



'Maternal Obesity'

Research Investigation

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Executive Summary

This research has engaged with the proliferation of medical scientific and popular media interest in the emerging health issue termed 'maternal obesity'. The emergence of 'maternal obesity' as a significant health issue of concern is demonstrated by a large number of new medical scientific investigations along with the sensational and extensive coverage of these new research findings in the popular media. The coalescence of these forces has started to result in changes to maternity care and public health policy within Aotearoa New Zealand. These changes are orientated towards the classification and management of 'maternal obesity' as a high risk phenomenon requiring surveillance and intervention. Recognising this contested domain of 'obesity' knowledge, and biomedical conceptualisations of women's reproductive bodies more generally, this research has cast a critical lens over the biomedical and news media construction of 'maternal obesity'. It provides a platform for a critical discussion and debate about this contemporary framing of the issue and the resulting policy and practice changes.

The literature review has provided a 'stocktake' of the current status of medical and other health science knowledge about 'maternal obesity'. The review confirmed the proliferation of recent medical and other health science interest in 'maternal obesity' and the framing of 'maternal obesity' as a serious and growing health issue. Within medical science, 'excess' weight in pregnant women is being comprehensively pathologised and medicalised resulting in larger pregnant women being classified as a 'high risk' group that require medical management. Like biomedical knowledge about 'obesity' more generally, the tentative and partial nature of current biomedical knowledge about 'maternal obesity' was confirmed with very little evidence currently available able demonstrate a causal relationship between 'maternal obesity' and the adverse outcomes associated with it, including long term health implications for offspring. Medical science's current one-eyed focus on identifying pathophysiological explanations for adverse outcomes associated with 'maternal obesity' was identified. There is currently very little consideration of the social and structural factors that may influence outcomes for larger pregnant women and their offspring. The lack of evidence to support 'maternal obesity' interventions was also identified. The lack of evidence of causation as well as effectiveness of interventions lends limited support for 'maternal obesity' interventions at this time.

The media analysis has investigated how new medical scientific research about 'maternal obesity' is being reported in the news media. Of interest in the media analysis was the role, if any, of the news media in 'interrogating' the findings of new medical science about 'maternal obesity'. Consistent with critiques of the reporting of scientific findings more generally, 'maternal obesity' reporting was found to constitute an 'institutional advertisement' with limited use of opposing sources and a sensationalist focus on the risks posed by 'maternal obesity'. Of particular concern given the findings of the literature review was the projection of medical scientific knowledge about 'maternal obesity' as complete, factual and unquestionable. This functions to reinforce the authority and dominance of biomedical discourses about 'maternal obesity' and reduces the possibility for alternative accounts that question and challenge, or that attempt to provide a more complex or complete account of the relationship between body weight and reproductive health. News media reporting was also identified as playing role in

moralising and gendering ‘maternal obesity’ as an issue. There is a strong emphasis in the articles on body weight management in pregnancy as the responsibility of ‘good mothering’ and ‘responsible citizenship’ with the failure to prioritise weight management or weight loss a sign of moral failure, selfishness and/or ignorance, and ultimately with ‘bad mothering’.

The discussion provides an overview of the dominant construction of ‘maternal obesity’ formed at the intersection of medical science and news media constructions, and considers the ways in which this construction is shaping, maternity care practice. The discussion then explores some of the social and structural factors that may be influencing outcomes associated with ‘maternal obesity’ but that have been excluded from medical science and news media discourse, highlighting the limitations of biomedical knowledge. In concluding, an argument is presented about the dangers of adopting an exclusively biomedical conceptualisation of and response to ‘maternal obesity’ by health policy makers and maternity care providers are argued. The need for a much more critical and holistic engagement with larger women’s body weight in relation to reproduction is emphasised. The report concludes with recommendations.

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Literature Review

'Maternal Obesity' as a medical problem:

A review of medical and health research

Introduction

There has recently been an increasing interest in the scientific and medical literature, health policy and the popular media about 'maternal obesity'. This refers to those pregnant women whose pre-pregnancy body weight, or in some instances whose weight gain during pregnancy, results in them being considered above the 'currently accepted norms for female body size' (Carryer, 2001). It is being argued that the incidence of 'maternal obesity', reflecting established concern with obesity more generally, is increasing to 'epidemic' proportions, particularly in developed countries (Nagle et al., 2011, p. 1)). Medical and scientific sectors are also concerned about the 'harms' and 'costs' associated with 'maternal obesity' including its effect on perinatal outcomes, health care costs, and as the harbinger of future obesity and disease in offspring. This has recently led to 'maternal obesity' being articulated as a key public and women's health issue with significant implications for maternal, child and future adult health, and as 'the biggest challenge for maternity services today' (Heslehurst, Bell, & Rankin, 2011, p. 161). The news media are constructing the results of new studies about 'maternal obesity' sensationally. In response, maternity care practice is changing to include the introduction of routine Body Mass Index (BMI) screening in primary maternity care and the classification and management of pregnant women considered obese as 'high risk'.

Biomedical definitions of 'normal' and 'problem' body weight continue to rely largely on the highly contested Body Mass Index (BMI) classification system, a crude population-level measure of weight-for-height that is argued to be both sex and age independent (World Health Organization, 2011). Questions about the applicability of BMI across ethnicities and population groups remain unresolved (World Health Organization, 2012). 'Excess' weight and 'obesity' are asserted from a biomedical and public health perspective to be related directly to health, and particularly to the incidence of non-communicable chronic diseases such as cardiovascular disease, diabetes, musculoskeletal disorders and some cancers. More recently 'obesity' has been framed as a disease in its own right, positioning thinness as a prerequisite to the experience of health.

Current biomedical and public health discourse frames 'overweight' and 'obesity' as a global health threat that is occurring in pandemic proportions with the need for global public health efforts directed towards the prevention and management of 'excess weight' (World Health Organization, 2011). The popular media have played a key role in communicating the 'obesity health crisis' internationally and domestically. Biomedical and public health sectors position the primary cause of overweight and obesity

as an energy imbalance between calories consumed and expended. The rising incidence is attributed to changes in dietary and physical activity patterns in developed, and increasingly developing, nations over time. However, strong arguments have been made within public health about the social and environmental drivers for obesity, in particular the relationship between obesity and poverty. Despite this, 'solutions' to 'problem weight' remain largely oriented towards weight loss, with a focus on individual commitment to 'lifestyle change'. There are also arguments for policies to support individual endeavours by addressing social and environmental enablers of obesity, such as food industry regulation (World Health Organization, 2011).

However, the framing of overweight and obesity as a medical problem, and the notion that we are in the midst of an 'obesity epidemic' remain highly contested scientific and social facts. Scholars working across a range of disciplines including the medical and social sciences are questioning the conflation of weight and health and the desirability and feasibility of weight-loss approaches over time (Burns & Gavey, 2004; Campos, 2004; Cogan & Ernsberger, 1999; Orbach, 2006). Carryer (2001, p. 92) summarises: 'It has been well argued that the relationship between body size and health is at best poorly understood and that there is limited support for medicine's contentions about the universal desirability of weight-loss'. Critical fat research has argued that current medical understandings of the category 'obesity' are imbued with Western cultural anxieties about fat and the desirability of thinness for beauty. From this perspective medical discourses on 'overweight and obesity' pathologise and medicalise fat, legitimise fat-phobia and contribute to the true epidemic of body dissatisfaction (Orbach, 2006).

These scholars argue that it is body dissatisfaction, fat stigma and the systemic prejudice and discrimination experienced by larger people that diminishes their health, rather than the presence of fat itself, which would be better understood as bodily variation rather than abnormality (Wray & Deery, 2008). For example, research has identified that large-bodied people frequently withdraw from exercise and recreational pursuits because of real or perceived stigma, and experience disordered eating resulting from persistent attempts to diet to achieve a 'normal' weight (Carryer, 2001). The media has been identified as critical in generating and perpetuating a moral panic about 'obesity' as an 'epidemic'. Critical feminist research has demonstrated that medical discourses of obesity intersect with gendered notions of the 'ideal' female body and maternal responsibility, to impact significantly on women's relationship with their bodies, enjoyment of health, and experience of and access to health care, particularly when they are large-bodied (Bordo, 1993; Carryer & Penny, 2008; Harper & Rail, 2010; Keenan & Stapleton, 2010; Saguy & Almeling, 2008; Tischner & Malson, 2011; Wray & Deery, 2008). These researchers argue that current biomedical 'obesity' discourse is yet another example of the medicalisation of women's normal life states and variation of embodiment. They also critique weight classification using BMI as reductionist and a poor measure of health (Keenan & Stapleton, 2010).

Review method

Given the contested domain of obesity knowledge, this literature review attempts to identify the current state of health research knowledge about 'maternal obesity', its implications and limitations. It also attempts to provide a platform for critical discussion and debate about health science framing of this issue. The review identifies research definitions of 'problem weight' in the context of pregnancy, the prevalence and drivers of 'maternal obesity'. It reviews adverse outcomes associated with 'maternal obesity', including those relating to fertility, perinatal outcomes and long-term health, and identifies causal hypotheses. It also reviews other impacts, including those on maternity care provision and health care resources, as well as providers and women's experience of 'maternal obesity'. Finally it outlines the proposed interventions for managing and preventing 'maternal obesity'.

The review collected articles from the past ten years related to 'maternal obesity', searching on Web of Science and Scopus. Three searches were undertaken using different search terms until no new items were generated. The first search used the terms matern*, obesity, pregnan*, weight and health. The second search used the terms matern*, obesity, pregnan*, weight. The third search used the terms maternity care and obesity. Searching continued until no new articles were encountered. Further literature was sourced through reference list searches. The author also used her own library and searched the University of Auckland library database. The search resulted in 59 articles all from peer reviewed journals. The articles included 15 review articles, 37 original research articles, 4 commentaries, 3 short communications, and two process articles both on the development of protocols. The majority were from medical science journals with a small proportion from midwifery and public health journals. The articles included in this review confirm the recent proliferation of interest in 'maternal obesity'. Of the collection, approximately 60% were published since 2010, and approximately 80% were published since 2006. Of the 37 research articles, 30 used a quantitative methodology and 7 used a qualitative methodology. The sample is considered by the author to be comprehensive and representative of the current medical and health science literature. The methodological rigour of the original research and the accuracy of the conclusions drawn in both the original research articles and the reviews are beyond the scope of this review. All references to 'obesity' and 'maternal obesity' and other contested biomedical terms are marked with single inverted commas. The author's preferred term is larger pregnant women in place of 'obese' or 'obesity'. Relevant articles were read and summarised and the details of these and other related articles were entered into an Endnote Library.

'Maternal obesity' as a medical problem

The health research included in this review universally agreed that overweight and obesity in pregnancy pose medical risks and complications, that the risks and complications intensify the greater the pregnant women's weight, and that the prevalence of obesity in the pregnant population is increasing. 'Maternal obesity' is identified as a key public and women's health issue, posing a significant threat to both maternal and child health, and to the delivery of maternity services (CMACE-RCOG, as cited in Heslehurst, 2011, p. 439):

Obesity is arguably the biggest challenge facing maternity services today. It is a challenge not only because of the magnitude of the problem...but also because of the impact that obesity has on women's reproductive health and that of their babies.

Reflecting trends in biomedical approaches to obesity more generally, 'maternal obesity' is being framed in the literature as a non-communicable disease in its own right, not just as a contributing factor in the incidence of non-communicable diseases and other health risks (Kerrigan & Kingdon, 2010). The risks posed by 'overweight' and 'obesity' are asserted as affecting all aspects of female reproduction from fertility to the long term health of offspring. As Jarvie and Ramsay (2010, p. 83) argue: 'The effect of adiposity is manifest in nearly every aspect of female reproductive life whether as a metabolic or reproductive complication or as a technical problem affecting clinical issues such as ultrasound scanning or surgery'. The gravity of the harms posed by 'maternal obesity' are emphasised in the literature. Kerigan and Kingdon (2010, p. 139) describes it as 'one of the greatest threats to childbearing women'. A midwife participant in a study by Furness et al. (2011, p. 5) conceptualises the risks posed by obesity as similar to cigarette smoking and comparably life threatening: 'It's quite acceptable now to talk to women, about smoking, but it's still not quite acceptable to say to a woman, 'your weight may kill your baby'. The research also emphasises the impacts of 'obesity' on maternity services, particularly the cost of providing care to 'overweight' and 'obese' women. As Denison & Chiswick (2011, p. 457) argue, 'maternal obesity' 'presents a major challenge for healthcare providers'. Galtier-Dereure et al., as cited in, Heslehurst et al. (2008, p. 636) conclude that the prenatal care cost alone in overweight and obese women was 5.4- to 16.2-fold higher compared with 'ideal weight' women.

The research emphasises the widespread and increasing prevalence of obesity amongst reproductive age women, and like obesity more generally, frames 'maternal obesity' as an 'epidemic', 'pandemic' and a 'crisis'. As Krishnamoorthy, Schram and Hill (2006, p. 1135) argue '[o]besity is now the most common clinical risk factor encountered in obstetric practice...The increasing numbers of obese pregnant woman and potential health and economic implications are staggering.' Majumdar, Saleh and Candelier (2010, p. 570) describe 'maternal obesity' as 'a growing crisis' and Denison & Chiswick (2011, p. 457) as a 'global pandemic'. Nagle et al. (2011, p. 1) report an increase in 'obesity' in pregnancy to 'epidemic proportions'. A number of studies included in the review recognise 'maternal obesity' as a significant emerging health concern in the established focus on childhood and adult 'obesity'. Heslehurst (2011, p. 439) observes: 'in addition to a long-standing focus on both childhood and adult obesity, there has been more recent concern relating to maternal obesity'. 'Maternal obesity' is reported to have featured in over 20 national UK reports and guidelines since 2003 (Heslehurst, 2011, p. 439).

The research conceptualises 'maternal obesity' as an opportunity to 'turn the tide' on the problem of obesity in populations by harnessing women's desire for a healthy baby and capitalising on women's increased engagement with health services during their pregnancy and postnatal period. As Smith and Lavender (2011, p. 780) argue: '[p]regnancy has been suggested as the ideal time to intervene to reduce adult obesity and prevent obesity in the next generation'. Furness et al (2011, p. 2) describe pregnancy 'as a naturally occurring opportunity to alter embedded attitudes and habits and adopt new activities

and, therefore to address obesity'. Heslehurst, Bell and Rankin (2011, p. 161) see 'the antenatal period [as] an opportune time to engage women with behaviour change interventions as the health of the baby provides a powerful motivator'. The research simultaneously positions 'overweight' pregnant women as the greatest new 'threat' in the 'fight against obesity' and as the site where the much bigger problem of 'population obesity' may best be tackled.

Classifications of 'problem' weight in pregnancy

Most of the literature in this review utilises the World Health Organisation (WHO) classifications of 'normal' and 'problem' weight for the general population as determined by BMI (weight in kilograms/height in metres squared). BMI categories are: overweight, ≥ 25 ; obese, ≥ 30 ; morbidly obese, $\geq 40 \text{ kg/m}^2$; and extreme obesity $\geq 50 \text{ kg/m}^2$ (McGuire, Dyson, & Renfrew, 2010, p. 108). The advantages of the BMI measurement are argued to be its 'simplicity, ease of ascertainment, general acceptability and likely consistency across studies' (McGuire et al., 2010, p. 108). However, several studies also recognise limitations in the system. One study questions its ability to generalise classifications across ethnic groups (Nommsen-Rivers, Chantry, Peerson, Cohen, & Dewey, 2010, pp. 582-583). Studies use 'obesity' classifications for the general population in the absence of evidence-based BMI categories for pregnant women, and two express some uncertainty about its validity in this context (Heslehurst, 2011; McGuire et al., 2010). Heslehurst (2011, p. 440) acknowledges that despite the 'recent increased focus on maternal obesity, there are no internationally agreed definitions for clinically 'diagnosing' maternal weight status and associated risks'. The WHO classifications are usually applied to early pregnancy as a proxy for pre-pregnancy weight, as pre-pregnancy BMI is frequently not available and weight gain in early pregnancy is usually minimal (Heslehurst, 2011, p. 440). There is currently no evidence to determine what constitutes 'problem' weight later in pregnancy using the BMI classification, given the naturally incurred weight gain during pregnancy from the fetus, fluids and placenta (Heslehurst, 2011, p. 442). Heslehurst (2011, p. 442) notes: 'Current UK guidelines state that weight for height should be measured at the booking appointment (the first antenatal appointment with a health professional), and it is this early pregnancy measurement on which subsequent recommendations in the guidelines are made'. The complications associated in the literature with 'maternal obesity' therefore usually relate to early pregnancy weight (as a substitute for pre-pregnancy weight), rather than weight gained during pregnancy or weight at the time of birth (Catalano & Ehrenberg, 2006, p. 1126).

There is broad agreement in the literature that the risks and harms posed by 'maternal obesity' are on a continuum and increase as BMI increases. As Majumdar, Saleh and Candelier (2010, p. 570) argue, 'there exists a scale continuum of risk of developing obstetric morbidities with maternal obesity: the greater the BMI, the greater the risk'. However, while the research strongly emphasises the accumulation of risk relating to the highest categories of obesity - 'morbid' and 'extreme' obesity - it also emphasised that all excess weight is problematic, including women classified as 'overweight' (Dodd, Grivell, Nguyen, Chan, & Robinson, 2011; Krishnamoorthy et al., 2006). Majumdar, Saleh and Candelier (2010, p. 570) argue there is increasing evidence that pregnant women with mild or moderate obesity as

well as those in the overweight category (BMI 25-29.9) are also at increased risk of obstetric morbidities, including antenatal complications and caesarean section, and thus should not be overlooked for proposed interventions.

Researchers are also interested in what constitutes 'appropriate' weight gain in pregnancy, suggesting that women with a higher pre-pregnancy BMI should aim to gain less, and certainly not more, than the recommended weight gain for 'normal' weight women. Kinnunen et al. (2007, p. 884) argue that weight gain during pregnancy in excess of the recommendations increases the risk of pregnancy complications, infant macrosomia (excessive birth weight) and caesarean. It is also one of the main factors used to explain high postpartum weight retention, which can affect subsequent pregnancies (Kinnunen et al., 2007). Quinlivan, Lam and Fisher (2011, p. 141) note that the recommended weight gain in pregnancy that accounts for physiological changes has been calculated at around 9.1 kg, with any additional gain representing an 'energy reserve for the mother'. However, they observe that '...in high-income industrialised nations, the average pregnancy weight gain has dramatically increased. Recent reviews put pregnancy weight gain as 13-15 kg' (Quinlivan et al., 2011, p. 141). These researchers also argue (2011, p. 141) that it is pre-pregnancy 'obesity' combined with excess weight gain during pregnancy itself that accumulates in the complications associated with 'maternal obesity'. Other studies in this review take a similar position. However Shaikh, Robinson and Teoh (2010, p. 79) acknowledge that the ideal weight gain for pregnancy is difficult to define, not only because it is determined to some extent by pre-pregnancy BMI but also because ideal weight gain is different for each maternal and fetal complication.

Prevalence of 'maternal obesity'

There is universal agreement in the studies reviewed that the prevalence of 'maternal obesity' is high and trending upwards, most especially in high-income countries, but increasingly in developed countries also (Catalano & Ehrenberg, 2006; Huda, Brodies, & Sattar, 2010; Krishnamoorthy et al., 2006; Nagle et al., 2011). The upward trend in weight amongst women during their reproductive years is explained as following the same trend as 'obesity' prevalence in the general population (Heslehurst, Rankin, Wilkinson, & Summerbell, 2010; Kanagalingam, Forouhi, Greer, & Sattar, 2005).

The increasing prevalence of 'maternal obesity' is noted in several country specific studies included in the review. A Swedish prevalence study by Brybnhildsen, Sydsjö, Norinder, Ekholm Selling, Sydsjö (2006, p. 398) found 'a marked increase in weight among Swedish women in childbearing age'. A UK 19-year prevalence study by Heslehurst et al's. (2010, p. 6) identified a substantial drop in the 'ideal BMI' range, and a population shift to the right with increasing levels of 'obesity'. Heslehurst et al. (2010, p. 7) note 'the increase in the proportion of women who are obese has doubled from 8% to 16% over the 19 years studied, whilst there has been a 12% decrease in the ideal BMI group from 66% to 54%'. Two thirds of the women who were classified as 'obese' during pregnancy were moderately obese (BMI 30.0 – 34.9 kg/m²), and the incidence was shown to decrease as the category of obesity increased (Heslehurst et al., 2010, p. 7). Kerrigan and Kingdon (2010, p. 138) argue that the prevalence of obesity

in the UK has trebled since the 1980s. Kannagalingam, Malini, Forouhi, Greer and Sattar describe evidence of increases in maternal booking weight 'of up to 20% over the last two decades' in the United States.

This review found no New Zealand-based 'maternal obesity' prevalence studies, and pre-pregnancy and early-pregnancy BMI data are not well documented in primary maternity care (Perinatal and Maternal Mortality Review Committee, 2010, p. 39). However, several Australian studies in this review note an upward trend in prevalence. Both Callaway (2006, p. 56) and Ngale et al. (2011, p. 1) argue that thirty-five percent of Australian women aged 25-35 years are 'overweight' or 'obese' with a BMI of greater than 25kg/m². Schmied, Duff, Dahlen, Mills and Kolt (2011, p. 424) note that rates of 'obese' women in Australia may be as high as 42.5 percent, and express concern that 'young women are gaining weight at a faster rate than older women bringing increased risks during the childbearing period of their lives'. While taken together these national studies suggest a global trend, Heslehurst et al. (2008, p. 636) acknowledge that international trends in 'maternal obesity' are difficult to estimate due to differences in measurement criteria. However Guelinck et al., as cited in, Heslehurst et al. (2008, p. 636) estimated that obesity varies from 1.8 to 25.3 percent of the global pregnant population using the World Health Organisation criteria of a BMI >30kg m-2'.

Determinants of 'maternal obesity'

The literature presents various rationales for the increasing prevalence of 'maternal obesity', reflecting contemporary debates within the health sector about the determinants of obesity more generally. These range from 'lifestyle behaviours' and individual lack of understanding or motivation, to social structural causes such as socio-economic deprivation. 'Maternal obesity' is also thought to increase with maternal age and parity. Several studies assert the causes of 'maternal obesity' as multi-factorial, accounting for both individual and societal/environmental factors. They argue that identifying the causes of 'obesity' is important to targeting interventions to women before, during and after their pregnancies.

A dominant rationale for the increase in 'maternal obesity' in the research was individual 'lifestyle behaviours' resulting in energy imbalance. These behaviours include hyperphagia (overeating), poor food choice, and inadequate exercise. Alexander and Liston (2006, p. 1167) and Shaikh, Robinson and Teoh (2010) emphasise the role of fast food, supermarkets and the sedentary lifestyle created by television and cars as the main casual factors for increasing 'maternal obesity'. As Shaikh, Robinson and Teoh (2010, p. 80) argue 'Excess gestational weight is more likely to be associated with consumption of unhealthy foods and reduced time spent in physical exertion'. In addition, the maternity care professionals (mostly midwives) in the study by Furness et al (2011, p. 3) felt that some women failed to understand the gravity of the 'obesity'-related risks and to 'view it as a medical problem', and lacked the information, motivation and skills to maintain a 'healthy lifestyle'. As one midwife (Furness et al., 2011, p. 4) states:

I think sometimes it is a motivation issue. Although they would like to lose the weight, they don't want to put the work in to actually do that. They think it's something that's not achievable, or they are just not motivated for it.

The midwives in this study were critical of what they perceived as 'obese' pregnant women's failure to prioritise their weight. They hypothesised that a reduction in weight stigma and their perception of increased social acceptability of larger body size resulted in women being less motivated to change (Furness et al., 2011, p. 5):

Midwives ... discussed how attitudes towards weight had changed over time, the greater acceptance of obesity, and the relative ease today of finding fashionable clothing in larger sizes. They felt these social changes meant larger women were still able to make positive social comparisons and were less motivated to heed midwives' advice to alter health behaviours and manage weight.

This perception of a reduction in weight stigma and a resulting lessening of motivation to lose weight, was not shared by the women interviewed in this study, and has not been documented elsewhere.

Another strong determinant emphasised in the literature is the relationship between social deprivation and other inequalities and 'obesity' incidence amongst pregnant women (Callaway et al., 2006; Roman et al., 2007). Heslehurst et al. (2010) and Heslehurst, Bell and Rankin (2011) found a strong relationship between socio-economic and ethnic inequalities and obesity in the UK pregnant and reproductive age population, and articulate this relationship as a 'major public health concern'. Heslehurst, Bell and Rankin (2011, p. 161) note:

...obese mothers are more likely to live in areas of high deprivation, be of black ethnic origin, unemployed and older than women with an ideal BMI. Most of these associations become stronger with increasing maternal BMI. For example, there is a two fold increase in moderately obese women living in areas of high deprivation compared with those residing in areas of low deprivation; this increases to an almost fivefold for extreme obesity.

Heslehurst et al. (2010, p. 11) emphasise that those women in the highest obesity categories, and thus facing the highest clinical risk, are those also facing the 'highest level of inequality' and deprivation. Kerrigan and Kingdon (2010, p. 144), however, were surprised not to find a clear correlation between maternal BMI and multiple deprivation indices, in contrast to the Health Survey for England 2005 which demonstrated 'clear links between social deprivation and obesity' (Kerrigan & Kingdon, p. 144). They theorise that because the data from the study relates to one of the 'most socially deprived areas from England's most deprived 20%' there was little room for variation between each ward in the city (Kerrigan & Kingdon, p. 144).

Several studies emphasise the multi-factorial causes of obesity in reproductive age women, arguing that a combination of behavioural and environmental causes combine to produce energy imbalance in individual women (Heslehurst et al., 2010; Huda et al., 2010; Roman et al., 2007). Roman and colleagues (2007, p. 2) note: 'Maternal obesity may be influenced by environmental, socio-economic, nutritional

and cultural conditions as well as by race and medical insurance provision making variations across different countries possible'. Huda, Brodies and Sattar (2010, p. 70) argue that the simple explanation for obesity is 'naturally' energy imbalance 'with more calories consumed than expended'. However, they acknowledge that the drivers towards obesity are more complicated and result from behavioural and environmental changes in the past few decades (Huda et al., p. 70):

These include an abundance of cheap, processed, energy-rich foods, increased portion sizes, advertising which increases consumption of these foods, and lifestyle factors that reduce energy expenditure including increased television watching, and environments at home, school and work that encourage less physical activity and promote a more sedentary lifestyle.

Several studies found relationships between maternal age and parity and 'maternal obesity' (Callaway et al., 2006; Kerrigan & Kingdon, 2010). These studies observe that BMI and the incidence of 'maternal obesity' have been shown to gradually increase with increased parity and maternal age. Callaway (2006, p. 59) theorise that this may reflect the tendency in high-income countries to gain weight with age, combined with the tendency to gain weight with each pregnancy. Callaway also identified an association between 'maternal obesity' and cigarette smoking, lower education level and being of Aboriginal/Torres Strait Islander or minority ethnic group descent. The concern with the gradual rise in proportions of obesity with increasing maternal age, argue Kerrigan and Kingdon (2010, p. 143) is the significant rise in the number of women leaving childbearing until they are older; the number of women giving birth at 40 has doubled since 1980. This means that 'women therefore enter the maternity care system when they are older and more likely to be obese' (Kerrigan & Kingdon, p. 143).

'Maternal obesity' and adverse outcomes

The association between 'maternal obesity' and both perinatal and long term adverse outcomes is a dominant consideration in the literature. The research considers 'maternal obesity' to be associated with a very broad range of adverse outcomes, perinatally and in the long-term health of mother and baby. These include a range of complications in obstetric and anaesthetic care, which in turn are reported to result in increased maternal and child mortality and morbidity. The adverse outcomes associated with 'maternal obesity' are considered to increase with the degree of obesity and to persist after accounting for other confounding demographic and health factors.

