obesity risks.

There is no literature to guide the expected size of effects so instead we have postulated a feasible size of 400 and looked at what could be detected with that sample size with $\alpha=.05$ and power of 80%. Although women will be presented with a 7 point scale, for purposes of seeing what could be detected, it has been assumed that responses have been dichotomized. If the distributions across the scales are appropriate so that t-tests can be used, then there will be more power to detect differences.

Emma will carry out a one week pilot study and see what the response rate is with consent and administration carried out by the clinic staff. If it is unacceptably low (less than 60%) then she will take over these roles of consent and administration.

About 20% of pregnant women are obese (80/400) and the number of smokers is thought to be similar. If 50% of non-obese (or non-smokers) are aware of a risk then the detectable alternative is 33% or 67%. The precision around an observed percentage of 50% in a group of 80 is 39% to 61%. The precision in a group 400 is 45% to 56%.

The comparison of knowledge of smoking risk and obesity risk will be a paired comparison. On the assumption of a phi correlation of 0.1 between knowledge of these two risks, the detectable alternatives are 41% or 59% versus 50% (i.e. +/- 9%). The higher the correlation, the smaller the detectable difference. For example, if phi=0.3 then differences of +/- 7% are detectable.

Emma Jeffs
APPENDIX G: 2008/09 Adult Nutrition Survey instructions for anthropometric measurement

7.4 Anthropometric measurements
Measurements were made on consenting participants, except pregnant women and participants who were unable to stand. Participants were asked to remove heavy outer clothing and shoes before measurements were taken. The first measurements were taken in the following order: height, weight and waist. A second measure of height, weight and waist was then made. If the first two measurements differed by more than 1%, the interviewer was prompted to take a third measurement.

Height
Height was measured using a portable stadiometer (Seca 214). The participant was asked to stand on the centre of the base with their back to the stadiometer, their feet together and heels touching the bottom of the stadiometer upright. The buttocks and upper part of the back should touch the stadiometer upright. The head does not have to touch the stadiometer.

The respondent’s head should be in the Frankfort plane. This is achieved when the lower edge of the eye socket (the orbitale) is horizontal with the tragion. The vertex will be the highest point on their head. If a participant’s head was not aligned properly, they were asked to raise or lower their chin until it was in the Frankfort Plane. The headboard was lowered until it was in contact with the head (the hair is compressed if needed). The reading was taken to the nearest 0.1 cm.

Weight
Weight was measured using electronic weighting scales (Tanita HD-351), with a maximum weight of 200 kg. The participant was asked to stand on the centre of the scales without support, their arms loosely by their sides, head facing forwards and with their weight distributed evenly on both feet. The reading was taken to the nearest 0.1 kg.
APPENDIX H: Summary of feedback meeting with Julie Beaumont, Charge Sonographer, Christchurch Radiology Group, post questionnaire pilot

At the end of the one-week pilot a meeting was held with Julie Beaumont to discuss feedback received from staff and participants during the pilot. Questions were also posed to ascertain if the equipment and processes for the questionnaire were acceptable to, and appropriate for, the recruitment centres. Below is a summary of the questions and the responses given.

GENERAL

Question: How long, on average, is the questionnaire taking to complete?
Around five to ten minutes. No one has taken more than 15 minutes to complete the questionnaire. Average seven minutes.

Question: Is this time frame acceptable to you and your staff?
Yes it is. When you first approached us I was expecting a much longer survey.

Question: When is the survey typically being completed?
We are mainly catching women in the time period between having their scan and waiting for the scan results. A few women have completed the survey prior to the scan, but they are the minority. My staff have said they are finding the survey to be a good time killer while the scan results are being organised.

Question: Who is asking potential participants if they would like to participate?
Mainly our sonographers. This is because they typically have a lot more time with the women and build a better rapport. My sonographers are very interested in this study so have really been selling it to our clients. I am finding our reception staff are generally too busy to ask. This is because at St Georges we are doing all types of scanning and x-rays as so are very busy out the front.

Question: Are there people helping the women out to complete their survey, like a family member?
The majority of our women do come with someone else, a partner, or often a mother. However I don’t think there is much communicating going on as the women are usually in a
waiting room between their scan and results and as this is typically a pretty quiet place, I don’t think much discussion goes on.

**LAYOUT**

**Question:** Have you had any comments about the layout from participants or your staff?
Not really. Staff are pleased it is only two pages. I think it looks very professional. I like that it has the University of Otago logo, it helps to formalise it a bit.

**Question:** Have there been any comments about anything being confusing, or difficult to read?
No. I think the definition of BMI and obesity that you have used is very clever. I don’t think many questions have been getting missed either.

**Question:** Are participants seeing both pages?
Yes

**Question:** Any other comments re: layout?
No. I like it.

**COMPLICATIONS FOR WHICH KNOWLEDGE IS BEING ASSESSED**

**Question:** Do you think we are covering all the main complications?
Yes. I’m interested in the question about shoulder dystocia. Ideally we would love you to ask women if they know that being overweight and obese can actually make it really hard for us to scan them, but it doesn’t really fit.

