Psychological Predictors of Weight Retention in Postpartum Women

by

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Submitted in partial fulfilment of the requirements for the degree of

Doctor of Psychology (Clinical)

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List of publications

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Phillips, J., King, R., & Skouteris, H. (2013). The influence of psychological factors on postpartum weight retention at nine months. *British Journal of Health Psychology,* published online 26 October 2013. doi: 10.1111/bjhp.12074

Table of contents

List of Tables

List of Figures

Abstract

Postpartum weight retention (PWR) is a critical risk factor for long-term overweight and obesity. Psychological factors have been demonstrated to play a key role in contributing to and maintaining PWR. This thesis endeavours to further explore the influence of psychological factors on PWR, and to specifically identify time-points during pregnancy and postpartum where interventions may be most effective. The first paper presents an empirically supported, multifactorial, conceptual model of predictors of PWR that incorporates medical and physiological, sociodemographic, and behavioural influences, as well as psychological factors, such as depression, anxiety, stress, and body dissatisfaction. The conceptual model provides a theoretical framework that underpins two prospective studies examining predictors of PWR. Empirical study one prospectively investigates the relationship between psychological distress during late pregnancy and early PWR, after controlling for other identified factors, using a sample of pregnant women, measured at 32 weeks gestation and three months postpartum. Only gestational weight gain (GWG) predicted PWR at three months. Cross-sectional analyses indicated that stress at three months postpartum was associated with early PWR, while body dissatisfaction approached significance. Empirical study two extended upon the first study to explore the prospective relationship between psychological factors and PWR at nine months after controlling for other identified factors using a sample of postpartum women measured at three months, six months, and nine months postpartum. GWG, longer duration of breastfeeding, and body dissatisfaction at three and six months postpartum each predicted PWR at nine months. Together,

the two empirical studies emphasised the importance of targeting prevention of GWG. Of the psychological variables, postpartum body dissatisfaction is an important predictor of the amount of weight that women retain, particularly within the later stages of the first postpartum year. Collectively, the three papers presented in this thesis offer an extension of previous examinations of psychological influences on PWR by accounting for a variety of sociodemographic and behavioural factors, and highlight a need for further and more rigourous testing of the conceptual model as an explanatory framework for excessive PWR. The relationship between body dissatisfaction and PWR is an area that warrants further attention in future pregnancy and postpartum research, and should be a key component in the development and implementation of appropriate interventions.

Part I

Introductory Chapters

Chapter One

Introduction

Half of Western women of childbearing age are overweight or obese, with pregnancy being a major contributing risk factor (Access Economics, 2008). Increasingly, women are gaining excessive amounts of weight during pregnancy, often resulting in higher levels of postpartum weight retention (PWR) (National Research Council & Institute of Medicine (IOM), 2007). Consequently, increased attention has been directed towards identification of factors that contribute to PWR in order to inform the development of appropriate interventions.

Pre-pregnancy body mass index (BMI), gestational weight gain (GWG), demographical influences, and behavioural factors all contribute to excessive PWR (Siega-Riz et al., 2010). Less researched, but equally important influences are psychological in nature, and include depression, stress, anxiety, and body dissatisfaction (Herring et al., 2008). To date, relatively few studies have specifically explored the influence of psychological factors on PWR whilst accounting for other known influences.

This thesis aims to provide greater understanding of the extent to which psychological factors may contribute to PWR. This will be achieved by first presenting an empirically supported, conceptual model which provides the basis for a series of prospective analyses following women's experiences from early pregnancy through the postpartum period. A further aim is to identify specific time-points during pregnancy and postpartum where such influences are most salient, with a view to inform future development of targeted and timely interventions.

This chapter will provide a brief overview of the PWR literature. Firstly, it will provide definitions of PWR, its impact on health, prevalence, and contributing factors. Next, the complexity of contributing factors to PWR will be highlighted, with specific focus on inter-relationships between psychological factors, PWR and other known influences. On the basis of this, it will be argued that psychological factors play a key role in the development and maintenance of PWR and therefore need to be considered in the context of other known influences. Lastly, the chapter will conclude with the rationale and aims of the thesis.

Outline of the Thesis

This thesis presents a series of papers that have been published in peer-reviewed journals, with supplementary chapters to provide additional contextual background and details of the research. Part one of the thesis presents the theoretical background of the research. Following a brief review of the literature in chapter one, chapter two presents a paper outlining an empirically supported conceptual model, entitled "A conceptual model of psychological predictors of postpartum weight retention," published in the *Journal of Reproductive & Infant Psychology*, July, 2012.

The remaining chapters comprise part two of the thesis and describe the empirical components of the research. Chapter three includes a comprehensive description of the methods employed for the empirical research papers that follow. Chapter four presents a paper entitled, "The influence of psychological distress during pregnancy on early postpartum weight retention," published online in the *Journal of Reproductive & Infant Psychology,* November, 2013, that explores how psychological factors during pregnancy may influence early PWR.

Chapter five extends upon this research, and presents a paper entitled, "The influence of psychological factors on postpartum weight retention at nine months," published online in the *British Journal of Health Psychology*, October, 2013, that explores the influence of psychological factors during later postpartum on longer-term PWR. Chapter six will discuss the findings of the papers provided in previous chapters in reference to the specified aims and hypotheses, and consideration of previous literature. The limitations and implications of the thesis will be addressed, and future directions for future research will be discussed.

Postpartum Weight Retention: Definition, Prevalence, Impact and Causes

Pregnancy represents a time of great change and transition for many women. It often heralds the first major bodily change since early adolescence (Park, Senior, & Stein, 2003; Patel, Wheatcroft, Park, & Stein, 2002), and like puberty and menopause, characterises a period in the female life-span where body fat deposition is more likely to increase (Rodin, Silberstein, & Striegel-Moore, 1985). In contrast to other developmental milestones, the physical changes that occur during pregnancy are rapid and profound, and occur over a relatively short period of time (Duncombe, Wertheim, Skouteris, Paxton, & Kelly, 2008; Herring et al., 2008), resulting in a higher likelihood of persisting changes, including PWR.

PWR is defined as the difference between weight at "some time after delivery" and weight prior to pregnancy (Oken, Taveras, Popoola, Rich-Edwards, & Gillman, 2007, p. 305). It is conventionally calculated as the difference between body weight at a given time postpartum, and early or pre-pregnancy body weight (IOM, 2009). Excessive or substantial PWR has been defined as 5

kilograms (kg) or more above pre-pregnancy weight at six months or one year after delivery (Gunderson et al., 2008; Rooney, Schauberger, & Mathiason, 2005).

The prevention of excessive and long-term PWR is paramount due to a number of associated negative long-term implications for maternal and child health. Excessive PWR contributes to the development of chronic diseases, including type II diabetes, hypertension, cardiovascular disease, and endometrial cancers (Berg & Scherer, 2005; Calle & Kaaks, 2004; Cartwright, 2004), and increases the risk of mental illness, including disordered eating symptoms and postpartum mood disorders (Astrachan-Fletcher, Veldhuis, Lively, Fowler, & Marcks, 2008). Furthermore, PWR is a critical pathway for long-term obesity and overweight in mothers (Amorim, Rossner, Neovius, Lourenco, & Linne, 2007; Rooney et al., 2005), and offspring (Scholl, Hediger, Schall, Ances, & Smith, 1995; Skouteris et al., 2010).

The speed with which pregnancy-related weight gain is lost plays a key role in predicting long-term overweight and obesity. Women who lose pregnancy weight by six months postpartum have less long-term weight gain at eight to 10 years follow-up (Rooney & Schauberger, 2002), whereas women who have residual weight retention at 12 months postpartum are more likely to be overweight or obese at 15 years follow-up (Linne, Dye, Barkeling, & Rossner, 2004). Overall, PWR is a better predictor of long-term overweight and obesity than weight gained during pregnancy (Linne et al., 2004). Therefore, there is need for interventions to target a return to pre-pregnancy weight within the first year postpartum.

In respect to determining how much weight women retain in the postpartum, research findings are mixed. An early review of the literature by

Gore, Brown, and Smith (2003) found that average estimates of weight retention associated with pregnancy are small, ranging from -0.27 kg to 3 kg, leading them to conclude that pregnancy has little effect on weight retention or weight gain during young adulthood. The authors identified only one study (Greene, Smicklas-Wright, Scholl, & Karp, 1988), based on a large sample of 7000 women, where PWR was slightly higher at 3.4 kg.

In contrast, more recent studies have found that the average amount of weight retention at 12 months post-birth is typically higher. Olson (2008) and Siega-Riz et al. (2009) found that one-fifth of women retain at least 5 kg of pregnancy weight gain six to 18 months post-birth. Furthermore, a large epidemiological study conducted in the United States indicated that women retain an average of 5 kg at six months postpartum (Pregnancy Nutrition Surveillance System (PNSS), cited by IOM, 2009). Moreover, at 12 months post-birth, a quarter of women retain more than 4.5kg, and 12% retain over 9.5kg (Infant Feeding Practices Study (IFPS II), cited by IOM, 2009). It was concluded that although PWR gradually declines over time, excessive PWR at one year postpartum remains a significant problem for a large proportion of women (IOM, 2009).

In exploring factors that influence PWR, it is first important to consider the rate at which weight is naturally lost from a biological standpoint. Most pregnancy-related weight is lost within the first few days after birth (Schmitt, Nicholson, & Schmitt, 2007), followed by loss of excess fluids gained during pregnancy within the first six weeks (Muscati, Gray-Donald, & Koski, 1996), and the uterus returning to its original size (Boscaglia, Skouteris, & Wertheim, 2003). Women tend to lose the greatest amount of weight in the first few months after

delivery, and then continue losing at a slow and steady rate until six months postpartum (Boscaglia et al., 2003; Somvanshi, 2002), with weight loss gradually declining as the one-year mark approaches (Walker, 1995). At 12 months postpartum, weight retention is mainly attributable to increases in body fat (Kac, Benicio, Velasquez-Melendez, Valente, & Struchiner, 2004).

However, postpartum weight changes are not purely biologically driven; a number of psychosocial factors play an important role in influencing and sustaining the amount of weight that women retain. Therefore, in order to develop a comprehensive understanding of the aetiology and perpetuating factors pertaining to PWR, psychosocial factors should be investigated in addition to biological influences (Skouteris, Carr, Wertheim, Paxton, & Duncombe, 2005).

The following sections of this literature review will outline known influences on PWR, including maternal weight and physiological factors, sociocontextual influences, and maternal behavioural factors. Following this, a comprehensive review of the relation of psychological factors specifically, depression, anxiety, stress, and body dissatisfaction, PWR and maternal weight, physiological, sociocontextual, and behavioural factors will be presented. It will be argued that increased attention needs to be directed towards the influence of psychological factors in addition to behavioural changes and other identified factors (Skouteris et al., 2005). It is envisaged that a comprehensive evaluation of contributing factors that includes psychological influences could provide more information to identify women at higher risk for weight-related problems and assist in the development of appropriate and timely interventions (Herring et al., 2008).

Maternal weight and physiological factors. Maternal weight factors refer to high body mass index (BMI), which is calculated from a person's weight and height, and is used to measure body fatness (National Institutes of Health, 1998), and excessive GWG. Pre-pregnancy BMI and GWG are two of the most salient predictors of PWR (IOM, 2009), and are a risk factor for retaining at least 5 kg at one year postpartum (Siega-Riz et al., 2009). A further physiological factor unique to the postpartum period is disruption to sleep quality, which also impacts on PWR (Siega-Riz et al., 2010).

Pre-pregnancy body mass index. High pre-pregnancy body weight is a risk factor for retaining at least 4 kg at one year postpartum (Gunderson & Abrams, 1999; Siega-Riz et al., 2010). Women who are overweight at conception are at increased risk of retaining weight at 12 months postpartum (Gunderson, Abrams, & Selvin, 2001; Davis, Zyzanski, Olson, Stange, & Horwitz, 2009). However, there are inconsistencies across studies. Interestingly, low pre-pregnancy BMI is also predictive of higher PWR; women who are underweight prior to pregnancy have higher weight retention at six months postpartum (Huang & Dai, 2007; Huang, Wang, & Dai, 2010), and women with high self-reported pre-pregnancy BMI are less likely to retain 4.5kg at three months postpartum, compared to women who start pregnancy with a normal or underweight pre-pregnancy BMI (Siega-Riz et al., 2010). Such findings indicate that pre-pregnancy BMI alone does not necessarily predict PWR, and that exploration of additional factors, such as psychological factors, is warranted.

Gestational weight gain. GWG is the most salient and stable predictor of PWR (Amorim et al., 2007; Linne et al., 2004; Siega-Riz et al., 2010), exceeding the effects of pre-pregnancy BMI (Pedersen et al., 2011). High GWG predicts

PWR at three months (Siega-Riz et al., 2010), six months (Amorim et al., 2007; Rooney, & Scahuberger, 2002; Walker, 1996) and 10-18 months postpartum (Amorim et al., 2007; Siega-Riz et al., 2010). Excessive GWG also predicts long-term maternal obesity at 15-year follow-up (Nehring, Schmoll, Beyerlein, Hauner, & von Kries, 2011), and overweight and obesity in offspring (Scholl et al., 1995; Skouteris et al., 2010). In addition, GWG also impacts adversely on psychological functioning and well-being during the postpartum (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009b), specifically body dissatisfaction or body image difficulties (Clark et al., 2009b; Huang et al., 2010), and depressive symptomatology, stress and anxiety (Devine, Bove, & Olson, 2000; Webb, Siega-Riz, & Dole, 2009).

Sleep quality. Sleep quality is associated with the amount of weight women retain post-birth; however, there is a relative paucity of research that specifically examines this association. Studies using samples of men and non-pregnant women have indicated that both restricted and extended sleep durations are associated with a greater chance of obesity and chronic disease (Ayas et al., 2003a; Ayas et al., 2003b; Yaggi, Araujo, & McKinlay, 2006). Of the studies that have used postpartum samples, the number of hours slept per night has been associated with PWR (Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005; Siega-Riz et al., 2010). Specifically, sleep deprivation, defined as less than, or equal to five hours of sleep within a 24-hour period, is associated with weight retention of at least 5 kg above preconception body weight at one year postpartum (Gunderson et al., 2008).

However, there are inconsistencies regarding the specific time-points during pregnancy and postpartum where sleep quality influences PWR. Siega-Riz

et al. (2010) found a relationship between shorter sleep duration and higher PWR at three months, but not at 12 months, which could be attributed to the higher likelihood of sleep disturbance occurring during early postpartum, particularly following a first birth (Lee, McEnany, & Zaffke, 2000; Shinkoda, Matsumoto, & Park, 1999). As the infant gets older, and mothers are able to return to their usual sleeping patterns, the impact of sleep on weight retention may lessen so that it is no longer a significant predictor at 12 months postpartum (Siega-Riz et al., 2010).

Sleep quality is also associated with higher levels of psychological distress, specifically depressive symptoms, in non-pregnant adults (Agragun, Kara, & Solmaz, 1997; De Gennaro, Curcio, & Ferrara, 2004). In pregnant and postpartum samples of women, poor sleep quality during early pregnancy predicts higher levels of depressive symptoms later in pregnancy (Skouteris, Germano, Wertheim, Paxton, & Milgrom, 2008), and postpartum sleep quality is associated with the development of depressive symptoms during the first three months post-birth (Goyal, 2007; Wolfson, Crowley, Anwer, & Bassett, 2003). Such findings provide preliminary evidence that sleep quality plays an important role in respect to both psychological distress and PWR.