The underlying mechanisms for the association between 'maternal obesity' and adverse outcomes are not yet understood. However, the research speculates that it may be related to the altered metabolic state it associates with 'obesity', among other pathophysiological hypotheses. The research rarely considers the impact of social or structural factors such as the care of women categorised with 'maternal obesity' on outcomes. It strongly states the need for more research and conclusive evidence to explain the association between 'maternal obesity' and adverse outcomes.

The accumulation of risks and harms considered to be associated with 'maternal obesity' has led pregnant women classified as 'obese' to be labelled as 'high risk' and requiring 'high risk management'

by health professionals knowledgeable in the provision of care to 'obese' pregnant women (Denison & Chiswick, 2011, p. 457).

Fertility

A number of studies in the review considered 'maternal obesity' to be associated with sub-fertility, to impede the success of fertility treatment and be associated with the increased incidence of polycystic ovarian syndrome (Farquhar & Gillett, 2006; Gillett, Putt, & Farwuhar, 2006; Heslehurst et al., 2008; Huda et al., 2010; Jarvie & Ramsay, 2010; Nagle et al., 2011; Shaikh et al., 2010). Huda, Brodies and Sattar (2010, p. 72) argue that obesity 'decreases the chance of spontaneous pregnancy regardless of menstrual cycle characteristics and presence of ovulation'. According to Jarvie and Ramsay (2010, p. 83) up to 50 percent of obese women have polycystic ovarian syndrome compared with 30 percent of their 'lean counterparts'. Polycystic ovarian syndrome is associated with the absence of periods, infertility and miscarriage.

Farquhar and Gillett (2006, p. 1107) report women who are 'overweight' are more likely to be infertile and to have a lower success rate with in vitro fertilisation (IVF) and intracytoplasmic sperm injection (ICSI), the most common publicly funded fertility treatments in New Zealand. They also say that the risk of infertility increases and the success rate of reproductive technique decrease the higher the woman's BMI: 'several studies have reported that very obese women have half the chance of conceiving with assisted reproductive technique compared with women with a normal BMI range'. These researchers acknowledge that this association is not universally supported in the literature, with one study suggesting that obesity is not important to the outcome of fertility. However, the association between female 'obesity' and infertility has been accepted by New Zealand health service planners, who, partly due to concern for the impact of 'obese' women on their offspring have excluded women with a BMI >32 kg/m² from publicly-funded fertility treatment unless they lose weight first (Farquhar & Gillett, 2006, p. 1108). These researchers justify this exclusion on public health and health expenditure grounds:

By encouraging lifestyle changes such as weight loss, the message that obesity is a major health problem is reinforced. In addition, by reducing weight prior to pregnancy, obstetric complications and health problems for offspring should also be improved as well as reducing the costs of the assisted reproduction technique treatment. Lifestyle changes such as weight reduction and exercise are firmly in the control of the patient. This is an important public health message for women and their families in the reproductive years, and our experience shows that some women will achieve these.

Gillett and Farquhar (2006, p. 1221) acknowledge that some populations groups in New Zealand, such as Maori and Pacific peoples, have a higher mean BMI; however, the BMI threshold is universalised to all ethnic groups. This will inevitably result in inequalities in access to publicly-funded fertility treatments for these ethnic groups. Women's perspectives on BMI cut-offs for fertility treatments are not included in these studies (Farquhar & Gillett, 2006; Gillett et al., 2006).

Miscarriage

A number of studies report a significantly higher incidence of early and recurrent early miscarriages amongst 'obese' women compared with women in the 'normal weight' category (Catalano & Ehrenberg, 2006; Heslehurst, 2011; Huda et al., 2010; Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; Lashen, Fear, & Sturdee, 2004; Nagle et al., 2011; Shaikh et al., 2010; Yu, Teoh, & Robinson, 2006). Huda, Brodies and Sattar (2010, p. 72) argue that 'overweight and obese women are more likely to miscarry following both spontaneous and assisted conception' with the underlying mechanisms for this association 'yet to be determined'. In a study by Lashen, Fear and Sturdee (2004, p. 1644), the proportion of early, late and recurrent early miscarriage in the 'obese' group were 12.5, 2 and 0.4 percent respectively. The same measurements in the age-matched normal weight control (NWC) group were 10.5, 2 and 0.1 percent. They conclude 'the obese women had significantly higher incidence of early and recurrent early miscarriages compared with the NWC' (Lashen et al., p. 1644). Like Huda, Brodies and Sattar (2010), they acknowledge that 'the exact reason for the obesity-related increased risk of miscarriage is not known'. Lashen, Fear and Sturdee (2004, p. 1645) postulate several theories including possible metabolic disturbances in 'obese' pregnant women, oocyte quality and endometrial receptivity. Despite this lack of knowledge, they argue that obesity is an independent risk factor for miscarriage rather than the result of polycystic ovarian syndrome and diabetes, which have a higher incidence in obese pregnant women (Lashen et al., 2004, p. 1645).

Stillbirth and late fetal loss

A number of studies in this review associated 'maternal obesity' with a higher risk of stillbirth and late fetal loss (Denison & Chiswick, 2011; Heslehurst, 2011; Heslehurst et al., 2008; McCowan, George-Haddad, Stacey, & Thompson, 2007; McGuire et al., 2010; Nagle et al., 2011; Roman et al., 2007; Rowlands, Graves, de Jersey, McIntyre, & Callaway, 2010; Stacey, Thompson, Mitchell, Ekeroma, & Zuccollo, 2011; Yu et al., 2006). Stacey et al. (2011, p. 4) found that ethnicity was not independently associated with late stillbirth. However, they found that maternal 'overweight' and 'obesity' were, with 'obese' women 'having a more than 2 fold increase in risk compared to normal weight/underweight women (Stacey, Thompson, Mitchell, Ekeroma, & Zuccollo, 2011, p. 4).

Researchers also acknowledge that the underlying mechanism associating obesity and stillbirth is unknown, although they argue that it is independent of confounding variables such as gestational diabetes, hypertension, age, ethnicity, parity, socio-economic status and smoking (McGuire et al., 2010; Stacey, Thompson, Mitchell, Ekeroma, & Zuccollo, 2011). Stacy et al. (2011, p. 5) speculate that the mechanisms 'by which obesity increases the risk of stillbirth are likely to be multifactorial', and may include the altered metabolism profiles of 'obese' women, the association of metabolic disorders including diabetes and pre-eclampsia with obesity, the nutritional status of obese women, altered perception of fetal movements, and much higher rates of sleep-related disorders in 'obese' pregnant women (Stacey, Thompson, Mitchell, Ekeroma, & Zuccollo, p. 5). Roman et al. (2007, p. 425) speculate that placental dysfunction may be the probable underlying mechanism.

Congenital abnormalities

A number of studies in this review report 'maternal obesity' as an independent risk factor for a range of congenital fetal abnormalities and birth defects (Callaway et al., 2006; Catalano & Ehrenberg, 2006; Denison & Chiswick, 2011; Heslehurst, 2011; Heslehurst et al., 2008; Huda et al., 2010; Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; Nagle et al., 2011; Phatak & Ramsay, 2010; Rankin et al., 2010; Rowlands et al., 2010; Yu et al., 2006). These include neural tube defects such as anencephaly and spina bifida; cardiovascular anomalies; anomalies of the intestinal tract; congenital hernia; orofacial clefts; eye anomalies; genital anomalies including hypospadias; limb anomalies; and multiple congenital anomalies of the central nervous system. A population-based study of 10,249 cases by Waller et al, as cited in, Phatak and Ramsay (2010, p. 447) concluded that 'pre-pregnancy maternal obesity was positively associated with 7 out of 16 categories of birth defects'. Rankin et al. (2010, p. 1376) report that both extremes of BMI are independently associated with congenital abnormality, but did not find the same for women in the 'overweight' category or the breadth of abnormalities reported elsewhere:

After adjustment for available risk factors, we found that the overall risk of a structural congenital anomaly was greater for women who were obese or underweight at the start of pregnancy compared with women of recommended weight, but not for women who were overweight. More specifically, maternal obesity was associated with an increased risk of ventricular septal defects, cleft lip and eye anomalies while maternal underweight was associated with atrial septal defect, genital anomalies and hypospadias. No other significant associations were found between maternal BMI and any other congenital anomaly group or subtype.

Researchers acknowledge that the underlying mechanisms associating 'maternal obesity' and congenital abnormalities are not yet understood and postulate various theories (Huda et al., 2010; Jarvie & Ramsay, 2010; McGuire et al., 2010). Several studies suggest the association may be related to the higher incidence of undetected diabetes and hyperglycaemia in 'obese' women in early pregnancy (Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; McGuire et al., 2010). These conditions are an established risk factor for some congenital anomalies and researchers argue that this may provide a rationale for screening 'obese' women before pregnancy (Jarvie & Ramsay, 2010, p. 84). These researchers suggest:

It has been concluded in some studies that pre-pregnancy diagnosis of diabetes may permit appropriate intervention prior to conception and those obese women planning a pregnancy should be screened. One could postulate that weight reduction and tight glycaemic control may help reduce rates of congenital abnormalities in this high risk group.

However, the association between obesity and congenital anomalies has also been shown to be independent of diabetes (McGuire et al., 2010, p. 108). McGuire et al. (2010) hypothesise that nutritional deficiency, particularly folate, which is more common in 'obese' pregnant women, may be an underlying cause, although acknowledge that there is not yet supporting evidence. Jarvie and Ramsay

(2010, p. 84) articulate this more directly : 'Another hypothesis suggests that [congenital abnormalities] may be related to the poor diet of obese women'.

Several studies reported that the added risk of poorer image quality in ultrasound scans of 'obese' women compounds the association between 'maternal obesity' and congenital abnormalities (Huda et al., 2010; McGuire et al., 2010; Phatak & Ramsay, 2010). Phatak and Ramsay (2010, p. 447) argue that 'adipose tissue is known to attenuate ultrasound by absorption' which reduces the ability to 'visualise fetal structures' and results in a lower detection of abnormalities. McGuire et al. (2010, p. 108) report 'the risk of a residual congenital anomaly after an ultrasound examination is 1 in 100 among obese women compared with 1 in 250 among women of normal BMI'. Huda, Brodies and Sattar (2010, p. 72) suggest that this may partly contribute to the higher incidence of congenital abnormalities in 'obese' women, by reducing the number of terminations of pregnancy for fetal abnormalities. However, McGuire et al. (2010, p. 109) refute this suggestion: 'a sensitivity analysis of studies that included congenital anomalies ascertained from both completed and terminated pregnancies found a similar effect size of maternal obesity'. Regardless, these studies agree that reduced detection of fetal abnormalities in 'obese' women has a significant clinical impact, given the reported higher incidence of these abnormalities in this population group (Huda et al., 2010; Phatak & Ramsay, 2010).

Pregnancy complications

'Maternal obesity' is reported to be independently associated with significantly higher rates of antenatal maternal complications, including essential and pregnancy-induced hypertension or pre-eclampsia, intrauterine growth restriction (IUGR), obstetric cholestasis and gestational diabetes (GDM) (Callaway et al., 2006; Catalano & Ehrenberg, 2006; Dodd et al., 2011; Green & Shaker, 2011; Heslehurst, 2011; Heslehurst et al., 2008; Huda et al., 2010; Jarvie & Ramsay, 2010; Kerrigan & Kingdon, 2010; Majumdar et al., 2010; Nagle et al., 2011; Roman et al., 2007; Rowlands et al., 2010; Sathyapalan, Mellor, & Atkin, 2010). Heslehurst (2011, p. 445) report that the incidence of GDM in 'obese' pregnant women is significantly higher than that of the general obstetric population. Jarvie and Ramsay (2010, p. 84) say a 'plethora of data exists confirming the relationship between obesity and the development of pregnancy-induced hypertension and pre-eclampsia'.

The research also associates 'maternal obesity' with a higher incidence of thrombo-embolic complications during pregnancy, which carry a high risk of maternal mortality and morbidity (Heslehurst, 2011; Heslehurst et al., 2008; Huda et al., 2010; Jarvie & Ramsay, 2010; Nagle et al., 2011; Yu et al., 2006). Huda, Brodies and Sattar (2010, p. 73) report that 'obesity is an important risk factor for thromboembolism, the leading direct cause of maternal mortality in the UK, with almost half of all deaths due to pulmonary embolism occurring in overweight or obese women'. Pregnancy is recognised as a 'prothrombotic state' which is exaggerated in 'obesity'. Huda, Brodies and Sattar (2010, p. 73) argue that 'obesity' is both a direct risk for venous thrombo-embolism and is associated with other factors that 'amplify this risk', including operative delivery, pre-eclampsia and assisted conception.

The research relates these complications in turn to adverse childbirth outcomes and the need for more intensive maternity care resources. Heslehurst (2011, p. 445) says: 'Although these numerous adverse outcomes have a significant impact on maternal and infant health, the prevention and management of such complications also require more resource intensive maternity care'.

Intra-partum complications

The literature extensively reports associations between 'maternal obesity' and a range of intra-partum complications, which are both independently associated with 'maternal obesity' and interrelated. For example, 'maternal obesity' is associated directly with caesarean section and also with increased likelihood of induction of labour, which in turn increases the incidence of caesarean section.

i. Caesarean section and instrumental delivery

The association between 'maternal obesity', instrumental delivery (forceps and vacuum extraction) and operative delivery (caesarean section) is reported extensively in the literature (Alexander & Liston, 2006; Barau et al., 2006; Callaway et al., 2006; Catalano & Ehrenberg, 2006; Dodd et al., 2011; Green & Shaker, 2011; Heslehurst, 2011; Heslehurst et al., 2008; Homer, Kurinczuk, Spark, Brocklehurst, & Knight, 2011; Kerrigan & Kingdon, 2010; Majumdar et al., 2010; Nagle et al., 2011; Roman et al., 2007; Rowlands et al., 2010; Shaikh et al., 2010; Yu et al., 2006). Barau et al. (2006, p. 1175) report a strong and independent correlation between high pre-pregnancy BMI and caesarean section:

[a] linear trend between maternal pre-pregnancy BMI and risk of caesarean section exists regardless of potential confounders. Even when stratifying by major known risk factors e.g. Gestational diabetes or very short stature below 1.50 m, the incidence of caesarean section is approximately doubled as compared with the whole population.

Kerrigan and Kingdon's study (2010, p. 141) identified a similar trend but was not able to confirm whether the higher incidence of caesarean sections amongst 'obese' women was due to the 'physiology of obesity preventing normal birth', or the result of a number of pregnancy complications associated with obesity, such as pre-eclampsia. Heslehurst et al. (2008, p. 639) identified significantly increased odds of both instrumental delivery and emergency caesarean in 'obese' women but found that this was not significant for elective caesarean section. The research acknowledges that there is no direct evidence to explain the association between 'maternal obesity' and a higher caesarean section rate. A number of authors speculate about underlying mechanisms, with most considering the likely mechanism to be pathophysiological. Homer et al. (2011, p. 480) suggest a possible association with the medical and pregnancy complications relating to obesity, including diabetes and pre-eclampsia. Several studies suggest a mechanical explanation related to poor uterine contractility in 'obese' women (Barau et al., 2006; Bergholt, Lim, Jørgensen, & Robson, 2007; Homer et al., 2011). Bergholt, Lim, Jørgensen and Robson (2007, p. 163.e162) suggest: 'the presence of excess intra-abdominal adipose tissue could mechanically obstruct the progression of labour, contributing to a failure to progress. If progression of labour is mechanically obstructed, this could over time compromise fetoplacental circulation and cause

fetal distress'. Barau et al. (2006, p. 1176) argue that the underlying mechanisms are likely to be multifactorial, including 'increased fetal weights and soft tissue dystocia in maternal pelvises caused by the accumulation of fat tissues which narrows the genital tract'.

Green and Shaker (2011, p. 173) report that 'morbidly obese' women whose labour is induced are significantly less likely to achieve a vaginal delivery, falling from 70 percent for 'morbidly obese' women who spontaneously labour to 48 percent if labour is induced. The literature rarely considers the influence of the intrapartum care of 'obese' women on mode of delivery. Only Bergholt, Lim, Jørgensen and Robson (2007, p. 163.e162) suggest that difficulty in abdominal and vaginal examination in obese women in labour, as well fetal monitoring, may increase the rate of operative interventions. One study speculates about the role provider attitude may have in the higher caesarean section rate associated with 'maternal obesity' (Roman et al., 2007, p. 425): 'an important question is whether the incidence of these events is really higher in obese women or whether physicians were more likely to carry out a Caesarean section in obese women anyway'. Vahratian, Zhang, Troendle, Savitz and Siega-Riz (2004, p. 950) say that limited information was available on physician factors that may influence labour progression and increase the risk for caesarean delivery.

Several studies also report decreased success of vaginal birth after caesarean (VBAC) in 'obese' women (Alexander & Liston, 2006; Catalano & Ehrenberg, 2006; Yu et al, 2006). Alexander and Liston (2006, p. 1168) say that 'Bujold et al analysed the contribution of BMI to success and found a overall VBAC rate of up to 50% in women with BMI of 30 kg/m² and greater but a linear relationship between increasing BMI and failure of VBAC'.

ii. Induction of labour

A number of studies report significantly increased odds of induction and augmentation of labour in both 'overweight' and 'obese' women with the incidence increasing with maternal BMI (Bergholt et al., 2007; Dodds et al., 2011; Green & Shaker, 2011; Heslehurst, 2011; Heslehurst et al., 2008; Jarvie & Ramsay, 2010; Majumdar et al., 2010; Nagle et al., 2011; Shaikh et al., 2010; Yu et al., 2006). Jarvie and Ramsay (2010, p. 86) report 'Obese women appear to be significantly less likely to establish in spontaneous labour by 42 weeks of gestation'. Green and Shaker (2011, p. 173) found the induction rate was significantly higher in women who were 'morbidly obese' (59%) compared to the 'normal' BMI group (27%). In a very rare consideration of the impact of care rather than pathophysiology, Green and Shaker (2011, p. 173) suggest that the relationship between induction of labour and maternal obesity may be attributed to 'underlying pressure to act for the maternity provider when confronted with a term pregnant patient with high BMI'. This suggests the potential for the medicalisation of 'maternal obesity' to generate a cascade of interventions.

Researchers recognised that the increased odds of induction and augmentation of labour in 'obese' women was associated with increased rates of epidurals, instrumental delivery and caesarean section. Heslehurst et al. (2008, p. 674) reports:

There are increased odds for induction of labour in overweight and obese women, and failure to progress with the labour is more than twice as likely in obese women. The odds for requiring oxytocin or epidurals are also increased, and although these outcomes could not be meta-analysed by degree of obesity, one study shows an apparent increase in the requirement for epidurals with increasing severity of obesity.

'Maternal obesity' is also reported to be associated with increased odds of failed induction, which in turn may account for increased caesarean sections amongst 'obese' pregnant women (Heslehurst et al., 2008; Nagle et al., 2011; Yu et al., 2006). Nagle et al. (2011, p. 2) say: 'Compared to women who have a BMI between 20.1-25, obese women are more likely to experience: increased rates of induction of labour and a failed induction; a stay in hospital of more than five days and obese women require specific equipment for accurate monitoring and safe maternity care'.

iii. Malpresentation

Heslehurst et al. (2008, p. 675) report significantly increased odds of malpresentation in pregnant women who are 'obese', but not in women who were 'overweight'. However, the increased odds of malpresentation in 'obese' women excluded the incidence of occipital posterior, which was not found to be associated with BMI. Increased odds of malpresentation were not reported by other studies included in this review.

iv. Labour dystocia and longer labour

'Maternal obesity' is reported in several studies to be associated with an increased incidence of longer labour and labour dystocia (Heslehurst et al., 2008; Vahratian et al., 2004). Vahratian et al., (2004, p. 947) report '[l]abour progression before 6 cm of cervical dilation was significantly slower in overweight and obese women compared with normal-weight women, even after adjusting for labour induction and oxytocin use'. They speculate that this may be due to 'the added soft-tissue deposits in the pelvis of overweight and obese women, which coupled with a larger fetus, might necessitate more time and stronger contractions to progress through labour'.

v. Hospital contact and length of hospital stay

The research reports that the increased risks and complications associated with 'maternal obesity' result in increased levels of hospital contact and longer hospital stay (Callaway, 2006; Heslehurst et al., 2008; Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; Shaikh et al., 2010). This in turn is associated with a 'cumulative health service cost per patient' (Krishnamoorthy et al., 2006, p. 1136). Green and Shaker (2011, p. 174) disputed this finding, arguing that length of hospital stay, along with postnatal complications and neonatal morbidity, were not significantly different in women with 'morbid obesity'.

vi. Anaesthetic complications

A number of studies report an association between 'maternal obesity' and regional and general anaesthetic complications (Alexander & Liston, 2006; Catalano & Ehrenberg, 2006; ; Dresner et al., 2006; Krishnamoorthy et al., 2006; Jarvie & Ramsay, 2010; Rowlands et al., 2010; Shaikh et al., 2010; Yu et al., 2006). Complications with regional anaesthesia include difficulty with siting the epidural and reduced effectiveness or failure of epidurals (Dresner, Brocklesby, & Bamber, 2006; Shaikh et al., 2010). Dresner, Brocklesby and Bamber (2006, p. 1180) report:

Our results show that obesity and morbid obesity increase the chances of analgesic failure by epidurals, as shown by re-site rates, midwife satisfaction with epidural performance, and probably by patient satisfaction. There is also a clear association between obesity and the need for emergency caesarean section among women choosing epidural analgesia.

Complications with general anaesthesia are reported to include difficulty with intubation and hypoxia (Alexander & Liston, 2006; Shaikh et al., 2010).

vii. Fetal macrosomia

A number of studies in the review report an association between 'maternal obesity' and macrosomic babies, defined as a neonatal birthweight of >4kg. They say that the best predictor of macrosomia in infants is a maternal BMI >30 (Catalano & Ehrenberg, 2006; Denison & Chiswick, 2011; Dodds et al., 2011; Heslehurst et al., 2008; Heslehurst, 2011; Jarvie & Ramsay, 2010; Kerrigan & Kingdon, 2010; Krishnamoorthy et al., 2008; Nagle et al., 2011; Rowlands, 2010; Shaikh et al., 2010; Yu et al., 2006). Shaikh et al. (2010, p. 78) report that 'maternal obesity' 'was found to be a risk factor for macrosomia independent of GDM' but the underlying mechanisms are not known. Catalano and Ehrenberg (2006, p. 1128) suggest multiple factors may affect fetal growth in 'obese' pregnant women, including maternal nutrition and maternal weight gain during pregnancy. Shaikh et al. (2010, p. 79) report that macrosomia itself is associated with a range of intra and postpartum complications including 'prolonged first and second stage of labour, an increased risk of instrumental vaginal delivery, third stage perineal trauma, emergency caesarean section, postpartum haemorrhage, Apgar score <4, and admission to the special care baby unit'.

viii. Increased post-dates and pre-term delivery incidence

A number of studies associated 'maternal obesity' with increased odds of post-dates and pre-term delivery (Callaway, 2008; Catalano & Ehrenberg, 2006; Dodd et al., 2011; Heslehurst et al., 2008; Heslehurst, 2011; Jarvie & Ramsay, 2010; McGuire et al., 2010; Rowlands et al., 2010; Shaikh et al., 2010). Heslehurst et al. (2008, p. 673) report increased odds of post-date delivery as BMI increases. They also note the paradox of increased odds of pre-term delivery:

Interestingly in addition to having an increased odds of post-date delivery, there was also an increasing odds of preterm delivery at <37 weeks with increasing BMI category, whereas underweight was not significant.

Like the underlying mechanisms for other adverse outcomes associated with 'maternal obesity', the mechanism for these associations is not yet determined. However McGuire et al. (2010, p. 110) suggest they may include obesity-related 'metabolic syndrome', low grade or subclinical infection (particularly of the urinary tract) and acute inflammation of the fetal membranes.

ix. Fetal distress

Both Heslehurst (2011, p. 445) and Dodd et al. (2011, p. 137) report increased odds of fetal distress which in turn resulted in increased rates of emergency caesarean section and neonatal resuscitation and subsequently increased admission to the neonatal unit. These associations were not widely reported in the literature.

x. Postpartum haemorrhage

Several studies report increased odds of postpartum haemorrhage in women who are 'obese' (Catalano & Ehrenberg, 2006; Heslehurst, 2011; Heslehurst et al., 2008; Jarvie & Ramsay, 2010; Shaikh et al., 2010). Heslehurst et al. (2008, p. 639) report this association was significant for women categorised as 'overweight' to 'morbidly obese': 'Women who were overweight, obese and morbidly obese had significantly increased odds of haemorrhage when compared with women with an ideal BMI'.

Postnatal complications

The research associates a range of postnatal complications for women and their offspring with 'maternal obesity'. These complications are also reported to be directly and indirectly associated with high maternal BMI.

i. Maternal infection rates

A number of studies report increased rates of postnatal maternal infection associated with 'maternal obesity' (Catalano & Ehrenberg, 2006; Heslehurst et al., 2008; Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; Shaikh et al., 2010). This included caesarean wound infections as well as infections of the perineum, chest, breast and urinary tract. Catalano and Ehrenberg (2006, p. 1127) attribute this to the increased incidence of caesarean section related to 'maternal obesity': 'The increased caesarean rate in overweight and obese women is also associated with an increase in post-operative complications such as wound infection/breakdown, excessive blood loss and postpartum endometritis'. Jarvie and Ramsay (2010, p. 86) report that 'the presence of an apron of adipose tissue delays the healing of a caesarean section wound by promoting a warm, moist environment in which bacteria can flourish'.

ii. Birth trauma, Apgar score at 5 minutes, and neonatal admission

A number of studies report an association between 'maternal obesity' and poor neonatal outcomes including birth injuries/trauma, lower Apgar scores at 5 minutes (a measure of neonatal health immediately following birth) and increased rates of admission to the neonatal unit (Callaway, 2006; Dension & Chiswick, 2011; Dodd et al., 2011; Green & Shaker, 2011; Heslehurst, 2011; Heslehurst et al., 2008; Huda et al., 2010; Krishnamoorthy et al., 2006; Majumdar et al., 2010; McGuire et al., 2010; Nagle et al., 2011). Heslehurst et al. (2008, p. 659) report 'a significant increase in trauma incidence (defined as cuts, grazes, bruises, fractures, muscle haematomas, dislocation, cephalhaematomas and nerve palsies) in obese mothers when compared with non-obese'. Two studies in the review report lower Apgar scores at 5 minutes in the infants born to obese mothers (Heslehurst et al., 2008; Huda et al., 2010). Huda, Brodies and Sattar (2010, p. 73) report 'The impact of maternal obesity on the offspring is substantial. The short-term neonatal outcomes were subject to a recent meta-analysis and include low Apgar scores, fetal compromise, meconium, shoulder dystocia and neonatal intensive care use'.

A number of studies report higher rates of neonatal admissions for the offspring of 'obese' women (Callaway, 2006; Dension & Chiswick, 2011; Dodd et al., 2011; Green & Shaker, 2011; Heslehurst et al., 2008; Heslehurst, 2011; Krishnamoorthy et al., 2006; Majumdar et al., 2010; McGuire et al., 2010; Nagle et al., 2011). They associate these admissions with increased rates of meconium aspiration, neonatal hypoglycaemia, jaundice and respiratory distress in the offspring of 'obese' women.

The relationship between 'maternal obesity', shoulder dystocia and early neonatal death is unclear with contradictory findings in the literature reviewed (Dodd et al., 2011, p. 137). Green and Shaker (2011, p. 174) did not find neonatal morbidity to be 'significantly different in women with morbid obesity'.

iii. Breastfeeding rates and onset of lactation

The literature widely associates 'maternal obesity' with delayed onset of lactation (OL) and reduced breastfeeding initiation and duration (Heslehurst et al., 2011; Krishnamoorthy et al., 2006; McGuire et al., 2010; Nagle et al., 2011; Nommsen-Rivers et al., 2010; Shaikh et al., 2010; Yu et al., 2006). Nommsen-Rivers et al. (2010, p. 582) report the short-term adverse consequences of delayed OL included 'excess neonatal weight loss, suboptimal infant breastfeeding behaviour at day 7, and use of formula supplement'. Krishnamoorthy et al. (2006, p. 1137) argue that the higher formula feeding rates amongst 'obese' women increase the risk of childhood obesity. Researchers debate whether there is an association between 'maternal obesity' and failed lactation. Nommsen-Rivers et al. (2010, p. 582) argue that there is not: 'Forty percent did not experience OL until >72 h postpartum, but nearly all (98.3%) did within the first week. Thus even though delayed OL was common, failed OL was not'.