**Question:** Are there any complications that you would not include?
No

**Question:** Is there any other feedback regarding the complications questions?
No. I think you have done really well. I am wondering if you should put something about having a big baby at term? It’s just a woman may not realise that you mean a big baby
regardless of gestation (NB: following further consultation not further changes were made following this suggestion).

WEIGHING AND MEASURING

Question: How do you and your staff feel about weighing and measuring all women?
We are fine about it. I would maybe feel a bit awkward asking a “bigger lady” but at the end of the day the weight is actually a very useful number to have on record. It works well for us too.

Question: How are women typically reacting?
Some don’t blink an eyelid, others are a bit hesitant. All women hate being weighed.

Question: Are many refusing to be weighed?
Not many, maybe… five that I have seen.

Question: Can you describe the types of women who are refusing to be weighed?
I would say you would consider them all to be a bit on the bigger side.

Question: Is everyone happy to have their height measured?
Yes, no issues there.

Question: Are you satisfied with the equipment we have provided and the training we have provided?
Yes the stadiometers are great. Really useful too. It is good they are just small as it means we don’t have to worry too much about finding a place to put them as they fit anywhere. The scales are good too. All my staff are ok with the correct way to weight and measure the height of women.

Question: Are the clipboards and pens we provided you with ok? Have we given you enough?
Yes the clipboards are good (also asked if they can keep them at the end of the study). Maybe could we have some spare pens as they go missing easily, or we could maybe use some string to attach the pens to the clipboards?
OTHER

Question: Do you have any other feedback to give?
We think the survey looks good. I am just interested in whether Christchurch Radiology Group will be mentioned with regards to the assistance they have provided (told they will receive an acknowledgement in the thesis and also in any presentation I give).

Can we staple the survey to the consent form? (told that they can’t as this could mean we could figure out who had filled out each survey and this is not acceptable due to our ethical approval).
### APPENDIX I: Standard Operating procedure for data cleaning

<table>
<thead>
<tr>
<th>Survey code</th>
<th>Requiring consideration</th>
<th>Process</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 PHS_Initials</td>
<td>No initials recorded</td>
<td>Survey included. Initials recorded as a full stop (&quot;.&quot;)</td>
<td>19</td>
</tr>
<tr>
<td>2 PHS_DOB</td>
<td>No DOB recorded</td>
<td>Survey excluded</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Data checked for congruity within rational limits</td>
<td>Age range considered acceptable: 15 - 55 years. Dates outside these parameters checked (&lt;1997 -&gt;1957)</td>
<td>2</td>
</tr>
<tr>
<td>3 PHS_Parity</td>
<td>No parity recorded</td>
<td>Survey included. Parity recorded as a full stop (&quot;.&quot;)</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Data checked for congruity within rational limits</td>
<td>If parity recorded as &gt;4 (5+) survey checked for data recording accuracy</td>
<td>1</td>
</tr>
<tr>
<td>4 PHS_Gestation</td>
<td>No gestation recorded</td>
<td>Survey excluded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data checked for congruity within rational limits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 PHS_APSmoking</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop (&quot;.&quot;)</td>
<td>3</td>
</tr>
<tr>
<td>6 PHS_APWeighed</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop (&quot;.&quot;)</td>
<td>7</td>
</tr>
<tr>
<td>7 PHS_Education</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop (&quot;.&quot;)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Multiple answers chosen</td>
<td>Highest education level recorded</td>
<td></td>
</tr>
<tr>
<td>8 PHS_Ethnicity</td>
<td>Multiple answers chosen</td>
<td>All answers recorded</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Ethnicity recorded as 'New Zealander'</td>
<td>Ethnicity recorded as 'New Zealand European' (E1)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>No ethnicity recorded</td>
<td>Ethnicity recorded as '99'. Survey included.</td>
<td>9</td>
</tr>
<tr>
<td>9 PHS_Weight gain</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop (&quot;.&quot;)</td>
<td>9</td>
</tr>
<tr>
<td>10 PHS_Smoking2A to PHS_Smoking2J</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop (&quot;.&quot;)</td>
<td>2A=1 2B=3 2C=5 2D=3 2E=1 2F=3 2G=2 2H=1 2I=4 2J=1</td>
</tr>
</tbody>
</table>
|   | PHS_Weight2A to PHS_Weight2J | No data recorded | Survey included. Answer recorded as a full stop ('.') | 2A=8  
2B=11  
2C=11  
2D=10  
2E=10  
2F=10  
2G=10  
2H=9  
2I=9  
2J=9 |
<table>
<thead>
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<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>PHS_BMI</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop ('.')</td>
<td>4</td>
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<tr>
<td>12</td>
<td>Smoking and weight: long-term</td>
<td>For thematic analysis</td>
<td>.</td>
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</tr>
<tr>
<td>13</td>
<td>PHS_MWeight</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop ('.')</td>
<td>23</td>
</tr>
<tr>
<td>14</td>
<td>Data checked for congruity within rational limits</td>
<td>Weight checked if &lt;50 kg or &gt;120kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>PHS_MSS1Weight_2</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop ('.')</td>
<td>155</td>
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<tr>
<td>16</td>
<td>PHS_MSS1Height_2</td>
<td>No data recorded</td>
<td>Survey included. Answer recorded as a full stop ('.')</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Summary**