Sociocontextual/lifestyle, and medical factors. In examining psychosocial contributors to PWR, it is important to consider the sociodemographical context (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009a), specifically the role of demographic factors and social support, in addition to pregnancy-related medical factors.

Demographics. A number of sociodemographical factors influence longer-term weight retention at 12 months postpartum, including higher maternal age, black race, not returning to paid employment post-birth (Siega-Riz et al.,

2010), lower education (Pedersen et al., 2011), and multiparity (Walker, Fowles, & Sterling, 2011). Low socioeconomic status (SES) is a further predictor of higher PWR (Shrewsbury, Robb, Power, & Wardle, 2009; Walker et al., 2004), and specifically influences eating behaviour. Lower-income women are less likely to have good dietary quality during the postpartum (Cahill, Freeland-Graves, Shah, & Lu, 2010), and consume less fruit, vegetables and grains, and more fat and sugar during the first year postpartum (Goldy, Hanss-Nuss, Milani, & Freeland-Graves, 2005). Stressors that are unique to low-income women such as limited financial resources may provide some explanation for this (Beck, 2001).

SES also influences levels of psychological distress in pregnant women (e.g., Glazier, Elgar, Goel, & Holzafel, 2004; Pedersen et al., 2010), however, there is a paucity of research that examines this within the postpartum. Walker, Timmerman, Kim, and Sterling (2002) found that lower income predicted depressive symptoms during the postpartum; however, this study was limited by its cross-sectional design.

Social support. There is preliminary evidence that inadequate social support is associated with higher PWR (Harris, Ellison, & Clement, 1999; Walker, 1996; 1997). Social support is defined as a well-intentioned action that is given willingly to a person with whom there is a personal relationship, and that produces an immediate or relayed positive response in the recipient (Hupcey, 1998). Lower social support during pregnancy is associated with higher PWR at 18 months (Pedersen et al., 2011), and fewer social supports during postpartum predicts higher weight retention at two and a half years postpartum (Harris et al., 1999).

Social support is a major predictor of emotional and physical well-being (Hung, 2004), and inversely impacts upon distress, depression, and anxiety during pregnancy (Harris et al., 1999; Walker, 1997). Social support is an important protective factor against the development of depressive symptoms (Honey, Morgan, & Bennett, 2003; Logsdon & Usui, 2001), and low or inadequate social support is associated with higher levels of postpartum stress (Webster, Nicholas, Velacott, Cridland, & Fawcett, 2011). In light of the rapid changes that characterise the postpartum, the need for greater social support during this time is especially important (Gill, 2001; Logsdon & Usui, 2001), particularly from a spouse or romantic partner (Logsdon & Usui, 2001; Patel, Lee, Wheatcroft, Barnes, & Stein, 2005).

Medical factors. Pregnancy-related medical factors that are closely linked to GWG and which influence PWR, include pregnancy-induced hypertension (Gould-Rothberg, Magriples, Kershaw, Schindler Rising, & Ickovics, 2011), and gestational diabetes (Carreno et al., 2012). Additionally, mode of delivery, specifically caesarean section, has also been found to be associated with higher PWR (Nohr et al., 2008; Siega-Riz et al., 2009). The relationship between medical factors and PWR could be associated with behavioural factors, such as changes in diet and physical activity, for example, women who have given birth by caesarean section may exercise less as a consequence of surgery (Riley, 2011), but could also be due to psychological factors, for example, women with complications during pregnancy have higher levels of postpartum stress (Dulude, Belanger, & Sabourin, 2002; Hung, Lin, Stocker, & Yu, 2011).

Maternal behaviours. Consideration of behavioural factors is

essential when considering the aetiology and maintenance of excessive PWR. There are a number of maternal behavioural factors that influence PWR, including diet and physical activity (Amorim et al., 2007), in addition to breastfeeding, a factor unique to the postpartum period (Kac et al., 2004).

Dietary quality. The role transition and adjustment associated with new parenthood is often associated with the development of a more sedentary lifestyle and increased vulnerability to poor eating habits, such as increased energy intake and snack eating (Devine et al., 2000; Walker, 1996). Additionally, disruptions to routine, sleep and meal-times, lack of time and energy, and priorities of the baby over the mother's own, can impact upon women's previous strategies for controlling weight (Patel et al., 2002; Patel et al., 2005), such as establishment of regular eating patterns (Park et al., 2003).

In addition to influencing weight, postpartum dietary intake and quality is associated with psychological distress (Herring et al., 2008). Weight-related distress, body image, stress, neglect of self-care, and depressive symptoms are all associated with less healthy diets at one year postpartum (Goldy et al., 2005). This could be caused by overeating as a comfort, therefore leading to larger energy intake and higher weight gain (Hurley, Caulfield, Sacco, Costigan, & Dipetrio, 2005).

There is consistent evidence that psychological distress influences dietary quality, specifically the type of food consumed and the frequency of its consumption during pregnancy and the postpartum (Hurley et al., 2005). Additionally, increased dietary intake has been associated with anxiety and stress in samples of pregnant women (Laraia, Siega-Riz, Dole, & London, 2008; Macht, 2008; Torres & Nowson, 2007). Therefore, it would be useful to further explore

this relationship between psychological distress and dietary quality in postpartum women.

Physical activity. Physical activity is a further behavioural factor associated with PWR (Huang, Yeh, & Tsai, 2011). Women who are physically active during the postpartum are almost 10 times less likely to retain more than 5 kg above their pre-pregnancy BMI at one year post-birth (Althuizen, van Poppel, de Vries, Seidell, & van Mechelen, 2011). Additionally, fewer hours spent in sedentary activities, such as watching television, is associated with less PWR at one year postpartum (Oken et al., 2007).

In respect to the relationship between psychological functioning and physical activity, increased exercise is associated with decreased depressive symptoms and anxiety (ten Have, de Graaf, & Monshouwer, 2011), and increased body image satisfaction in general populations (Daniels & van Niekerk, 2011). However, during pregnancy, women tend to decrease their physical activity and delay returning to their pre-pregnancy diet and exercise practices in the postpartum period, and this is likely to have some impact on psychological well-being in the postpartum, in addition to the amount of weight that is retained (Huang et al., 2011).

Breastfeeding. The relationship between breastfeeding and PWR has been widely examined though the findings are mixed. Overall, longer duration of breastfeeding, i.e., occurring for at least six months is associated with less PWR (Baker et al., 2008; Kac et al., 2004; Maddah & Nikooyeh, 2009). In comparison, shorter duration, such as three months, appears to have minimal effect on postpartum weight loss (Krause, Lovelady, Peterson, Chowdhury, & Ostbye, 2010). At six months postpartum, exclusive breastfeeding has a greater influence

on postpartum weight loss than mixed feeding, however, both mixed and exclusive breastfeeding results in greater postpartum weight loss when compared to women who exclusively formula-feed their infants (Krause et al., 2010).

Psychological factors. The influence of psychological factors on PWR is a relatively new area of research with preliminary findings indicating that they play a stronger role in postpartum weight renormalisation than previously thought (Pedersen et al., 2011). Psychological factors thought to contribute to PWR are psychological distress, which includes depressive symptoms (Herring et al., 2008), anxiety (Skouteris, Wertheim, Rallis, Milgrom, & Paxton, 2009), and stress (Siega-Riz et al., 2010), and body dissatisfaction (Rallis, Skouteris, Wertheim, & Paxton, 2007).

Psychological distress. The relationship between psychological distress and obesity onset is well established in non-pregnant populations, where weight is positively associated with both depressive symptoms (Ali & Lindstrom, 2006; Simon et al., 2006; Stice, Presnell, Shaw, & Rhode, 2005), and anxiety (Roberts, Delegar, Strawbridge, & Kaplan, 2003). However, relatively little is known about how psychological states contribute to weight normalisation in pregnancy and postpartum (Pedersen et al., 2011).

Preliminary findings indicate that PWR is closely associated with negative psychological states, such as depression, stress, and anxiety (Devine et al., 2000; Jenkin & Tiggemann, 1997). During pregnancy, higher depression, anxiety, stress, and lower self-esteem are associated with excessive GWG (Duncombe et al., 2008). Similarly, during the postpartum, higher BMI is associated with reduced self-esteem, and higher anxiety and depressive symptoms (Devine et al., 2000; Jenkin & Tiggemann, 1997; Walker, 1997).

However, there are inconsistencies in the research regarding the specific stages within the perinatal period where psychological factors influence weight retention. Pedersen et al. (2011) found that women who reported symptoms of anxiety, depression, or distress during pregnancy had higher PWR at six months; however, this was not the case for women who only reported these symptoms during the postpartum. Conversely, Carter, Baker, and Brownell (2000) found that the relationship between BMI, eating attitudes, and symptoms of depression was only significant during the postpartum period, and not during pregnancy. Similarly, Herring et al. (2008) found that depression during pregnancy, either alone or in combination with postpartum depression, was not associated with substantial PWR at six months postpartum, and only new-onset depression in the early postpartum predicted substantial weight retention at 12 months postpartum. Given the postpartum represents a period where the risk of developing mood disturbance is increased (Milgrom et al., 2008), and that most women retain some residual weight from pregnancy, further research is required to clarify this relationship.

Much of the research that explores psychological well-being in the postpartum tends to focus predominantly on depressive symptoms (DiPietro, Costigan, & Sipsma, 2008), and neglects other aspects of psychological functioning, such as anxiety and stress (Miller, Pallant, & Negri, 2006). This is at least partly attributable to postpartum depression being the most prevalent postpartum psychological disorder (Milgrom et al., 2008). However, given that pregnancy and the postpartum period involve major transition, it is important to consider additional psychological factors, such as maternal stress (Matthey, Barnett, Howie, & Kavanagh, 2003). Stress is a distinct negative emotional state

that involves chronic arousal and impaired function, and, therefore, should be differentiated from the experience of depressed or anxious mood or affect (Lovibond & Lovibond, 1995). Given that higher levels of maternal stress are associated with higher PWR (e.g., Torres & Nowson, 2007; Siega-Riz et al., 2010), additional research is required to further establish this relationship.

In recent years, postpartum researchers have started to adopt a more global construct of postpartum mental health (Gjerdingen et al., 2009), that of psychological distress that incorporates depression, anxiety, and stress (DiPietro et al., 2008; Miller et al., 2006). This allows for the measurement of distress that is potentially missed when the diagnostic criteria for depression is used alone (Heron, O'Connor, Evans, Golding, & Glover, 2004; Matthey et al., 2003). Furthermore, comorbidity of symptoms relating to anxiety, stress, and depression is often high. For example, anxiety commonly co-occurs with depression (Kessler, Keller, & Wittchen, 2001), and in studies using samples of pregnant women, depressive symptoms have been related to stress (Derbyshire, Davies, Costarelli, & Dettmar, 2006; Jesse, Walcott-McQuigg, Mariella, & Swanson, 2005). Therefore, such an approach allows for a more thorough and comprehensive exploration of the influence of psychological factors on PWR, in comparison to focusing solely on depressive symptoms.

Body dissatisfaction. Body dissatisfaction is a further component of maternal psychological functioning that plays a key role in influencing PWR (Huang & Dai, 2007; Huang et al., 2010; Jenkin & Tiggemann, 1997; Walker, 1998). The term body image refers to the internal representation an individual has of his or her outer appearance (Thompson, Heinberg, Attabe, & Tantleff-Dunn, 1999). It is a broad term used to explore the cognitive, affective, behavioural, and

perceptual aspects of one's experiences of his or her body (Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002). Body dissatisfaction, on the other hand, is one facet of body image relating to the degree of dissatisfaction with particular aspects of the body such as one's size or shape (Thompson et al., 1999), particularly negative subjective evaluation of one's physical body, such as figure, weight, stomach and hips (Stice & Shaw, 2002). Body dissatisfaction is a consequence of the discrepancy between the perceived self and the ideal self, which is an internalised representation of society's portrayal of the ideal body (Silberstein, Striegel-Moore, Timoko, & Rodin, 1988).

As might be expected, the majority of postpartum research focuses predominantly on body dissatisfaction, rather than broader aspects of body image per se, as pregnancy often results in residual changes on particular aspects of the body (Clark et al., 2009b; Jenkin & Tiggemann, 1997; Rallis et al., 2007). Specifically, the body areas of weight, waist, muscle tone, and hips are nominated as arousing the most negative feelings during the postpartum (Walker et al., 2002).

As the postpartum is characterised by significant changes to one's body that progress rapidly over a short period of time (Skouteris et al., 2005), concerns and beliefs about body shape and weight can become more prominent (Patel et al., 2002). Therefore, pregnancy and the residual physical changes that remain in the postpartum can potentially be a powerful test of the factors leading to body dissatisfaction, compared to other times in women's lives when body shape remains relatively stable (Skouteris et al., 2005).

Despite the rapid and significant physical changes that pregnancy produces, many women adapt very positively to pregnancy-related weight gain,

with pregnancy appearing to offer some temporary protection against body concerns (Clark et al., 2009a; Clark et al., 2009b; Skouteris et al., 2005). Body dissatisfaction decreases as pregnancy progresses, with salience of body weight and shape being more pronounced in early pregnancy in comparison to late pregnancy (Clark et al., 2009b, Duncombe et al., 2008) and feelings of fatness decreasing late in pregnancy compared with early pregnancy (Clark et al., 2009b; Duncombe et al., 2008; Skouteris et al., 2005). This could be a consequence of women comparing body changes in early pregnancy to those of a woman who has gained weight rather than a woman who is pregnant (Duncombe et al., 2008). Additionally, events that are unique to pregnancy, such as increased perceived body functionality, emphasis placed upon the well-being of the developing infant, perceptual experiences related to pregnancy, and increased social connectedness, may offer some protection from body dissatisfaction (Clark et al., 2009a). Furthermore, pregnancy is the only time in a woman's life when weight gain is encouraged and expected (Mehta et al., 2011), with women being more accepting of their larger size and making fewer attempts to control it (Clark et al., 2009a; Davies & Wardle, 1994).

However, in contrast to both pre-pregnancy and pregnancy, the postpartum represents a period of increased vulnerability to body dissatisfaction (Clark et al., 2009b; Rallis et al., 2007). Almost half of new mothers are dissatisfied with their weight six months after giving birth (Walker, 1998), and report feeling most fat at this particular time-point (Rallis et al., 2007). Additionally, body dissatisfaction during the postpartum progressively worsens over time. A longitudinal study by Gjerdingen et al. (2009) found that body dissatisfaction steadily increased from one month to nine months postpartum, and

was associated with eating abnormalities, increased weight in comparison to pre-pregnancy, and worse mental health. Similarly, Clark et al. (2009b) found that body dissatisfaction in the postpartum steadily increased over the first 12 months, and was greater during the postpartum in comparison to pre-pregnancy and late pregnancy.

Residual weight gain from pregnancy plays a key role in the development and maintenance of body dissatisfaction in the postpartum period (Clark et al., 2009b; Huang et al., 2010). Women are typically heavier after delivery in comparison to pre-pregnancy, which in addition to the re-emergence of pre-pregnancy body dissatisfaction and attitudes to weight (Devine et al., 2000), causes increased body dissatisfaction (Baker et al., 1999). Furthermore, the postpartum represents a period where there is increased perceived pressure to lose excess weight rapidly (Boscaglia et al., 2003), which is closely associated with the residual weight gain from pregnancy (Clark et al., 2009b).