The mechanisms for OL and reduced breastfeeding by 'obese' women are unknown but researchers suggest they are multifactorial and largely pathophysiological. Yu et al. (2006, p. 1122–1123) suggest that delayed onset of lactation and reduced breastfeeding rates in obese women are due to mechanical and endocrine mechanisms: 'the simple mechanical difficulties of latching on and proper positioning of

infant when the mother is obese can pose a problem for establishing breastfeeding. From an endocrine perspective, obesity is associated with reduced prolactin response to suckling'. McGuire et al. (2010, p. 111) also suggest possible structural and psychosocial factors, including increased difficulty with the positioning of the baby and body discomfort related to breastfeeding in front of others. Nommsen-Rivers et al. (2010, p. 583) is the only study to suggest a potential impact on breastfeeding outcome from the early breastfeeding care and support provided to 'obese' women. They report that the early breastfeeding experience is likely to be critical to the establishment of breastfeeding by these women (Nommsen-Rivers et al., 2010, p. 583).

Long-term effects

The literature identifies the long term effects of 'maternal obesity', particularly for the offspring of 'obese' women, as an emerging area, with particular interest in how 'maternal obesity' and the 'womb environment' may programme the fetus for future 'obesity'. Some researchers say the association between 'maternal obesity' and long-term outcomes remains highly speculative, with current evidence 'inconclusive' (Heslehurst, Bell & Rankin, 2011, p. 161). However, other studies are much more assertive about the association (Catalano & Ehrenberg, 2006, p. 1126). All acknowledge that the underlying mechanisms of 'maternal obesity' that may be associated with long-term effects are not yet understood. Given the interest, there is likely to be a proliferation of research in this area in the near future.

i. Fetal programming

A large number of reviewed studies suggested that 'maternal obesity' may also have an 'in-utero influence on offspring leading to a cycling of risk factors through the generations' (Freeman, 2010, p. 113), with fetal or in-utero 'programming' leading to adult disease (Catalano & Ehrenberg, 2006; Denison & Chiswick, 2011; Freeman, 2010; Heslehurst et al., 2011; Huda et al., 2010; Nagle et al., 2011; Norman & Reynolds, 2011; Rowlands et al, 2010; Shaikh et al, 2010; Yu et al, 2006). Norman and Reynolds (2011, p. 453) capture this thinking: 'The in utero effects of maternal obesity have consequences long beyond pregnancy'.

The most 'widely investigated' in the literature (Shaikh et al, 2010, p. 79) is the programming effect of 'maternal obesity' and 'fetal overnutrition' on offspring 'obesity' both in childhood and future adulthood (Catalano & Ehrenberg, 2006; Heslehurst, 2011; Huda et al, 2010; McGuire et al, 2010; Rowlands et al, 2010 Shaikh et al, 2010). Huda, Brodies and Sattar (2010, p. 73) argue: 'Epidemiological evidence has shown that babies born to obese women are more likely to be obese in childhood and adulthood and to have increased risks of cardiovascular disease in later life'. Likewise Catalano and Ehrenberg (2006, p. 1131) report the relationship between macrosomia and future obesity: 'There is abundant evidence linking higher birth weights to increased obesity in adolescents as well as adults for at least 25 years'. Shaikh et al (2010, p.79) suggest that this programming of future obesity may result from 'obese' mothers as well as those who gain excess gestational weight, both of which are associated with neonatal macrosomia. Heslehurst (2011, p. 445) says 'maternal obesity' is thought to influence the development

of future obesity by programming appetite, metabolism and activity levels in offspring, but that much more evidence is needed to prove programming theory. As well as future obesity, Norman and Reynolds (2011, p. 452) suggest 'exposure' to 'maternal obesity', may be linked with asthma and 'adverse neurodevelopmental outcomes including cognitive problems and attention deficit disorders'.

The underlying mechanisms that may support programming theory are yet to be identified and remain hypothesis. Huda, Brodies and Sattar (2010, p. 73) suggest that although the longer-term consequences of 'maternal obesity' are yet to be fully determined, there is increasing observational evidence suggestive of a programming effect related to 'an adverse maternal nutritional environment'. Freeman (2010, pp. 113-117) suggest several theories for the underlying mechanisms in 'maternal obesity' that may result in 'fetal programming' including the 'metabolic abnormalities associated with obese pregnancy'. Freeman (2010, p. 114) describes the mechanisms thought to underlie 'fetal programming':

In terms of programming of human obesity, it is clear that both maternal genes and environment (particularly lifestyle and diet) have an influence on maternal obesity which is commonly associated with maternal insulin resistance. There may be direct effects on fetal metabolism and tissue development via inheritance of maternal obesity susceptibility genes, but there are also likely indirect effects via the supply of nutrients/metabolites to the fetus (both in terms of quantity and quality). These direct and indirect effects may combine to influence neonatal body composition and metabolism such that the impact of environmental stimuli throughout life lead to fat accumulation, expression of cardiovascular risk markers and earlier development of CVD and type 2 diabetes.

Freeman (2010) argues that the aim now is to collect 'sufficient mechanistic data to attempt to support this hypothesis'. All studies report the need for more investigation and more robust evidence to confirm 'whether infants of obese women have a future disease risk' (Rowlands et al., 2010, p. 96).

ii. Future maternal health

Future maternal health is not widely considered in the literature, with most studies emphasising future maternal weight gain and the subsequent effects on the offspring of future pregnancies (Heslehurst et al, 2008; Krishnamoorthy et al, 2006; Shaikh et al, 2010). Shaikh et al (2010, p. 79) argue that 'Pregnant women who gain excess gestational weight are more likely to retain weight in the postpartum period, placing these mothers (and their future offspring) at risk of further complications with subsequent pregnancies due to maternal obesity persisting and progressing'. Heslehurst et al (2008) also suggest 'maternal obesity' may increase women's later risk of diabetes mellitus.

Underlying mechanisms for adverse outcomes from 'maternal obesity'

As demonstrated above, the underlying mechanisms of the reported associations between 'maternal obesity', perinatal and long-term adverse outcomes are not yet well understood. There is, however,

extensive speculation in the literature about possible mechanisms and a strongly identified need for more research and evidence to define these associations. Almost all speculation about mechanisms is orientated towards a 'pathophysiological link between obesity and the various adverse outcomes of pregnancy' (Sebire et al., 2001, p. 1181) and it is largely agreed that the underlying mechanisms are likely to be multifactorial. In particular, speculation focuses on mechanical, endocrine and metabolic explanations, with metabolic mechanisms such as impaired glucose tolerance and insulin resistance in obese pregnant women independent of diabetes being the most widely postulated. They are also argued to be the mechanisms 'backed by most evidence' (Norman & Reynolds, 2011, p. 453).

Some studies generalise theories about mechanisms to all adverse outcomes (Norman & Reynolds, 2011); many studies attach theories to individual adverse outcomes. Non-pathophysiological mechanisms including social and structural factors are rarely considered in the research. The research identifies as vital more robust and conclusive biomedical evidence of the underlying mechanisms resulting in adverse outcomes associated with 'maternal obesity' so that effective and safe interventions and management strategies can be developed (Heslehurst et al., 2008; Heslehurst, 2011; Norman & Reynolds, 2011; Sebire et al., 2001). Given this, there is likely to be a proliferation of biomedical research into these mechanisms in the near future.

'Maternal obesity' and maternity care

There is also a strong emphasis in the literature on the implications of 'maternal obesity' for the provision of maternity care. These concerns centre on the need for more resource-intensive maternity care and the added economic costs of providing maternity care to 'obese' women. As Huda, Brodies and Sattar (2010, p. 70) report: 'Although difficult to quantify, the significant rise in rates of obesity and in particular the associated adverse maternal and perinatal outcomes are resulting in an increased burden on health care resources and economic cost'.

The research emphasises ways in which 'maternal obesity' complicates the provision of basic maternity care and the strain this places on the public health system. Emphasis on the cost of care in some studies eclipses concern about health outcomes.

Increased resource requirements

A number of studies emphasise the impact of 'maternal obesity' on the provision of basic maternity care (Callaway, 2006; Furness et al., 2011; Huda et al., 2010; Heslehurst et al., 2011; Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; Nagle et al., 2011; Rowlands et al., 2010; Schmied et al., 2011; Yu et al., 2006). Rowlands et al (2010, p. 96) argue that as maternal BMI increases, so too, do the 'practical difficulties of providing every aspect of obstetric care'. Challenges they identify include difficulty lifting patients particularly post-operatively, gaining venous access, accurate blood pressure measurement, fetal assessment, finding appropriate beds, operating tables and trolleys, surgical and anaesthetic

complications, and post-epidural analgesia (Callaway, 2006; Krishnamoorthy et al., 2006; Rowlands et al., 2010; Yu et al., 2006). Yu et al (2006, p. 1121) report intrapartum complications in 'obese' women including 'failure of epidural insertion, increased risk of aspiration during anaesthesia, difficult intubation, poor peripheral access and difficulty in monitoring maternal blood pressures'.

Of particular concern in the literature is how these challenges and complications result in the need for more 'resource intensive maternity care' including more physical equipment, provisions for longer hospital stays, more screening appointments and more health professional hours (Heslehurst, 2011; Rowlands et al., 2010; Yu et al., 2006). Studies argue that some of the additional resources to care for 'obese' women are easy to quantify, including physical equipment for heavier patients and the resources needed for increased childbirth interventions including induction of labour and operative delivery, and increased neonatal intensive care use (Heslehurst, 2011; Rowlands et al., 2010). Studies report the additional physical equipments for 'obese' women include beds, operating tables, wheelchairs, trolleys and scales designed to carry extra weight; and larger blood pressure cuffs and spinal needles (Heslehurst, 2011; Yu et al., 2007). As well as increasing the need for childbirth interventions such as caesarean section, studies say that surgery and anaesthesia is more technically challenging with 'obese' women, requiring 'more staff to be present during delivery, including multiple senior health care professionals' (Heslehurst, 2011, p. 447). Yu et al (2007, p. 1121) report the need for 'specific resources such as additional blood products, a large operating table and extra personnel in the delivery room'.

Indirect resource implications are also associated with 'maternal obesity'. For example, studies report that difficulties with ultrasonography and external electronic fetal monitoring with 'obese' mothers result in longer ultrasound appointments, repeat scans, alternative screening and monitoring procedures such as serum screening for nuchal translucency or fetal scalp electrodes to monitor fetal heart rate (Heslehurst, 2011; Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; Phatak & Ramsay, 2010). Phatak and Ramsay (2010, p. 449) emphasise the need for increased ultrasound resources: 'Our study indicates that maternal obesity has significant implications for health resources, with many obese women requiring longer than allotted time for completion of anatomical survey and almost half of all women with BMI >40kg/m² requiring a second appointment to complete the anatomy scan'.

Cost to the public health system

Many studies emphasise the economic implications of providing maternity care to 'obese' women (Callaway et al., 2006; Dodd et al., 2011; Furness et al., 2011; Heslehurst, 2011; Heslehurst, Bell, et al., 2011; Heslehurst, Moore, et al., 2011; Heslehurst et al., 2010; Heslehurst et al., 2008; Huda et al., 2010; Kanagalingam et al., 2005; Majumdar et al., 2010; Phatak & Ramsay, 2010; Rankin et al., 2010; Rowlands et al., 2010; S. A. Smith, Heslehurst, Ells, & Wilkinson, 2011). Callaway et al. (2006, p. 59) reports: 'As BMI increases, caesarean section rates, maternal morbidity, neonatal morbidity, neonatal intensive care utilisation and length of hospital stay all increase, which has important implications for the cost of health care delivery'.

Some studies emphasise the importance of quantifying the economic cost of 'maternal obesity' while acknowledging that this is difficult. Rowlands et al (2010, p. 96) argue: 'Despite widespread evidence of increased pregnancy complications among obese women, the economic implications of maternal obesity have gained relatively little research attention, and robust estimates of the financial costs appear to be lacking altogether'. Furness et al (2011, p. 2) estimate the care cost for 'obese' pregnant women to be 'at least five times greater than that of normal weight mothers'. Heslehurst et al (2008, p. 636) suggest the costs may be much higher. They cite a conclusion by Galtier-Dereure et al. (as cited in, Heslehurst et al, 2008, p. 636) that the prenatal care cost in 'overweight' and 'obese' women alone was '5.4- to 16.2-fold higher compared with ideal weight women'. Heslehurst et al. (2008, p. 636) suggest that this may be an underestimate because only hospitalisation costs were counted and the impact of obesity on resources has been shown to exceed hospitalisation costs. The literature agrees that there is an 'absence of published studies addressing the quantifiable impact of maternal obesity on service delivery in its entirety' (Heslehurst et al., p. 636).

Experience of 'maternal obesity'

Few studies in the literature use a qualitative methodology or include a qualitative component which considers the experiential aspects of 'maternal obesity'. Experiential aspects include the experience of being 'obese' when pregnant, the experience of care provided to 'obese' pregnant women, and the experience of staff providing this care. Qualitative studies are oriented more towards the staff experience of providing care to 'obese' pregnant women than the experiences of women themselves, and were more likely to be from midwifery than medical literature.

Providers' experience

Several studies in the review considered how the provision of care to 'obese' women impacts on providers (Alexander & Liston, 2006; Furness et al., 2011; Heslehurst, 2011; Heslehurst, Bell and Rankin, 2011; Heslehurst et al., 2011; Phatak & Ramsay, 2010; Schmied et al., 2011). They considered the physical impacts of providing care to large women and the emotional impact of having 'difficult' conversations with women about their weight and its reported association with adverse outcomes in childbirth.

i. Physical impact

Several studies report the physical strain on staff of providing maternity care to 'obese' women. The midwives in Schmied et al's (2011, p. 427) study were concerned about the occupational health and safety of staff when caring for 'obese' women, given that appropriate equipment was frequently not available or not suited to the needs of labouring women, particularly in emergencies. For example, mechanical lifters designed to lift overweight patients were not designed to pull back and retract legs, a

manoeuvre the midwives considered placed them at risk when providing care to large women. Schmied et al (2011, p. 428) said:

Participants described the actual and potential risk for injury to staff. For example, one midwife spoke of being gripped by a very large woman weighing over 150 kg during labour, and another described how a colleague who weighed around 50kg was on sick leave after injuring her back during an emergency to lift a woman's leg during childbirth.

Phatak and Ramsay (2010, p. 449) observed increased musculoskeletal injuries among sonographers when conducting ultrasounds of 'obese' women. They note that musculoskeletal injuries are a 'known occupational hazard for sonographers' and that sonographers 'experienced considerable strain while scanning women with a BMI >30 kg/m²'. Alexander and Liston (2006, pp. 1169-1170) describe the added complications and discomforts for clinicians operating and performing assisted vaginal deliveries on 'obese' pregnant women. They argue:

... obesity is a big problem getting bigger. Progressively more obstetricians and gynaecologists are faced with operating on obese women. All doctors caring for these women should be aware of specific problems that they face (Alexander & Liston, 2006, p. 1171).

ii. Emotional impact

Several studies also consider that emotional impact of providing care to 'obese' pregnant women, particularly conversations with them about the adverse outcomes associated with their weight, and the issues this raised for health providers about their own body weight (Furness et al., 2011; Heslehurst, 2011; Schmied et al., 2011). Furness et al. (2011, p. 5) report the midwives in their study expressed awkwardness and anxiety about raising weight issues with pregnant women for fear of causing offence, and described the impact of this on their ability to communicate openly with 'obese' clients. One midwife reflected:

I have a disk that I work out people's BMI on, and it says 'obese' there, and I can't say it; I say to them 'well this is where your BMI is, look.' And I've said it, but she can't say 'she called me obese', but I say 'look, look, you're there look, that's what it says you are'. So I'm anxious, but I'm also protecting myself, y'know, and we don't use the language that we should be using sometimes, do we? (Furness et al., p. 5).

Other healthcare professionals including midwives and sonographers also described difficulties in broaching the topic of 'obesity' and the adverse outcomes associated with it with women and their families during pregnancy (Heslehurst et al., 2011, p. 447). These providers also expressed anxiety about negative reactions from women and their fear of complaints. The providers in the study by Schmied et al's (2011, p. 426) described feeling 'damned if you do, damned if you don't' when it came to discussing weight with 'obese' women: 'participants relayed stories of receiving telephone calls or letters from women and/or their family members dissatisfied with some element of their care; for example, 'the midwife said my daughter was fat'.

Both Schmied et al. (2011, p. 427) and Heslehurst (2011, p. 447) report that health professionals' own weight concerns influenced these discussions with pregnant women, particularly if the health provider themselves had a high BMI. Schmied et al. (2011, p. 427) report:

...participants were also conscious that their own physical size influenced how comfortable they felt in communicating with obese pregnant women about their weight. One midwife reflected 'like I'm overweight. You know, how can I sit there and tell this lady about her weight when I'm overweight?'

Patient experience of maternal obesity

Medical research rarely considered the maternity care experiences of 'overweight' and 'obese' women. However, several studies in the midwifery literature focus on or include 'obese' women's experiences (Alexander & Liston, 2006; Furber & McCowan, 2011; Furness et al., 2011; Heslehurst, 2011; Heslehurst, Bell, et al., 2011; Heslehurst, Moore, et al., 2011; McGuire et al., 2010; Nommsen-Rivers et al., 2010; Nyman, Prebensen, & Flensner, 2010; Schmied et al., 2011; D. Smith & Lavendar, 2011; Vahratian et al., 2004). These studies tend to acknowledge the stigma associated with obesity. This includes how it may be perpetuated in maternity care, particularly in health professional attitudes and the information and care provided to 'overweight' and 'obese' women. These studies speculate about the implications for women's self-esteem and body image, and engagement with care.

i. Self-esteem and body image

How 'obese' women feel about their body and the impact this has on their childbirth experience and outcomes is a significant gap in the literature. Several studies make passing reference to body image and self-esteem in relation to 'maternal obesity'. In concluding their study, Alexander and Lister (2006, p. 1171) note 'These women often have low self-esteem and are embarrassed about their body habitus. All staff involved in their care should be sensitive to their needs'. McGuire et al (2010, p. 110) consider the impact of obese women's self esteem and perceptions of shame on their ability to breastfeed: 'Obese women express less intention to initiate and continue breastfeeding. Multiple factors may contribute including low self-esteem and confidence, mental health issues and depression'. Only in Nyman et al (2010) and Furber and McGowan (2011) does the issue get more scrutiny. In a study by Nyman et al (2010), pregnant 'obese' women described being constantly aware of their body and its largeness and alert to scrutiny from others. This resulted in experiences of shame and guilt and the experience for women of being separate from their body, 'the body was experienced as an 'it' and just being a 'carrier' for the baby' (Nyman, p. 426). The women in Furber and McGowan's (2011) study described feeling humiliated and embarrassed when trying health promoting activities during pregnancy such as aquanatal exercises classes because of the body exposure required. As Furber and McGowan (2011, p. 3) said:

Embarrassment about their size was a significant feature for many women, and this impacted on their body image. For some women who had experienced humiliating encounters during past

experiences, there was an expectation that their maternity care may be humiliating due to their size.

No studies consider how poor body image and internalised stigma may impact on women's labour experience and birth outcomes. This is a significant omission, considering that labour usually requires greater body exposure and is an intense body experience for women.

ii. Health professional attitudes

Several studies note the negative attitudes and assumptions of health professionals and the impact this has on pregnant women's experience and engagement with care (Furber & McGowan, 2011; Heslehurst, 2011; Nyman et al., 2010; Smith & Lavender, 2011). Heslehurst (2011, p. 447) reports on the experiences of 'obese' patients more generally:

Health-care professionals have been described by obese patients (including pregnant and non-pregnant populations) as being insulting, demeaning, discriminating, judgemental, blame-inducing, patronising and derogatory in their care.

These experiences were reported to be typical of 'overweight' and 'obese' women's experience of maternity care. Women in several studies were reported as embarrassed about their bodies and vulnerable to negative attitudes, judgements and guilt (Furber & McGowan, 2011; Furness et al., 2011; Heslehurst, 2011; Nyman et al., 2010; Smith & Lavender, 2011). Smith and Lavender (p. 786) report that the studies in their review:

...included reports of women reporting being treated in a 'sarcastic and negative manner' and being 'suspicious' of health professionals. Embarrassment and guilt were reported as feelings experienced by the women when receiving health care, especially at ultrasound appointments.

Some women reported extreme and abusive examples of this kind of treatment. A woman in Furness et al's (2011, p. 6) study reports her previous experience with an obstetric consultant:

He used to have me in tears – every time I'd go and see him, he'd tell me I was putting on too much weight, and he would literally shout at me. I don't smoke, I've never drunk throughout; it was the only thing that I was doing wrong, and he used to have me in tears.

Women in this study also report their frustration at health professionals' assumption that they eat poorly and don't exercise because they were a certain BMI, and the stigmatising effect of this. One woman describes this dynamic:

I think the stigma is that if you're over a certain BMI that you don't exercise isn't it? (General agreement). That's what people think. I mean if you're slim and you've got a low BMI then they automatically think that you exercise, if you're not then they think that you don't. (Furness et al., 2011, p. 5)

Several studies report the implications of these negative attitudes and experiences, including the undermining of women's influence on their maternity experience and avoidance or disengagement with care. Pregnant women described 'avoiding confronting healthcare professionals about humiliating treatment relating to their obesity, due to the fear of jeopardising their maternity care', suggesting that women are less likely to advocate for themselves to enable informed decisions about their care (Heslehurst et al., 2011, p. 447). The result, report Smith and Lavender (2011, p. 788) is that 'obese women are less likely to benefit from current maternity policy to provide women-centred care, and to promote informed choice, continuity and access to services'. Furness (2011, p. 5) found that obesity stigma and health provider attitude had a negative impact on communication between midwives and women, frequently resulting in the provision of poor or contradictory information for women. Women in Smith and Lavender's study (2011, p. 786) reported lack of clarity about the reasoning for increased screening and monitoring which left them with the impression that the focus was on their baby rather than themselves. A woman in a study by Keely et al's (as cited in, Bell & Heslehurst, 2011) says: 'It was kind of weird actually. It hadn't been raised at all until I got a phone call from the midwife saying, 'I've got two scans and an appointment with a consultant for you'. I was like, 'What's wrong, like?' And then she said 'No, no, it's just because you're obviously...a BMI over 40'. Women in Furber and McGowan's (2011) study found the experience of ultrasound particularly distressing: 'A common and persistent experience expressed in both pregnancy and postnatal data in relation to ultrasound screening was upset and humiliation. Sonographers often document (on the report) difficulties in visualising the fetus without prior explanation to the woman'. Studies report that negative or insensitive attitudes impact on engagement with care, with women avoiding or delaying seeking care for fear of further negative experiences (Furber & McGowan, 2011; Heslehurst, 2011). Heslehurst et al. (2011, p. e174) speculate that 'if services were not developed in a sensitive manner, women might disengage from antenatal services, which could be more detrimental to their health than addressing the issue of obesity at all'.

iii. Medicalisation

How the care provided to 'overweight' and 'obese' women impacts on outcomes associated with 'maternal obesity' is a significant gap in the literature, with only three studies acknowledging the impact of the medicalisation of 'maternal obesity' on outcomes (Furber & McGowan, 2011; Nyman et al., 2010; Smith & Lavender, 2011). The women in these studies described being labelled with a higher risk of medical complications because of their size and stereotyped as unlikely to be able to give birth normally. Smith and Lavender (2011, p. 787) provide a rare examination of how the medicalisation of 'maternal obesity' may increase the risk of a cascade of interventions: the 'medicalisation of the pregnancy experience' for obese women left them 'feeling negative towards health professionals and the level of advice and guidance received'. In addition, they found that as a result of being labelled 'high risk' women were less likely to 'benefit from current maternity policy to provide women-centered care, and to promote informed choice, continuity and access to services' (Smith & Lavender, p. 787). The 'high risk' labelling of 'obese' women in early pregnancy care also excluded them from guidelines for low-risk care that promote normality and midwife-led care (Smith & Lavender, p. 787). For example, women in

Furber and McGowan's (2011, p. 6) study described a referral for an anaesthetic consultation during pregnancy because of their obesity which they perceived was used to promote the use of epidural anaesthetic to them. The effect of this, suggest Smith and Lavender (2011, p. 787) potentially 'further increase[s] the risk of a cascade of interventions in labour and birth with important implications for intrapartum and neonatal outcomes'. These researchers emphasise the importance of understanding the needs and experiences of pregnant women with a BMI >30 kg/m² to improve their experience and outcome in the context of 'maternal obesity'.

Proposed interventions and management of 'maternal obesity'

The research proposes a plethora of 'maternal obesity' interventions, emphasising the urgency of intervening to 'break the cycle of obesity' during pregnancy (Catalano & Ehrenberg, 2006, p. 1131). This is despite a widely-identified lack of evidence about the underlying mechanisms that link 'maternal obesity' with adverse outcomes as well as evidence about appropriate interventions (Catalano & Ehrenberg, 2006; Denison & Chiswick, 2011; Dodd et al., 2011; Rowlands et al., 2010). As Rowlands et al (2010, p. 98) argue:

Because of the multitude of short- and long-term implications of maternal obesity, and the potentially large economic impact, it is important that efforts are made to attempt to address this problem. However, there is a paucity of evidence to inform recommendations in this area with an urgent need for good quality research.

Most interventions proposed in the literature are oriented towards prevention, with an emphasis on weight-loss or the management of 'obese' women as high-risk patients to mitigate risk. The literature stresses the need for more research to build an evidence base for interventions. Researchers argue that in the context of limited public health resources, decisions need to be made about which interventions will warrant investment, requiring evaluation of the 'costs' of 'maternal obesity' and the effectiveness of interventions (Rowlands et al., 2010, p. 98).

National and regional guidelines

Several studies report the absence of, need for, and development of evidence-based national or regional guidelines for the management of 'maternal obesity' to ensure consistent and quality care (Dodd et al., 2011; Fitzsimons & Modder, 2010; Heslehurst, 2011; Nagle et al., 2011). Fitzsimons and Modder (2010, p. 100) report that despite the well-documented problems and complications presented by 'obese' women in pregnancy 'there is currently no national clinical guideline available in the UK with regard to the clinical care and provision of services for women with obesity in pregnancy'.

Pre-conception care and weight loss

A number of studies suggest that pre-conception care and counselling focussing on weight loss is the ideal intervention, although they acknowledge that the majority of pregnancies are unplanned (Dension & Chiswick, 2011; Heslehurst et al., 2008; Jarvie & Ramsay, 2010; Kerrigan & Kingdon, 2010; Krishnamoorthy et al., 2006; Majumdar et al., 2010; Rowlands et al., 2010; Sebire et al., 2001; Shaikh et al., 2010). Rowlands et al (2010) identify a low rate of pregnancy planning as a barrier to high quality pre-conception care and says that 'women comply poorly with even relatively simple preconceptual recommendations, such as folic acid supplementation' (Rowlands et al., 2010, p. 96). Given this: 'the complex lifestyle changes required for weight loss prior to pregnancy are likely to be difficult to achieve in many obese women' (Rowlands et al, p. 96). However, they argue that a high quality pre-conception programme may have a positive impact on a range of health conditions by changing smoking and alcohol behaviours as well as weight loss. Majumdar, Saleh and Candelier (2010, p. 570) argue that all women with a BMI >30 should receive pre-pregnancy counselling about weight loss, not just those in the morbidly obese category >40. Several studies propose that public health interventions should target young women entering the 'reproductive phase of life' about the 'health effects of obesity' to ensure they 'enter pregnancy at a healthy weight (Heslehurst et al., 2008; Krishnamoorthy et al., 2006; Rowlands et al., 2010). As Heslehurst et al (2008, p. 680) suggest:

Ideally women would have a healthy weight status prior to conception, and efforts need to be focused on adolescents and young women, potentially through school-based programmes and via family-planning services. Developing a successful programme of public health interventions to prevent maternal obesity would stem rising NHS resource implications, and minimise the risks to both mother and baby.