<table>
<thead>
<tr>
<th></th>
<th>n=</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total surveys returned</td>
<td>420</td>
<td></td>
</tr>
<tr>
<td>Total surveys excluded</td>
<td>9</td>
<td>2.14</td>
</tr>
<tr>
<td>Total surveys included for data analysis</td>
<td>411</td>
<td>97.86</td>
</tr>
</tbody>
</table>
APPENDIX J: Letter of confirmation of ethics approval

29 August 2011

Dr Helen Paterson
University of Otago - Dunedin School Of Medicine
Department of Women's and Children's Health
Dunedin School of Medicine
P O Box 913
Dunedin

Attention: Emma Jeffs

Dear Dr Paterson

Ethics ref: URB/11/EXP/032 (please quote in all correspondence)
Study title: Women's knowledge and perceptions of the risks of excess weight in pregnancy
Principal Investigator: Dr Helen Paterson

Thank you for the above application. The Chairperson and Deputy Chairperson of the Upper South B Regional Ethics Committee have reviewed this application and have approved it under expedited review because this study meets the criteria for expedited review under the Ethical Guidelines for Observational Studies: Observational Research, Audits and Related Activities, NEAC, December 2006.

Approved Documents
- Study Protocol
- Information sheet and consent form (long and short versions) version 1 dated 10 August 2011
- Questionnaire version 1 dated 10 August 2011

Final Report
The study is approved until 1 July 2012. A final report is required at the end of the study and a report form to assist with this is available at http://www.newhealth.govt.nz/ethicscommittees. If the study will not be completed as advised, please forward a report form and an application for extension of ethical approval one month before the above date.
Amendments

It is also a condition of approval that the Committee is advised if the study does not commence, or is altered in any way, including all documentation eg advertisements, letters to prospective participants.

Please quote the above ethics committee reference number in all correspondence.

It should be noted that Ethics Committee approval does not imply any resource commitment or administrative facilitation by any healthcare provider within whose facility the research is to be carried out. The organisation may specify their own processes regarding notification or approval.

On behalf of the committee, I would like to take this opportunity to wish you all the best with your research.

Yours sincerely

Diana J. Whipp

Mrs Diana Whipp
Administrator Upper South B Regional Ethics Committee
Email: Diana_Whipp@moh.govt.nz
APPENDIX K: Letter of confirmation of Māori consultation

NGĀI TAHU RESEARCH CONSULTATION COMMITTEE
TE KOMITI RAKAHAU KI KĀI TAHU

04/10/2011 - 18
Tuesday, 04 October 2011

Dr Paterson
Women's and Children's Health
Dunedin

Tēnā koe Dr Paterson

Title: Women's knowledge and perceptions of the risks of excess weight in pregnancy.

The Ngāi Tahu Research Consultation Committee (The Committee) met on Tuesday, 04 October 2011 to discuss your research proposition.

By way of introduction, this response from the Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum, it states "Ngāi Tahu acknowledges that the consultation process outlined in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago". As such, this response is not "approval" or "mandate" for the research, rather it is a mandated response from a Ngāi Tahu appointed committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology; they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGeachan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon; adequately informing a party about relevant information upon which the proposal is based; listening to what the others have to say with an open mind (in that there is room to be persuaded against the proposal); undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee considers the research to be of importance to Māori health.

As this study involves human participants, the Committee strongly encourage that ethnicity data be collected as part of the research project. That is the questions on self-identified ethnicity and descent, these questions are contained in the 2006 census.

The Committee suggests including in the research team a researcher with expertise in analysing and interpreting data by ethnicity.

The Ministry of Health website http://www.Māorihealth.govt.nz/moh.nsf/indexma/publications contains a list of Māori health publications. The Committee recommends you review the Māori health publications on this website, eg. Unequal Impact II: Māori and Non-Māori Cancer

The Ngāi Tahu Research Consultation Committee has membership from:
Te Rūnanga o Ōākou Incorporated
Kāti Heiurapa Rūnuka ki Puāteokai
Te Rūnanga o Moeraki

140
NGĀI TAHU RESEARCH CONSULTATION COMMITTEE
Te Komiti Rakahau ki Kai Tahu


The Committee suggests dissemination of the research findings to Māori health organisations regarding this study.

We wish you every success in your research and the Committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 04 October 2011 to 04 April 2013.

The recommendations and suggestions above are provided on your proposal submitted through the consultation website process. These recommendations and suggestions do not necessarily relate to ethical issues with the research, including methodology. Other committees may also provide feedback in these areas.

Nāhaku noa, nā

Mark Brunton
Kaitakawaenga Rangahau Māori
Facilitator Research Māori
Research Division
Te Whare Wānanga o Otago
Ph: +64 3 479 8738
email: mark.brunton@otago.ac.nz
Web: www.otago.ac.nz

The Ngāi Tahu Research Consultation Committee has membership from:

Te Rūnanga o Ōtākou Incorporated
Kāti Huirapa Rūnanga ki Puketawhai
Te Rūnanga o Mōeraki