Unsurprisingly, women with higher postpartum body weight have higher body dissatisfaction in comparison to postpartum women within the healthy BMI range (Huang & Dai, 2007; Huang et al., 2004), similar to findings in general female populations (Reboussin et al., 2000), and in pregnancy (DiPietro, Millet, Costigan, Gurewitsch, & Caulfield, 2003; Mehta et al., 2010). However, interestingly, body dissatisfaction may predict the rate in which postpartum body weight is retained (Huang & Dai, 2007; Huang et al., 2010). Women with lower body dissatisfaction are more successful in losing weight during the postpartum (O'Toole, Sawicki, & Artal, 2003; Patel et al., 2005; Texeira et al., 2006). Similarly, women who perceive themselves to be heavier in the postpartum compared to pre-pregnancy have higher longer-term weight gain (Harris et al.,

1999), with similar findings in pregnancy, where lower body dissatisfaction results in lower GWG (Mehta et al., 2010).

Postpartum body dissatisfaction is also closely associated with psychological distress (Duncombe et al., 2008; Gjerdingen et al., 2009). This could be attributed to women having unrealistic expectations about the length of time it takes to lose the excess weight of pregnancy, thereby increasing the likelihood of psychological distress (Jenkin & Tiggemann, 1997; Walker, 1998). Depressive symptoms are associated with body image disturbance in perinatal populations (i.e., 20 weeks gestation until one month post-birth) (Rallis et al., 2007; Skouteris et al., 2005), and in non-pregnant women (Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006). During pregnancy, greater body dissatisfaction and depression is associated with higher GWG (Cameron et al., 1996; Fox & Yamaguchi, 1997; Haedt & Keel, 2007), with similar patterns evident during the postpartum (Gjerdingen et al., 2009). Furthermore, psychological stressors and body image concerns, coupled with the residual bodily changes of pregnancy, are associated with disordered eating symptoms and increased risk of postpartum mood disorders (Astrachan-Fletcher et al., 2008).

Summary and Rationale

In summary, PWR has been identified as a critical pathway for long-term overweight and obesity in Western women, and contributes to a number of negative health outcomes for both mothers and offspring (Davis, Stange, & Horwitz, 2012; Linne et al., 2004). Given that up to half of Western women of childbearing age are either overweight or obese (Access Economics, 2008), it is critical that further exploration is directed towards uncovering why women are retaining excess weight following pregnancy. It is well established that GWG is a

salient and consistent cause of PWR (Amorim et al., 2007; Siega-Riz et al., 2010), however, to regard GWG as a stand-alone explanation for excessive PWR neglects complex inter-relationships between other known contributing factors. Although GWG and maternal behaviours such as dietary intake and physical activity tend to be reliable predictors of weight status, and may adequately explain weight gain and retention in some women, rates of excessive PWR are high and increasing, which therefore, warrants further and broader exploration.

The influence of psychological factors, such as depression, anxiety, stress, and body dissatisfaction on PWR has been largely neglected with only a small number of studies exploring their influence to date (e.g., Herring et al., 2008; Pedersen et al., 2011; Siega-Riz et al., 2010). This is surprising, as the link between psychological factors and obesity in different populations is well established (e.g., Ali & Lindstrom, 2006; Reboussin et al., 2000). Preliminary research indicates that psychological factors play a more salient role in predicting PWR than previously thought. Therefore, there is a need to further explore how these factors might influence PWR.

In determining the influence of psychological factors on PWR, it is essential to account for the complexity and multifactorial nature of contributing factors. An empirically supported theoretical model may provide a clearer indication of the effects of multiple variables on predicting PWR, given the number of variables that are likely to exert an influence (Kamysheva et al., 2008; Thompson et al., 2007). Davis, Stange, and Horwitz (2012) proposed a conceptual model based on factors contributing to the development of stress during pregnancy that predicted PWR and the development of obesity in later life. Their model proposed that the determinants of maternal stress include genetics, health

status, race/ethnicity, and SES, in the context of suboptimal social, cultural and physical environments. Chronic exposure to stress was purported to contribute to changes in biology and behaviour that result in an impaired ability to maintain a state of equilibrium, leading to excessive GWG, PWR, and later life obesity. While the model by Davis et al. (2012) highlights how stress can impact on GWG and PWR via a range of sociocultural and physical factors, it did not consider the impact of key psychological variables such as depression, anxiety and body image, all of which have been shown to be associated with postpartum BMI and weight retention (e.g., Clark et al., 2009b; Siega-Riz et al., 2010). Therefore, in the following chapters, a multifactorial model will be proposed to investigate and further understand the complex interplay between a variety of factors in predicting weight retention in the postpartum. The guiding aim of the model is that maternal weight factors, sleep quality, demographic influences, social support, pregnancy-related medical factors, and maternal behaviours, all have some influence on psychological factors, which in turn, influence PWR.

In addition, there are inconsistencies in the literature regarding the specific time-points during pregnancy and postpartum where psychological influences are most salient (Pedersen et al., 2011; Siega-Riz et al., 2010). This is important to explore in further depth in order to inform the development and timing of interventions (Siega-Riz et al., 2010).

Aims of Thesis

This thesis endeavours to explore the influence of psychological factors on PWR whilst accounting for other known biological and psychosocial influences, and to gain further understanding of the specific time-points during pregnancy and the first nine months postpartum where psychological influences

are most influential. The first aim of the current thesis is to present an empirically supported, conceptual, multifactorial model that illustrates inter-relationships between maternal weight-related and physiological factors, sociocontextual influences, behavioural factors, and psychological influences on PWR. This model will be used as a conceptual framework to increase understanding of the influence of psychological factors in the development and maintenance of PWR.

An additional aim of the thesis is to extend upon existing research by furthering understanding of the specific time-points during pregnancy and postpartum where psychological factors predict both early (i.e., three months), and longer-term (i.e., nine months) PWR. This will contribute to increasing knowledge in respect to devising focused interventions during pregnancy and/or postpartum that specifically targets a return to pre-pregnancy weight within the first year postpartum. A series of hierarchical regressions will be conducted to specifically examine how well psychological factors predict both short- and long-term PWR. Hierarchical multiple regression is a particularly suitable methodology as it allows for specification of a fixed order of entry for variables in order to control for the effects of covariates, and to test the effects of certain predictors independent of the influence of others.

Two empirical studies will be presented, each exploring the influence of psychological factors on PWR on different time-points during the perinatal period. In the first empirical study, it was hypothesised that depression, anxiety, stress, and body dissatisfaction during pregnancy and early postpartum would be associated with higher levels of PWR at three months post-birth. In the second empirical study, it was hypothesised that higher levels of psychological distress,

specifically, depression, anxiety, and stress, and body dissatisfaction at three and six months postpartum, would result in higher levels of PWR at nine months.

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Chapter Two

A Conceptual Model of Psychological Predictors of Postpartum Weight Retention

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Abstract

Obesity and being overweight affect almost half of all women of childbearing age, with postpartum weight retention (PWR) being a key contributing factor. Retention of postpartum weight has a number of negative health implications for mothers and offspring, including longer-term higher body mass index. There is increasing evidence that psychological factors are associated with PWR, including depressive symptoms, anxiety, stress, and body dissatisfaction. However, what is less known is how these psychological factors might combine with maternal physiological and physical weight factors, sociocontextual influences, pregnancy-related medical factors, and maternal behaviours to lead to PWR. We have incorporated identified psychological influences within an empirically supported, multifactorial, conceptual model of hypothesised predictors of PWR, and argue that a systematic and rigorous evaluation of this conceptual model will inform the development of appropriate prevention strategies.

Keywords: postpartum; weight retention; obesity; depression; anxiety; body dissatisfaction

The incidence of maternal obesity and overweight in Western societies is an increasing problem, affecting almost 50% of women of childbearing age (National Research Council & Institute of Medicine (IOM), 2007). A key contributing factor of weight retention in women is gestational weight gain (GWG), which is correlated positively with postpartum weight retention (PWR) (Amorim, Rossner, Neovius, Lourenco, & Linne, 2007). Research has shown consistently that many women retain an average of 1.5–2.5 kg from pregnancy (e.g., Gjerdingen et al., 2009), with 20% of women retaining at least 5 kg of pregnancy weight gain six to 18 months post- birth (Siega-Riz et al., 2009). Furthermore, weight retention at 12 months postpartum predicts overweight problems at 15-year follow-up, and is a better predictor of longer-term weight retention than GWG alone (Linne, Dye, Barkeling, & Rosnner, 2004).

Excessive and long-term weight retention poses a number of negative health implications for both mothers and offspring, including maternal overweight and obesity (Amorim et al., 2007), and childhood obesity (Skouteris et al., 2010). Hence, understanding the factors that contribute to PWR is important in order to design effective intervention strategies for the prevention of PWR and, specifically, to encourage a return to pre-pregnancy weight within the first 12 months postpartum.

Davis, Stange, and Horwitz (2012) proposed a conceptual model based on factors contributing to the development of stress during pregnancy that predicted PWR and the development of obesity in later life. Their model proposed that the determinants of maternal stress include genetics, health status, race/ethnicity and socioeconomic status (SES), in the context of suboptimal social, cultural and physical environments. Chronic exposure to stress was purported to contribute to

changes in biology and behaviour that result in an impaired ability to maintain a state of equilibrium, leading to excessive GWG, PWR, and later life obesity. While the model by Davis et al. (2012) highlights how stress can impact on GWG and PWR via a range of sociocultural and physical factors, it did not consider the impact of key psychological variables such as depression, anxiety and body image, all of which have been shown to be associated with postpartum body mass index (BMI) and weight retention (e.g., Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009b; Siega-Riz et al., 2010).

Clearly, any complete model of predictors of PWR needs to be multifactorial to explain the difficulty many women face returning to their pre-pregnancy weight post-birth. We argue here that psychological factors (depression, anxiety, stress, body dissatisfaction) mediate the influence of maternal physiological and physical weight factors and sociocontextual/lifestyle factors (social support, demographics and medical factors) on maternal behaviours (physical activity, dietary quality, breastfeeding), which subsequently predict postpartum weight loss/retention. Our proposed model is shown in Figure 2.1 and the rationale for the paths to PWR, based on evidence from empirical studies, is provided in the body of this article.

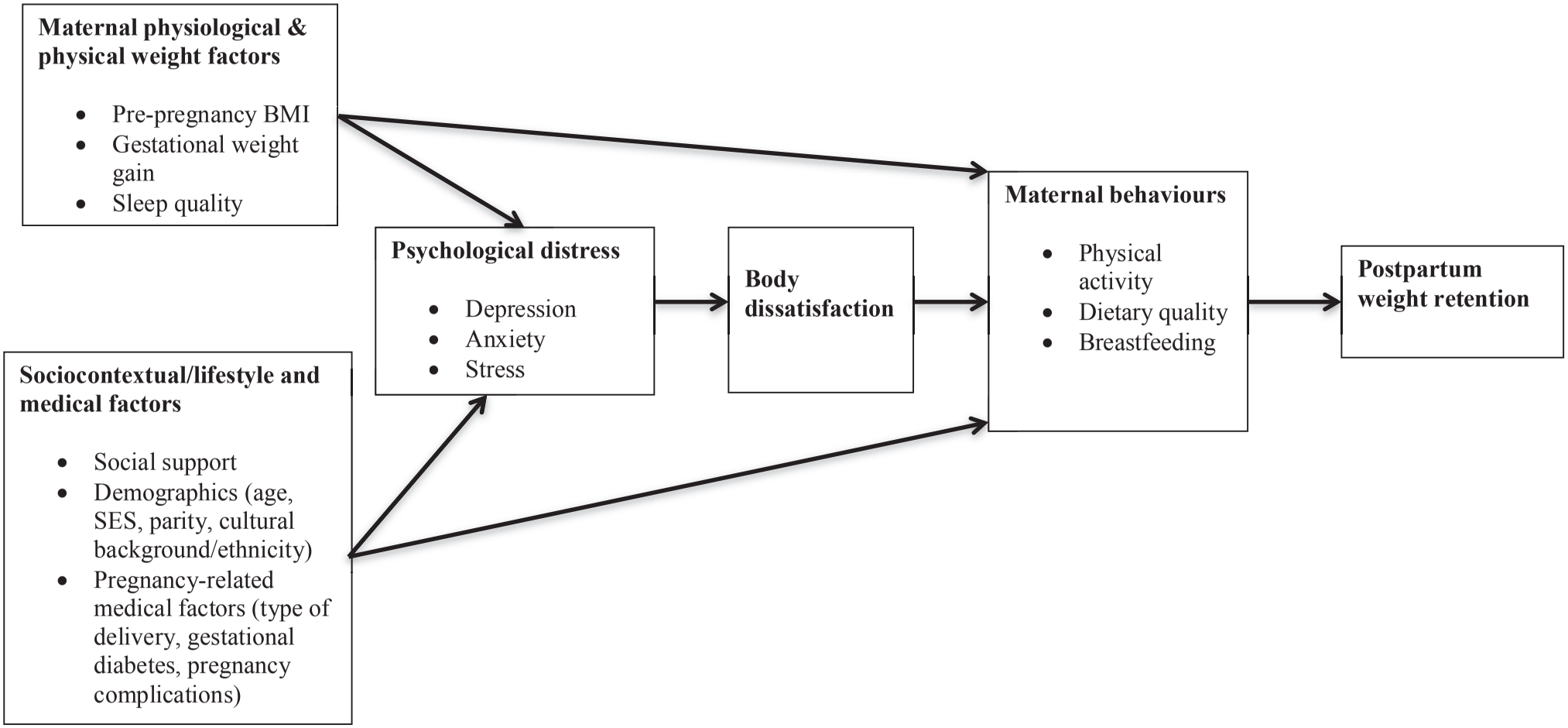

Figure 2.1 A conceptual model of psychological predictors of postpartum weight retention

Maternal Physiological and Physical Weight Factors

Maternal weight factors refer to high BMI, which is calculated from a person's weight and height, and is used to measure body fatness (National Institutes of Health, 1998), and excessive GWG. Pre-pregnancy BMI and GWG are two of the most salient predictors of PWR (IOM, 2009), and are a risk factor for retaining at least 5 kg at one year postpartum (Siega-Riz et al., 2009). A further physiological factor unique to the postpartum period is disruption to sleep quality, which also impacts on PWR (Siega-Riz et al., 2010).

Pre-pregnancy body mass index. A high BMI at conception increases the risk of retaining residual weight at 12 months postpartum (Davis, Zyzanski, Olson, Stange, & Horwitz, 2009). However, women who are underweight at conception are also more likely to gain excessive gestational weight in comparison to women of normal weight, and therefore retain more weight in the postpartum (Huang, Wang, & Dai, 2010). Such findings indicate that high pre-pregnancy BMI alone does not necessarily predict PWR, and that exploration of additional factors, such as psychological well-being, is warranted. Therefore, our model proposes that pre-pregnancy weight gain will: (1) directly influence maternal behaviours, which in turn will result in higher weight retention, and/or (2) influence maternal behaviours via psychological influences.

Gestational weight gain. GWG is a particularly potent risk factor for PWR (Amorim et al., 2007; Cheng, Walker, Tseng, & Lin, 2011), exceeding the effects of pre-pregnancy BMI (Siega-Riz et al., 2010). GWG predicts PWR at three months (Siega-Riz et al., 2010), six months (Amorim et al., 2007), and 10–18 months postpartum (Amorim et al., 2007; Siega-Riz et al., 2010).