Routine BMI measurement at booking and weight monitoring during pregnancy

Several studies argue the importance of routine BMI measurement at the initial antenatal or booking visit as well as routine regular weight monitoring throughout pregnancy (Alexander & Liston, 2006; Dresener et al., 2006; Krishnamoorthy et al., 2006; Rowlands et al., 2010). Krishnamoorthy et al. (2006, p. 1137) suggests: 'The pre-pregnancy BMI and booking BMI should ideally be recorded at the first visit in the first trimester, followed by regular monitoring of gestational weight gain throughout the pregnancy'. Dresener et al. (2006, p. 1181) argue that regular weight monitoring during pregnancy provides the opportunity to highlight to pregnant women the increased risks posed by 'excessive weight gain during pregnancy' and to encourage 'sensible weight control'. None of these studies acknowledge the limitations of BMI classification. However, Farrar and Duley (2007) provide a rare example of critical commentary in the literature, questioning the value of weighing women throughout pregnancy. While they affirm the usefulness of recording of BMI at the booking visit, they question the value of routine weighing throughout pregnancy. As a screening test for adverse pregnancy outcomes, they argue that routine weighing 'fails on the basic criteria of not having adequate sensitivity or specificity, and has the potential adverse effect of leading to unnecessary anxiety' (Farrar & Duley, p. 1283). They also say that evidence is lacking that interventions based on these measurements, such as efforts to control weight by altering diet and exercise during pregnancy, will improve outcomes for either mother or baby. On

this basis they suggest that it would seem more sensible to promote optimal weight before pregnancy, and healthy diet and lifestyle during pregnancy rather than monitoring weight gain. Farrar and Duley (2007, p. 1284) conclude (2007, p. 1284):

Routine weighing during pregnancy has not been demonstrated to have any direct benefit for either the woman or her child, and there are concerns it may lead to unnecessary anxiety. In the absence of evidence of benefit, women should not be required to have their weight measured throughout pregnancy, unless there is a specific clinical reason. If the sole purpose of weighing is for epidemiological research, this should be explained to women and they should have the option to decline.

High-risk classification and model of care

The majority of studies in the review argue the importance of classifying 'obese' women as a 'high risk group' with management during the antenatal, intra-partum and postnatal period appropriate to pregnancies classified as high risk (Alexander & Liston, 2006; Denison & Chiswick, 2011; Heslehurst et al., 2008; Jarvie & Ramsay, 2010; Kerrigan and Kingdon, 2010; Krishnamoorthy et al., 2006; Majumdar et al., 2010; Quinlivan et al., 2011). Krishnamoorthy et al. (2006, p. 1137) argues in light of the maternal and fetal risks associated with 'obesity' in pregnancy it is time that obstetricians acknowledge the 'obese mother' as a high-risk pregnancy and provide high-risk management of these pregnancies. Likewise Jarvie and Ramsay (2010, p. 83) argue 'It is important to consider obese women as a high risk group with a linear increase in risk of complications associated with their degree of obesity'. Majumdar, Saleh and Candelier (2010, p. 570) insist that this high-risk classification and care should be extended to all pregnancies where the woman has a BMI greater than 30 (mild to moderate obesity) and not just those women with a BMI over 40 (morbid and extreme obesity). As Majumdar, Saleh and Candelier (2010, p. 570) say: 'There needs to be increased awareness among providers of maternity care services that all obese pregnant women, whatever their BMI, are a high-risk group and should be managed as such'.

Many of the studies considering 'maternal obesity' interventions focus on the model of care most appropriate to 'obese' women. Most studies, consistent with the classification of 'maternal obesity' as high risk, propose high-risk management with obstetric consultant-led care within a multidisciplinary team that includes primary care physicians, anaesthetists, midwives, dieticians, exercise advisors and other specialists depending on maternal complications (Alexander & Liston, 2006; Denison & Chiswick, 2011; Heslehurst et al., 2008; Jarvie & Ramsay, 2010; Kerrigan et al., 2010; Krishnamoorthy et al., 2006). Denison & Chiswick (2011, p. 461) argue that without interventions shown to improve pregnancy outcome, 'clinicians are left with optimising maternal health pre-pregnancy and providing appropriate high-risk (often not evidence-based) antenatal care for pregnant women'. Jarvie and Ramsay (2010, p. 87) agree that 'careful surveillance of obese women at each stage of pregnancy' is currently the best that can be done in the face of a lack of evidence to support 'maternal obesity' interventions: 'randomised controlled trials of interventions for obese pregnancy are not available and are therefore urgently required'.

Several studies, however, argue that more consideration needs to be given to the viability of midwife-led continuity of care for 'obese' pregnant women. Nagle et al. (2011, p. 4) report that 'obese' pregnant women who receive high-risk management are at increased risk of 'fragmented care, miscommunication and confusion resulting from information being presented from a variety of sources'. They say that continuity of midwifery care for 'obese' pregnant women may address some of these issues and help improve 'maternal obesity' outcomes, but acknowledge that this needs to be evaluated as continuity of midwifery care normally only caters for 'low-risk' women (Nagle et al, p. 4). Quinlivan et al. (2011, p. 142) trialled a four-step model for the management of 'overweight' and 'obese' pregnant women including: 'continuity of care by a single maternity provider; assessing weight gain each antenatal visit; a brief (5m) intervention by a food technologist before each visit; and assessment by a clinical psychologist'. They report that the intervention helped to reduce the incidence of gestational diabetes and maternal weight gain, but that more evidence is required before the intervention is widely introduced (Quinlivan et al, p. 145).

Location of care

There is broad agreement in the literature that 'obese' women should give birth in tertiary level facilities with specialist consultant and anaesthetic cover and appropriate emergency facilities. Researchers acknowledge that this creates increased demands on tertiary services. Several studies also propose separate specialist obesity antenatal clinics for 'obese' pregnant women (Krishnamoorthy et al., 2006; Furness et al., 2011). Krishnamoorthy (2006, p. 1137) reports:

Strong arguments exist for planning and developing services for obese women within maternity departments either within an existing 'medical antenatal clinic' for mothers with other medical disorders of pregnancy or, given the high prevalence of obesity, as a separate 'maternal obesity clinic.

These researchers acknowledge that planning these services would need to take into account local prevalence rates of 'obesity' in pregnancy.

Screening and medical management

Several studies recommend extra screening and medical management to mitigate the complications and adverse outcomes associated with 'maternal obesity'. Because of the complications associated with the insertion and management of epidural pain relief in 'obese' women, several studies recommend a routine antenatal anaesthetic consultation (Alexander & Liston, 2006; Dension & Chiswick, 2011; Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; Yu et al., 2006). Yu et al. (2006, p. 1121) suggest that along with an antenatal anaesthetic consult 'prophylactic placement of an epidural catheter when not contraindicated in labouring morbidly obese women would potentially decrease anaesthetic and perinatal complications associated with attempts at emergency provision of regional or general anaesthesia'.

Given the increased caesarean section rate reported to be associated with 'maternal obesity', some studies have suggested the consideration of routine caesarean section for 'extremely obese women'. For example, Green and Shaker (2011, p. 174) argue:

...that management of morbidly obese women with a singleton pregnancy should aim for vaginal delivery and await spontaneous onset of labour. However, should the need arise to deliver before spontaneous onset of labour, elective caesarean section should be considered an alternative for induction of labour.

However, Homer et al. (2011, p. 480) dispute the evidence for this, noting the increasing recommendations for 'planned caesarean delivery to avoid the perceived risks of emergency caesarean delivery' in extremely obese women. Their study:

... does not provide any evidence to support a policy of routine caesarean delivery for extremely obese women on the basis of concern of higher rates of delivery complications, but does support a policy of individualised decision making on mode of delivery based on a thorough assessment of potential risk factors for poor delivery outcomes (Homer et al, p. 482).

Researchers also suggested routine GDM screening for women over 30 BMI and serial growth scans as abdominal palpation of obese women can be unreliable (Krishnamoorthy et al., 2006, p. 1138).

Information and counselling

A number of studies emphasise the importance of counselling and information sharing with obese women and their families about the risks associated with 'maternal obesity' and how this will influence their care (Alexander & Liston, 2006; Nagle et al., 2011; Phatak & Ramsay, 2010). Nagle et al. (2011, p. 2) argue that there is significant variation in the quality and quantity of information available for 'obese' women, which compromises their ability to make informed choices about their care. Typical of the thinking around this intervention, Krishnamoorthy et al. (2006, p. 1136) recommend:

...women should be counselled regarding the implications of obesity on the course of pregnancy and its outcome, the proposed care plan to address these implications and this discussion needs to be clearly documented. She is likely to benefit from consistent support and advice regarding preventing excessive weight gain, support by written information.

Alexander and Liston (2006, p. 1171) recommend a direct approach to talking with 'obese' women suggesting that health care professionals should be prepared to have 'open and frank discussions about their care' with 'obese' women and their partners and that to avoid doing so out of discomfort or politeness is 'paternalistic and should be avoided'. In the context of ultrasound scans Phatak and Ramsay (2010, p. 449) argue women should be provided with information and counselled about the limitations and 'insurmountable (in some cases) difficulties in obtaining adequate images in women with increased abdominal wall adiposity'. Phatak and Ramsay (2010, p. 449) recommend that 'This group require to be counselled about potential requirement for a further appointment to complete the anatomical survey and also the likelihood that it may not be possible to complete'. They do not provide

advice, recommend how this information should be shared, or consider how it may be received by women.

'Lifestyle' Interventions

By far the most postulated 'maternal obesity' intervention in the literature are those that can be loosely termed 'lifestyle interventions' to achieve weight loss, despite broad agreement in the literature about a lack of evidence of their effectiveness (Denison & Chiswick, 2011; Dodds et al., 2011; Furness et al., 2011; Huda, 2010; Kinnunen et al., 2007; Krishnamoorthy et al., 2006; McGuire et al., 2010; Norman & Reynolds, 2011; Rowlands et al., 2010; Shaikh et al., 2010). 'Lifestyle interventions' include counselling on diet as well as physical activity during pregnancy, aiming to control pregnancy weight gain and ultimately promote weight loss. Krishnamoorthy et al. (2011, p. 458) recommend regular visits to the dietician for 'obese' pregnant women 'incorporating dietary and healthy lifestyle advice including exercise'.

The prioritisation of this intervention assumes 'excess weight' to be associated with poor diet and lack of exercise, although this assumption is not explicitly stated in any of the studies. Denison and Chiswick (2011, p. 458) demonstrate this assumption: 'the dietary information, food knowledge and nutritional intake required by a lean woman is very different from that required by an overweight or obese woman, who is likely to have a more unbalanced diet, to be consuming larger portion sizes'. The research acknowledges a lack of, or mixed, evidence about the effectiveness of antenatal 'lifestyle interventions' and a need for more research (Dodd et al., 2011; Huda et al., 2010; Kinnunen et al., 2007; Norman & Reynolds, 2011; Rowlands et al., 2010; Shaikh et al., 2010). For example, Kinnunen et al. (2007, p. 889) trialled individualised counselling on diet and physical activity during pregnancy and found: 'The intervention maintained the proportion of high-fibre bread of total weekly amount of bread and increased the intake of vegetables, fruit and berries and dietary fibre, but did not have an effect on total weekly LTPA or gestational weight gain'. Likewise Dodd et al. (2011, p. 139) found 'The effect of providing an antenatal dietary intervention was uncertain, both in limiting weight gain during pregnancy, and in terms of the impact on other important maternal and infant health outcomes'. Both studies say that larger high-quality randomised trials are needed to show whether and how excessive gestational weight gain and adverse maternal and infant outcomes can be prevented by dietary and physical activity counselling.

In a study by Furness et al. (2011, p. 8), health providers considered individual women's motivation the key determinant in the success of 'lifestyle interventions' in pregnancy, suggesting that 'more should be done to motivate obese pregnant women to make healthy lifestyle changes. This would clearly require additional investment in order to train and resource maternity service teams with the time and skills to deliver'. Several studies recommend psychological as well as 'lifestyle interventions' (Denison & Chiswick, 2011; Quinlivan et al., 2011). Denison and Chiswick (2011, p. 459) discuss the benefits of Cognitive Behavioural Therapy (CBT), noting that it has been shown to promote short-term weight loss but not to be effective in the long term. They speculate that 'complex interventions comprising dietary

advice, exercise and psychological interventions to reduce or control gestational weight gain or reduce the incidence of fetal macrosomia' may prove useful with clinical trials currently underway to determine effectiveness (Denison & Chiswick).

Pharmaceutical interventions

Several studies explore the promise of pharmaceutical interventions to mitigate the metabolic disturbances reported to be associated with 'maternal obesity' (Denison & Chiswick, 2011; Jarvie & Ramsay, 2010; Krishnamoorthy et al., 2006; Norman & Reynolds, 2011). They expressed particular interest in the Efficacy of Metformin in Pregnant Women with a raised BMI (EMPOWaR) trial underway in the United Kingdom. It examines the use of diabetes drug Metformin to reduce adverse outcome in obese pregnant women; results are not yet available. Other studies recommend caution in the use of pharmaceuticals. Freeman (2010, p. 116) argues that since lifestyle change is 'notoriously difficult to implement, especially in pregnancy' and pharmacological therapies are undesirable, 'nutritional therapy or supplementation might be effective'. Krishnamoorthy et al. (2006, p. 1136) agree, suggesting micronutrient supplementation, such as increasing obese women's level of folate supplementation to help prevent neural tube defects.

Surgical interventions

Several studies consider the use of bariatric surgery, such as gastric bypass and banding, to reduce weight prior to pregnancy, but there is no consensus about its benefits (Catalano & Ehrenberg, 2006; Denison & Chiswick, 2011; Rowlands et al., 2010; Shaikh et al., 2010). Shaikh et al. (2010, p. 81) report: 'A systemic review of 75 articles concluded that there were lower maternal complication rates and better neonatal outcomes following bariatric surgery than in obese women without bariatric surgery or rates approaching those of non-obese women'. Likewise Rowlands et al. (2010, p. 96) report 'Bariatric surgery prior to pregnancy appears to be highly effective, and warrants further analysis of costs and benefits'. Again, these studies assume planned pregnancies.

Catalano and Ehrenberg (2006, p. 1131) and Denison and Chiswick (2011, p. 461) are less enthusiastic about bariatric surgery, questioning evidence of its long-term effectiveness, potential for side effects, impact on pregnancy and its expense. Denison and Chiswick (2011, p. 461) report:

Currently, evidence is insufficient to assess the effect of bariatric surgery on mode of delivery, nutritional status and fertility. Similarly, there are few data available to inform timing of surgery with respect to pregnancy, with successful pregnancies being achieved within 1 – 2 years of the procedure. Finally bariatric surgery is not without its complications, which can include bowel obstructions, preterm delivery and ultimately.

Postnatal support

Several studies argue the importance of ongoing postnatal support, particularly if women are planning a subsequent pregnancy (Krishnamoorthy et al., 2006; Rowlands et al., 2010; Shaikh et al., 2010).

Krishnamoorthy et al. (2006, p. 1138) recommends 'ideally, support should continue in the community setting after discharge from maternity care, encouraging women to adhere to diet, exercise and healthy lifestyle measures in the long term'. Rowlands et al. (2010, p. 97) reports evidence that 'even modest amounts of weight loss between pregnancies can reduce the risk of gestational diabetes in subsequent pregnancy' and recommends that the 'costs and benefits of interconception care need to be evaluated'.

Shaikh et al. (2010, p. 79) recommend that postnatal support should include help with breastfeeding to contribute to maternal weight loss.

Incentives

Denison and Chiswick (2011, p. 461) are the sole authors in this review to consider financial or other incentives for weight loss before or during pregnancy. They argue that such interventions are effective in initiating 'simple, time-limited behavioural change'. However, they acknowledge that their role in improving pregnancy outcome in 'obese' women is not known.

Community development, community service provision

Smith et al. (2011) identified the importance of public health and community services such as primary health care, community exercise, healthy cooking classes and breastfeeding workshops in helping to create environments which will address 'maternal obesity'. They identified current barriers such as child care provision as preventing the inclusion of 'obese' women in these services and argue that effectively addressing 'maternal obesity' will require maternity and community health services to work together to ensure women do not fall through the gaps and are aware of the services available to them.

The role of fathers

A single study in the review considers the role of men in the reproductive process in relation to obesity (Kelly et al., 2011, p. 147). These researchers propose that both pre-conception and antenatal care could be utilised to promote weight loss for obese 'fathers-to-be'. They suggest this intervention could improve the health of these men as well as their ability to 'subsequently support the family'. This intervention presumes that men are the sole or main economic provider for the family. Kelly et al. (2011, p. 147) argue that ultimately future public health interventions 'may need to embrace both parents and the family unit if they are to be successful in reducing obesity levels in reproductive age groups'.

Conclusion

This review confirms the proliferation of recent medical and health science interest in 'maternal obesity' and demonstrates universal consensus in framing 'maternal obesity' as a serious and growing health

issue. It is clear that the body weight of larger women has been, and is being, comprehensively pathologised and medicalised in the context of reproduction. It is reasonable to assume that this is likely to intensify as more research is produced, especially about pathophysiological mechanisms underlying the association between 'maternal obesity' and adverse outcomes, as well as new developmental theories regarding the origins of 'obesity' and disease. At present, however, the case for 'maternal obesity' as a serious health issue relies almost entirely on association and is not supported by evidence about causation.

The literature presents body weight as something which is modifiable, largely determined by 'lifestyle', and a primary determinant of reproductive and long-term health. An entrenched binary is evident in the literature, where 'normal weight' women are presumed to be 'healthy', the result of 'good lifestyle behaviours' including regular exercise and a balanced and nutritional diet. Women with 'excess' weight are presumed to be 'unhealthy' with poor nutrition and lack of exercise. The literature represents and accepts being 'overweight' and 'obese' as antithetical to the experience of health and wellbeing in pregnant women.

Weight classifications for pregnant women emerge as problematic in this review. Few studies acknowledge or consider the limitations of BMI classification generally and in their applicability to pregnancy. Others simply apply BMI classifications to pregnancy despite acknowledging a lack of evidence to support this. Given the reliance of 'maternal obesity' science on the BMI system, this is a significant concern. The applicability of BMI classifications to pregnancy and to pregnant women of diverse ethnicities requires much greater consideration.

A very broad range of short and long-term adverse outcomes are being associated with 'maternal obesity', largely relying on epidemiological and observational data. The underlying mechanisms that would explain how or why 'maternal obesity' is related to these harms remain speculative and are clearly still not well understood in the literature. Researchers broadly agree that 'maternal obesity' is associated with adverse outcomes in the absence of obesity-related pathologies, for example diabetes. Authors' attempts to explain causation almost exclusively focus on pathophysiological explanations, and a proliferation of research on the underlying pathophysiological mechanisms of 'maternal obesity' should be anticipated.

Consideration of how provider attitudes, approach to care, and broadly reported stigmatising and discriminatory treatment of larger bodied people within and outside the health system may influence the outcomes associated with 'maternal obesity' remains a significant gap in the literature. These dynamics have been well documented elsewhere (Puhl & Brownell, 2001; Schwartz, O'Neal Chambliss, Brownell, Blair, & Billington, 2003). Given the proliferation of interest in the area and the gravity of outcomes being associated with 'maternal obesity', this needs to be urgently addressed. Hypotheses relating to fetal programming and pregnancy as the site where health and disease originate, have significant implications for gender equality, human rights and women's health. Given the highly

contested domain of obesity knowledge more generally, there is an urgent need for critical evaluation and response to this burgeoning new interest in 'maternal obesity' in the medical sciences.

While there is a strong focus on the adverse outcomes associated with 'maternal obesity', it is clear that an underlying concern in many studies is how this association impacts on the delivery of maternity care and specifically on 'constrained' public health system resources and expenditure. The drivers for the emergence of 'maternal obesity' as a significant new health concern warrant further consideration. There is a paucity of attention in the medical literature on pregnant women's experience when their body weight is classified as a medical problem in maternity care, and how this may also impact on outcomes. This body of literature does not consider the social, cultural, political or structural factors that may influence outcomes for larger women in reproduction and thus the conceptualisation of 'maternal obesity' as a medical problem.

The literature proposes a large number of interventions for managing and preventing 'maternal obesity', but most lack evidence of their effectiveness. Women's experience of interventions and the impact of interventions on their maternity care experience is an under-researched area. The lack of evidence of causation as well as effectiveness of interventions suggests limited support for 'maternal obesity' interventions at this time. Further, this lack of evidence compromises informed decision making by pregnant women considered 'obese'. Women must be provided with evidence-based information about how their body weight may contribute to poor outcomes and what they can do about it. This information is not yet available, meaning that a weight-based focus in maternity care is not easily justified. Some interventions already introduced, such as the exclusion of women with a higher BMI from publicly-funded fertility treatment, raise health equity and human rights issues not considered in the literature. This is another gap that should be addressed.

References

- Alexander, C., & Liston, W. (2006). Operating on the obese women - a review. [Review article]. *BJOG An International Journal of Obstetrics and Gynaecology*(113), 1167-1172. doi: 10.1111/j.1471-0528.2006.01073x
- Barau, G., Robillard, P.-Y., Hulsey, T. C., Dedecker, F., Laffite, A., Geradin, P., & Kauffmann, E. (2006). Linear association between maternal pre-pregnancy body mass index and risk of caesarean section in term deliveries. [General obstetrics]. *BJOG An International Journal of Obstetrics and Gynaecology*. doi: 10.1111/j1471-0528.2006.10138.x
- Bell, R., & Heslehurst, N. (2011). *Discussing maternal obesity*. <http://www.fuse.ac.uk>: Fuse: The Centre for Translational Research in Public Health, Retrieved from http://www.fuse.ac.uk/uploads/event/vid_12989_Discussing%20Maternal%20Obesity.pdf.
- Bergholt, T., Lim, L. K., Jørgensen, J. S., & Robson, M., S. (2007). Maternal body mass index in the first trimester and risk of cesarean delivery in nulliparous women in spontaneous labor. [Research]. *American Journal of Obstetrics*(196), 163.e161-163.e165.
- Bordo, S. (1993). *Unbearable weight: Feminism, western culture and the body*. Berkley: University of California Press.
- Brynhildsen, J., Sydsjö, A., Norinder, E., Ekholm Selling, K., & Sydsjö, G. (2006). Trends in body mass index during early pregnancy in Swedish women 1978-2001. [Original Research]. *Journal of the Royal Institute of Public Health*(120), 393-399. doi: 10.1016/j.puhe.2005.10.015
- Burns, M., & Gavey, N. (2004). 'Healthy weight' at what cost? 'Bulimia' and a discourse of weight control. *Journal of Health Psychology*(9), 549-565. doi: 10.1177/1359105304044039
- Callaway, L., Prins, J. B., Chang, A. M., & McIntyre, D. H. (2006). The prevalence and impact of overweight and obesity in an Australian obstetric population. [Research]. *Medical Journal of Australia*, 184(2), 56-59.
- Campos, P. (2004). *The Obesity Myth - why America's obsession with weight is bad for your health*. Gotham: New York.
- Carryer, J. (2001). Embodied largeness: A significant women's health issue. *Nursing Inquiry*, 8(2), 90-97.
- Carryer, J., & Penny, S. (2008). Addressing the panic about 'obesity': Policy to protect health (pp. 0-13). <http://forumonpublicpolicy.com/archivespring08/carryer.pdf>: Forum on Public Policy.
- Catalano, P. M., & Ehrenberg, H. M. (2006). The short - and long - term implications of maternal obesity on the mother and her offspring. [Review article]. *BJOG An International Journal of Obstetrics and Gynaecology*. doi: 10.1111/j.1471-0528.2006.00989.x
- Cogan, J. C., & Ernsberger, P. (1999). Dieting, weight, and health: Reconceptualizing research and policy. *Journal of Social Issues*, 55(2), 187-205.

- Denison, F. C., & Chiswick, C. (2011). 70th anniversary conference on 'nutrition and health: from conception to adolescence'. Symposium I: Consequences of obesity and overweight during pregnancy: Improving pregnancy outcome in obese women. *Proceedings of the Nutrition Society*(70), 457-464. doi: 10.1017/S0029665111001637
- Dodd, J., M., Grivell, R., M., Nguyen, A.-M., Chan, A., & Robinson, J. S. (2011). Maternal and perinatal health outcomes by body mass index category. [Original Article]. *Australian and New Zealand Journal of Obstetrics and Gynaecology*(51), 136-140. doi: 10.1111/j.1479-828X.2010.01272.x
- Dresner, M., Brocklesby, J., & Bamber, J. (2006). Audit of the influence of body mass index on the performance of epidural analgesia in labour and the subsequent mode of delivery. [General obstetrics]. *BJOG An International Journal of Obstetrics and Gynaecology*. doi: 10.1111/j.1471-0528.2006.01048x
- Farquhar, C. M., & Gillett, W. R. (2006). Prioritising for fertility treatments - should a high BMI exclude treatment? [Commentary]. *BJOG An International Journal of Obstetrics and Gynaecology*, 1107-1109. doi: 10.1111/j.1471-0528.20069.00994.x
- Farrar, D., & Duley, L. (2007). Commentary: But why should women be weighed routinely during pregnancy? *International Epidemiological Association*(36), 1283-1284. doi: 10.1093/ije/dym210
- Fitzsimons, K. J., & Modder, J. (2010). Setting maternity care standards for women with obesity in pregnancy. *Seminars in Fetal and Neonatal Medicine*(15), 100-107. doi: 10.1016/j.siny.2009.09.004
- Freeman, D. J. (2010). Effects of maternal obesity on fetal growth and body composition: Implications for programming and future health. *Seminars in Fetal and Neonatal Medicine*(15), 113-118. doi: 10.1016/j.siny.2009.009.001
- Furber, C. M., & McCowan, L. M. E. (2011). A qualitative study of the experiences of women who are obese and pregnant in the UK. *Midwifery*, 27(4), 437-444. doi: 10.1016/j.midw.2010.04.001
- Furness, P. J., McSeveny, K., Arden, M. A., Garland, C., Dearden, A. M., & Soltani, H. (2011). Maternal obesity support services: A qualitative study of the perspectives of women and midwives. [Research Article]. *BMC Pregnancy and Childbirth*, 11(69). doi: 10.1186/1471-2393-11-69
- Gillett, W. R., Putt, T., & Farquhar, C. M. (2006). Prioritising for fertility treatments - the effect of excluding women with a high body mass index. [Short communication]. *BJOG An International Journal of Obstetrics and Gynaecology*, 1218-1221. doi: 10.1111/j.1471-0528.2006.00995.x
- Green, C., & Shaker, D. (2011). Impact of morbid obesity on the mode of delivery and obstetric outcome in nulliparous singleton pregnancy and the implications for rural maternity services. [Short Communication]. *Australian and New Zealand Journal of Obstetrics and Gynaecology*(51), 172-174. doi: 10.1111/j.1479-828X.2010.01271.x
- Harper, E. A., & Rail, G. (2010). Contesting "silhouettes of a pregnant belly": Young pregnant women's discursive constructions of the body. *Aporia*, 3(1), 5-10.

- Heslehurst, N. (2011). 70th anniversary conference on 'nutrition and health: from conception to adolescence'. Symposium I: Consequences of obesity and overweight during pregnancy: Identifying 'at risk' women and the impact of maternal obesity on National Health Service maternity services. *Proceedings of the Nutrition Society*(70), 439-449. doi: 10.1017/S0029665111001625
- Heslehurst, N., Bell, R., & Rankin, J. (2011). Tackling maternal obesity: The challenge for public health. [Current topics and opinions]. *Perspectives in Public Health*, 131(4), 161-162. doi: 10.1177/1757913911412477
- Heslehurst, N., Moore, H., Rankin, J., Ells, L., J., Wilkinson, J. R., Summerbell, C. D., & Dietetics, D. (2011). How can maternity services be developed to effectively address maternal obesity? A qualitative study. *Midwifery*(27), e170-e177. doi: 10.1016/j.midw.2010.01.007
- Heslehurst, N., Rankin, J., Wilkinson, J. R., & Summerbell, C. D. (2010). A nationally representative study of maternal obesity in England, UK: Trends in incidence and demographic inequalities in 619,323 births, 1989-2007. *International Journal of Obesity*(34), 420-428. doi: <http://dx.doi.org/10.1038/ijo.2008.250>
- Heslehurst, N., Simpson, H., Ells, L. J., Rankin, J., Wilkinson, J., Lang, R., . . . Summerbell, C. D. (2008). The impact of maternal BMI status on pregnancy outcomes with immediate short-term obstetric resource implications: a meta-analysis. *Obesity Reviews*(9), 635-683. doi: 10.1111/j.1467-789X.2008.00511.x
- Homer, C. S. E., Kurinczuk, J. J., Spark, P., Brocklehurst, P., & Knight, M. (2011). Planned vaginal delivery or planned caesarean delivery in women with extreme obesity. [Epidemiology]. *BJOG An International Journal of Obstetrics and Gynaecology*. doi: 10.1111/j.1471-0528.2010.02832.x
- Huda, S., S., Brodies, L. E., & Sattar, N. (2010). Obesity in pregnancy: Prevalence and metabolic consequences. (15), 70-76. doi: 10.1016/j.siny.2009.09.006
- Jarvie, E., & Ramsay, J. E. (2010). Obstetric management of obesity in pregnancy. *Seminars in Fetal and Neonatal Medicine*(15), 83-88. doi: 10.1016/j.siny.2009.10.001
- Kanagalingam, M. G., Forouhi, N. G., Greer, I. A., & Sattar, N. (2005). Changes in booking body mass index over a decade: Retrospective analysis from a Glasgow Maternity Hospital. [Short communication]. *BJOG An International Journal of Obstetrics and Gynaecology*, 112, 1431-1433. doi: 10.1111/j.1471.0528.2005.00685.x
- Keenan, J., & Stapleton, H. (2010). Bonny babies? Motherhood and nurturing in the age of obesity. *Health, Risk and Society*, 12(4), 369-383. doi: 10.1080/13698571003792926
- Kelly, R., Farah, N., O'Connor, N., Kennelly, M., Stuart, B., & Turner, M. J. (2011). A comparison of maternal and paternal body mass index in early pregnancy. [Original Article]. *Australian and New Zealand Journal of Obstetrics and Gynaecology*(51), 147-150. doi: 10.1111/j1479-828X.2010.01257.x

- Kerrigan, A. M., & Kingdon, C. (2010). Maternal obesity and pregnancy: A retrospective study. *Midwifery*(26), 138-146. doi: 10.1016/j.midw.2008.12.005
- Kinnunen, T. I., Pasanen, M., Aittasalo, M., Fogelholm, M., Hilakivi-Clarke, L., Weiderpass, E., & Luoto, R. (2007). Preventing excessive weight gain during pregnancy - a controlled trial in primary health care. [Original Article]. *European Journal of Clinical Nutrition*(61), 884-891.
- Krishnamoorthy, U., Schram, C. M. H., & Hill, S. R. (2006). Maternal obesity in pregnancy: Is it time for meaningful research to inform preventive and management strategies. [Review Article]. *BJOG An International Journal of Obstetrics and Gynaecology*, 113(10), 1134-1140. doi: 10.1111/j.1471-0528.2006.01045.x
- Lashen, H., Fear, K., & Sturdee, D. W. (2004). Obesity is associated with increased risk of first trimester and recurrent miscarriage: Matched case-control study. *Human Reproduction*, 19(7), 1644-1646. doi: 10.1093/humrep/deh277
- Majumdar, A., Saleh, S., & Candelier, C. K. (2010). Failure to recognise the impact of 'moderate' obesity (BMI 30-40) on adverse obstetric outcomes. *Journal of Obstetrics and Gynaecology*, 30(6), 567-570. doi: 10.3109/01443615.2010.492434
- McCowan, L. M. E., George-Haddad, M., Stacey, T., & Thompson, J. M. D. (2007). Fetal growth restriction and other risk factors for stillbirth in a New Zealand setting. [Original Article]. *Australian and New Zealand Journal of Obstetrics and Gynaecology*(47), 450-456. doi: 10.1111/j.1479-828X.2007.00778.x
- McGuire, W., Dyson, L., & Renfrew, M. (2010). Maternal obesity: Consequences for children, challenges for clinicians and carers. *Seminars in Fetal and Neonatal Medicine*(15), 108-112. doi: 10.1016/j.siny.2009.09.005
- Nagle, C., Skouteris, H., Hotchin, A., Bruce, L., Patterson, D., & Teale, G. (2011). Continuity of midwifery care and gestational weight gain in obese women: A randomised controlled trial. [Study Protocol]. *BMC Public Health*, 11(174).
- Nommsen-Rivers, L., Chantry, C. J., Peerson, J. M., Cohen, R. J., & Dewey, K. (2010). Delayed onset of lactogenesis among first-time mothers is related to maternal obesity and factors associated with ineffective breastfeeding¹⁻⁴. *American Society for Nutrition*(92), 574-584.
- Norman, J. E., & Reynolds, R. (2011). 70th anniversary conference on 'nutrition and health: from conception to adolescence'. Symposium I: Consequences of obesity and overweight during pregnancy: The consequences of obesity and excess weight gain in pregnancy. *Proceedings of the Nutrition Society*(70), 450-456. doi: 10.1017/S0029665111003077
- Nyman, V. M. K., Prebensen, A. K., & Flensner, G. E. M. (2010). Obese women's experiences of encounters with midwives and physicians during pregnancy and childbirth. *Midwifery*(26), 424-429.
- Orbach. (2006). Commentary: There is a public health crisis - its not fat on the body but fat in the mind and the fat of profits. *International Journal of Epidemiology*(35), 67-69. doi: 10.1093/ije/dyi256

- Perinatal and Maternal Mortality Review Committee. (2010). *Perinatal and Maternal Mortality in New Zealand 2008. Fourth report to the Minister of Health*. Wellington: Perinatal and Maternal Mortality Review Committee Retrieved from <http://www.pmmrc.health.govt.nz>.
- Phatak, M., & Ramsay, J. (2010). Impact of maternal obesity on procedure of mid-trimester anomaly scan. *Journal of Obstetrics and Gynaecology*, 30(5), 447-450. doi: 10.3109/01443611003797679
- Puhl, R., & Brownell, K. D. (2001). Bias, discrimination, and obesity. *Obesity Research*, 9(12), 788–805. doi: 10.1038/oby.2001.108
- Quinlivan, J. A., Lam, L. T., & Fisher, J. (2011). A randomised trial of a four-step multidisciplinary approach to the antenatal care of obese pregnant women. [Original Article]. *Australian and New Zealand Journal of Obstetrics and Gynaecology*(51), 141-146. doi: 10.1111/j.1479-828X.20210.01268.x
- Rankin, J., Tennant, P. W. G., Stothard, K. J., Bythell, M., Summerbell, C. D., & Bell, R. (2010). Maternal body mass index and congenital anomaly risk: A cohort study. [Original Article]. *International Journal of Obesity*(34), 1371-1380.
- Roman, H., Robillard, P. Y., Hulse, T. C., Laffitte, A., Kouteich, K., Marpeau, L., & Barau, G. (2007). Obstetrical and neonatal outcomes in obese women. *West Indian Medical Journal*, 56(5), 421-426.
- Rowlands, I., Graves, N., de Jersey, S., McIntyre, D. H., & Callaway, L. (2010). Obesity in pregnancy: Outcomes and economics. *Seminars in Fetal and Neonatal Medicine*(15), 94-99. doi: 10.1016/j.siny.2009.09.003
- Saguy, A., & Almeling, R. (2008). Fat in the Fire? Science, the news media and the 'obesity epidemic'. *Sociological Forum*, 23(1), 53-83. doi: 10.1111/j.1573-7861.2007.00046.x
- Sathyapalan, T., Mellor, D., & Atkin, S. L. (2010). Obesity and gestational diabetes. *Seminars in Fetal and Neonatal Medicine*(15), 89-93. doi: 10.1016/j.siny.2009.09.002
- Schmied, V. A., Duff, M., Dahlen, H. G., Mills, A. E., & Kolt, G. S. (2011). 'Not waving but drowning': a study of the experiences and concerns of midwives and other health professionals caring for obese childbearing women. *Midwifery*(27), 424-430. doi: 10.1016/j.midw.2010.02.010
- Schwartz, M., O'Neal Chambliss, H., Brownell, K. D., Blair, S. N., & Billington, C. (2003). Weight bias among health professionals specializing in obesity. *Obesity Research*, 11(9), 1033–1039. doi: 10.1038/oby.2003.142
- Sebire, N. J., Jolly, M., Harris, J. P., Wadsworth, J., Joffe, M., Beard, R. W., . . . Robinson, S. (2001). Maternal obesity and pregnancy outcome: A study of 287,213 pregnancies in London. [Paper]. *International Journal of Obesity*(25), 1175-1182.
- Shaikh, S., Robinson, S., & Teoh, T. G. (2010). Management of maternal obesity prior to and during pregnancy. *Seminars in Fetal and Neonatal Medicine*(15), 77-82. doi: 10.1016/j.siny.2009.10.003

- Smith, D., & Lavendar, T. (2011). The maternity experience for women with a body mass index ≥ 30 kg/m²: a meta-synthesis *BJOG An International Journal of Obstetrics and Gynaecology*, 779-789. Retrieved from: What is the maternity experience for obese women, researchers ask website: http://www.bjog.org/details/news/1029677/What_is_the_maternity_experience_for_obese_women_researchers_ask.html doi:10.1111/j.147-0528.2011.02924.x
- Smith, S. A., Heslehurst, N., Ells, L. J., & Wilkinson, J. R. (2011). Community-based service provision for the prevention and management of maternal obesity in the North East of England: A qualitative study. [Original Research]. *Public Health*(125), 518-524. doi: 10.1016/j.puhe.2011.05.004
- Stacey, T., Thompson, J. M. D., Mitchell, E. A., Ekeroma, A. J., & Zuccollo, J. M. (2011). Relationship between obesity, ethnicity and risk of late stillbirth: A case control study. [Research Article]. *BMC Pregnancy and Childbirth*, 11(3).
- Stacey, T., Thompson, J. M. D., Mitchell, E. A., Ekeroma, A. J., Zuccollo, J. M., & McCowan, L. M. E. (2011). Relationship between obesity, ethnicity and risk of late stillbirth: A case control study.
- Tischner, I., & Malson, H. (2011). Deconstructing health and the un/healthy 'fat' woman. *Journal of Community and Applied Psychology*, 22(1), 50-62. doi: 10.1002/casp.1096
- Vahratian, A., Zhang, J., Troendle, J. F., Savitz, D. A., & Siega-Riz, A. M. (2004). Maternal prepregnancy overweight and obesity and the pattern of labour progression in term nulliparous women. *The American College of Obstetricians and Gynecologists*, 104(5, Part 1), 943-951. doi: 10.1097/01.AOG.0000142713.53197.91
- World Health Organization. (2011). Obesity and overweight. Fact sheet no311 Retrieved 5 March, 2012, from <http://www.who.int/mediacentre/factsheets/fs311/en/index.html>
- World Health Organization. (2012). BMI classification Retrieved 5 March, 2012, from http://apps.who.int/bmi/index.jsp?introPage=intro_3.html
- Wray, S., & Deery, R. (2008). The medicalization of body size and women's healthcare. *Health Care for Women International*, 29(3), 227-243. doi: 10.1080/07399330701738291
- Yu, C. K. H., Teoh, T. G., & Robinson, S. (2006). Obesity in pregnancy. [Review Article]. *BJOG An International Journal of Obstetrics and Gynaecology*. doi: 10.1111/j.1471-0528.2006.00991.x

Media Analysis:

News media texts on ‘maternal obesity’

Introduction

This media analysis sampled a collection of news media stories on new scientific findings or emerging medical knowledge about ‘maternal obesity’ and conducted a thematic analysis of their content. The analysis aimed to identify how medical knowledge about ‘maternal obesity’ is being communicated to the general public through the news media; the role of the news media in the construction of ‘maternal obesity’ as a medical problem; and how these constructions may shape social and cultural concepts of pregnancy, body weight and the origins of health and illness.

The popular media is an important site of analysis because it has been identified in the feminist and critical obesity literature as a key site in the construction of meanings about women’s bodies (Bordo, 1993; Kaplan, 1992; Martin, 1988, 1989, 1991, 1994, 1999) and of the pathologising of, and panic about, obesity (Carryer & Penny, 2008; Harper & Rail, 2010; Keenan & Stapleton, 2010; Saguy & Almeling, 2008; Tischner & Malson, 2011; Wray & Deery, 2008). As Martin (1999, p. 97) argues, while the concepts of the body and health that constitute the social imagination are learned and developed in multiple and diverse ways in families, organisations, communities, and institutions, they are significantly developed ‘in relation to (influencing and being influenced by) the vast and heterogeneous contents of popular media’. These researchers argue that the way that popular media represent new scientific findings is critical to maintaining the authority and dominance of medical conceptualisations of the body and of health, even when medical knowledge is tentative. In her analysis of media constructions of assisted reproductive technologies, Bharadwaj (2000, p. 64) argues that science journalism in the West rarely engages critically with scientific findings and tends to project ‘a progressive and beneficial face of science’. In doing so, science journalism has been critiqued for overlooking the tentative nature of scientific inquiry, and its social and political context, frequently assuming the form of an ‘institutional advertisement’ (Dyck, 1995 ,as cited in, Bharadwaj, 2000, p. 64).

In conducting this analysis I was interested in the standard story or dominant discourses about ‘maternal obesity’ being told in the news media during my sample period. I was also interested in whether the news media constructions of new ‘maternal obesity’ medical research is tending towards an ‘institutional advertisement’ as critiqued by (Dyck, 1995 ,as cited in, Bharadwaj, 2000, p. 64) and, like obesity science journalism more generally, is implicated in dramatising ‘maternal obesity’ (Carryer & Penny, 2008; Harper & Rail, 2010; Keenan & Stapleton, 2010; Saguy & Almeling, 2008; Tischner & Malson, 2011; Wray & Deery, 2008), or whether this knowledge was critically examined and located as tentative and partial. Below I outline the methodology of this media analysis, including a brief explanation of the theoretical principles that underlie it. I outline both the collection of the data set and

the process of analysis. I then present my findings. I have used single inverted commas to highlight terms such as 'obesity' that are contested and thus which I use tentatively.

Method

The method of thematic analysis used here is informed by the theoretical principles of feminist poststructuralism and social constructionism. Poststructuralism insists on the historical and cultural specificity of all knowledge, including that generated within medical and scientific paradigms. It rejects the notion of a universal material and social world that exists independently of the knower and that can be 'discovered' through research. Rather, all knowledge, including that produced as research, is understood as rooted in the values and interests of particular groups and informed by power relations. Thus, from a poststructuralist perspective, there are no universal truths to be encountered in social inquiry, only partial or situated knowledge that is constructed in the specifics of time and place (Leatherby, 2003; Pilcher & Whelehan, 2004). Informed by the intellectual movement of poststructuralism, social constructionism likewise takes a critical stance towards taken-for-granted knowledge; assumes the historical and cultural specificity of all knowledge; conceptualises knowledge as produced through social interaction, especially language and discourse; and asserts that constructions of knowledge effect social practices and vice versa (Burr, 1995, p. 12).

Feminist women's health researchers, informed by poststructuralist and social constructionist principles, have challenged the 'objective' knowledge of science and biomedicine to reveal the gendered stereotypes and metaphors about women's bodies hidden within them (Martin, 1988, 1989, 1991, 1994, 1999). Feminist social constructionist studies have argued that women's bodies and bodily processes, such as menstruation, reproduction and menopause, have been constructed as deviant, faulty or risky and thus requiring both expert and self surveillance (Davis-Floyd, 2003; Howson, 2001; Ryan, Carryer, & Patterson, 2003). For these researchers, the strongly held cultural notion that science and biomedicine produce 'naturally unfolding scientific knowledge (with its objectivity, rationality and empiricism)' is rejected (Lupton, 2003, p. 26). Instead, biomedical and scientific knowledge about, and practices around, the body are understood as products of their social and political context (Harding, 1997, p. 147; Ryan et al., 2003, p. 40). Likewise critical fat studies researchers have argued that current medical understandings of the category 'obesity' are imbued with Western cultural anxieties about fat and the desirability of thinness as aesthetic. From this perspective, medical discourses on 'overweight and obesity' are working to pathologise and medicalise fat, legitimise fat-phobia and contribute to an epidemic of body dissatisfaction (Orbach, 2006).

Thematic analysis

Research from this perspective is focused on the constructive effects of discourse and the discursive procedures whereby human beings gain an understanding of their common world. The aim is to deconstruct or destabilise the taken-for-granted assumptions about how things are and to identify and

examine the presence and effects of discourse that construct knowledge, practices and subjects, and to present alternative accounts that challenge and question.

The approach to thematic analysis employed here takes as its focus of inquiry the constructive effects of discourses within texts. All discourses are considered to be textual (expressed in texts), and also inter-textual (drawing upon other texts and their discourse to achieve meaning) (Lupton, 2003, p. 20). Burr (1995, p. 166) argues that discourse analysis can be understood as deconstructive as it attempts to take texts apart and see how discourses construct them to present particular images of people and their practices. In analysing the functions or effects of discourses within texts, the analyst attempt to identify which discourses are privileged and thus become dominant in a given context, and the power implications of this. The researcher may be concerned to identify the subject positions offered by different discourses, and the identity and political implications of these (Burr, 1995, p. 166).

In undertaking this project I was interested in the following questions:

1. How is the body weight of larger pregnant women being constructed within biomedical and news media discourses?
2. What implications do these constructions have for conceptualisations of pregnancy, the origins of health and illness, and women's roles and responsibilities for their future children?
3. Do the practices and bodies of knowledge that are intended to improve maternal and child health also have the potential to compromise the health and wellbeing of women?

Below I briefly outline the data selection and the analysis process.

Data set

The data set for this analysis consisted of 18 months of electronically available print and electronic news media texts relating to 'maternal obesity' from 1 August 2010 to 1 April 2012. The broader interest of the author was in popular media representations which would include social media, magazines, television including television news, websites, and blogs. However to manage the size and scope of the project this particular analysis was restricted to print and electronic news media, and in particular news and feature articles from daily newspapers, and the news websites operated by the two major news corporations in New Zealand, Fairfax Media and APN Holdings. Print and electronic news media was chosen because of its wide circulation, easy accessibility, regularity and because news media has been acknowledged by both sociologists of medicine and health and the health sector, as important in communicating medical science and health information (Lupton & Mclean, 1998). The author acknowledges the limitations of this restricted sample, particularly the exclusion of news magazines and other 'official' news sources. The articles were sourced from Fairfax Media's www.stuff.co.nz and APN News and Media's www.nzherald.co.nz. I also searched for print news media articles for the same period on the full-text news media database Newztext Plus. Search terms used on all three sites were:

obes*, pregnan*, fat, wom*, matern*, BMI. These search terms were chosen as they covered my main areas of interest and were confirmed as appropriate through an informal review of news media articles collected by the author over the past year. These searches resulted in 34 news articles for analysis, all of which were included in the final sample (see Appendix 1 for the list of articles). Articles were from daily papers representing most of Aotearoa New Zealand's main centres- Dunedin, Chirstchurch, Wellington and Auckland and some regional newspapers. The articles were numbered in chronological order for ease of handling.

Process of analysis

The analysis aimed to ascertain the meanings about 'maternal obesity' contained in the article sample to identify the dominant discourses or story being told about 'maternal obesity' in the news media. Braun & Clarke (2006) provide a 'recipe' for undertaking thematic analysis which can be adapted to the particular theoretical concepts that underlie the research investigation. It is a pattern analysis - repeated patterns of meaning are sorted across the data set rather than within each data item and are then made sense of according to the theoretical orientation of the research (Braun & Clarke, 2006).

The process of analysis began with repeated close critical readings of the articles to familiarise myself with the content and their breadth and depth (Braun & Clarke, 2006, p. 87), to "immerse" myself in the texts. Braun & Clarke (2006, p. 87) argue that 'immersion usually involves "repeated reading" of the data, and reading the data in an active way – searching for meanings, patterns and so on'.

The next step involved generating the initial codes. Braun & Clarke (2006, p. 86) say codes identify 'a feature of the data that appears interesting to the analyst, and which refers to 'the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon'. I worked systematically through the articles identifying, listing and numbering interesting and repetitive aspects of the data that I thought may form recurring patterns across the data set. I then went through each article line by line and identified extracts that represented that code.

This resulted in a coding directory of 55 codes, each with all of the occurrences of each particular code listed. The next step 'refocuses the analysis at the broader level of themes, rather than codes' (Braun & Clarke, 2006, p. 89). It involved sorting the different codes into potential themes, and collating all the relevant coded data extracts with the identified themes. I did this visually by mapping the relationship between the codes to form themes, and then mapping the themes in relation to each other. Codes were arranged together to form main and subthemes, some codes were abandoned and a small number grouped together to form a category I titled 'contradictions and outliers'. I ended this phase with a collection of candidate and sub-themes, all related to coded extracts from the data (Braun & Clarke, 2006, p. 90).

The final steps involved reviewing, defining and naming themes. This involved reading 'all of the collated abstracts for each theme' and considering whether they did indeed form a 'coherent pattern'

(Braun & Clarke, 2006, p. 91). This resulted in some re-arrangement, with some collapsed together, others separated out, and several reworked. I then reread the entire data set to ensure my thematic map accurately reflected the meanings evident in the data set as a whole. Having verified that the thematic map worked I defined the themes and chose which extracts best demonstrate each one. Finally I developed an accompanying narrative for each theme explaining the dynamics of the theme and how they relate to the overall story of the data (Braun & Clarke, 2006, p. 92).

Findings

There are three clusters of themes in my final analysis: those relating to the 'problem' of 'maternal obesity'; those relating to what should be done about this 'problem'; and contradictory or outlier themes. The first two clusters represent different aspects of the dominant discourses about 'maternal obesity' in the print and electronic news media during the sample period. The third cluster demonstrates departures from this dominant story, including contradictory or alternative discourses and critical engagement with the scientific knowledge being presented.

Consistent with the media constructions of obesity science more generally, the story of 'maternal obesity' told in these articles is a dramatic framing with imagery of 'life and death', battle and sacrifice. Scientists and clinicians are framed as leading the 'fight' against 'maternal obesity' and their knowledge claims are largely treated as authoritative and unquestionable with few opposing sources used by reporters. Women, whether they be pregnant or potentially pregnant (arguably most women of reproductive age), are framed as individually responsible for the 'crisis' of 'maternal obesity' and of the 'obesity epidemic' more generally through the conditions created in 'the womb environment'. Body weight is framed as something which is modifiable and a primary determinant of health. Being 'overweight' or 'obese' excludes the possibility of health, results from the individual's failure to manage their behaviour, and is framed as a significant financial burden to the country. Women's reproductive bodies are represented as a 'womb environment' or 'container' for the fetus, which, if not managed appropriately, will affect the life-long health of the future child. Medical knowledge about 'maternal obesity' is framed as complete and factual, rather than tentative and partial.

The 'problem' of 'maternal obesity'

In the first cluster of themes identified in this analysis, 'maternal obesity' is represented as a significant and growing medical and social problem that is putting the health of the fetus and future children, indeed the whole of society, at risk. The themes contained within this cluster relate to scale of the 'problem'; the causes of 'maternal obesity'; the burden 'maternal obesity' is placing on the public health system; and the implications of 'maternal obesity' both for childbirth outcomes and the future health of children born to 'obese' women.

The mother of all problems: 'maternal obesity' as a growing crisis

'Maternal obesity' is represented in these articles as a significant and growing issue that represents the 'new wave' of effects of the 'obesity epidemic' afflicting society. Pregnancy is positioned in this story as the new 'battleground' for the fight against obesity with the need to get 'mothers on board' and engaged with the 'fight':

New Zealand College of Midwives midwifery Advisor Norma Campbell said obesity during pregnancy was becoming a "bigger and bigger issue". (Article 7)

"We have to start focusing more on the help of mothers...otherwise we will never tackle this epidemic completely. In 2009, an OECD report found 26.5 per cent of New Zealanders were obese. Obesity costs the health system about \$500 million each year. (Article 15)

The incidence of 'maternal obesity' is framed as high and as rapidly increasing:

Pregnant women are packing on too many kilograms, risking their health and that of their babies and costing the health system a fortune. A staggering 41.5 per cent of the 7735 women who gave birth at Auckland's National Women's Hospital in 2009 were classified as overweight or obese. (Article 6)

Middlemore has the busiest maternity ward in the country. The number of obese pregnant patients increased from 15 percent in 2006 to 35 percent last year. Several had body mass indexes higher than 50, well above the recommended maximum of 25, said consultant Yvonne Lake. (Article 10)

Almost half of women of child-bearing age are overweight or obese and more than 15 per cent of pregnant women are obese. (Article 25)

This is despite acknowledgement in some of the articles that an accurate picture of the diversity of pregnant women's body weight is impossible since there is no national data:

Previous data on pregnant weights at National Women's are incomplete and there is no national statistics on the size of expectant mums. But national and international research showed it was a growing problem... (Article 6)

Reports of the prevalence of 'maternal obesity' in the articles vary widely. In items discussing this issue, the prevalence of childbearing age women who are 'overweight' and 'obese' tends to be conflated despite adverse outcomes being associated only with women with very high BMIs. This not only heightens the perception of prevalence but also suggests that any woman whose body weight is above the 'normal' BMI category is implicated in this 'crisis', which is inconsistent with the literature. This represents an implicit moral judgement of pregnant women's body weight deemed to be 'excessive'

regardless of whether this weight is thought to be associated with adverse outcomes in their pregnancies:

According to the study, 38 per cent of women giving birth in New Zealand are overweight or obese. (Article 7)

Almost half of women of child-bearing age are overweight or obese and more than 15 per cent of pregnant women are obese. (Article 25)

Almost 60 percent of women of child-bearing age in wealthy countries are overweight or obese, The Lancet reported in April. (Article 29)

Health on the scales: ‘maternal obesity’ as an absence of health

‘Maternal obesity’ is represented in these articles as a state which is contradictory to the experience of health and that results from unhealthy lifestyles, poor food choices, hyperphagia (overeating) and the lack of information or understanding about what action is needed for a ‘normal’ or ‘healthy’ weight. Health is closely indexed to weight in these articles, with a binary opposition between ‘healthy weight’ - weight that can be classified within the ‘normal body weight’ category of the Body Mass Index (BMI) - and weight which is outside that category and therefore ‘unhealthy weight’. Body weight is framed as modifiable. It is pregnant women’s individual responsibility to comply with and maintain a ‘healthy weight’ before, during and after pregnancy:

“The message has to be that they have to be a healthy weight when they go into pregnancy, they have to control their diets when they are pregnant, then they need to be encouraged and supported with breastfeeding once their baby is born. There are a number of different stages where you can intervene to improve outcomes.” (Article 29)

Larger pregnant women are presumed to overeat and to have ‘unhealthy’ diets, consisting of takeaways and junk food and devoid of fresh fruit and vegetables. This is represented as resulting from a failure to understand the future consequences of such a diet, a lack of information, and/or a lack of self-control:

“We had another study where we put the offspring of obese mums on a healthy diet. The offspring on a healthy diet were much better off than those who had an unhealthy diet. “I think the message is: what you are doing today has an impact and everyone can do that, provided they have the information and the wherewithal to buy healthy food.” (Article 29)

Ludwig said when pregnant women overeat, some of those extra calories overstimulate the fetus’ growth. (Article 1)

BJOG editor Philip Steer said pregnant women needed to eat fewer takeaways and more fresh fruit and vegetable. “This study emphasises the importance of good diet and nutrition. Unfortunately, many people find it difficult to resist the temptations of ‘junk’ food.” (Article 2)

There is no acknowledgement of variation in body size and mean body weight across different ethnic groups. The construction of a 'normal' or 'healthy' body weight could be critiqued as Eurocentric, disadvantaging, for example, various Pacific populations who have a higher mean BMI.