There is increasing evidence that psychological factors such as depression, stress and anxiety are associated with excessive weight gain in general

populations (e.g., Ali & Lindstrom, 2006), and in pregnant women who experience excessive GWG (e.g., Mehta, Siega-Riz, & Herring, 2010). However, further research is needed to understand causal pathways linking factors such as depression, anxiety and stress, and GWG and PWR. Therefore, our conceptual model proposes that GWG will: (1) directly influence maternal behaviours, such as diet and physical activity, and/or (2) influence levels of psychological distress, which in turn will influence maternal behaviours and PWR.

Sleep quality. The influence of sleep quality and duration on PWR is a relatively new area of research. The findings of studies with men and non-pregnant women indicate that both restricted and extended sleep durations are associated with obesity and chronic disease (Ayas et al., 2003; Yaggi, Araujo, & McKinlay, 2006). In postpartum samples, decreased hours of sleep have been associated with weight retention (e.g., Siega-Riz et al., 2010), with one study finding that shorter sleep duration predicted retention of at least 5 kg above pre-conception body weight at 12 months postpartum (Gunderson et al., 2008). However, findings are inconsistent, as other studies have found that the relationship between PWR and sleep deprivation is only significant in the first three months postpartum, and results from disruptions to usual sleeping routine associated with having a very young infant (e.g., Siega-Riz et al., 2010).

Given these inconsistencies, further examination of additional factors, particularly psychological influences, is warranted. For example, disturbed sleep quality during the later stages of pregnancy predicts symptoms of depression in the first few weeks postpartum (Skouteris, Germano, Wertheim, Paxton, & Milgrom, 2008) and poor sleep quality is also associated with postpartum psychological distress (Herring et al., 2008; Siega-Riz et al., 2010). Therefore, we propose that sleep quality will (1) directly influence weight retention via maternal

behaviours, and/or (2) influence weight retention through psychological distress.

Sociocontextual/Lifestyle and Medical Factors

When considering psychosocial contributors to PWR, it is important to examine the influence of the social context (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009a), specifically the role of demographic factors and social support, in addition to pregnancy-related medical factors.

Demographics. Maternal age, cultural background/ethnicity (Siega-Riz et al., 2010), primiparity (Gunderson & Abrams, 1999), and SES (Shrewsbury, Robb, Power, & Wardle, 2009) have all been found to influence PWR. We also know that lower SES is associated with higher levels of depression, anxiety and distress in pregnancy (e.g., Pederson et al., 2011), and depressive symptoms during the postpartum (Walker, Timmerman, Kim, & Sterling, 2002). Ethnicity is also associated with postpartum body dissatisfaction (Walker et al., 2002). Therefore, our model proposes that demographic factors such as age, SES, ethnicity, and parity, will (1) directly influence PWR via maternal behaviours, and/or (2) influence PWR through psychological distress.

Social support. There is increasing evidence that social support influences both PWR and psychological well-being. Social support plays a protective role against the development of postpartum depressive symptoms (Webster, Nicholas, Velacott, Cridland, & Fawcett, 2011) and maternal stress (Hung & Chung, 2001), with support from a spouse or romantic partner being of particular importance (Patel, Lee, Wheatcroft, Barnes, & Stein, 2005). Inadequate social support has also been found to correlate with reported PWR (Harris, Ellison, & Clement, 1999); however, further research is required to determine whether this relationship is robust. The proposed model predicts that social support will (1) directly influence PWR via maternal behaviours, and/or (2) influence psychological well-

being, which in turn will influence PWR.

Pregnancy-related medical factors. Medical factors that are closely linked to GWG and that influence PWR include pregnancy-induced hypertension (Gould-Rothberg, Magriples, Kershaw, Schindler Rising, & Ickovics, 2011), and gestational diabetes (Carreno et al., 2012). Addition- ally, mode of delivery, specifically caesarean section, is associated with higher PWR (Siega-Riz et al., 2009). The relationship between medical factors and PWR could be associated with behavioural factors, such as changes in diet and physical activity; for example, women who have given birth by caesarean section may exercise less as a consequence of surgery (Riley, 2011).

Pregnancy-related medical factors may also influence psychological well-being; caesarean and instrumental vaginal deliveries have been associated with higher levels of postpartum psychological distress in comparison to normal vaginal deliveries (e.g., Lydon-Rochelle, Holt, & Martin, 2001). However, there are inconsistencies in findings, with a recent study reporting no association between mode of delivery and postpartum emotional distress (Adams, Eberhard-Gran, Sandvik, & Eskild, 2012); additional research to further explore these relationships is warranted.

Therefore, our conceptual model proposes that pregnancy-related medical factors, including delivery mode, gestational diabetes and pregnancy complications will: (1) influence PWR via maternal behaviours, such as diet and levels of physical activity, and/or (2) predict psychological distress, which in turn will influence maternal behaviours and PWR.

Psychological Factors

The influence of psychological factors on PWR is a relatively new area of research, with little known about how psychological state contributes to weight

normalisation in pregnancy and the postpartum (Pedersen et al., 2011). However, as noted throughout this article, there is increasing evidence that psychological factors play a much stronger role in PWR than previously thought. Psychological factors thought to contribute to PWR include depressive symptoms (Herring et al., 2008), anxiety (Skouteris, Wertheim, Rallis, Milgrom, & Paxton, 2009), stress (Siega-Riz et al., 2010), and body dissatisfaction (Rallis, Skouteris, Wertheim, & Paxton, 2007).

Psychological distress. The predictive power of depressive symptoms on obesity is well established in non- pregnant samples of women (e.g., Stice, Presnell, Shaw, & Rhode, 2005). Women with depressive symptoms lose half as much weight as women without depression (Linde et al., 2004). With respect to pregnancy and postpartum research, women who experienced higher depressive symptoms, trait anxiety or stress during pregnancy are more likely to have excessive GWG (Kamysheva, Skouteris, Wertheim, Paxton, & Milgrom, 2008; Rallis et al., 2007). This pattern continues into the postpartum, with PWR associated with depressive symptoms (Herring et al., 2008).

Pre-pregnancy BMI is a risk factor for self-reported depressive symptoms in the postpartum (LaCoursiere, Baksh, Bloebaum, & Varrner, 2006); however, new-onset depression in the early postpartum also predicts weight retention at 12 months (Herring et al., 2008). Therefore, based on these findings, our model proposes that both pre-pregnancy BMI and GWG will be associated with psychological distress, and that psychological distress will precede PWR.

There is a paucity of research that examines the role of anxiety in influencing PWR. This is surprising given the high comorbidity of anxiety and depression (Kessler, Keller, & Wittchen, 2001). Furthermore, anxiety in late pregnancy has been shown to predict greater depressive symptoms three months

post-birth (Skouteris et al., 2009).

In addition to anxiety, the influence of stress on PWR is not clear, with studies yielding mixed findings. For example, one study found no relationship between parenting stress and PWR (Vernon, Young-Hyman, & Looney, 2010). In contrast, stress associated with having an infant hospitalised at birth was a risk factor for increased weight retention at 12 months postpartum (Siega-Riz et al., 2010). Overall, there is some evidence that stress impacts adversely on PWR, however, additional research is required to determine whether these relationships are robust.

Body dissatisfaction. Closely tied to both maternal weight factors and psychological distress is body dissatisfaction or body image difficulties (Clark et al., 2009b; Huang et al., 2010; Mehta et al., 2010). Body dissatisfaction refers to the degree of dissatisfaction with particular aspects of the body, such as one's size or shape (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999), particularly the negative subjective evaluation of one's figure, weight, stomach and hips (Stice & Shaw, 2002). Like depressive symptoms, body dissatisfaction appears to play a role in the rate at which weight is lost. Women with positive body image have been found to be more successful in losing weight during the postpartum (Texeira et al., 2006), with similar patterns observed in pregnant women, where body satisfaction during pregnancy was related to pregnancy weight gain (Mehta et al., 2010). Such findings suggest that higher levels of body dissatisfaction result in increased GWG and PWR.

There is consistent evidence that in comparison to pre-pregnancy and late pregnancy, body image concerns become particularly salient in the postpartum, and progressively worsen over time, reflective of most women retaining at least some residual weight following birth, and the length of time taken to lose

additional weight gained during pregnancy (Clark et al., 2009a, 2009b; Gjerdingen et al., 2009; Rallis et al., 2007). Postpartum women often express a desire to return to their pre-pregnancy shape and weight quickly (Jenkin & Tiggemann, 1997); therefore, if weight loss is perceived to not be occurring quickly enough (Walker, 1998), increased body dissatisfaction and psychological distress may occur (Gjerdingen et al., 2009).

It is important to further explore relationships between body dissatisfaction and psychological disturbance, and how these factors may combine to contribute to increased PWR. Body dissatisfaction is associated consistently with psychological disturbance, particularly depressive symptoms and anxiety. This relationship has been found in pregnant women (e.g., Skouteris, Carr, Wertheim, Paxton, & Duncombe, 2005), perinatal populations (i.e., 20 weeks gestation until one month post-birth; Clark et al., 2009b; Herring et al., 2008; Rallis et al., 2007; Skouteris et al., 2005), and in non-pregnant women (Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006). Depressive symptoms experienced during pregnancy were shown to predict body dissatisfaction late in pregnancy, and also at six and 12 months postpartum, suggesting that body image disturbance may arise as a consequence of depression during pregnancy (Clark et al., 2009b; Skouteris et al., 2005); depressive symptoms at six months postpartum also predicted body image disturbance at 12 months postpartum (Rallis et al., 2007). Consequently our model proposes that psychological distress, consisting of depressive features, anxiety and stress symptoms, will predict body dissatisfaction, which in turn will influence PWR.

Maternal Behaviours

Finally, there are a number of maternal behavioural factors that influence PWR. Diet and physical activity are both important behavioural components of

postpartum weight loss (Amorim et al., 2007), in addition to breastfeeding, a factor unique to the postpartum period (Kac, Benicio, Velasquez-Melendez, Valente, & Struchiner, 2004).

Dietary quality. It is generally accepted that a reduction in energy intake is necessary to facilitate weight loss in overweight and obese individuals (Texeira et al., 2006). In postpartum samples, high levels of total energy intake have been associated with increased risk of weight retention (Oken, Taveras, Popoola, Rich-Edwards, & Gillman, 2007); however, quality of food may also be an important predictor of post-birth weight change (Althuizen, van Poppel, de Vries, Seidell, & van Mechelen, 2011). For example, high intake of trans fats (Oken et al., 2007) and saturated fats (Althuizen et al., 2011) predict substantial PWR; however, there are presently very few studies that specifically investigate the influence of dietary quality on PWR.

Additionally, less healthy diets have been associated with depressive symptoms at one year postpartum, in addition to weight-related distress, body image, and stress (Goldy, Milani, Hanss-Nuss, & Freeland-Graves, 2005), with similar findings in samples of pregnant women (Laraia, Siega-Riz, Dole, & London, 2008; Macht, 2008). Therefore, our model proposes that psychological factors, including depression, anxiety, stress and body dissatisfaction, influence dietary quality, which in turn impact upon PWR.

Physical activity. Physical activity is a further behavioural factor associated with PWR (Huang, Yeh, & Tsai, 2011). A recent longitudinal study found that women who reported being physically active during the postpartum were almost 10 times less likely to retain more than 5 kg above their pre-pregnancy BMI one year post-birth (Althuizen et al., 2011). Additionally, fewer hours spent in sedentary activities, such as watching television, is associated with

less PWR at one year postpartum (Oken et al., 2007).

In general populations, physical activity is associated with decreased depressive symptoms and anxiety (ten Have, de Graaf, & Monshouwer, 2011), and increased body image satisfaction (Daniels & van Niekerkwith, 2011). However, women tend to decrease their physical activity during pregnancy and delay returning to their pre-pregnancy diet and exercise practices in the postpartum period (Huang et al., 2011), and this is likely to have some impact on psychological well-being in the postpartum, in addition to the amount of weight that is retained (Huang et al., 2011). Therefore, our conceptual model proposes that psychological distress and body dissatisfaction will influence levels of physical activity, which in turn will influence PWR.

Breastfeeding. The relationship between breastfeeding and weight retention in the postpartum has been examined widely with mixed results. Some studies have found increased weight loss among lactating compared to non-lactating mothers (e.g., Kac et al., 2004), while others have not (Haiek, Kramer, Ciampi, & Tirado, 2001). A longer duration of breastfeeding, i.e., six to 12 months, is linked to increased weight loss in the postpartum (Kac et al., 2004); however, this has not been replicated consistently (e.g., Siega-Riz et al., 2010). Such discrepancies have been attributed to problems in assessing breastfeeding practices particularly in relation to intensity, small sample sizes, short duration of measurement and attrition (Kac et al., 2004; Krause, Lovelady, Peterson, Chowdhury, & Ostbye, 2010), and need to be addressed in future research.

Research has shown that women's likelihood or willingness to breastfeed is influenced by degree of body image satisfaction both prior to pregnancy and during pregnancy (Huang, Wang, & Chen, 2004). While postpartum body image dissatisfaction is associated with a lower likelihood of breastfeeding and higher

levels of PWR (Walker & Freeland-Graves, 1998), there is a dearth of research that examines the inter-relationships between these factors. Therefore, the model proposes that body dissatisfaction will influence women's likelihood to breastfeed, which in turn will impact upon PWR.

Future Directions and Implications for Practice

In summary, there is increasing evidence that maternal psychological factors such as depressive symptoms, anxiety, stress and body image dissatisfaction can result in increased weight retention in postpartum women (Herring et al., 2008; Pedersen et al., 2011). Further exploration into how these psychological factors combine with maternal weight factors, sleep, sociocontextual influences, behavioural and medical factors to impact on PWR is warranted.

In the proposed conceptual model, it is argued that sociocontextual influences, including demographics, social support, and medical factors, coupled with maternal physiological and physical weight characteristics, including maternal weight prior to and during pregnancy, and sleep quality, each influence levels of psychological distress, which in turn influence body dissatisfaction. To date, there is limited research that uses a conceptual model to further explore and understand the influences of psychological predictors on PWR. Given the number and complexity of psychological factors that are likely to exert an influence, the conceptual model outlined aims to further clarify these relationships in order to inform the development and implementation of appropriate intervention strategies to prevent PWR.

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Part II

Empirical Studies

Chapter Three

Method

Participants were members of the *Maternal Health & Wellbeing* Study (MHWS), with approval by the Deakin University Human Research Ethics Committee (see Appendix A). The MHWS is a longitudinal study beginning in March 2010 and completed in January 2014, that has collected 20 waves of data throughout pregnancy and the first year postpartum by mail survey on domains including psychological functioning, self-esteem, relationship quality, life events, maternal behaviours, and social support. Additional data collected during the postpartum included measures of child temperament, parenting stress, and infant feeding. The original MHWS cohort comprised 446 women who were recruited between March 2010 and July 2012 via advertisements on mother, child, and baby web forums, parenting magazines, general media advertising, and word-of-mouth. The advertisements invited women who were 10-16 weeks pregnant to take part in a *Maternal Health & Wellbeing* study that was exploring women's general experiences during pregnancy and post-birth. Setting the recruitment period at 10-16 weeks gestation enabled women to consider the pregnancy certain (threat of miscarriage having subsided) prior to volunteering. The advertisements and flyers (see Appendix B) outlined the purpose of the study, the frequency and type of data collection, as well as the contact details of the project manager. Information about the study was also publicised by the researchers via word-of-mouth.