Super-sizing maternity care?: 'maternal obesity' as a burden on the public health system

'Maternal obesity' is represented in these articles as a significant financial and resource burden on the public health system. The added care and resources supposedly required by larger pregnant women are represented as amounting to 'millions and millions' of extra public health dollars. There are clearly strong economic drivers behind the interest in 'maternal obesity'. The implicit message here is that the added costs to the public health system associated with 'maternal obesity' are avoidable and caused by the selfish or ignorant behaviour of individual women. The hyperbole used to describe the economic 'burden' of 'maternal obesity' includes terms such as 'costing the health system a fortune'. Weight-based puns such as 'heavy burden' or 'heavy strain' and 'massive problem' are frequently deployed, mocking large women whilst also being alarmist:

Pregnant women are packing on too many kilograms, risking their health and that of their babies and costing the health system a fortune. "It's a massive problem," she said. "It costs the health system millions and millions...Big mums put a heavy strain on the health system", McCowan said, because they required more nursing and midwifery assistance. Many hospitals now have expensive super-sized beds and wheelchairs. (Article 6)

Certainly there are more and more large babies being born to larger and larger women, leading to a whole new suite of health problems and birthing risks. It costs money, in terms of the pregnancies themselves, but also down the track when seemingly an even bigger swathe of our population will be type 2 diabetics...I'm sure the UK trial will be watched eagerly by all countries struggling to contain health costs, including New Zealand. (Article 32)

The articles emphasise the need for, and cost of, additional infrastructure including extra staffing requirements, larger beds and wheelchairs, and more advanced ultrasound technology. Technology, in this case, ultrasound technology, is framed in this excerpt as a 'weapon' in the 'fight against fat' and as a 'life-saving intervention':

Fat-busting ultrasound machines are giving overweight mums-to-be the chance to see their unborn babies' faces for the first time. The technology at Auckland's Middlemore Hospital is a first for New Zealand and was developed to cope with a rise in the number of obese pregnant women....Ultrasounds allow staff to identify birth defects and other potential problems. Layers of fat made it hard to get a clear picture of an unborn baby, she said. The machines provided much clearer images, and could show them in 3D. They have allowed staff to identify four cases of congenital heart disease that may not have been found otherwise. "It's made a huge

difference,” said Lake. Middlemore bought two \$200,000 machines with funds from the Mayoress Ball and Lion Foundation. (Article 10)

A heavy burden: ‘maternal obesity’ and adverse childbirth outcomes

‘Maternal obesity’ is also represented as the leading cause of pregnancy complications and as the reason for increasing rates of childbirth interventions:

He said the issue was changing the face of maternity care in New Zealand. “It’s starting to impact on the way we deliver pregnancy care, more inductions, C-sections, bleeding and the babies are twice as likely to be admitted to the special care baby unit.” (Article 6)

“Obesity is now the leading cause of pregnancy complications...” (Article 8)

Rising obesity is driving an increase in pregnancy complications, an Australasian study of more than 3000 women shows. (Article 7)

The articles associate a catalogue of adverse reproductive and childbirth outcomes with ‘maternal obesity’. The range of adverse outcomes, highly reflective of the ‘maternal obesity’ literature, include a negative impact on fertility, congenital abnormalities in offspring, stillbirth, the development of pregnancy complications such as pre-eclampsia and gestational diabetes, needing a caesarean section, postpartum haemorrhage, admission of babies to the neonatal unit and reduced rates of breastfeeding:

Nearly half of all newborn babies that die are born to overweight or obese mothers, prompting concerns that increasing obesity rates could spark a rise in the number of baby deaths. (Article 3)

The study found 25 percent of overweight and 36 percent of obese women who went into labour at full term delivered by caesarean. This compared with 18 percent of women with normal body weight. Principal investigator, New Zealander Lesley McGowan, said the findings showed obese women were also at risk of pre-eclampsia – a hypertensive condition which means the baby is more likely to be born prematurely or undernourished, “We found that overweight women have a 5.7 per cent chance of developing pre-eclampsia and this increased to 10.7 percent in obese women versus 3.9 percent in those with a normal weight,” she said. Obese women were less likely to successfully breastfeed. Breastfeeding reduces the risk of childhood obesity. (Article 7)

The articles construct the association between ‘maternal obesity’ and adverse childbirth outcomes sensationally, reading like a ‘catalogue of harms’ and including headlines such as ‘Mum’s obesity may have role in baby’s deaths’ (Article 3) and ‘Big mums risk babies’ health’ (Article 6).

‘Obesity’ in pregnant women is represented in article 11 as an even greater risk factor for stillbirth than smoking cigarettes. The construction of obesity as a pregnancy health risk equal to or exceeding that of smoking warrants investigation in its own right. Such an investigation would need to consider the extent to which this construction may impact on public health messages to pregnant women about

smoking in pregnancy and the extent to which body weight is a modifiable risk factor in the same way that smoking is, not to mention the desirability or feasibility of weight loss for pregnant women.

“Our research in New Zealand shows that the most important risk factor for stillbirth is pregnant women being overweight or obese,” she explained. “Unfortunately we are all getting bigger and 38 – 40% of pregnant women are either overweight or obese. To put that in perspective, if all pregnant women were of normal weight we’d get rid of a third of stillbirths, and if no-one smoked during pregnancy we would get rid of a sixth of stillbirths..”. The age and background of mothers, and alcohol use are also thought to be factors, although McCowan said they are not as significant as obesity. (Article 11)

Pregnancy complications including pre-eclampsia and gestational diabetes are presented as a complication caused by ‘maternal obesity’, and as contributing to other complications and poor outcomes:

In pregnancy, one of the most serious risks of obesity is gestational diabetes, which has increased significantly over the past 20 years. The condition results in an increased rate of still birth, premature delivery, surgical intervention during labour and higher birth weight. The diagnostic criteria for gestational diabetes will change next year leading to a substantial increase in the number of women affected. (Article 29)

Typical with science journalism in daily newspapers, there is little consideration of the underlying mechanisms of ‘maternal obesity’ that result in adverse outcomes. Those articles that do attempt to explain mechanisms, again reflecting the literature, rely entirely on pathophysiological explanations related to the ‘quality’ of the uterine environment in ‘obese’ pregnant women. The tentative or speculative nature of the medical theories about the underlying mechanisms in ‘maternal obesity’ is not made explicit, and nor are these knowledge claims challenged by other sources in the articles:

“The fetus is developing in an abnormal metabolic environment where there is excess blood sugar,” he said. “That could alter the development of tissues, organs and perhaps even the wiring of the brain that regulates appetite and metabolism.” (Article 1)

The articles do not consider social or structural factors that could influence the outcomes supposedly associated with ‘maternal obesity’.

An obesity time bomb?: the pregnant body as the harbinger of future obesity

As well as being associated with a plethora of adverse reproductive and childbirth outcomes, the articles represent ‘maternal obesity’ as the cause of future obesity and ill-health in the offspring born to ‘obese’ women. In this theme, women’s reproductive bodies are framed as a ‘womb environment’ or ‘container’ for the fetus. If the conditions of this ‘container’ or ‘environment’ are compromised by the

effects of the pregnant women's weight or diet, the pregnant body becomes an 'obesity time bomb' or the harbinger of obesity in offspring and thus the underlying cause of the 'obesity epidemic':

Being born very large as a result of this kind of atmosphere in the womb is correlated with becoming obese as an adult. And the last thing populations need, according to health authorities, is even more obese and/or type 2 diabetics. (Article 32)

Childhood obesity starts in the womb, with overweight mothers giving birth to fat babies... The study was led by Professor Neena Modi, the UK's top authority on high-risk health problems in newborns. She said magnetic resonance imaging (MRI) scans had provided clear evidence that being overweight or obese in pregnancy could result in potentially harmful changes to a baby's fat levels while still in the womb. (Article 25)

Expectant mother's diets could be creating an obesity timebomb for their unborn children, a groundbreaking study involving New Zealand scientists has revealed. (Article 15)

As well as programming offspring for future obesity, a 'toxic womb environment' resulting from pregnant women's obesity or an 'obesogenic' diet is also represented as determining life-long health:

The discovery adds weight to New Zealand-led research that shows a baby's environment before its birth may determine its life-long health. (Article 33)

Auckland University professor Sir Peter Gluckman, who led the New Zealand arm of the study, said there had been a long-suspected link between a poor start to life and the later development of heart disease, diabetes and obesity, but until now there had not been human data to back up the idea. (Article 16)

While the emphasis is largely on the long-term effects of pregnant women's body weight as something that may be passed on to the fetus, some articles emphasise the diets and lifestyle choices of pregnant women and how they contribute to future obesity in offspring:

The study suggests that pregnant women need to be aware of everything they are eating, and moderate not only their consumption of foods that are fatty but also those that are high in fructose. It showed that failing to do so could cause liver problems. Researchers say the study is a warning to mothers to moderate their intake of processed bread, cake, fizzy drinks and lollies. (Article 9)

What a woman eats and drinks during her pregnancy can alter her child's DNA. That change can determine whether her child will grow up to be obese, and can even increase the risk of later obesity and disease. (Article 15)

Based on the work of Professor Peter Gluckman and other scientists, health officials are focusing on how a mother's diet can determine a child's weight and risk of diabetes and heart disease in

later life. The shift in thinking will be about an end to funding for some schemes that focus on changing adult behaviour....Prof Gluckman, an international obesity expert and Prime Minister John Key's chief science advisor, says the evidence is growing that a bad diet or unhealthy lifestyle in pregnancy can switch on obesity genes in a fetus. Overfeeding and weaning a baby on to the wrong foods could have a similar effect. (Article 31)

Again, few articles attempt to provide an explanation of the underlying mechanisms that might explain how an 'obesogenic diet' determines the future body weight and 'life-long health' of offspring. Those that do, refer to the effects of 'maternal obesity' and pregnancy diet in 'altering DNA', no suggestion that this is largely speculative. There is no consideration in these articles of the social or structural factors which may influence health across a person's life-course. The framing of pregnant women as solely responsible for 'producing health' has the effect of gendering and individualising responsibility for health, which is reduced to the absence of excess body weight. This construction of maternal responsibility represents pregnant women as somehow removed from the material and social world, and reduces their personhood to their reproductive capacity. For example, in this excerpt from article 25, the effects of the 'womb environment' on the baby are described without actually mentioning the pregnant woman whose womb it is, let alone the material and social conditions of her life:

"This shows how sensitive the baby is to the environment experienced within the womb and how lifelong effects may be initiated before birth." (Article 25)

What should be done about the 'problem' of 'maternal obesity?'

The second cluster of themes relates to what should be done about the 'problem' of 'maternal obesity'. The story of 'maternal obesity' continues here with calls to action to prevent its effects on future children and on society. This cluster locates pregnancy as the site where the battle against the 'obesity epidemic' must take place; stresses the need for preconceptual interventions to prevent 'maternal obesity'; and discusses how the risks of 'maternal obesity' in pregnancy should best be managed. It emphasises pregnant women's individual responsibility to 'take stock' of the problem of 'obesity' to reduce the risks she poses for her future child. If pregnant women fail to do this, they are positioned as needing to submit to medical surveillance and management including 'drastic measures' if necessary.

Obesity prevention starts in the womb

In this theme, the perils posed by 'maternal obesity' for future offspring are framed as preventable, or at least able to be reduced, if women are informed about what is required, accept their responsibilities, and take assertive action:

A women's weight does not have to be a life sentence for her baby. (Article 29)

“Pregnancy and where possible prior to pregnancy, may well be the ideal times to encourage women to adopt a healthy diet, improve their intake of important nutrients, and make lifestyle changes to reduce their risk of obesity”. (Article 2)

The ‘womb environment’ is represented as ‘ground zero’ in the struggle to contain the ‘obesity epidemic’ with the need to get women on board and engaged in tackling the ‘crisis’:

The Government is set to reduce funding for adult nutrition programmes and will instead target pregnant women to tackle the obesity crisis. (Article 31)

It was vital for moves to be made to help mothers, particularly new mothers, to look after themselves. “The study demonstrates the importance of developmental factors before birth in the pathway to childhood obesity – and we already know that childhood obesity is an important predictor of later diabetes and heart disease,” he said. “It does imply that attention to mothers’ health and nutritional status early in pregnancy is very important, to get the best for your baby. “We have to start focusing more on the help of mothers...otherwise we will never tackle this epidemic completely.” (Article 15)

Thinking ahead: obesity prevention before conception

The articles strongly emphasise the need to intervene early and prepare the ‘maternal environment’ for reproduction to prevent future obesity and other ‘ill-health’ in offspring. ‘Getting in early’ includes encouraging women prior to conception to adopt a ‘healthy diet’, to lose weight, improve their intake of ‘important nutrients’ and generally make ‘lifestyle changes’ to reduce their risk of obesity:

“The whole story is one which really starts at preconception,” Professor Jeffery explained. “The message has to be that they have to be a healthy weight when they go into pregnancy, they have to control their diets when they are pregnant, then they need to be encouraged and supported with breastfeeding once their baby is born. There are a number of different stages where you can intervene to improve outcomes.” (Article 29)

“Implementation of preconception care for all women could reduce these risk factors..” (Article 12)

“Pregnancy and where possible prior to pregnancy, may well be the ideal times to encourage women to adopt a healthy diet, improve their intake of important nutrients, and make lifestyle changes to reduce their risk of obesity”. (Article 2)

Educating women is represented as the most important intervention, with the implicit assumptions that women simply are not aware of what is required of them and that weight-loss and compliance with nutritional advice will follow education.

Prof Gluckman said “education is at the core” with better targeted information. (Article 31)

Again the articles do not consider the material and social conditions of women's lives that may shape their 'lifestyle choices' and their engagement with public health messages.

Some articles propose that education should start not just before conception for those women who are wanting to become pregnant, but before women even reach their reproductive years:

"To reduce the pregnancy risks, we should be working to prevent obesity in young women."
(Article 21/23)

Auckland University's Liggins Institute, which Prof Gluckman used to head, is also experimenting with providing nutrition and health literacy to adolescent girls. (Article 31)

The notion of a population-level intervention aimed at young women relies on the construction of all women and girls as 'pre-pregnant' regardless of their future procreative intentions or even whether or not they are fertile. It also displaces women from the centre of health education aimed at them. 'Women's health' becomes the project to ensure the 'health' of potential future children and a 'healthy' society, rather than a project to secure health for women in their own right and as defined by their own priorities and experiences. The implication of this construction for the human right of all people to health requires further investigation.

Making the best of a bad situation: managing 'maternal obesity'

These articles emphasise preventing 'maternal obesity' and an 'obesogenic womb environment' through interventions aimed at women before they conceive. However, they also propose a range of ways to manage women who find themselves 'obese' and pregnant. The standard story here is that the pregnancies of 'obese' women should be subject to close surveillance and carefully managed; that interventions to reduce the risk of harm to the fetus are warranted; and that drastic measures can be justified if necessary. The following subthemes demonstrate the various propositions in the news media sample for the management of the 'obese' pregnant body.

Weighing in: weight monitoring as a 'maternal obesity' intervention

The articles focus strongly on monitoring women's weight while pregnant. This includes measuring and recording pregnant women's height and weight at the first antenatal visit, advising on appropriate weight gain in pregnancy, and monitoring women's weight during pregnancy. The rationale for weight monitoring in pregnancy is represented as an effort to ensure women do not gain more weight while pregnant, despite some degree of weight gain widely accepted as a physiological response to pregnancy:

Obese women shouldn't gain any more weight. Pregnant women are increasingly at risk of obesity-related complications. They should be weighed at their first visit and a goal set for their gestational weight gain, Dr Wise says....They should be told: "Whatever you

do, don't gain any weight," she says. "It's the one thing that will help you have a normal birth." (Article 24)

She said Kiwi midwives and obstetricians recorded weights and heights so they could advise patients of ideal weight gains. (Article 6)

The practice of weight monitoring and management in pregnancy is represented both as a 'life saving' measure and as 'empowering' for women. However, no rationale was provided to support either claim:

Having the correct information could save a baby's life. (Article 14)

Dr Paterson said the data "empowered" women and she was keen to work co-operatively with lead maternity carers to improve the situation. (Article 14)

Articles also emphasised that women should not be 'allowed' to self report their weight and height and that Ministry of Health guidelines should mandate that weight and height should be measured by a health professional. The suggestion here, of course, is that women cannot be trusted to honestly or accurately report their own weight and that weight measurement should be left to experts:

Height and weight checks on pregnant women should be standardised by the Ministry of Health to cut the risk of complications, a Southern District Health Board obstetrician/gynaecologist says. Dr Helen Paterson, also a senior lecturer at the Dunedin School of Medicine, said research in the board's catchment area last year showed many lead maternity carers allowed women to self-report heights and weights, rather than take a measurement. Exact measurements were important because the data helped track the growth of the fetus. (Article 14)

The articles do not consider any potential harmful effects of weight monitoring in pregnancy, evidence for some of these is considered in the discussion.

Getting yourself under control: lifestyle changes as 'maternal obesity' intervention

The articles emphasise the need for 'obese' pregnant women to make 'lifestyle changes' including modifying their diet and increasing their levels of physical activity, so that they do not gain more weight and pose even more of a risk to their future child:

Health guidelines say mums-to-be don't need to increase their calorie intake until the last three months, when they need only an extra 200 calories a day – the equivalent of a small sandwich or a small bowl of sugar-free muesli. "It can have serious consequences". (Article 30)

Dr Morton said exercise was generally good for everyone’s health, including pregnant women. “Being active in pregnancy probably tends to mean that that woman is going to be active post-natally, and the chances are that is creating an environment that is likely to be potentially better for the child in terms of learnt behaviours than being born into a home where exercise is not routine.” (Article 34)

Making these ‘lifestyle changes’ is framed as a moral issue, being ‘the least women can do’ for their future children. Women are urged to tolerate the ‘discomfort’ of making such changes and that it is a ‘small price to pay’ for a ‘healthy child’. The project of pregnancy for ‘obese’ women, in they want to be ‘a good mother’ is represented as an exercise in restraint, tolerance and self sacrifice:

“Its never too early to start preventing obesity,” said Stephan Rossner, a professor in the obesity unit at Karolinska Hospital in Sweden who was not connected to the study. “It may be uncomfortable for mothers to eat less and change their lifestyle, but after nine months they will get a great payoff for their children.” (Article 1)

At-risk women should still undertake sensible exercise and ignore the myth they were “eating for two” and thus could eat whatever they wanted. (Article 5)

Again this representation of ‘maternal obesity’ relies on the construction of ‘body weight’ as something that is modifiable, and weight loss or the maintenance of weight in pregnancy as something that is both highly desirable, even morally right, as well as achievable. To be a ‘good mother’, ‘obese’ pregnant women are constructed as needing to comply with traditional gendered notions of motherhood, in which women sacrifice themselves in service to the family. The articles again do not consider the material and social conditions of women’s lives that shape their ‘lifestyle’ choices and ‘health’ seeking behaviours. Further, the construction of ‘health’ and ‘health seeking’ as an individual project, renders invisible ethnic and other social inequities that result in differential access by various groups in society to the conditions that create health.

By any means possible: pharmacological and surgical interventions

Failing all else, the standard story of ‘maternal obesity’ concludes that that drastic measures, including pharmacological and surgical interventions, may be warranted to mitigate the risk of obesity in the offspring of ‘obese’ women. The need for more intensive medical management of ‘maternal obesity’ is framed as the result of women failing to follow professional advice, and to prioritise their baby’s health over their own desires and temptations:

In the US, more than a third of women of normal weight and more than half of overweight and obese women gain more weight than their doctors recommend. (Article 1)

BJOG editor Philip Steer said pregnant women needed to eat fewer takeaways and more fresh fruit and vegetable. "This study emphasises the importance of good diet and nutrition. Unfortunately, many people find it difficult to resist the temptations of 'junk' food." (Article 2)

Pregnant women are packing on too many kilograms, risking their health and that of their babies. (Article 6)

Pharmaceutical interventions are framed as a potential solution. The potential for pregnant women to 'take a pill' to prevent 'passing on obesity' to their children received much attention in the mass media during this sample period:

What would you do if you could take a pill while pregnant and greatly reduce your child's chance of becoming obese as an adult? It may sound fantastical, but that is the option being given to morbidly obese pregnant women in four British cities as a result of an NHS trial to try and counteract the "programming" that babies receive in the womb. In the case of pregnant women who are obese or have gestational diabetes, too much insulin is made, meaning babies get too much nutrition, and are born overly large themselves. (Article 32)

The rationale for a pharmacological intervention is the failure of 'obese' pregnant women to lose or manage their weight in preparation for pregnancy. In this context, acquiescing to pharmacological interventions is represented as the right 'moral' action to reduce the harm an 'obese' pregnant woman poses to her baby:

Ian Campbell, medical director of the UK charity Weight Concern, told BBC.com (9 May) the study is intriguing. "In an ideal world you would want women to take stock of their weight before pregnancy, but in reality that's not going to happen," Dr Campbell says. (Article 19)

Contradictions and outliers

This cluster of themes represents departures from the dominant story about 'maternal obesity' in the sample. In the first theme, pregnant women's body weight is articulated as not a 'problem' at all, with all pregnant women, regardless of their body size, argued to be at risk of producing obesity in their offspring through the effects of diet. The second theme is a departure from the highly gendered nature of the dominant story, where reproduction and the future health of offspring is the responsibility solely of women. In this theme the role men play through the quality of their sperm enters the frame. The final two themes represent some exceptions to the reporting of 'maternal obesity' science as 'institutional advertisement', with some critique of the dominant story about 'maternal obesity' and representation of medical science as tentative and incomplete.

It's not what you weigh, it's what you eat: pregnancy diet and future obesity

The following excerpts represent a departure from the construction of 'maternal obesity' as the harbinger of future obesity in offspring. In these excerpts the problem is not pregnant or 'pre-pregnant' women's body weight. Rather, the 'problem' is pregnant women's diet and food choices, with all women, regardless of their body size, framed as potential producers of 'obesity' in offspring:

Kiwi scientists have helped prove a link between a mother's diet during pregnancy and the risk of childhood obesity. The study, led by South Hampton University and including New Zealand researchers, shows for the first time that a mother's diet during pregnancy can alter the function of her child's DNA and can lead to children having a tendency to "lay down" more fat. The study shows this has nothing to do with the mother's weight or the child's weight at birth. (Article 16)

An important finding was that neither a mother's weight nor the baby's birth-weight made a difference. A slim mother could give birth to a slim child whose DNA make-up had changed because of the food she ate. The effects would manifest themselves only years later. (Article 15)

Interestingly while these excerpts frame pregnant women's diet as the critical determinant of future obesity in her offspring, there is no information provided in the articles about what food may be problematic and thus how these 'effects of diet' may be mitigated or prevented.

Father's in the frame: the effect of male obesity and diet on sperm quality

The dominant story in these articles is highly gendered in that pregnant and 'pre-pregnant' women are represented as solely responsible for reproductive outcomes and the future 'health' of their children and society. This representation of pregnant women removes them from the material and social context of their lives and omits the paternal and social contributions to reproductive and future health outcomes. In the excerpts below, the contribution that sperm may play in the production of 'future obesity' in offspring enters the frame. Interestingly, the findings of studies relating to the role of men in the 'production of obesity' are framed much more tentatively with an emphasis on the emergent nature of the evidence and its 'weakness':

The new study "reinforces that it's important for both male and the female to be eliminating as many bad things in their diet or their life as possible...Being overweight and drinking alcohol were linked to lower sperm concentration and motility – how well sperm swam." (Article 28)

And its not just the mother's diet that plays a role. Researchers at the University of New South Wales also found that male rats on a high fat diet sired babies that were more likely to develop diabetes. "Having a fat dad affected the baby rat's pancreas so it was unable to respond normally to glucose – they were on their way to diabetes," Professor Morris said. "Its one of the first demonstrations that an environmental factor in the father might be transmitted to its offspring." (Article 29)

"We also have emerging evidence, although it's much weaker, that fathers who are fat when they inseminate their partner are more likely to [have] babies who are obese." (Article 31)

Weighing in: critical responses to 'maternal obesity'

The reporting of new scientific findings about 'maternal obesity' was, for the most part, consistent with (Dyck's, 1995, as cited in, Bharadwaj, 2000, p. 64) critique of science journalism as tending towards 'institutional advertisement'. The articles did not include other sources that were critical of the findings or research methods of the studies, and tended to dramatise the findings. However, the excerpts below represent brief departures from 'maternal obesity' reporting as 'institutional advertisement' and demonstrate some critical engagement with the issue and the science behind it. The first excerpt is the only acknowledgement in the sample of articles that weight can be a sensitive issue and that caution may be warranted in discussions with people about their weight:

Weight was a sensitive issue to broach and there was a lack of services to refer them to.
(Article 7)

The second two excerpts acknowledge that dieting and exercise can create problems for women's reproductive health and childbirth outcomes, suggesting that 'maternal obesity' interventions themselves hold the potential to contribute to the adverse outcomes associated with 'maternal obesity':

Kiwi women and girls are dieting their way out of a chance to have children, says a leading fertility specialist. Dr Stella Milson says young women should slow down, eat more and exercise moderately – or pay "too great a price". (Article 26)

Women who become pregnant while dieting may increase the risk of their children becoming obese or diabetic, a major study has found. (Article 33)

In the fourth excerpt, both the dramatising of 'maternal obesity' and its reported association with future obesity in offspring are called into question with an appeal to 'calm down'. This is the only reference in the sample to assert a relationship between an intense focus on weight and the potential to develop eating difficulties and disorders :

"It's well established that the majority of fat kids don't become fat adults, and most fat adults weren't fat kids," Caro Institute Scholar Patrick Basham said. "We need to calm down." He worried that stressing about weight so early. "The focus from an early age on not being fat will only increase the number of young people with eating disorders." (Article 20)

Medical science as an incomplete story

The dominant story of 'maternal obesity' in the news media during the sample period represented both the prevalence of 'maternal obesity' and the new medical findings that frame it as a 'problem' as conclusively proven and unquestionable. However, there were several departs from this

representation. One article framed the prevalence of 'maternal obesity' and its association with adverse childbirth outcomes much more tentatively. It acknowledged data about the prevalence of 'maternal obesity' as lacking and 'incomplete' and framed the association between 'maternal obesity' and perinatal deaths as emerging, supported only by limited data with a need for more research:

...Helen Paterson, a senior lecturer in women's and children's health at the Dunedin School of Medicine, said New Zealand data was limited and more local research was needed to assess whether obesity contributed to perinatal death.

"Unbelievably, we don't know what the national data [for all pregnant women] is." (Article 3)

Previous data on pregnant weights at National Women's are incomplete and there is no national statistics on the size of expectant mums. (Article 6)

Conclusion

This media analysis identified the dominant discourses about 'maternal obesity' in the news media during the sample period, and the themes that constitute this account. It also identified contradictory and outlier discourses which depart from the dominant story.

Reflecting criticism of the reporting of obesity science more generally, this news media sample frames 'maternal obesity' in a dramatic account of a 'crisis', due to the burden it places on the public health system and as the harbinger of future obesity and ill-health in society. The discourse of 'maternal obesity' is constructed as the leading cause of pregnancy complications and as the reason for increasing rates of childbirth interventions, and associated with a catalogue of adverse reproductive and childbirth outcomes. 'Maternal obesity' is also cast as the cause of future obesity and ill-health in the offspring of 'obese' women, indeed as the origin of the 'obesity epidemic'. Women's pregnant bodies are constructed as a potentially toxic 'womb environment' that should be prepared for, and managed during pregnancy, through weight control and diet, to ensure an appropriate fetal environment.

Body weight is represented as modifiable and a primary determinant of health. Weight-loss is conceptualised as both desirable and achievable; and the marker of a woman's commitment to 'being healthy', a responsible citizen, and a 'good mother'. 'Health' here is the project of individuals, is determined through individual choice and willpower, and is demonstrated through the achievement of a 'healthy weight'. In women's reproductive years, 'health' is to be achieved for the wellbeing of the future child and society, rather than for women's own wellbeing. These articles represent obesity in women of reproductive age as the result of poor lifestyle choices, overeating, ignorance and the failure to follow professional advice. To be 'good mothers,' 'obese' pregnant women must accept the risks they pose to their future children and submit to medical surveillance, make 'lifestyle changes,' and if

necessary accept the need for surgery or drug treatments for their weight. These media items emphasise self-sacrifice, restraint and tolerance. However, ideally they imply that preparation for pregnancy should begin before women even reach reproductive age. This requires casting all women and adolescent girls as pre-pregnant, and educating women about their reproductive responsibilities from a young age.

Consistent with critiques of science journalism more generally, the articles largely function as 'institutional advertisements'. They cite very few sources who were critical of the medical research about 'maternal obesity' being discussed. The articles do not mention the influence of social forces such as weight-based stigma and discrimination on how 'maternal obesity' is conceptualised and the 'outcomes' associated with it. Neither did they mention the social and structural determinants of health, including socially constructed gender roles and responsibilities. The articles accepted the binary of weight and health and modifying body weight as a health intervention as doctrine. The sample was not explicit about the tentative and emerging nature of this new medical research, did not examine research methods and made no effort to distinguish between association and causation. Many articles relied on expert testimony, rather than attempting to explain underlying mechanisms. Those that attempted to do so, reflecting the science they were writing about, relied entirely on pathophysiological explanations. Scientists and clinicians were represented as crusaders who are 'sounding the warning' and 'leading the fight' against 'maternal obesity'. Their knowledge claims are largely treated as authoritative and unquestionable.

In addressing my first research question, this analysis has demonstrated how the body weight of larger pregnant women is being constructed at the intersection of biomedical and news media discourses. It is clear that the official story of 'maternal obesity' is not complete. Given the significant role of the popular media in developing the 'concepts of the body and health' that come to 'constitute the social imagination' what is left out of the official story is of critical importance. In failing to critically examine the medical research conceptualisations of 'maternal obesity' and to locate medical scientific knowledge about 'maternal obesity' as tentative and partial, news media reporting of the issue functions to reinforce the authority and dominance of these conceptualisations, establishing them as 'truth'. This diminishes the possibility for alternative accounts that challenge and question, with consequences for health equity and social justice in health.

In the following discussion I will consider the implications of the way in which 'maternal obesity' is being constructed for conceptualisations of pregnancy, the origins of health and illness, and women's roles and responsibilities for their future children. I will ask whether the practices and bodies of knowledge intended to improve maternal and child health also have the potential to compromise the health and wellbeing of women?

References

- Bharadwaj, A. (2000). How some Indian baby makers are made: Media narratives and assisted conception in India. *Anthropology and Medicine*, 7(1), 63-78.
- Bordo, S. (1993). *Unbearable weight: Feminism, western culture and the body*. Berkley: University of California Press.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*(3), 77-101.
- Burr, V. (1995). *An introduction to social constructionism*. London: Routledge.
- Carrier, J., & Penny, S. (2008). Addressing the panic about 'obesity': Policy to protect health (pp. 0-13). <http://forumonpublicpolicy.com/archivespring08/carryer.pdf>: Forum on Public Policy.
- Davis-Floyd, R. (2003). *Birth as an American right of passage* (2nd ed.). Berkley: University of California Press.
- Harding, J. (1997). Bodies at risk: sex, surveillance and hormone replacement therapy. In A. Petersen & R. Bunton (Eds.), *Foucault, health and medicine* (pp. 134-150). London: Routledge.
- Harper, E. A., & Rail, G. (2010). Contesting "silhouettes of a pregnant belly": Young pregnant women's discursive constructions of the body. *Aporia*, 3(1), 5-10.
- Howson, A. (2001). "Watching you-watching me": Visualizing techniques and the cervix. *Women's Studies International Forum*, 24(1), 97-110.
- Kaplan, E. A. (1992). *Motherhood and representation: The mother in popular culture and melodrama*. London: Routledge.
- Keenan, J., & Stapleton, H. (2010). Bonny babies? Motherhood and nuturing in the age of obesity. *Health, Risk and Society*, 12(4), 369-383. doi: 10.1080/13698571003792926
- Leatherby, G. (2003). *Feminist research in theory and practice*. Philadelphia: Open University Press.
- Lupton, D. (2003). *Medicine as culture* (2nd ed.). London: Sage Publications.
- Lupton, D., & Mclean, J. (1998). Representing doctors: Discourses and images in the Australian press. *Social Science and Medicine*, 46(8), 947-958.
- Martin, E. (1988). The fetus as intruder: Mother's bodies and medical metaphors. In R. Davis-Floyd & J. Dumit (Eds.), *Cyborg babies: From techno-sex to techno-tots* (pp. 125-142). New York: Routledge.
- Martin, E. (1989). *The woman in the body: A cultural analysis of reproduction*. Boston: Beacon Press.
- Martin, E. (1991). The egg and the sperm: How science has constructed a roman based in stereotypical male-female roles. *Signs: Journal of Women in Culture and Society*, 16(3), 485-501.

- Martin, E. (1994). *Flexible bodies: The role of immunity in American culture from the days of polio to the age of AIDS*. Boston: Beacon Press.
- Martin, E. (1999). The woman in the flexible body. In A. E. Clarke & V. Olesen (Eds.), *Revisioning women, health and healing: Feminist, cultural, and technoscience perspectives* (pp. 97-115). London: Routledge.
- Orbach. (2006). Commentary: There is a public health crisis - its not fat on the body but fat in the mind and the fat of profits. *International Journal of Epidemiology*(35), 67-69. doi: 10.1093/ije/dyi256
- Pilcher, J., & Whelehan, I. (2004). *50 key concepts in gender studies*. London: Sage Publications.
- Ryan, A., Carryer, J., & Patterson, L. (2003). *Healthy concerns: Sociology for New Zealand nursing and midwifery students*. Auckland: Pearson Education.
- Saguy, A., & Almeling, R. (2008). Fat in the Fire? Science, the news media and the 'obesity epidemic'. *Sociological Forum*, 23(1), 53-83. doi: 10.1111/j.1573-7861.2007.00046.x
- Tischner, I., & Malson, H. (2011). Deconstructing health and the un/healthy 'fat' woman. *Journal of Community and Applied Psychology*, 22(1), 50-62. doi: 10.1002/casp.1096
- Wray, S., & Deery, R. (2008). The medicalization of body size and women's healthcare. *Health Care for Women International*, 29(3), 227-243. doi: 10.1080/07399330701738291

Discussion

Developing a critical response to dominant 'maternal obesity' discourse

Introduction

The emergence of 'maternal obesity' as a significant health issue is demonstrated by a large number of new research studies and the sensational and extensive coverage of these new findings in the print news media. This combination has started to result in changes to maternity care and public health policy in Aotearoa New Zealand. These changes are orientated towards the classification and management of 'maternal obesity' as a high-risk phenomenon requiring surveillance and intervention. Given the extensive interest, it is reasonable to assume that the medicalisation of 'maternal obesity' will intensify in the near future, making this investigation very timely. High interest in 'maternal obesity' must be understood in the context of broader concern, particularly in Western developed countries, with what has been termed the 'obesity epidemic'. This 'crisis' has framed 'obesity' as a disease with high prevalence which is increasing exponentially, and as a significant health and economic threat that must be tackled through global and national efforts (World Health Organization, 2011). The popular media is widely recognised as playing an instrumental role in the framing of 'obesity' in these terms.

Western biomedical constructions of 'obesity' dominate the shaping of contemporary social and cultural understandings of embodiment and health. These constructions frame 'obesity' as a disease rather than part of normal human diversity, construct body weight as indexed to health and as modifiable. However, while these biomedical constructions are hegemonic in understandings of health, they are far from universally accepted. Through the contribution of critical scholarship from a variety of disciplines, 'obesity' knowledge is increasingly and strongly contested. Rather than proven scientific fact, this analysis argues that these dominant biomedical explanations and solutions about 'obesity' are tentative, partial, reductionist, as well as imbued with Western cultural anxieties about fat embodiment and valuing of slenderness as the desired norm (Burns & Gavey, 2004; Campos, 2004; Carryer, 2001; Cogan & Ernsberger, 1999; Orbach, 2006). The gendered nature of dominant biomedical 'obesity' discourse has also been demonstrated. Critical feminist research over the past two decades has challenged the 'objective' knowledge of science and biomedicine to reveal the gendered metaphors and stereotypes within them (Bordo, 1993; Kaplan, 1992; Martin, 1988, 1989, 1994, 1999). This research has demonstrated how women's normal life stages and bodily process such a menstruation, childbirth and menopause have been medicalised and subjected to often unnecessary intervention as a consequence of gendered biomedical knowledge. These scholars argue that dominant biomedical constructions of 'obesity' intersect with strongly-held Western cultural notions of the desirability of female thinness to have a particular impact on women, in a further example of the medicalisation of women's variation in embodiment (Bordo, 1993; Carryer & Penny, 2008; Harper & Rail, 2010; Keenan & Stapleton, 2010; Saguy & Almeling, 2008; Tischner & Malson, 2011; Wray & Deery, 2008).

Recognising this contested domain of 'obesity' knowledge, and biomedical conceptualisations of women's reproductive bodies more generally, this research has cast a critical lens over the biomedical and news media construction of 'maternal obesity'. It aims to provide a platform for a critical discussion and debate about this contemporary framing of the issue and the resulting policy and practice changes. It is particularly interested in considering social and structural dynamics excluded from the biomedical framing of 'maternal obesity' and ensuring that broader ways of understanding the issue can be considered. The implications of the dominant biomedical construction of 'maternal obesity' for women's health, gender equity and social justice in health are an overarching concern.

The literature review provided a stock take of current health research knowledge about 'maternal obesity'. Within medical science, 'excess' weight in pregnant women is being comprehensively pathologised and medicalised, resulting in larger pregnant women being classified as a high-risk group that requires medical management. Like biomedical knowledge about 'obesity' more generally, the review showed the tentative and partial nature of current biomedical knowledge about 'maternal obesity', and the lack of evidence demonstrating a causal relationship between 'maternal obesity' and the adverse outcomes associated with it, including long-term health implications for offspring. It also identified the limited research focus on pathophysiological explanations for adverse outcomes associated with 'maternal obesity'. Health researchers largely fail to consider the social and structural factors that may influence outcomes for larger pregnant women and their offspring.

The media analysis explored how critical the news media is of health research findings about 'maternal obesity'. It found that, consistent with critiques of science journalism more generally, news media constructions of 'maternal obesity' constitute an 'institutional advertisement' for health research, characterised by an almost complete absence of critical engagement with the findings, and a sensationalist focus on the risks posed by 'maternal obesity'. Of particular concern was the representation of health research knowledge about 'maternal obesity' as complete, proven and unquestionable. This reinforces the authority and dominance of biomedical discourses about 'maternal obesity' and reduces the possibility for alternative accounts that attempt to provide a more complex understanding of the relationship between body weight and reproductive health. News media constructions also play a role in moralising and gendering the 'maternal obesity' issue. The articles strongly emphasise women's responsibility to manage their body weight in pregnancy to be good mothers and responsible citizens. Their failure to prioritise weight management or lose weight was represented as a sign of moral failure, selfishness or ignorance, and ultimately of bad mothering.

In this discussion I provide an overview of the dominant construction of 'maternal obesity' formed at the intersection of medical science and news media constructions, and consider the ways in which this construction is shaping, maternity care practice. The discussion then explores some of the social and structural factors that may be influencing outcomes associated with 'maternal obesity' but that have been excluded from medical science and news media discourse, highlighting the limitations of biomedical knowledge.

The 'making' of 'maternal obesity'

The dominant biomedical construction of 'maternal obesity' frames it as a growing crisis, as a non-communicable disease in its own right and as antithetical to a healthy or normal pregnancy. Despite a lack of data to support reports of increasing prevalence in Aotearoa New Zealand, and questions about the applicability of the BMI system for the classification of body weight during pregnancy, 'maternal obesity' is constructed in health research and news media as a significant and growing problem. It is framed as the leading cause of pregnancy complications and as the driver for increasing rates of childbirth interventions. 'Maternal obesity' is associated with a catalogue of adverse reproductive outcomes and with long-term obesity and ill-health in offspring. Adverse outcomes include infertility; pregnancy loss including miscarriage and stillbirth; congenital abnormalities in offspring; increased risk of pregnancy complications such as pre-eclampsia and gestational diabetes; birth complications such as postpartum haemorrhage; higher rates of childbirth interventions such as induction of labour and caesarean section; lower rates of breastfeeding; higher rates of postnatal infections; and offspring who are more likely to require neonatal care. Emerging scientific theories about the developmental origins of health and disease, including 'fetal programming', also frame 'maternal obesity' as the harbinger of future 'obesity' and ill health in offspring. This concern with the short and long-term outcomes associated with 'maternal obesity' is strongly oriented towards their economic impact. 'Maternal obesity' is being framed in biomedical and news media discourse as placing a significant strain on the public health system. Research and media both strongly emphasise the economic costs of providing care to 'obese' pregnant women and the added pressure on providers of maternity care.

The research proposes a suite of interventions for preventing and managing 'maternal obesity' despite common acknowledgement that there is little evidence for many of these interventions. The research strongly emphasises 'lifestyle' interventions, including diet modification and physical activity, proposing that they should be targeted at women before they become pregnant, including during adolescence, as well as during and after pregnancy. The research frames weight loss and maintenance before and during pregnancy as desirable and achievable, but also argues that it is women's responsibility as potential mothers to be and good citizens to maintain a 'healthy' weight during their reproductive years. If weight loss or maintenance cannot be achieved through 'lifestyle' interventions, the research suggests that more intensive, including pharmaceutical, interventions may be warranted to help manage the pregnant body that is failing to manage itself. The results of these studies into these interventions are likely to be extensively reported and will require critical engagement, given the complex ethical and safety questions they pose and the strong commercial drivers for their uptake. A number of interventions are also aimed at the classification, surveillance and management of 'obese' pregnant women as 'high risk'. These include calls for national and regional guidelines, the introduction of routine BMI measurement and weight monitoring in pregnancy, consultant-led care, BMI cut-offs for primary and secondary birth facilities, extra screening for 'obese' pregnant women, and more intensive medical management.

Current responses to 'maternal obesity': the shift to a weight-based focus in maternity care

The literature review and media analysis have brought into stark relief the gendered biomedical discourses about body weight and women's reproductive bodies that constitute the dominant construction of 'maternal obesity'. Consistent with critiques of the construction of large female bodies more generally, the large pregnant body is being subjected to both medicalisation and moralisation with the construction of pregnant subjects at 'high risk' to themselves, but 'more importantly', to the fetus (Keenan & Stapleton, 2010, p. 370). In response to the proliferation of health research and news media concern with 'maternal obesity', and despite the tentative and partial state of current biomedical knowledge, reproductive health care in Aotearoa New Zealand is being reoriented towards a body weight focus.

Weight restrictions and monitoring

BMI restrictions on eligibility for publicly-funded fertility treatment were introduced in 2000, excluding women with a BMI $>32 \text{ kg/m}^2$ (Farquhar & Gillett, 2006). The rationale for this policy has been framed in economic as well as moral terms. The economic rationale aims to reduce the costs of fertility treatment by increasing the likelihood that the procedures will be successful, as well as reducing the costs of providing maternity care to 'obese' pregnant women. The moral rationale aims to tell women that their 'excess' body weight poses a risk for their pregnancy and their offspring (Farquhar & Gilbert.). This policy assumes that achieving a lean BMI is 'firmly in the control of the patient' through lifestyle changes such as weight reduction and exercise (Farquhar & Gillett, p. 1108). New Zealand has led the world in restricting 'obese' women's eligibility for publicly-funded fertility treatment. The United Kingdom, Canada and Sweden have followed suit, although in the context of fierce public debate about whether such policies constitute gender and weight-based discrimination and, therefore, undermine women's reproductive rights (Abraham, 2011). There is little research into the views and experiences of women classified as 'obese' and excluded from publicly-funded fertility treatment. As well as constituting gender and weight-based discrimination, the impacts of this policy on ethnic health inequalities requires much greater consideration, given the higher mean BMI amongst Māori and Pacific women (Farquhar & Gillett).

Some primary and secondary birthing facilities are also restricting access according to BMI. This means that women above a certain BMI, either at the time of booking or giving birth, are unable to choose their place of birth regardless of whether or not they have other pregnancy complications. The rationale provided for BMI-based restrictions includes the safety of 'high-risk' women outside tertiary hospitals and increased resource requirements such as weight maximums for beds and trolleys. Again the extent to which this is discriminatory to larger pregnant women, as well as contributing to more, and potentially unnecessary, childbirth interventions by excluding them from low-intervention birthing environments, require urgent consideration. Routine BMI screening at the first antenatal visit is in the process of being enforced in primary maternity care (New Zealand College of Midwives, 2012). The practice has previously been ad hoc; the Perinatal and Maternal Mortality Review Committee in 2010

identified a gap in BMI data collection for pregnant women, meaning 'the contribution of obesity to perinatal death could not be accurately estimated' (Perinatal and Maternal Mortality Review Committee, 2010, p. 39). The health sector is discussing the reintroduction of a policy of routine weight monitoring in pregnancy, but it is unclear whether its purpose would be epidemiological or to inform clinical practice (Goodwin, 2011).

Medical management of 'maternal obesity'

New Zealand clinicians have recently called for the development of a national guideline for the management of obesity in pregnancy similar to the Queensland Maternity and Neonatal Clinical Guideline on Obesity (2010). The Queensland guideline entrenches biomedical knowledge about 'maternal obesity' and its medical management as a high-risk condition. Ironically, given the purpose of the document, yet consistent with the findings of this research, it recognises that there is 'little high level evidence on best practice management of obesity in pregnancy and the puerperium' (Queensland Maternity and Neonatal Clinical Guidelines Program, p. 6). The guideline is instead based on 'current information' and 'consensus recommendations' (Ibid.). It recommends many of the interventions identified in the literature review, including the calculation and classification of BMI in pregnancy; weight gain recommendations for larger women during pregnancy; basic equipment and resource requirements in facilities where 'obese' pregnant women will receive care; requirements for the assessment and monitoring of 'obese' pregnant women during pregnancy and labour; anaesthetic considerations for 'obese' pregnant women; and nutrition and physical activity advice. While a commitment to evidence-based care is good in principle, the limitations of current evidence for the medical management of 'maternal obesity' raise significant concerns about a New Zealand guideline based uncritically on this knowledge. In lieu of New Zealand-based guidelines, 'maternal obesity' training days are being delivered by district health boards and provider groups to educate providers on the risks, adverse outcomes and management options associated with 'maternal obesity'.

Pre-conception and prenatal obesity prevention

Health research is also strongly interested in interventions targeted at women before and during pregnancy to prevent future 'obesity' and ill-health in offspring. These interventions are based on 'fetal programming' theory and suggest a re-orientation of the 'battle against obesity' to the pregnant or pre-pregnant body. A recent article in New Zealand's national Sunday paper, the *Sunday Star Times*, 'State to trim fat by targeting mums-to-be' (Vance, 2012) reported that 'The Government is set to reduce funding for adult nutrition programmes and will instead target pregnant women to tackle the obesity crisis'. One of the terms of reference for the Parliamentary Health Committee's Inquiry into preventing child abuse and improving children's health outcomes asks: 'what practical improvements can be made to health, education, social and other services, targeted at the preconception period that will improve infant and child outcomes (including the maintenance of a health body weight)' (Health Committee, 2012).

While well intentioned, child health interventions targeted to women before conception or prenatally must be careful not to intrude on women's reproductive autonomy, and their 'sexual and reproductive

human rights' (SRHR) as affirmed in international treaties such as the Convention for the Elimination of Discrimination against Women (CEDAW). Such interventions, if they are not attentive to women's SRHR, risk reducing women to their reproductive capacity and may subject women to inappropriate state interference in their reproductive choices and behaviours. The Center for Reproductive Rights (2012, p. 10), responding to the trend towards prenatal protection, argue in their paper 'Whose right to life? Women's Rights and Prenatal Protections under Human Rights and Comparative Law':

States must therefore ensure that any steps taken to protect their interest in prenatal life are consistent with the fundamental human rights of women. To do otherwise...runs the risk of treating women "as a mere instrument for reproduction," violating her right to dignity. Thus any legal protections granted to prenatal life cannot be prioritized over women's rights. Furthermore, prenatal protections must not perpetuate discrimination against women, as non-discrimination is one of the founding principles of human rights law.

Feminist researchers have described the gendered implications of a fetus-centric approach to pregnancy, whereby women bear sole responsibility for the health and welfare of their future children as a result of their unique role in reproduction (Daniels, 1999; Delany, 2011; Haraway, 2000; Jackson & Mannix, 2004; Layne, 2003; Lupton, 1999; Mitchell, 2001; Morgan & Michaels, 1999; Taylor, 2004). These researchers argue that the major determinants of health and wellbeing of future children and their families and whānau are much more likely to be social and structural (access to education, income, food security, warm secure housing, nurturing relationships free of abuse, cultural identity, and social connectedness and inclusion) rather than the result of individual pregnant or 'pre-pregnant' women's choices and behaviors. From this perspective responsibility for good pregnancy outcomes should be shared. As Jackson and Mannix (2004, p. 151) argue:

...it is easier to blame individual parturient women for causing harm to their unborn children than to consider the role played by societies and governments for policies that are not friendly or supportive to women and, especially, women as mothers.

Feminist researchers have also argued that regulating pregnant women's behavior to prevent fetal harm is the result of changing and problematic concepts of pregnancy. They argue that concern for the wellbeing of pregnant women is increasingly secondary to concern for the wellbeing of fetuses in Western society. This has resulted from the emergence of fetal personhood and the related notion that pregnant women are at best a vessel or container for the fetus and at worst an inherent threat to the wellbeing of the fetus that must be managed to ensure happy and healthy future children. These researchers have identified these constructions of pregnancy, mothering and health origins as highly gendered, undermining women's self-concept, their identities as mothers, and the broader principles of social justice in health. They argue that women's value in society is determined by more than their reproductive capacity (Daniels, 1999; Delany, 2011; Haraway, 2000; Jackson & Mannix, 2004; Layne, 2003; Lupton, 1999; Mitchell, 2001; Morgan & Michaels, 1999; Taylor, 2004). From this perspective, a consideration of pre-conceptual and prenatal health should focus on women's health and wellbeing, with an understanding that the health of future children, if women choose to have children, will be a natural consequence.

A one-eyed monster? Complicating ‘maternal obesity’ discourse

The biomedical construction of ‘maternal obesity’ is currently blind to the social and structural forces that influence the catalogue of adverse outcomes associated with it and its conceptualisation as a serious health threat. Biomedical knowledge about ‘maternal obesity’ is also tentative and partial, yet projected in the popular media as complete and unquestionable. The power of biomedical knowledge claims can be seen in the refocusing of reproductive health and maternity care towards weight management. Given the contested nature of obesity knowledge more generally, and the current ‘one-eyed’ focus of the biomedical construction of ‘maternal obesity,’ there is an urgent need to develop a more complex view of the issue and its relationship to reproductive health outcomes. This involves considering the social and political context of ‘fatness’. This discussion explores the well-documented phenomenon of weight bias, stigma and discrimination in health care and the health-diminishing phenomenon of poor body image and internalised stigma in ‘overweight’ and ‘obese’ women. These two dynamics do not exhaust the social and structural factors that may influence how ‘maternal obesity’ is conceptualised and the outcomes associated with it. They are highlighted to demonstrate the need to think more critically about ‘maternal obesity’ and to question the limitations of biomedical knowledge.

Weight-based stigma and discrimination in health care

The impact of weight bias, stigma and discrimination on health outcomes and its effects on the delivery of health care have been well documented (Carryer, 2001; Puhl, Andreyeva, & Brownell, 2008; Puhl & Brownell, 2001; Puhl & Heuer, 2009; Puhl & Latner, 2007; Puhl, Moss-Racusin, Schwartz, & Brownell, 2008; Schwartz, O’Neal Chambliss, Brownell, Blair, & Billington, 2003; Wray & Deery, 2008). Wray and Deery (2008, p. 240) argue that the stigma of fatness is associated with ‘mistreatment and inappropriate health care’ compounded by the ‘significant physiological and psychological harm that current media hysteria on body weight often generates’. Puhl and Heuer’s (2009) review identifies multiple forms of weight bias in health care settings to which larger patients are vulnerable. These include negative attitudes amongst health care providers towards ‘obese’ people, including ‘beliefs that obese patients are lazy, noncompliant, undisciplined, and have low willpower’ (Puhl & Heuer, p. 3). The impact of such attitudes on the care provided to ‘obese’ patients has also been demonstrated, including health providers spending less time with ‘obese’ patients, making less effort to counsel ‘obese’ patients, and being less inclined to offer health promotion advice or information (Puhl & Heuer, p. 6). ‘Overweight’ and ‘obese’ patients describe inappropriate comments and disrespectful treatment from health providers about their weight, and report being treated as ‘second class citizens’ in the healthcare system (Puhl & Heuer, p. 7). Research also suggests that ‘overweight’ and ‘obese’ patients are likely to report lower levels of satisfaction with most aspects of medical care than patients with smaller bodies. Research demonstrates that ‘obese’ patients who experience stigma in health-care settings may disengage with care, and may ‘delay or forgo essential preventative care’ (Puhl & Heuer). For example, several studies have demonstrated that ‘obese’ women are less likely to participate in preventative health care such as breast and cervical screening. Puhl and Heuer (p.7) report their reasons:

When asked about specific reasons for delay of care, women reported disrespectful treatment and negative attitudes from providers, embarrassment about being weighed, receiving unsolicited advice to lose weight, and gowns, exam tables, and other equipment being too small to be functional. The percentage of women reporting these concerns increased as BMI increased.

Puhl and Heur (2009, p. 7) suggest that removing the stigma-related barriers to cancer screening may help diminish the relationship between excess body weight and cancer mortality. This is a powerful insight given the biomedical focus on identifying pathophysiological causation.

There is little research about the extent of weight-based discrimination in pre-conception and maternity care, and the ways in which it may contribute to some of the adverse outcomes being associated with 'maternal obesity'. There were no studies in the literature review that explicitly examined weight bias in maternity care and its effects. In particular there were no studies examining maternity providers' attitudes to 'overweight' or 'obese' pregnant women and how such attitudes may influence their clinical decision making and the care they provide. It seems highly likely, however, that the weight-based bias, stigma and discrimination found in other parts of the health system also exists in maternity care. There is some indication of this in the few studies in the literature review that examined 'obese' women's experience of maternity care (Furber & McCowan, 2011; Nyman, Prebensen, & Flensner, 2010; Smith & Lavendar, 2011). The women's experiences suggested the effects of weight bias, stigma and discrimination in all aspects of maternity care. Examples included the attitudes of maternity care providers; the provision of information and decision making about their care; the ways women were described in their health records; the experience of ultrasound and other screening; providers' belief in women's physical abilities; and the medicalisation of their care.

There are clear signals in these studies that weight bias, stigma and discrimination are significantly implicated in some of the adverse outcomes being associated with 'maternal obesity' and thus in its construction as a significant health issue warranting medical management. This creates a vicious circle. For example, Furber and McGown's (2011, p. 6) study provides evidence of 'obese' pregnant women being labelled as at higher risk of complications because of their size. This results in more medicalised care including increased screening and monitoring, referral for an anaesthetic consult, and exclusion from low-risk birthing environments. This then results in a higher rate of interventions, such as induction of labour, epidurals and caesarean sections, which are then likely attributed to 'obesity' itself rather than the model of care provided to 'obese' pregnant women. The effect of the medicalisation of childbirth in initiating a 'cascade of interventions' has been well documented in midwifery literature. From this perspective, care interventions can have unintended effects during labour and birth that disrupt the physiological process, leading to more interventions which in turn create even more problems. In another example, being subjected to humiliating or degrading treatment may mean 'obese' pregnant women are less likely to participate in screening or other aspects of routine antenatal care, leading to poorer outcomes which are then associated with their weight. Wray and Deery (2008, p. 240) observe 'the pathologisation of fatness as a dangerous disease is in itself dangerous'.