Those interested in participating contacted the project manager, who then mailed the cover letter, plain language statements, consent forms (Appendix C), and the questionnaires described below with reply paid envelopes to the nominated address (Appendix D). These documents provided participants with information regarding the contact details of the researchers, the approximate time

it would take to complete the questionnaires, and the areas the questions would enquire about. Information about confidentiality and consent, as well as the possible benefits and risks of participating in the research was also provided. Interested participants were offered the opportunity to ask any questions prior to providing voluntary consent. To protect anonymity, participants were assigned an identification (ID) number. Participant names, contact details and ID numbers were contained in separate, password-protected files on a shared drive that was only accessible by the research team. Only ID numbers were printed on returned questionnaires. Each questionnaire was completed at home by participants, and returned to the project manager in reply-paid envelopes. Participants who completed questionnaires at recruitment (16 weeks pregnancy), post-birth (one month postpartum) through to 12 months postpartum, received a $30 gift voucher at each of these time-points.

The two empirical studies presented in the current research used data collected at selected time-points. Empirical study 1 included data collected during the first trimester of pregnancy (M = 16.57 weeks, SD = .97), 32 weeks (M = 32.60, SD = .84) gestation, and three months (M = 13.24, SD = 1.78 weeks) postpartum. Empirical study 2 used data collected during the first trimester of pregnancy (M = 16.61 weeks, SD = .93), 12 weeks (three months) postpartum (M = 13.21, SD = 1.56), 24 weeks (six months) postpartum (M = 25.78, SD = 1.62), and 32 weeks (nine months) postpartum (M = 37.78, SD = 2.47).

Regarding attrition, for study 1, 280 women completed baseline questionnaires, and of these participants 53 (18.9%) withdrew, and their data were not included in the final analyses. Chi-square goodness-of-fit tests (a = .05) indicated that there were no significant differences in respect to age, education,

income, pre-pregnancy BMI, and GWG between the final sample in the study (*N* = 227) and those who withdrew.

For study 2, 203 women completed questionnaires at the first time-point (three months postpartum), but by time three (nine months postpartum), 77 (26.36%) had withdrawn. Therefore, data for these women was not used in the final analyses. Chi-square goodness-of-fit tests (*a* = .05) indicated that there were no significant differences in respect to age, education, income, pre-pregnancy BMI, and GWG between the final sample in the study (*N* = 126) and the participants who withdrew.

Further chi-square goodness-of-fit tests (*a* = .05) indicated that there were also no notable differences in respect to demographic and weight variables detected between the samples used in both studies and the reamining participants who took part in the MHWS study (*N* = 219).

Participants

The sample for study 1 consisted of 227 pregnant women aged between 19 and 42 (*M* = 30.82, *SD* = 4.36). Study 2 comprised a sample of 126 pregnant women (each of whom were included in the first study) with an age range between 21 and 41 years (*M* = 31.00, *SD* = 4.11). A summary of the demographic characteristics of the samples used for both studies is provided in Table 3.1.

For study 1, an obstetrician, general practitioner, or midwife had objectively weighed 17.2% of participants during the first trimester of pregnancy (*M* = 9.43 weeks, *SD* = 3.16). Participants also provided self-reported weight during trimester one of pregnancy (*M* = 9.35 weeks, *SD* = 3.16). At 32 weeks gestation, slightly more than a third of the women (38.2%) had been objectively weighed (*M* =78.75 kg, *SD* = 16.12). At three months postpartum, there was

inadequate data available for comparisons of objectively measured weight with self-reported weight.

For study 2, 48.4% of the sample had been weighed by an obstetrician, general practitioner or midwife during the first trimester of pregnancy (M = 13.57, SD = 3.28 weeks); insufficient objective weight data was available during the other time-points in the postpartum (three, six and nine months) to use in the analyses. Comparisons between average self-reported height and weight and objective measures collected at each time-point is included in Table 3.2.

Table 3.1
Demographic Characteristics of Samples in Empirical Studies

	Study 1 (*N* = 227)		Study 2 (*N* = 126)	
	n	%	*n*	%
Education				
Tertiary level (post high school)	202	88.9	112	88.9
High school or less	25	11.1	14	11.1
Household income				
> A$105,000	143	62.9	78	61.8
A$65,000 – A$105,000	55	24.2	31	24.6
< A$65,000	29	12.8	17	13.5
Employment				
In paid employment	180	79.3	98	77.8
Full-time carer	46	20.7	28	22.2
Parity				
Primiparous	131	57.7	65	51.6
Multiparous	96	42.3	61	48.4
Marital status				
Married	176	77.5	102	81
De-facto	47	20.7	22	17.5
Single	4	1.8	2	1.5
Birth location				
Australia	195	85.9	109	86.5
New Zealand	10	4.4	6	4.8
United Kingdom	10	4.4	4	3.2
Europe	6	2.6	4	3.2
North America	4	1.8	2	1.6
Africa	1	.4	0	0
Asia	1	.4	1	.8
Drug use during pregnancy				
Smoking	2	.3	11	9.1
Alcohol	16	7	8	6.3
Delivery type				
Vaginal (no complications)	175	77.1	95	75.4
Emergency caesarean	25	11	13	10.3
Elective caesarean	26	11.5	17	13.5
Vaginal breech birth	1	.4	0	0
Psychiatric history				
None	149	65.6	82	65.1
Minor depression	40	17.6	23	18.3
Anxiety disorder	32	14.1	21	16.7
Major depression	14	6.2	5	4
Postnatal depression	8	3.5	6	4.8
Bipolar disorder	3	1.3	1	.8
Antenatal depression	2	.9	2	1.6
Eating disorder	2	.9	0	0
Receiving current treatment	14	6.2	6	4.8
Family history of mental illness	106	46.7	33	34.9

Table 3.2

Means and Standard Deviations for Objectively Measured and Self-Reported Height and Weight at Each Time-Point for Both Studies.

	Study 1		Study 2	
	Objective measurement	*Self-reported*	*Objective measurement*	*Self-reported*
Height (cm)	167 (*SD*=.07)	167 (*SD*=.07)	168 (*SD*=7.24)	167 (*SD*=.07)
Weight (kg)				
Pre-pregnancy	N/A	70.05 (*SD*=14.81)	N/A	70.84 (*SD*=14.34)
16 weeks gestation	70.17 (*SD*=16.55)	73.81 (*SD*=16.33)	71.82 (*SD*=13.92)	75.47 (*SD*=16.91)
32 weeks gestation	78.75 (*SD*=16.12)	81.72 (*SD*=16.42)	-	-
3 months postpartum	N/A	76.56 (*SD*=16.54)	N/A	78.95 (*SD*=16.91)
6 months postpartum	-	-	N/A	76.52 (*SD*=17.10)
9 months postpartum	-	-	N/A	74.81 (*SD*=16.78)

Note: N/A – data not available/not collected.

Materials

As observed in the seven sets of questionnaires (Appendix E), data were collected for a wide range of maternal variables. The data collection schedule is summarised in Table 3.3.

Table 3.3

Data Collection Schedule

	Pregnancy phase (weeks)		Postpartum phase (months)			
Measure	16	32	1	3	6	9
Demographics	*					
Self-reported weight	*	*		*	*	*
Physical activity		*		*	*	
Dietary quality		*				
Birth details			*			
Breastfeeding				*	*	
DASS-21		*		*	*	
EPDS		*		*	*	
BAQ		*		*	*	
MSPSS		*		*	*	
PSQI		*		*	*	
Approx completion time (min)	45	25	10	25	25	10

Note: DASS-21 – Depression Anxiety Stress Scales (21 item version), EPDS – Edinburgh Postnatal Depression Scale, BAQ – Body Attitudes Questionnaire, MSPSS – Multidimensional Scale of Perceived Social Support, PSQI – Pittsburgh Sleep Quality Index.

The questionnaire packs contained the following measures:

Weight measures.

Pre-pregnancy body mass index. Pre-pregnancy body mass index (BMI) was calculated based on self-reported retrospective weight, and height. Average self-reported pre-pregnancy BMI in study 1 was 25.17 (*SD* = 4.98), and 25.37 (*SD* = 4.69) for study 2. A 10-point rating scale where participants rated their

confidence in the accuracy of their report of pre-pregnancy weight was also collected (0 = *not at all confident,* 10 = *extremely confident*). In study 1, the mean level of confidence in weight gain was 7.90 (*SD* = 2.02), and in study 2, 7.99 (*SD* = 2.01). Table 3.4 summarises the distribution of pre-pregnancy BMI for samples used for both studies.

Gestational weight gain. Gestational weight gain (GWG) was calculated by subtracting pre-pregnancy weight from self-reported weight at 32 weeks gestation, which was consistent with similar studies (e.g., Montpetit, Plourde, Cohen, & Koski, 2012; Siega-Riz et al., 2010). In study 1, the average amount of weight gained from pre-pregnancy to 32 weeks gestation was 13.74 kg (*SD* = 5.41), and in study 2, average amount of GWG was 14.63 kg (*SD* = 5.75) Average GWG in relation to pre-pregnancy BMI for samples in both studies is summarised in Table 3.4. Adequacy of GWG was assessed with IOM's (2009) guidelines on total recommended weight gain during pregnancy (12.5-18 kg for underweight women, 11.5-16 kg for women of healthy weight, 7-11.5 kg for overweight women, and 5-9 kg for obese women). As can be observed in Table 3.4, women who started pregnancy within the overweight and obese BMI ranges tended to exceed the recommended GWG ranges in both studies.

Outcome variable: Postpartum weight retention. PWR was assessed through self-report and was calculated for studies 1 and 2 by subtracting pre-pregnancy weight from weight at three months postpartum. PWR was defined as a difference in weight of at least 5 kg compared to self-reported pre-pregnancy BMI. This cut-off predicts later obesity (Gunderson & Abrams, 1999) and has been frequently used in similar studies (e.g., Herring et al., 2008; Pedersen et al., 2011; Walker, Fowles, & Sterling, 2011). In study 1, 62.6% (N = 142)

Table 3.4

BMI and Weight Changes From Pre-Pregnancy Through Postpartum for Both Studies.

	Study 1 (*N* = 227)						Study 2 (*N* = 126)					
	Pre-pregnancy		Average GWG		PWR (3 months)		Pre-pregnancy		Average GWG		PWR (9 months)	
BMI range	*n*	*%*	*M*	*SD*	*n*	*%*	*n*	*%*	*M*	*SD*	*n*	*%*
Underweight	6	2.7	13.05	5.83	2	.9	2	1.6	15.95	1.34	1	.8
Healthy	131	57.7	13.77	4.03	83	36.6	71	56.1	14.32	4.12	51	40.8
Overweight	54	23.9	14.92	5.84	75	33	35	27.6	15.22	6.23	47	37.6
Obese	36	15.8	11.84	8.14	67	29.5	18	14.6	16.83	14.15	26	20.8

Note: BMI was computed as weight (kg)/height(m)^2 in accordance with the World Health Organisation (WHO) (2000) guidelines: <18.5 kg/m^2 = underweight, 18.5-24.9 kg/m^2 = healthy weight, 25-29.9 kg/m^2 = overweight, >30 kg/m^2 = obese. GWG – average amount of weight gained from pre-pregnancy to 32 weeks gestation, PWR –postpartum weight retention at 3 months postpartum (study one), and 9 months postpartum (study two).

of the sample had retained 5 or more kg at three months postpartum. In study 2, 43.7% (N = 55) had high PWR at nine months postpartum.

Covariate measures.

Physical activity. At each time point, participants recalled the duration of physical activity undertaken over the previous week. In study 1, average exercise duration at 32 weeks gestation was 127.85 minutes (SD = 105.88), and at three months postpartum, average duration was 129.14 minutes (SD = 85.06). In study 2, average exercise duration at three months postpartum was 129.95 minutes (SD = 83.83), and at six months postpartum, average duration was 143.83 minutes (SD = 106.33).

Social support. Social support was assessed with the 12-item Multidimensional Scale of Perceived Social Support (MSPSS), a measure of perceived levels of social support from family, friends and significant others over the last eight weeks. Items were rated from *very strongly disagree* (1) to *very strongly agree* (7), with higher scores representing stronger social support. Test-retest reliability and construct validity have been supported (Zimet, Dahlem, & Farley, 1988). Cronbach's alpha for study 1 was .81, and for study 2, was .96.

Sleep quality. Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI) (Buysee, Reynolds, Monk, & Berman, 1989), a seven domain (19 item) self-rated questionnaire that measures quality and patterns of sleep over the past month. Higher scores reflect poorer sleep quality (Smyth, 1999). Total PSQI has demonstrated construct validity (Jomeen & Martin, 2007) and internal consistency in pregnancy (Jomeen & Martin, 2007; Skouteris, Germano, Wertheim, Paxton, & Milgrom, 2008) and postpartum. Total PSQI has

obtained a Cronbach's alpha of .83 (Smyth, 1999). Cronbach's alpha for study 1 was .75, and for study 2, was .74.

Dietary quality. Dietary quality was assessed in study 1 at 32 weeks gestation using the National Nutrition Survey Food Frequency Questionnaire (Australian Bureau of Statistics, 1995), a retrospective questionnaire that provides semi-quantitative information on the longer-term consumption of 107 foods, beverages and vitamin and mineral supplements. Average frequency of consumption in the last 12 months was rated from *never or less than once a month* (1) to *6+ times per day* (9). Cronbach's alpha was .71.

Delivery type and feeding practices. At one month post-birth, information was collected from participants regarding infant feeding practices (exclusive breastfeeding, combined breastfeeding, formula, and solids), and mode of delivery.

Psychological measures.

Anxiety and Stress. Anxiety and stress were assessed using the relevant subscales of the Depression, Anxiety and Stress Scales (DASS-21); a shortened version of the 42-item DASS (Lovibond & Lovibond, 1995). The DASS-21 is a widely used and valid measure of generalised psychological distress (Henry & Crawford, 2005). Anxiety (seven items) and stress (seven items) were rated over the past month, ranging from *did not apply to me at all – never* (0) to *applied to me very much, or most of the time – almost always* (3). Higher scores represented greater severity of symptoms. Cronbach's alpha in study 1 was .90, and in study 2 was .91.

Depression. Depressive symptoms were assessed with the 10-item Edinburgh Postnatal Depression Scale (EPDS), a widely used self-report

screening measure validated for antenatal and postpartum use (Murray & Cox, 1990; Thorpe, 1993), and which does not include somatic items that may be misleading as indicators of depression (Evans, Heron, Francomb, Oke, & Golding, 2001; Matthey, Henshaw, Elliott, & Barnett, 2006). Postpartum depression was rated over the past month, and ranged from *no/not at all/never* (0) to *yes/ quite a lot/most of the time* (3). Cronbach's alpha in study 1 was .85, and.86 in study 2.

Body dissatisfaction. Body dissatisfaction was assessed with four subscales of the Body Attitudes Questionnaire (BAQ) (Ben-Tovim & Walker, 1991) that were considered most relevant for pregnant and postpartum women: feeling fat (13 items), strength and fitness (six items), salience of weight and shape issues (eight items), and attractiveness (five items). Items were rated from *definitely disagree* (1) to *definitely agree* (5). Items in each subscale were scored so that a higher score represented greater endorsement for each of the measured dimensions. Factor structure, test-retest reliability and construct validity have been demonstrated in a variety of samples (Ben-Tovim & Walker, 1991; 1992). In study 1, Cronbach's alpha for the Attractiveness subscale was .83; Feeling Fat subscale, .94; Salience of Weight/Shape .82; Strength and Fitness, .47, with the mean of the four subscales being .74. In study 2, Cronbach's alpha for the Attractiveness subscale was .67; Feeling Fat, .93; Salience of Weight/Shape, .81; Strength and Fitness, .63; the mean of the four subscales was .76.

Overview of Data Analyses

This section provides a brief overview of the data analyses conducted in the two studies. Firstly, there will be a description of the data cleaning undertaken. Next, the examination of correlations between variables will be

described. Thirdly, there will be a description of the power analyses undertaken. Finally, there will be an overview of the hierarchical regressions conducted in the two studies.

Distributions of all variables for participants were screened through SPSS (Statistical Package for the Social Sciences) Version 21, for accuracy of data entry, missing values, non-normality, outliers, internal consistency and the assumptions of regression using SPSS FREQUENCIES, SPSS RELIABILITY ANALYSIS and SPSS REGRESSION.

Random missing values were replaced with the group mean for the variable, as recommended by Tabachnick and Fidell (2007). No out of range data were evident. All variables were screened separately for normality and linearity, and for univariate and multivariate outliers. Visual inspection of histograms and box-plots revealed the presence of extreme outliers for several scales and individual items. In addition, a number of items and scales had skew and/or kurtosis. As a result, logarithm transformations were conducted on the following variables used in study 1: parity, delivery type, exercise duration (all time-points), feeding practices (three months postpartum), the DASS anxiety subscale (all time-points), DASS stress subscale (three months postpartum), and EPDS (32 weeks gestation). For study 2, logarithm transformations were conducted on the following variables: parity, delivery type, breastfeeding (three months postpartum), exercise duration (three and six months postpartum), the DASS anxiety subscale (three and six months postpartum), and the DASS stress subscale (three months postpartum).

Following transformation of variables, a number of extreme outliers were observed to remain. As hierarchical multiple regression is highly sensitive to

outliers, steps were taken to reduce the impact to retain all variables and cases in the analysis. In accordance with recommendations of Field (2009), the outlying cases were replaced with the next highest or lowest value in the data set plus one. No univariate or multivariate outliers were evident following censoring of the data.

Intercorrelations were examined for the outcome variable (PWR), psychological variables and covariates to assess for inclusion in the regression analyses. Of the covariates used in study 1, only GWG was correlated with PWR, and of the psychological variables, only body dissatisfaction, specifically the Feeling Fat and Salience of Weight & Shape subscales of the BAQ, were correlated with PWR. In study 2, GWG was associated positively and significantly with PWR, and also feeding practices at six months postpartum. Of the psychological variables, body dissatisfaction was correlated positively and significantly with PWR, specifically, feeling fat, and salience of weight/shape. In contrast, attractiveness was negatively correlated with PWR. Tables of correlations, means, and standard deviations for variables that had adequate correlations to be included in the regression analyses are included in Appendix E.

Acceptability of sample size was calculated to assess suitability for hierarchical multiple regression. Green (1991) recommends a minimum acceptable sample size of $50 + 8k$, where k is the number of predictors, for overall fit of the regression model. Study 1 included five predictor variables, therefore a minimum sample size of 90 (50 + 40) was required. For assessment of individual predictors within the model, a minimum sample size of $104 + k$ is optimal (Green, 1991), requiring a minimum sample size of 109. Given the sample size for study 1 was 227, both of these requirements were satisfied. Additionally, based on

G*Power (Faul, Erdfelder, Lang & Buchner, 2007), the sample size of 227 gave adequate power based on a small (r = .10) to medium effect size (r = .30), an alpha of 0.05, and 80% power to detect a relationship between psychological variables and PWR in hierarchical regression analyses.

Study 2 included six predictor variables, therefore in accordance with guidelines by Green (1991), a minimum sample size of 98 (50 + 48) was required. For assessment of individual predictors within the model, a minimum sample size of 104 + k was optimal (Green, 1991), requiring a minimum sample size of 110 in study two. As the sample size for study 2 was 126, both of these requirements were satisfied in addition to adequate power based on small (r = .10) to medium (r = .30) effect sizes, an alpha of .05, and 95% power to detect a relationship between psychological variables and PWR in hierarchical regression analyses, based on G*Power (Faul et al., 2007).

For both studies, hierarchical multiple regression was used to assess the ability of psychological variables to predict weight retention at three and nine months postpartum respectively, after controlling for the influence of GWG. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. In all regressions, not all of the covariates were treated as continuous variables; covariates such as education, breastfeeding, and delivery type were treated as categorical variables.

In study 1, multicollinearity was observed between depression and stress at three months postpartum, r = .71, and between feeling fat and salience of weight/shape at 32 weeks gestation, r = .77 and T2, r = .74, and in study 2, multicollinearity was observed between depression and stress at three months postpartum, r = .79, and between salience of weight/shape and feeling fat at six

months postpartum, $r = .78$. Given recommendations that bivariate correlations of .70 or higher are sub-optimal for regression analyses (Pallant, 2010), the variables with the lowest correlation with the outcome variables (depression and salience of weight/shape) were omitted from both analyses**.**

For study 1, two hierarchical regressions were performed. For the first regression, GWG was entered at step 1 due to its established strong relationship to PWR. At step 2, demographic, physiological, and medical variables were entered, followed by maternal behavioural factors at step 3. At step 4, stress (32 weeks gestation) and depression (32 weeks gestation) were entered, followed by feeling fat (32 weeks gestation) at step 5.

The second hierarchical regression performed in study 1 included entry of GWG at step 1, demographic, physiological and medical variables at step 2 and maternal behavioural factors at step 3. This was followed by the addition of stress (three months postpartum) at step 4, and feeling fat (three months postpartum) at step 5.

A single hierarchical regression was performed in study 2. Given the smaller sample size of 126, variables were selected for entry into the regression based on strength of correlation with the outcome variable in order to meet the requirements of sample size, where $N > 50 + 8m$ is optimal for generalisability of results (Tabachnick & Fidell, 2007). Nine predictor variables were used in the regression analysis: GWG and pre-pregnancy BMI at step 1, age, education and social support at step 2, exercise, breastfeeding, and sleep at step 3, stress (three months postpartum) at step 4, and body dissatisfaction (salience of weight/shape or feeling fat) (six months postpartum) at step 5.

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Chapter Four

The Influence of Psychological Distress During Pregnancy on Early Postpartum Weight Retention

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Abstract

Background: Pregnancy has been identified as a risk factor for increasing rates of obesity in women. In recent years, psychological factors have been demonstrated to play a key role in contributing to and maintaining postpartum weight retention (PWR).

Objective: The aim of this study was to explore the relationship between psychological distress during late pregnancy and early postpartum, specifically depression, anxiety, stress, and body dissatisfaction, and early PWR.

Methods: Pregnant women ($N = 227$) completed a series of questionnaires at 32 weeks gestation and three months postpartum.

Results: The most salient predictor of PWR was gestational weight gain (GWG). In a prospective hierarchical regression analysis, only GWG contributed unique prediction of early PWR. In a second hierarchical regression analysis examining cross-sectional relationships with three month PWR, GWG and early postpartum stress contributed unique variance while the contribution of feelings of fatness approached significance.

Conclusions: Given the large association of GWG to early PWR, interventions should focus on the prevention of GWG during pregnancy, as well as screening for body dissatisfaction and stress in the early postpartum.

Keywords: Intervention, longitudinal, postnatal depression, pregnancy, psychosocial factors

Pregnancy-related weight gain and retention is an increasing problem in developed countries, affecting almost 50% of women of childbearing age, and has been identified as a critical pathway for long-term obesity for both mothers (IOM, 2009) and offspring (Skouteris et al., 2010). Therefore, there is an increasing need to understand why women gain and retain excessive amounts of weight throughout their pregnancies and postpartum periods (Montgomery et al., 2011).

A range of physiological, sociocultural, medical, and behavioural factors influence postpartum weight retention (PWR), though inconsistency exists across studies (Phillips, King, & Skouteris, 2012). Of these factors, the most salient and consistent predictor of PWR is excessive gestational weight gain (GWG) (Siega-Riz et al., 2010). Other physiological and medical influences include high pre-pregnancy body mass index (BMI), poor sleep quality (Siega-Riz et al., 2010), pregnancy complications (Carreno et al., 2012), and caesarean mode of delivery (Viswanathan et al., 2008). Sociodemographic factors identified include low maternal level of education, unemployment, younger maternal age, black ethnicity (Siega-Riz et al., 2010), multiparity (Gunderson & Abrams, 1999), low social support (Harris, Ellison, & Clement, 1999), and low socioeconomic status (SES) (Pedersen et al., 2011). Finally, behavioural factors such as poor dietary quality (Althuizen, van Poppel, de Vries, Seidell, & van Mechelen, 2011), low levels of physical activity (Huang, Yeh, & Tsai, 2011), and breastfeeding for shorter durations (i.e., less than six months) (Krause, Lovelady, Peterson, Chowdhury, & Ostbye, 2010) also influence PWR.

However, the role of psychological factors during pregnancy and postpartum, are less well understood (Pedersen et al., 2011). Depression, stress and anxiety during pregnancy are associated with excessive GWG (Webb, Siega-

Riz, & Dole, 2008), and with PWR at six months (Pedersen et al., 2011). Yet, comparatively few studies have examined whether postpartum psychological distress influences PWR. What is known, though, is that there is a relatively high prevalence of postpartum depression (Buist et al., 2008), and that postpartum depression onset during the first six months post-birth is associated with substantial long-term weight retention (Herring et al., 2008a). Therefore, further understanding of how both peripartum and postpartum distress are related to early PWR is required.

Similarly, the relationship between stress and PWR also warrants further exploration. During pregnancy, women may experience amplification of stress in relation to adjusting to the emotional and physiological changes associated with the transition to motherhood (Webb et al., 2008). Furthermore, in the postpartum changes to routine could cause additional stress and impact upon women's previous strategies for controlling weight (Patel, Lee, Wheatcroft, Barnes, & Stein, 2005). The limited studies that have explored the relationship between early postpartum stress and weight retention provide inconsistent findings. One study found no relationship between parenting stress and PWR (Vernon, Young-Hyman, & Looney, 2010), whereas in contrast, stress associated with having an infant hospitalised at birth was a risk factor for increased weight retention at 12 months postpartum (Siega-Riz et al., 2010).

Like depression, anxiety and stress, body dissatisfaction during pregnancy and postpartum is associated with the rate at which weight is gained and retained. Increased body dissatisfaction during pregnancy is associated with excessive GWG (Mehta, Siega-Riz, & Herring, 2010) and postpartum body dissatisfaction is associated with PWR (Huang & Dai, 2007). In comparison to both pre-pregnancy

and late pregnancy, body dissatisfaction is stronger during the postpartum (Rallis, Skouteris, Wertheim, & Paxton, 2007), with women experiencing most body dissatisfaction at six weeks and at six months post-birth (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009b). However, further research is required to clarify the relationship between body dissatisfaction and PWR.

Further investigation of the effects of psychological influences on PWR is essential, as there is a currently a paucity of research that explores such relationships, after controlling for other identified contributing factors, as outlined by Phillips et al. (2012) in Figure 4.1. Hence, the overall aim of this study was to examine the relationship between psychological factors during pregnancy and early postpartum and PWR, after controlling for the influences of maternal weight, medical, sleep quality, sociocontextual, and behavioural factors, as stipulated in Phillips et al.'s (2012) conceptual model. It was hypothesised that depression, anxiety, stress, and body dissatisfaction during pregnancy and early postpartum would be associated with higher levels of PWR at three months postpartum.

Method

Participants

Participants were 227 pregnant women aged between aged between 19 and 42 (M = 30.82, SD = 4.36) who volunteered to participate in a longitudinal study of GWG and PWR. Participants were administered questionnaires at two time points: approximately 32 weeks (Time 1, T1) (M = 32.60, SD = .84) gestation, and three months (Time 2, T2) (M = 13.24, SD = 1.78 weeks) post-birth.

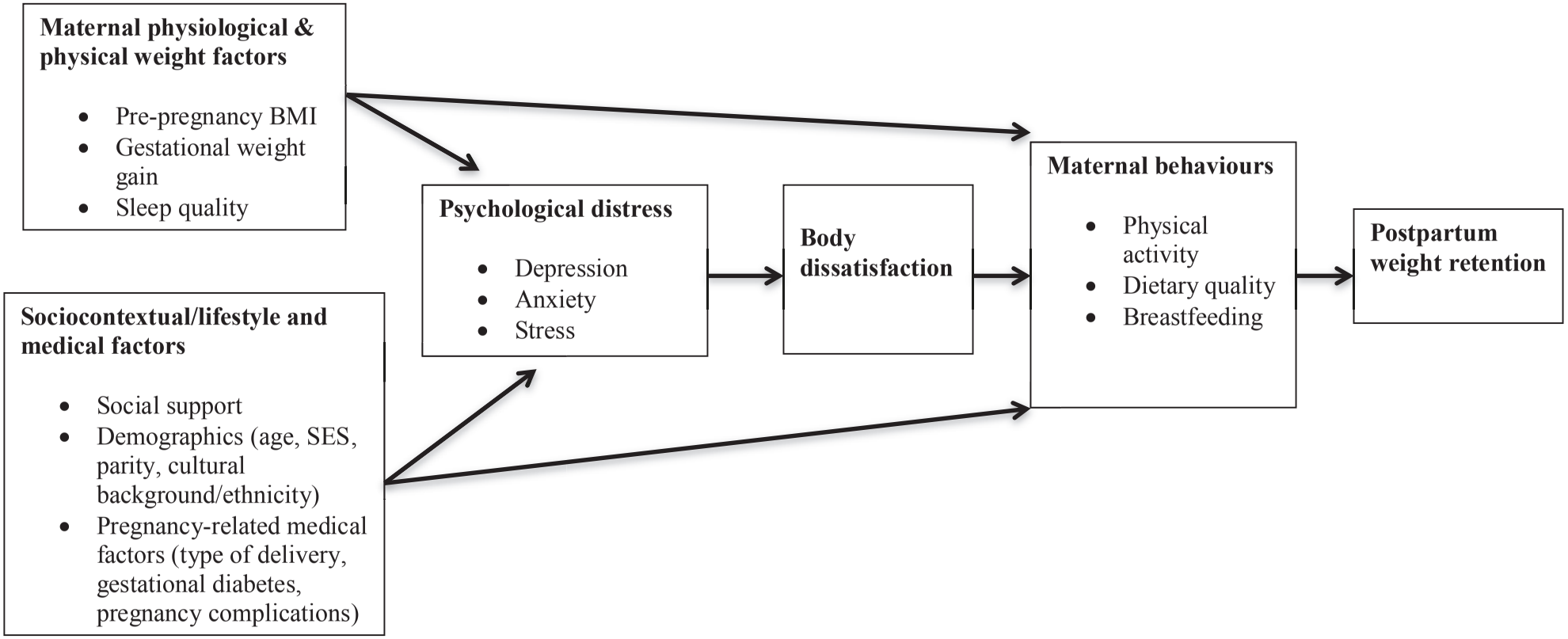

Figure 4.1. An empirically supported, multifactorial, conceptual model of psychological influences on postpartum weight retention. From "A conceptual model of psychological predictors of postpartum weight retention," by J. Phillips, R. King and H. Skouteris, 2012, *Journal of Reproductive & Infant Psychology, 30,* 278–288.

A total of 280 women agreed to take part in the study and completed at least the initial questionnaires; 53 (18.9%) dropped out and their data were not included in the final analyses. Chi-square goodness-of-fit tests ($\alpha = .05$) indicated that there were no significant differences in respect to age, education, income, pre-pregnancy BMI, and GWG between the final sample in the study ($N = 227$) and those who withdrew.