Given the well-documented incidence and effects of weight and size discrimination in health care more generally, there is an urgent need for research and public discussion about the ways in which weight bias, stigma and discrimination is manifested in maternity care and how it impacts on the outcomes associated with 'maternal obesity'. It is interesting that fierce public debate about weight discrimination has resulted from the proposal to restrict larger women from publicly funded fertility treatment in other countries, but has been largely absent from public discourse in Aotearoa New Zealand. Creating public understanding about the health effects of weight bias, stigma and discrimination may be an important goal for women's health advocates and health promoters.

Body image and internalised stigma

The social construction of fatness, and its gendered implications, render larger women vulnerable to negative body image and internalised stigma, which in turn are associated with poorer health outcomes (Harper & Rail, 2010). An increasing body of evidence demonstrates the relationship between body image dissatisfaction, risk-taking behaviours, and poor health outcomes (Commonwealth Office of the Status of Women, 2003; Women's Health Victoria, 2009). Negative body image has been shown to be implicated in the incidence of eating difficulties and disorders, including cycles of reduction dieting; depression and other mental disorders; smoking, problematic alcohol and other drug use; poorer sexual health and increased vulnerability in sexual negotiation; and reduced likelihood of participation in health promoting activities such as sustainable and enjoyable exercise (Commonwealth Office of the Status of Women; Women's Health Victoria). These outcomes in turn have been shown to effect body image. In Carryer's (Carryer, 2001, p. 91) research with large women, largeness was found to preclude good health, not because of its pathological influences but because of the consequence of the 'self- and socially imposed restrictions that prevent large women from relaxation, recreation, exercise and a sense of safety and deservedness when accessing health-care'. This led Carryer to conclude that obesity functions as a socially constructed disability. As a participant in Carryer's (p. 91) study describes:

You see it seems to me that being overweight is like a trap, because being overweight makes it harder and more painful to exercise, it makes it more difficult to get involved to get out and do things and it makes it more difficult to be taken seriously in terms of healthcare. But all of those things, not taking your health seriously, not enjoying your life and getting out and not exercising are quite detrimental to health in themselves, it's like a vicious cycle that we get trapped in, that all large women get trapped in.

Carryer's participants described how they 'constrain a large number of lifestyle and other choices because they perceive their large bodies to be either unsuited or unacceptable for many settings. In particular, they withdrew from exercise participation, sit on the sidelines in recreational pursuits and feel hesitant in many social areas because of real or imagined stigmatisation'. Puhl, Moss-Racusin and Schwartz (2007) found that 'overweight' and 'obese' individuals who internalise weight stigma, including negative weight-based stereotypes, are more vulnerable to the negative impact of stigma on eating behaviours. They conclude that weight stigma and negative body image are not health promoting for 'overweight' and 'obese' people (Puhl et al.).

Pregnancy has traditionally been enjoyed as a time of release from the pressures to uphold the 'feminine ideal' or the 'slim, tight, youthful' body, creating the conditions for a more enjoyable and less anxious relationship with female embodiment (Harper & Rail, 2010, p. 5). However, the recent emergence of the 'yummy mummy' construct in popular culture has resulted in increased pressure to 'uphold an ideal feminine body during pregnancy' and to 'bounce back' (Harper & Rail, p. 5). The rise of the biomedical construction of 'maternal obesity' as a serious health threat and the reorientation of maternity care to a weight-based focus is likely to further erode the protectiveness of pregnancy for women's body image. There is currently little research which explicitly examines the implications of negative body image during pregnancy and childbirth amongst larger pregnant women, including the contribution of poor body image and internalised stigma to the adverse outcomes associated with 'maternal obesity'. However, there are indications in the literature of such effects (Furber & McCowan, 2011; Nyman et al., 2010; Smith & Lavendar, 2011). 'Obese' pregnant women in these studies reported low self-esteem and embarrassment about their bodies, which in turn created a reluctance to participate in health promoting activities such as aquanatal classes and other activities intended to support health and wellbeing. They also expressed anxiety about body exposure which impacted on their ability to successfully breastfeed in the presence of others.

The review found no studies exploring how negative body image and self-stigmatisation impacted on women's confidence and ability to give birth physiologically, nor how a weight-based focus in pregnancy care intersected with negative body image and disordered eating to contribute to adverse outcomes. The literature also does not consider the impact of poor body image and internalised stigma, or the experience of weight bias, stigma and discrimination, on 'obese' pregnant women's mental health and confidence in entering into mothering. Given the association between poor body image, internalised stigma and a range of poor health outcomes for large women more generally, there is an urgent need to consider more comprehensively how this may be implicated in adverse outcomes associated with 'maternal obesity'.

Above, two social and structural factors that may influence outcomes for larger pregnant women have been considered. These require further investigation along with other potential factors that have been beyond the scope of this discussion including the implications of disordered eating including reduction dieting on the outcomes for the outcomes associated with 'maternal obesity'.

The way forward: policy and practice responses and areas for further research

It is clear that the dominant biomedical construction of 'maternal obesity' does not provide a full account of the relationship between body weight and reproductive health outcomes. It also clear that research which considers the impact of the social and political context of 'fatness' and the lived experience of larger women is urgently needed to make sense of this relationship,. As Elizabeth Probyn points out, (2008, as cited in Tischner & Malson, 2011, p. 20), 'bodies and experiences such as 'being fat' are embodied and are located in cultural, societal and economic contexts, and cannot be adequately considered in contextually isolated ways'. Such research will enable a more holistic engagement with

larger women's body weight in the context of reproduction and is likely to reveal significant opportunities for improving outcomes beyond those currently offered by biomedicine. If the causes of the adverse outcomes associated with 'maternal obesity' are shown to be more than pathophysiological, this undermines the very notion of 'maternal obesity' as pathological and warranting a high degree of medical management. This makes room for other ways to understand the relationship between body weight and reproductive health and to provide maternity care appropriate to women of varying body sizes.

In the meantime it is imperative that policies and practices seeking to improve reproductive health outcomes through weight-based interventions engage critically with current biomedical knowledge about 'maternal obesity'. This knowledge should not be treated as complete, entirely authoritative, value-free, or unaffected by gendered power relations (Wray & Deery, 2008, p. 232). What is needed, these researchers argue (Wray & Deery, p. 239) is critical reflection on the construction of scientific biomedical knowledge and its relation to formations of hegemonic power:

This means questioning the basic foundations of these knowledge claims and how they come to be invested with power to inform ideology, policy, and practice. Further, we need to consider the interplay between social, political, and cultural ideas and values and the production of scientific medical knowledge of what constitutes obesity and its impact on health.

If policies and practices that are intended to improve maternal and child health are informed solely and uncritically by biomedical knowledge about 'maternal obesity', they have the potential to compromise the health and wellbeing of women, for example by further perpetuating weight bias, stigma and discrimination, and leading pregnant women into a cycle of potentially unnecessary medical intervention.

The task, argues Carryer (2001, p. 95) is to 'reconceptualise 'obesity' by moving beyond the simplistic medical behaviour of labelling body size as a disease'. Instead, she argues 'we could consider more thoughtfully what it is about body size which most precludes the full achievement of health, and respond accordingly'. For example, the assumptions about 'maternal obesity' being perpetuated in the biomedical literature and communicated in news media, along with the little research that has considered 'obese' pregnant women's experiences of maternity care, suggest that obesity stigma in maternity care needs to be challenged. Schwartz et al. (2003, p. 1038) found the highest prevalence of fat bias amongst young health professionals and suggest that this needs to be addressed in medical school and other health professional education programmes. Puhl and Brownell (2001, p. 793) describe the results of an intervention to reduce stigma towards obese patients among medical students:

Before random assignment to a control group or education intervention involving videos, written materials, and role playing exercises, the majority of medical students in this study (N = 75) characterised obese individuals as lazy (57%), sloppy (52%), and lacking in self-control (62%), despite indicating an accurate scientific understanding of the cause of obesity. After the educational course, students demonstrated significantly improved attitudes and beliefs about

obesity compared with the control group. The effectiveness of the intervention was still supported 1 year later.

This strongly supports introducing critical weight perspectives into health professional education programmes to address weight bias, stigma and discrimination. Significant efforts will also be needed to raise weight bias and discrimination as a health and social problem in the health sector and publicly. This would be a worthy goal for the public health and health promotion sector consistent with their professional commitment to the social determinants of health (World Health Organisation, 1986).

Finally, as a society, we need to decide whether we will accept an individualised and gendered conceptualisation of health, or whether we will instead insist that health is much more than the project of individuals to achieve the absence of disease through willpower and choice. Health from this perspective would be asserted as socially, culturally and structurally determined, as inextricable from power relations, and as best achieved through social justice and equity. If health is understood in this way, women alone cannot be positioned as solely responsible for reproductive health outcomes and responsibility for health must be shared. This also means that health policy and practice that marginalises and discriminates against people based on their human diversity, whether gender, ethnicity or body weight, becomes the problem rather than the solution.

Recommendations

- 1) Research is urgently needed that focuses on the lived experience of larger women during pregnancy, and the breadth of social, cultural, political and structural factors that influence maternity outcomes for women classified as ‘obese’. This includes the incidence and effects of weight bias, stigma and discrimination in maternity care; the relationship between body image, internalised stigma and maternity health outcomes; the influence of eating difficulties including chronic reduction dieting on reproductive health; the relationship between the medical labelling of obesity and interventions; and women’s experience of a weight-based focus in maternity care including weight monitoring and medical management of ‘maternal obesity’.
- 2) Health policy makers, service planners and providers need to engage critically with emerging biomedical knowledge about ‘maternal obesity’ and its news media representations. They need to recognise that ‘obesity’ knowledge is contested and to include a diversity of perspectives in the development of weight-based interventions and other changes to maternity care in response to biomedical findings. This includes ensuring consumer participation and relevant social science perspectives. The lack of evidence of causation as well as effectiveness of interventions lends limited support for ‘maternal obesity’ interventions at this time.
- 3) Health promoters and women’s health advocates need to prioritise health sector and public literacy about weight bias, stigma and discrimination and its health effects. This should include education for maternity care providers about these issues.
- 4) Health planners and policy makers need to address the effects of weight bias, stigma and discrimination in maternity care. This includes evaluating current weight restrictions in reproductive health care, including BMI cut-offs for eligibility for publicly-funded fertility treatment and access to primary and secondary birthing facilities. Evaluations of weight bias and discrimination in these services should also be built into service audits.
- 5) Health promotion organisations need to develop resources to support positive body image in pregnant women, particularly women classified as ‘overweight’ and ‘obese’, and evaluate their effectiveness.
- 6) Health promotion interventions aimed at girls and women before conception or during pregnancy, with the aim of addressing the developmental origins of obesity and disease, must be consistent with and not compromise women’s sexual and reproductive human rights. Any such interventions should be informed by gender impact assessment to ensure they do not discriminate against women and do not undermine the principle of gender equity in healthcare.
- 7) Given the biomedical, policy and news media focus on ‘obesity’ more generally, the number of people affected by such interest, and the implications of weight bias, stigma and discrimination, a national inquiry on weight discrimination is timely. This would be well led by the Human Rights Commission.

References

- Abraham, C. (2011). Canadian MDs consider denying fertility treatments to obese women, *The Globe and Mail*. Retrieved from <http://www.theglobeandmail.com/life/health-and-fitness/canadian-mds-consider-denying-fertility-treatments-to-obese-women/article595016/>
- Bordo, S. (1993). *Unbearable weight: Feminism, western culture and the body*. Berkley: University of California Press.
- Burns, M., & Gavey, N. (2004). 'Healthy weight' at what cost? 'Bulimia' and a discourse of weight control. *Journal of Health Psychology*(9), 549-565. doi: 10.1177/1359105304044039
- Campos, P. (2004). *The Obesity Myth - why America's obsession with weight is bad for your health*. Gotham: New York.
- Carrier, J. (2001). Embodied largeness: A significant women's health issue. *Nursing Inquiry*, 8(2), 90-97.
- Carrier, J., & Penny, S. (2008). Addressing the panic about 'obesity': Policy to protect health (pp. 0-13). <http://forumonpublicpolicy.com/archivespring08/carryer.pdf>: Forum on Public Policy.
- Center for Reproductive Rights. (2012). Whose right to life? Women's rights and prenatal protections under human rights and comparative law: Centre for Reproductive Rights,.
- Cogan, J. C., & Ernsberger, P. (1999). Dieting, weight, and health: Reconceptualizing research and policy. *Journal of Social Issues*, 55(2), 187-205.
- Commonwealth Office of the Status of Women. (2003). *Key issues affecting women*. Commonwealth Office of the Status of Women,.
- Daniels, C. (1999). Father, mothers, and fetal harm: Rethinking gender difference and reproductive responsibility. In L. Morgan & M. Michaels (Eds.), *Fetal Subjects, Feminist Positions* (pp. 83-89). Philadelphia: University of Pennsylvania Press.
- Delany, T. (2011). *To entrap and empower: Maternal responsibility in an age of neo-liberal health*. School of Social Sciences. University of Adelaide.
- Farquhar, C. M., & Gillett, W. R. (2006). Prioritising for fertility treatments - should a high BMI exclude treatment? [Commentary]. *BJOG An International Journal of Obstetrics and Gynaecology*, 1107-1109. doi: 10.1111/j.1471-0528.20069.00994.x
- Furber, C. M., & McCowan, L. M. E. (2011). A qualitative study of the experiences of women who are obese and pregnant in the UK. *Midwifery*, 27(4), 437-444. doi: 10.1016/j.midw.2010.04.001
- Goodwin, E. (2011). Call for ministry to lead in checking pregnant women, *Otago Daily Times*. Retrieved from <http://www.odt.co.nz/print/156448>
- Haraway, D. (2000). The virtual speculum in the new world order. In G. Kirkup, L. Janes, K. Woodward & F. Hovenden (Eds.), *The Gendered Cyborg: A Reader* (pp. 221-245). London: Routledge.
- Harper, E. A., & Rail, G. (2010). Contesting "silhouettes of a pregnant belly": Young pregnant women's discursive constructions of the body. *Aporia*, 3(1), 5-10.

- Health Committee. (2012). *Inquiry into preventing child abuse and improving children's health outcomes* [www.parliament.nz: House of Representatives Retrieved from http://www.parliament.nz/en-NZ/PB/SC/About/Media/9/2/d/00SCHE_MediaRelease20120301_1-Inquiry-into-preventing-child-abuse.htm](http://www.parliament.nz/en-NZ/PB/SC/About/Media/9/2/d/00SCHE_MediaRelease20120301_1-Inquiry-into-preventing-child-abuse.htm).
- Jackson, D., & Mannix, J. (2004). 'Giving voice to the burden of blame: A feminist study of mothers' experiences of mother blaming'. *International Journal of Nursing Practice*(10), 150-158.
- Kaplan, E. A. (1992). *Motherhood and representation: The mother in popular culture and melodrama*. London: Routledge.
- Keenan, J., & Stapleton, H. (2010). Bonny babies? Motherhood and nurturing in the age of obesity. *Health, Risk and Society*, 12(4), 369-383. doi: 10.1080/13698571003792926
- Layne, L. (2003). *Motherhood lost: Feminist account of pregnancy loss in America*. New York: Routledge.
- Lupton, D. (1999). Risk and the ontology of pregnant embodiment. In D. Lupton (Ed.), *Risk and Sociocultural Theory: New Directions and Perspectives* (pp. 59-85). Cambridge: Cambridge University.
- Martin, E. (1988). The fetus as intruder: Mother's bodies and medical metaphors. In R. Davis-Floyd & J. Dumit (Eds.), *Cyborg babies: From techno-sex to techno-tots* (pp. 125-142). New York: Routledge.
- Martin, E. (1989). *The woman in the body: A cultural analysis of reproduction*. Boston: Beacon Press.
- Martin, E. (1994). *Flexible bodies: The role of immunity in American culture from the days of polio to the age of AIDS*. Boston: Beacon Press.
- Martin, E. (1999). The woman in the flexible body. In A. E. Clarke & V. Olesen (Eds.), *Revisioning women, health and healing: Feminist, cultural, and technoscience perspectives* (pp. 97-115). London: Routledge.
- Mitchell, L. (2001). *Baby's first picture: Ultrasound and the politics of fetal subjects*. Toronto: University of Toronto Press.
- Morgan, L., & Michaels, M. (1999). The fetal imperative. In L. Morgan & M. Michaels (Eds.), *Fetal Subject, Feminist Positions* (pp. 1-11). Philadelphia: University of Pennsylvania Press.
- New Zealand College of Midwives. (2012). Assessment of fetal wellbeing during pregnancy *Consensus Statement*. <http://www.midwife.org.nz/index.cfm/3,108,559/antenatal-fetal-wellbeing-2012.pdf>: New Zealand College of Midwives Inc.
- Nyman, V. M. K., Prebensen, A. K., & Flensner, G. E. M. (2010). Obese women's experiences of encounters with midwives and physicians during pregnancy and childbirth. *Midwifery*(26), 424-429.
- Orbach. (2006). Commentary: There is a public health crisis - its not fat on the body but fat in the mind and the fat of profits. *International Journal of Epidemiology*(35), 67-69. doi: 10.1093/ije/dyi256

- Perinatal and Maternal Mortality Review Committee. (2010). *Perinatal and Maternal Mortality in New Zealand 2008. Fourth report to the Minister of Health*. Wellington: Perinatal and Maternal Mortality Review Committee Retrieved from <http://www.pmmrc.health.govt.nz>.
- Puhl, R., Andreyeva, T., & Brownell, K. D. (2008). Perceptions of weight discrimination: Prevalence and comparison to race and gender discrimination in America. [Original Article]. *International Journal of Obesity*, 32(6), 992-1000.
- Puhl, R., & Brownell, K. D. (2001). Bias, discrimination, and obesity. *Obesity Research*, 9(12), 788–805. doi: 10.1038/oby.2001.108
- Puhl, R., & Heuer, C. A. (2009). The stigma of obesity: A review and update. [Epidemiology Reviews]. *Obesity*, 17(5), 941-964. doi: 1038/oby.2008.636
- Puhl, R., & Latner, J. D. (2007). Stigma, obesity, and the health of the nation's children. *Psychological Bulletin*, 133(4), 557-580. doi: 10.1037/0033-2909.133.4.557
- Puhl, R., Moss-Racusin, C. A., & Schwartz, M. B. (2007). Internalization of weight bias: Implications for binge eating and emotional well-being. [Original Research as Short Communication]. *Obesity*, 15(1), 19-23.
- Puhl, R., Moss-Racusin, C. A., Schwartz, M. B., & Brownell, K. D. (2008). Weight stigmatization and bias reduction: Perspectives of overweight and obese adults. *Health Education Research*, 23(2), 347-358. doi: 10.1093/her/cym052
- Queensland Maternity and Neonatal Clinical Guidelines Program. (2010). *Obesity*. (MN10.14-V3-R15). Queensland Government Retrieved from <http://www.health.qld.gov.au>.
- Saguy, A., & Almeling, R. (2008). Fat in the Fire? Science, the news media and the 'obesity epidemic'. *Sociological Forum*, 23(1), 53-83. doi: 10.1111/j.1573-7861.2007.00046.x
- Schwartz, M., O'Neal Chambliss, H., Brownell, K. D., Blair, S. N., & Billington, C. (2003). Weight bias among health professionals specializing in obesity. *Obesity Research*, 11(9), 1033–1039. doi: 10.1038/oby.2003.142
- Smith, D., & Lavendar, T. (2011). The maternity experience for women with a body mass index ≥ 30 kg/m²: a meta-synthesis *BJOG An International Journal of Obstetrics and Gynaecology*, 779-789. Retrieved from: What is the maternity experience for obese women, researchers ask website: http://www.bjog.org/details/news/1029677/What_is_the_maternity_experience_for_obese_women_researchers_ask.html doi:10.1111/j.147-0528.2011.02924.x
- Taylor, J. (2004). A fetish is born: Sonographers and the making of the public fetus In J. Taylor, L. Layne & D. Wozniak (Eds.), *Consuming motherhood* (pp. 187-210). Rutgers: University Press.
- Tischner, I., & Malson, H. (2011). Deconstructing health and the un/healthy 'fat' woman. *Journal of Community and Applied Psychology*, 22(1), 50-62. doi: 10.1002/casp.1096
- Vance, A. (2012). State to trim fat by targeting mums-to-be, www.stuff.co.nz. Retrieved from www.stuff.co.nz/national/politics/6553113/state-to-trim-fat-by

Women's Health Victoria. (2009). *Women's and body image. Gender impact assessment no. 8.*
www.whv.org.au: Women's Health Victoria.

World Health Organisation. (1986). 1st Global Conference on Health Promotion: Ottawa 1986 *The Ottawa Charter for Health Promotion.*
http://www.who.int/hpr/NPH/docs/ottawa_charter_hp.pdf: World Health Organization.

World Health Organization. (2011). Obesity and overweight. Fact sheet no311 Retrieved 5 March, 2012,
from <http://www.who.int/mediacentre/factsheets/fs311/en/index.html>

Wray, S., & Deery, R. (2008). The medicalization of body size and women's healthcare. *Health Care for Women International*, 29(3), 227-243. doi: 10.1080/07399330701738291

Appendix One

List of News Media Articles

- [1] Anonymous. (2010). Overeating while pregnant leads to obese babies, Life & Style. Retrieved from <http://www.stuff.co.nz/life-style/wellbeing/3997417/overeating-while>
- [2] NZPA. (2010). Study: Good diet cuts risk of too small babies, The New Zealand Herald. Retrieved from <http://www.nzherald.co.nz/news/print.cfm?objectid=10678376>
- [3] Newton, K., & NZPA. (2010). Mums' obesity may have role in baby deaths, The Dominion Post. Retrieved from <http://www.stuff.co.nz/national/health/4239829/mums-obesity-may>
- [4] Larsen, R. (2010). Gestational diabetes affecting more women. Pharmacy Today, (November 2010). Retrieved from http://www.knowledge-basket.co.nz/search/doc_view.php?d11=archpharm/text/2010/Nov/doc0561.html
- [5] Corderoy, A. (2010). Growing problem of pregnant diabetics, Life & Style. Retrieved from <http://www.stuff.co.nz/life-style/wellbeing/4453452/growing-problem>
- [6] Grunwell, R. (2011). Big mums risk babies' health, The New Zealand Herald. Retrieved from http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10702999
- [7] Todd, R. (2011). Study links obesity to birth risks, The Press. Retrieved from <http://www.stuff.co.nz/national/health/4620685/Study-links-obesity-to-birth-risks>
- [8] NZPA. (2011). Study: Sugars could harm unborn baby, The New Zealand Herald. Retrieved from <http://www.nzherald.co.nz/news/print.cfm?objectid=10705623>
- [9] Davison, I. (2011). Fruit juice, apples linked to fetus harm, The New Zealand Herald. Retrieved from http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10705749
- [10] Gilles, A. (2011). Breakthrough for bigger mums, The New Zealand Herald. Retrieved from http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10708989
- [11] Television New Zealand (Producer). (2011). Factors revealed in NZ's high still birth rate - study. Television New Zealand Limited
- [12] Newton, K. (2011). Obesity, smoking lift stillbirth risk, National, The Dominion Post. Retrieved from <http://www.stuff.co.nz/national/health/4887561/Obesity-smoking-lift-stillbirth-risk>

- [13] Johnston, M. (2011). NZ's stillbirth rate among highest, The New Zealand Herald. Retrieved from <http://www.nzherald.co.nz/news/print.cfm?objectid=10719156>
- [14] Goodwin, E. (2011). Call for ministry to lead in checking pregnant women, Otago Daily Times. Retrieved from <http://www.odt.co.nz/print/156448>
- [15] Tapaleao, V. (2011). Mum's diet key to baby health, The New Zealand Herald. Retrieved from http://www.nzherald.co.nz/vaimoana-tapaleao/news/article.cfm?a_id=367&objectid=10720252
- [16] Anonymous. (2011). NZ research links child obesity to mother's diet, www.stuff.co.nz. Retrieved from <http://www.stuff.co.nz/national/health/4902690/NZ-research-links-child-obesity-to-mothers-diet>
- [17] Grunwell, R. (2011). Kiwi tests may save mum, The New Zealand Herald. Retrieved from <http://www.nzherald.co.nz/news/print.cfm?objectid=10722613>
- [18] Wall, T. (2011). Making better babies, Stuff. Retrieved from www.stuff.co.nz/life-style/wellbeing/4947473/making-better-babies
- [19] Hutchison, J. (2011). Drug tested to prevent obese kids, Pharmacy Today. Retrieved from http://www.knowledge-basket.co.nz/search/doc_view.php?d1=archpharm/text/2011/Jun/doc0266.html
- [20] Anonymous. (2011). Size does matter, says new baby research, www.stuff.co.nz. Retrieved from www.stuff.co.nz/national/health/5193544/size-does-matter-says
- [21] Newton, K. (2011). Birth, pregnancy complications worse for obese, diabetic mums, The Dominion Post. Retrieved from <http://www.stuff.co.nz/life-style/wellbeing/5350228/Complications-worse-for-obese-diabetic-mums>
- [22] Anonymous. (2011). Study highlights pregnancy risks, The Marlborough Express.
- [23] Newton, K. (2011). Complications worse for obese, diabetic mums, www.stuff.co.nz. Retrieved from www.stuff.co.nz/life-style/wellbeing/5350228/complications-w
- [24] Cameron, A. (2011). Practical tips on pregnancy, Doctor. Retrieved from http://www.knowledge-basket.co.nz/ezproxy.auckland.ac.nz/search/doc_view.php?d4=magz/text/doctor/2011/Sep/doc1024.html
- [25] Hope, J. (2011). Some babies already obese in the womb, New Zealand Herald. Retrieved from http://www.nzherald.co.nz/lifestyle/news/article.cfm?c_id=6&objectid=10754502
- [26] Shadwell, T. (2011). Dieting NZ women, girls 'losing chance of children', New Zealand Herald. Retrieved from http://www.nzherald.co.nz/lifestyle/news/article.cfm?c_id=6&objectid=10755410

- [27] Anonymous. (2011). Loss of baby increases stillbirth risk, [www.stuff.co.nz](http://www.stuff.co.nz/life-style/wellbeing/5835069/loss-of-baby-inc). Retrieved from www.stuff.co.nz/life-style/wellbeing/5835069/loss-of-baby-inc
- [28] Anonymous. (2011). Your sperm are what you eat, www.stuff.co.nz. Retrieved from www.stuff.co.nz/life-style/wellbeing/6006458/your-sperm-are
- [29] Browne, R. (2011). Obesity starts in the womb, www.stuff.co.nz. Retrieved from <http://www.stuff.co.nz/life-style/wellbeing/6070724/Obesity-starts-in-the-womb>
- [30] Anonymous. (2011). Sweet-toothed mums having sugar addict babies, New Zealand Herald. Retrieved from <http://www.nzherald.co.nz/news/print.cfm?objectid=10772738>
- [31] Vance, A. (2012). State to trim fat by targeting mums-to-be, www.stuff.co.nz. Retrieved from www.stuff.co.nz/national/politics/6553113/state-to-trim-fat-by
- [32] De Boni, D. (2012). Dita de Boni: Would you take a pill to stop obesity in the womb?, New Zealand Herald. Retrieved from www.nzherald.co.nz/news/print.cfm?objectid=10796362&pnum
- [33] Davison, I. (2012). Warning on weight loss before conception, New Zealand Herald. Retrieved from www.nzherald.co.nz/news/print.cfm?objectid=10796854
- [34] Collins, S. (2012). Exercise and work = smaller baby, New Zealand Herald. Retrieved from www.nzherald.co.nz/news/print.cfm?objectid=10793977