Procedure

Relevant ethics approvals and written informed consent were obtained from all women who participated. Pregnant women were recruited via advertising on mother, child and baby forums, parenting magazines, baby and children's markets, obstetrician referrals, and general media advertising. The advertisement placed on forums and in advertising campaigns invited women to take part in a *Maternal Health & Well-Being* study that was exploring women's general experiences during pregnancy and post-birth. Interested participants were provided with a Plain Language Statement, which clearly detailed the aims and procedures of the project and were offered the opportunity to ask any questions before providing voluntary consent. At both time-points, women completed a series of questionnaires. Each questionnaire was code-numbered for confidentiality, completed at home by participants, and returned in reply-paid envelopes.

Measures

Outcome variable. PWR was assessed through self-report and was calculated by subtracting pre-pregnancy weight from weight at T2. PWR was defined as a difference in weight of at least 5 kg compared to self-reported pre-pregnancy weight, as this cut-off predicts later obesity (Gunderson & Abrams,

1999) and has been frequently used in similar studies (e.g., Herring et al., 2008a; Pedersen et al., 2011; Walker, Fowles, & Sterling, 2011).

Psychological variables. Anxiety and stress were assessed at both time-points using the relevant subscales of the Depression, Anxiety and Stress Scales (DASS-21); a shortened version of the 42-item DASS (Lovibond & Lovibond, 1995). The DASS-21 is a widely used and valid measure of generalised psychological distress (Henry & Crawford, 2005). Anxiety (seven items) and stress (seven items) were rated from *did not apply to me at all – never* (0) to *applied to me very much, or most of the time – almost always* (3). Higher scores represented greater severity of symptoms. Cronbach's alpha for the Anxiety subscale was .70, and .87 for the Stress subscale.

Depressive symptoms were assessed with the 10-item Edinburgh Postnatal Depression Scale (EPDS), a widely used self-report screening measure validated for antenatal and postpartum use (Murray & Cox, 1990; Thorpe, 1993). Scores of 13 and above indicated the presence of depressive symptoms. Cronbach's alpha in the current study was .85.

Body dissatisfaction was assessed with four subscales of the Body Attitudes Questionnaire (BAQ) (Ben-Tovim & Walker, 1991) considered most relevant for pregnant and postpartum women: feeling fat (13 items), strength and fitness (six items), salience of weight and shape issues (eight items); and attractiveness (five items). Items were rated from *definitely disagree* (1) to *definitely agree* (5). Higher subscale scores represented greater salience in each of the measured dimensions. Factor structure, test-retest reliability and construct validity have been demonstrated in a variety of samples (Ben-Tovim & Walker, 1991; 1992). Cronbach's alpha for the Attractiveness subscale was .83; Feeling

Fat subscale, .94; Salience of Weight/Shape .82; Strength and Fitness, .47, with the mean of the four subscales being .74.

Covariates. Demographic information was collected at T1 and included maternal age, race/ethnicity, education, parity, level of education, household income, and self-reported pre-pregnancy weight. At T2, additional demographic information was collected, including infant feeding practices (exclusive breastfeeding, combined breastfeeding, formula, and solids), and mode of delivery (vaginal no complications, vaginal breech birth, elective caesarean, emergency caesarean).

Pre-pregnancy BMI was calculated based on self-reported retrospective weight, and height collected at T1. A 10-point rating scale where participants rated their confidence in the accuracy of their report of pre-pregnancy weight was also collected (0 = *not at all confident,* 10 = *extremely confident*), with a mean of 7.90 (*SD* = 2.02). Overall, 153 (67.4%) participants rated their confidence in accuracy of self-reported weight as 8 or above, 46 (20.3%) provided a rating of 6 or 7, and 28 (12.3%) rated 5 or less. GWG was calculated by subtracting pre-pregnancy weight from self-reported weight at T2, to ensure consistency with similar studies (e.g., Montpetit, Plourde, Cohen, & Koski, 2012; Siega-Riz et al., 2010).

At both time points, participants recalled the duration of physical activity undertaken over the previous week; with average exercise duration at T1 being 127.85 minutes (*SD* = 105.88), and at T2, average duration was 129.14 minutes (*SD* = 85.06). Dietary quality was measured at T1 using the National Nutrition Survey Food Frequency Questionnaire (Australian Bureau of Statistics, 1995).

Daily fruit and vegetable intake was rated from *don't eat fruit/vegetables* (0) to *six servings or more* (4). Cronbach's alpha was .71.

Social support was assessed at both time points with the 12-item Multidimensional Scale of Perceived Social Support (MSPSS), a measure of perceived levels of social support from family, friends and significant others over the last eight weeks. Items were rated from *very strongly disagree* (1) to *very strongly agree* (7), with higher scores representing stronger social support. Test-retest reliability and construct validity have been supported (Zimet, Dahlem, & Farley, 1988). Cronbach's alpha was .81.

Sleep quality was also assessed at both time-points with the Pittsburgh Sleep Quality Index (PSQI) (Buysee, Reynolds, Monk, & Berman, 1989) which measures quality and patterns of sleep over the past month, with higher scores reflecting poorer sleep quality (Smyth, 1999). Total PSQI has demonstrated construct validity (Jomeen & Martin, 2007) and internal consistency in pregnancy (Jomeen & Martin, 2007; Skouteris, Germano, Wertheim, Paxton, & Milgrom, 2008) and postpartum. Total PSQI has obtained a Cronbach's alpha of .83 (Smyth, 1999); current study alpha = .75.

Statistical Analyses

Hierarchical multiple regression was used to assess the ability of psychological variables to predict weight retention at T2, after controlling for the influence of covariates. Distributions of all variables for the 227 participants were screened through SPSS (Statistical Package for the Social Sciences) Version 21 for accuracy of data entry, missing values, non-normality and outliers. The sample size provided adequate power based on small to medium effect sizes, an alpha of .05, and 80% power to detect relationships between psychological variables and

PWR in hierarchical regression analyses (Faul, Erdfelder, Lang & Buchner, 2007). Green (1991) recommends a minimum acceptable sample size of 50 + 8*k*, where *k* is the number of predictors, for overall fit of the regression model. The analysis included 14 predictor variables: GWG, age, education, parity, delivery type, pre-pregnancy BMI, social support (T1), exercise (T1) dietary quality (T1), breastfeeding, sleep quality (T1), stress (T1), depression (T1), and feeling fat (T1). Therefore, a minimum sample size of 162 (50 + 112) was required. For assessment of individual predictors within the model, a minimum sample size of 104 + *k* is optimal (Green, 1991), requiring a minimum sample size of 118. In the current study's sample of 227, both of these requirements were satisfied.

Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. Logarithm transformations were conducted on the following variables: parity, delivery type, exercise duration (T1 & T2), feeding practices (T2), the DASS anxiety subscale (T1 & T2), the DASS stress subscale (T2) and EPDS (T1). Multicollinearity was observed between depression and stress at T2, $r = .71$, and between feeling fat and salience of weight/shape at T1, $r = .77$ and T2, $r = .74$. Given recommendations that bivariate correlations of .70 or higher are sub-optimal for regression analyses (Pallant, 2010), the variables with the lowest correlation with the outcome variables (depression and salience of weight/shape) were omitted from the analysis**.**

Results

The sample comprised 227 women; demographic characteristics are shown in Table 4.1. Average self-reported height was 167 cm (*SD* = .07), and average self-reported pre-pregnancy weight was 70.05 kg (*SD* = 14.81), equating

to an average BMI of 25.17 (*SD* = 4.98). Table 4.2 shows the sample distribution of pre-pregnancy BMI. Thirty-nine participants (17.2%) had been weighed by an obstetrician, general practitioner, or midwife during the first trimester of pregnancy (*M* = 9.43, *SD* = 3.16 weeks), with objective height averaging 167 cm (*SD* = .07) and objective weight averaging 70.17 kg (*SD* =16.55).

At T1, just over a third of women (*n* = 81, 38.2%) had been objectively weighed (*M* =78.75 kg, *SD* = 16.12), and average self-reported weight was 81.72 kg (*SD* =16.42). The average amount of weight gained from pre-pregnancy to T1 was 13.74 kg (*SD* = 5.41) (see Table 4.2 for average GWG according to pre-pregnancy BMI).

With respect to PWR at T2, average self-reported weight was 76.56 kg (*SD* = 16.54). 85 (37.4%) participants had retained less than 5 kg, and 142 (62.6%) had retained 5 or more kg; the mean amount of weight retained was 6.10 kg (*SD* = 5.56) (see Table 4.2 for the distribution of participants' BMI at T2).

Intercorrelations were examined for the outcome variable (PWR), and covariates, and these are shown in Table 4.3, along with the means and standard deviations for these covariates. Of the covariates, GWG was associated significantly and positively with PWR. In contrast, delivery type, and exercise duration (T2) were associated negatively with PWR. Intercorrelations for PWR and psychological variables are included in Table 4.4; feeling fat (T1), and

Table 4.1

Demographic Characteristics of Sample (N = 227)

	n	*%*
Education		
Tertiary level (post high school)	202	88.9
High school or less	25	11.1
Household income		
> A$105,000	143	62.9
A$65,000 – A$105,000	55	24.2
< A$65,000	29	12.8
Employment		
In paid employment	180	79.3
Full-time carer	46	20.7
Parity		
Primiparous	131	57.7
Multiparous	96	42.3
Marital status		
Married	176	77.5
De-facto	47	20.7
Single	4	1.8
Birth location		
Australia	195	85.9
New Zealand	10	4.4
United Kingdom	10	4.4
Europe	6	2.6
North America	4	1.8
Africa	1	.4
Asia	1	.4
Drug use during pregnancy		
Smoking	2	.3
Alcohol	16	7
Delivery type		
Vaginal (no complications)	175	77.1
Emergency caesarean	25	11
Elective caesarean	26	11.5
Vaginal breech birth	1	.4
Psychiatric history		
None	149	65.6
Minor depression	40	17.6
Anxiety disorder	32	14.1
Major depression	14	6.2
Postnatal depression	8	3.5
Bipolar disorder	3	1.3
Antenatal depression	2	.9
Eating disorder	2	.9
Receiving current treatment	14	6.2
Family history of mental illness	106	46.7

salience of weight (T1) were associated positively and significantly with PWR. Of the psychological variables measured in T2, stress, feeling fat, and salience of weight/shape, were associated positively and significantly with PWR.

Table 4.2

BMI and Weight Changes From Pre-Pregnancy to 3 Months Postpartum.

	Pre-pregnancy		Average GWG		PWR	
BMI range	*N*	*%*	*M*	*SD*	*N*	*%*
Underweight	6	2.7%	13.05	5.83	2	.9%
Healthy	131	57.7%	13.77	4.03	83	36.6%
Overweight	54	23.9%	14.92	5.84	75	33%
Obese	36	15.8%	11.84	8.14	67	29.5%

Note: BMI was computed as weight (kg)/height(m)^2 in accordance with the World Health Organisation's (WHO) (2000) guidelines: <18.5 kg/m^2 = underweight, 18.5-24.9 kg/m^2 = healthy weight, 25-29.9 kg/m^2 = overweight, >30 kg/m^2 = obese. GWG – average amount of weight gained from pre-pregnancy to T1, PWR – self-reported weight at T2.

In step 1, GWG was entered due to its established strong relationship to PWR. As can be seen in Table 4.5, this resulted in 41% of the variance being predicted; R^2 change of .41, $F\triangle$ (1, 52) = 36.69, $p < .001$. At step 2, demographic, physiological, and medical variables were entered but did not contribute to any additional variance ($\triangle R^2$ = .00, $F\triangle$ (7, 45) = .03, p = 1.00). At step 3, maternal behavioural factors were entered but did not add to the prediction of PWR ($\triangle R^2$ = .01, $F\triangle$ (4, 41) = .19, p = .95). At step 4, stress (T1) and depression (T1) were entered, and at step 5, feeling fat (T1) was entered. The addition of neither of these psychological variables led to significant R^2 change ($\triangle R^2$ = .02, $F\triangle$ (2, 39) = .60, p = .55, $\triangle R^2$ = .00, $F\triangle$ (1, 38) = .25, p =

Table 4.3
Means, Standard Deviations, and Intercorrelations for PWR and Covariates.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 PWR	-															
2 Age	-.05	-														
3 Education	.03	.13*	-													
4 Income	.05	.22**	.35**	-												
5 Parity	-.11	.18	-.39**	-.21*	-											
6 Delivery type	-.15*	.14*	-.12	-.17*	.42**	-										
7 Exercise (T1)	-.12	-.04	.10	-.02	.21	.07	-									
8 Exercise (T2)	-.15*	-.10	-.09	.10	-.15	-.06	.28**	-								
9 Diet (T1)	.00	-.09	.20**	.06	-.26**	-.10	.18*	.07	-							
10 Breastfeeding (T2)	.05	.11	-.06	.07	.05	-.03	-.04	-.01	-.01	-						
11 Social support(T1)	-.05	-.11	.19**	.12	-.07	.01	-.07	.15*	.10	.03	-					
12 Social support(T2)	-.03	-.08	.08	.08	-.17	-.03	.07	.17*	.04	.03	.38**	-				
13 Pre-preg BMI	-.03	.13	-.15*	-.34**	.22*	.18**	-.11	-.25**	-.13	.00	-.13	-.03	-			
14 GWG	.64**	-.09	.03	.08	-.15	-.17*	-.04	-.10	.02	.03	-.06	.01	-.07	-		
15 Sleep (T1)	-.02	.03	-.12	-.12	.20	.13	-.15	-.06	-.11	.07	-.16*	-.20**	.14*	-.04	-	
16 Sleep (T2)	.00	-.03	.03	-.09	.13	.03	-.18*	-.15*	-.04	.01	-.10	-.40**	.05	-.01	.23**	-
M	6.10	30.82	6.11	5.90	.58	.12	127.85	129.14	2.72	.09	72.85	73.22	25.17	13.74	12.46	12.86
SD	5.56	4.36	1.66	1.77	.85	.23	105.88	85.06	.97	.16	7.85	7.61	4.98	5.41	3.15	2.45
Possible range of scores			1-8	1-8		1-8			0-4	1-6	0-100	0-100			0-21	0-21

Note: Cases were excluded pairwise and correlations performed on transformed variables. PWR = postpartum weight retention, BMI = body mass index, GWG = gestational weight gain, T1 = 32 weeks gestation, T2 = three months postpartum
*$p < .05$, ** $p < .01$

Table 4.4
Means, Standard Deviations, and Intercorrelations for Psychological Variables and PWR

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 PWR	-														
2 Stress (T1)	.12	-													
3 Depression (T1)	.10	.65**	-												
4 Anxiety (T1)	-.03	.35**	.16	-											
5 Attractiveness (T1)	-.08	-.29**	-.25**	-.18*	-										
6 Feeling fat (T1)	.24**	.32**	.24**	.14	-.54**	-									
7 Salience weight/shape(T1)	.20**	.24**	.16*	.16	-.39**	.77**	-								
8 Strength/fitness (T1)	-.04	-.29**	-.37**	-.02	.38**	-.24**	-.13*	-							
9 Stress (T2)	.27**	.37**	.33**	.10	-.15*	.22**	.21**	-.25**	-						
10 Depression (T2)	.15*	.37**	.38**	.07	-.13*	.15*	.12	-.22**	.71**	-					
11 Anxiety (T2)	.00	.16	.17	-.21	-.05	-.06	-.10	-.09	.46**	.35**	-				
12 Attractiveness (T2)	-.12	-.15*	-.21**	-.01	.37**	-.24**	-.20**	.20**	-.33**	-.41**	-.01	-			
13 Feeling fat (T2)	.27**	.14*	.12	.07	-.23**	.36**	.25**	-.13*	.24**	.22**	-.17	-.53**	-		
14 Salience weight/shape(T2)	.20**	.09	.06	.11	-.16*	.30**	.30**	-.11	.17*	.13*	-.11	-.41**	.74**	-	
15 Strength/fitness (T2)	.01	-.10	-.19**	-.15	.28**	-.12	-.07	.49**	-.16*	-.24**	.08	.44**	-.19**	-.25**	-
M	6.10	8.78	4.99	3.51	16.33	30.01	10.96	17.59	11.09	5.90	1.49	16.03	38.27	12.48	17.95
SD	5.56	5.98	4.13	3.65	2.89	7.33	3.19	3.72	5.43	4.26	2.24	3.19	10.35	3.78	2.96
Range of possible scores		0-21	0-21	0-21	5-25	12-60	5-25	6-30	0-21	0-21	0-21	5-25	12-60	5-25	6-30

Note: Cases were excluded pairwise and correlations performed on transformed variables. PWR = postpartum weight retention, GWG = gestational weight gain, T1 = 32 weeks gestation, T2 = three months postpartum
Significant correlations: $^{**}p < 0.01$, $^{*}p < 0.05$ (2-tailed)

.62, respectively). Therefore, of the pregnancy-related variables, only GWG contributed to the prediction of PWR at three months.

Table 4.5

Hierarchical Regression Predicting Relationships Between Maternal Weight, Sociodemographic, Maternal Behavioural, and Psychological Variables on 3 Month PWR.

Predictors	R^2 change	*B*	*SE B*	β
Step 1	.41 ($p < .001$)			
GWG		.66	.10	.64**
Step 2	.00 (*n.s.*)			
Age		.01	.16	.00
Education		.05	.45	.01
Income		.02	.42	.01
Parity		.17	4.44	.01
Delivery type		-1.07	3.13	-.04
Pre-pregnancy BMI		.03	.14	.03
Social support (T1)		-.01	.08	-.01
Step 3	.01 (*n.s.)*			
Exercise (T1)		-2.04	2.49	-.11
Dietary quality (T1)		.09	.81	.01
Breastfeeding (T2)		1.08	4.21	.03
Sleep quality (T1)		-.04	.22	-.02
Step 4	.02 (*n.s.*)			
Stress (T1)		.02	.15	.02
Depression (T1)		.19	.23	.14
Step 5	.00 (*n.s.*)			
Feeling fat (T1)		.04	.08	.07

Note: B – unstandardised coefficients, β = standardised coefficients, *n.s.* = not significant ($p > .05$), GWG = gestational weight gain, BMI = body mass index, T1 = 32 weeks gestation, T2 = 3 months postpartum.
**$p < 0.01$

Given the weak influence of pregnancy-related variables, a second regression analysis was performed using cross-sectional data at T2 to further explore the influence of psychological variables on PWR. As shown in Table 4.6, GWG was entered into the regression model at step 1 resulting in 41% of the variance being predicted R^2 change of .41, $F\triangle$ (1, 69) = 48.68, $p < .001$. At step

2, demographic and physiological and medical variables were entered but did not contribute to any additional variance ($\triangle R^2$ = .00, $F\triangle$ (7, 62) = .06, p = 1.00). At step 3, maternal behavioural factors were entered but did not add to the prediction of PWR ($\triangle R^2$ = .01, $F\triangle$ (3, 59) = .28, p = .84). At step 4, the addition of stress (T2) led to significant R^2 change ($\triangle R^2$ = .05, $F\triangle$ (1, 58) = 5.81, p >.05), and the addition of feeling fat (T2) at step 5 contributed a marginally significant further 3% of variance $\triangle R^2$ = .03, $F\triangle$ (1, 57) = 3.68, p =.06).

Table 4.6

Hierarchical Regression Exploring Cross-Sectional Relationships Between Maternal Weight, Sociodemographic, Maternal Behavioural, and Psychological Variables on 3 Month PWR.

Predictors	R^2 change	*B*	*SE B*	β
Step 1	.41 (p < .001)			
GWG		.661	.10	.64**
Step 2	.00 (*n.s.*)			
Age		.00	.14	.00
Education		.04	.38	.01
Income		.02	.36	.01
Parity		- .05	3.81	.00
Delivery type		-1.02	2.66	-.04
Pre-pregnancy BMI		.03	.12	.03
Social support (T2)		- .03	.07	-.04
Step 3	.01 (*n.s.)*			
Exercise (T2)		-1.87	2.24	-.09
Breastfeeding (T2)		1.18	3.50	.03
Sleep quality (T2)		- .06	.25	-.03
Step 4	.05 (p < .05)			
Stress (T2)		7.41	3.08	.26*
Step 5	.03 (p = .06)			
Feeling fat (T2)		.11	.06	.20

Note: B – unstandardised coefficients, β = standardised coefficients, *n.s.* = not significant (p > .05), GWG = gestational weight gain, BMI = body mass index, T2 = 3 months postpartum.
**p < 0.01, *p < 0.05

Discussion

The aim of this study was to examine the relationship between psychological factors during pregnancy and early postpartum, and PWR, after controlling for the influences of maternal weight, medical, sleep quality, sociocontextual, and behavioural factors. The hypothesis that psychological factors such as stress and body dissatisfaction during pregnancy and early postpartum would result in higher levels of weight retention at three months postpartum was only partially supported. Overall, the most salient predictor of PWR was GWG, a finding that is consistent with previous research (Montpetit et al., 2012; Siega-Riz et al., 2010). Body dissatisfaction, specifically feeling fat and salience of weight/shape, during pregnancy and early postpartum, was associated with early PWR, however, such relationships were only very modest, and may suggest a lack of association once the most influential factor, GWG, was included in the model. Early postpartum stress was associated with early PWR, which supports findings by Siega-Riz et al. (2010), where stress associated with having an infant hospitalised was related to PWR at three months.

The relatively weak association between psychological factors and early PWR suggests that three months postpartum may be too soon to identify such relationships, given the strong influence of GWG. Psychological factors may play a more influential role in predicting PWR at later stages in the postpartum. Consistent with this, postpartum psychological distress predicts weight retention at six to 18 months (Herring et al., 2008a), but not at six weeks postpartum (Walker, Sterling, Kim, Arheart, & Timmerman, 2006). Similarly, Siega-Riz et al. (2010) found that various psychosocial predictors of PWR varied in salience over the course of the first postpartum year. Sociodemographic factors, such as age,

parity, and SES, influenced PWR six to 12 months postpartum, but not during early postpartum (Pedersen et al., 2011; Siega-Riz et al., 2010), with similar findings for behavioural factors such as diet, physical activity (Siega-Riz et al., 2010), and breastfeeding (Krause et al., 2010). Conversely, GWG is a consistent predictor of PWR throughout the first postpartum year and beyond (Siega-Riz et al., 2010). Given this consistent influence over time, it is important to devise interventions that target the prevention of GWG, and specifically focus on achieving weight gains in recommended ranges (Siega-Riz et al., 2010).

The lack of association between sleep quality and PWR was unexpected, particularly given that the first month post-birth is when sleep disturbance is most intense (Gunderson et al., 2008). Siega-Riz et al. (2010) found a relationship between sleep and PWR at three months post-birth; however sleep duration (i.e., number of hours slept per night) was examined rather than sleep quality, which incorporates a much broader conceptualisation of sleep, including sleep duration, efficiency, latency, use of sleep medication and so forth (Buysee et al., 1989). In light of this finding, bivariate correlations between sleep duration and PWR were explored in the current study, however did not show a strong association. Furthermore, sleep duration in Siega-Riz et al.'s (2010) study only predicted moderate PWR at three months (i.e., weight retention of between 0.45 - 4.5 kg); therefore, these results should be interpreted with caution, particularly given the relative paucity of studies that examine the relationship between sleep quality and early PWR. Sleep quality at six months postpartum is associated with longer-term (i.e., 12 months) PWR (Gunderson et al., 2008), which could warrant further exploration of the effects of extended sleep quality disturbance with longer term PWR.

Several limitations in this study need to be considered in interpreting these findings. First, the generalisability of findings may be limited due to the majority of participants being white, married and moderate-to-high income women. Secondly, the association between stress and PWR was based on cross-sectional data, and further exploration through a longitudinal design would be worthwhile. A third limitation was that the measures used for stress and depression were very strongly correlated, resulting in depression at three months postpartum being omitted from the analysis. Future research could explore the development of a measure of psychological distress for pregnancy and postpartum. A further limitation is the limited time-points during pregnancy and postpartum used in this study. For example, unique pregnancy-specific events such as procedural scans and ultrasounds may be associated with increased levels of stress, and warrants further exploration. Future research could explore the effect of psychological distress at various stages throughout pregnancy.

Finally, as the majority of weight-related data and physical activity were self-reported, it is subject to recall error (Pedersen et al., 2011) and other errors inherent with this mode of data collection (Siega-Riz et al., 2010). Some objective measures of weight were collected, and were comparable to self-reported weight, however the availability of such objective measurements was limited, therefore only self-reported weight data was used in analyses. Although previous research supports a strong correlation between self-reported and objectively measured weight during pregnancy (Cameron et al., 1996), and the postpartum (Hinkle et al., 2012), in interpreting the results, it is important to note that accuracy of self-reported weight during pregnancy and postpartum is associated with body size. Excessive GWG is higher in obese or overweight women who under-report pre-

pregnancy BMI, and in healthy weight women who over-assess pre-pregnancy BMI, which could be at least partially attributable to increased body dissatisfaction (Herring et al., 2008b). Additional research is required to further understand these relationships. If reporting bias was present in the current study, it is assumed that the bias is similar in reporting pre-pregnancy weight, GWG and PWR (Keppel & Teffel, 1993). The limited availability of objectively measured weights highlights a need for health practitioners to routinely monitor weight gain and retention during pregnancy and early postpartum as part of gynaecologic and obstetric care (Hill et al., 2013), and interventions should include the provision of information to mothers about postpartum weight changes (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009a; Rallis et al., 2007).

However, a major strength of the study is that a broad array of information was collected with respect to demographic, medical, behavioural and psychological factors allowing for comprehensive exploration. Furthermore, there was a relatively low attrition rate, which has been a limitation of similar studies where postal questionnaires have been used as the mode of data collection (e.g., Rallis et al., 2008).

In conclusion, the results of this study reaffirm the salience of GWG as a predictor of PWR, and also indicate that, to a lesser degree, early postpartum stress and body dissatisfaction is associated with higher PWR. Whether this is true for later PWR in uncertain at this point and requires investigation. The implications of these findings are that GWG should be monitored closely throughout pregnancy, due to its significant influence on the amount of weight retained in the early postpartum, in turn itself a risk factor for long-term overweight and obesity and associated health problems (Linne, Dye, Barkeling, &

Rossner, 2004). Interventions should focus on the prevention of GWG, and also screening for body image difficulties throughout pregnancy and the postpartum. These findings may also inform the development of interventions to focus on the management of psychological stress as one component in managing or preventing PWR.

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Chapter Five

The Influence of Psychological Factors on Postpartum Weight Retention at Nine Months.

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Abstract

Objectives: Postpartum weight retention has been identified as a critical pathway for long-term overweight and obesity. In recent years, psychological factors have been demonstrated to play a key role in contributing to and maintaining postpartum weight retention (PWR).

Design: Therefore, the aim of this study was to explore the relationship between postpartum psychological distress and PWR at nine months, after controlling for maternal weight factors, sleep quality, sociocontextual influences, and maternal behaviours.

Method: Pregnant women (N = 126) completed a series of questionnaires at multiple time-points from early pregnancy until nine months postpartum.

Results: Hierarchical regression indicated that gestational weight gain, shorter duration (six months or less) of breastfeeding, and postpartum body dissatisfaction at three and six months are associated with higher PWR at nine months; stress, depression and anxiety had minimal influence.

Conclusion: Interventions aimed at preventing excessive PWR should specifically target the prevention of body dissatisfaction and excessive weight gain during pregnancy.

Postpartum weight retention (PWR) is an increasing health problem for women who have had a child, and has a range of negative health implications for both mother and offspring (National Research Council & IOM, 2007; Skouteris et al., 2010). Excessive or substantial PWR has been defined as 5 kilograms (kg) or more above pre-pregnancy weight at six months or one year after delivery (Gunderson et al., 2008; Rooney, Shauberger, & Mathiason, 2005). Weight retention at 12 months postpartum is a critical pathway for longer-term (i.e., 15 years) overweight and obesity, and is a better predictor of longer-term weight retention than gestational weight gain (GWG) alone (Linne, Dye, Barkeling, & Rossner, 2004). Therefore, increased understanding of the factors that contribute to and maintain PWR throughout the first 12 months post-birth is required in order to devise intervention and prevention strategies that specifically target a return to pre-pregnancy weight within the first year.

Influences on PWR are complex and multifactorial (Phillips, King, & Skouteris, 2012). It is well established that GWG is one of the most salient and consistent predictors of PWR (Huang, Wang, & Dai, 2010; Siega-Riz et al., 2010). Additional influences include higher pre-pregnancy body mass index (BMI) (Amorim, Rossner, Neovius, Lourenco, & Linne, 2007), poor sleep quality (Gunderson et al., 2008), medical complications during pregnancy (Carreno et al., 2012), and caesarean mode of delivery (Viswanathan et al., 2008). Demographic and sociocontextual influences include low social support (Harris, Ellison, & Clement, 1999), higher maternal age (being older than 30 years or being younger than 23 years at first childbirth), (Kac, Benicio, Velasquez-Melendez, Valente, & Struchiner, 2004), low education, black ethnicity (Siega-Riz et al., 2010), multiparity (Gunderson & Abrams, 1999), and low socioeconomic status (SES)

(Shrewsbury, Robb, Power, & Wardle, 2009). Finally, behavioural factors including breastfeeding for shorter durations (Kac et al., 2004), poor dietary quality, and low levels of physical activity (Althuizen, van Poppel, de Vries, Seidell, & van Mechelen, 2011) are also associated with PWR.

The influence of psychological influences, such as depression (Herring et al., 2008b), stress (Siega-Riz et al., 2010), and body dissatisfaction (Huang & Dai, 2007; Huang et al., 2010) play a more significant role in women's postpartum weight status than previously thought. However, the salience of psychological factors on PWR varies across the first postpartum year (Siega-Riz et al., 2010), and may exert a stronger influence on longer-term PWR rather than earlier (Phillips, King, & Skouteris, 2013). Depression and stress experienced in the early postpartum predicts weight retention at 12 (Herring et al., 2008b; Siega-Riz et al., 2010) and 18 months postpartum (Pedersen et al., 2011). Additionally, in comparison to pre-pregnancy and late pregnancy, body image concerns become particularly salient in the postpartum, and progressively worsen over time (Gjerdingen et al., 2009; Rallis, Skouteris, Wertheim, & Paxton, 2007).

Residual weight gain from pregnancy plays a key role in the development and maintenance of body dissatisfaction and psychological distress in the postpartum period (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009b; Huang et al., 2010). The postpartum is a period where women often express a desire to return to their pre-pregnancy shape and weight quickly, therefore if weight loss is not perceived to occur quickly enough, the likelihood of body dissatisfaction and psychological distress may increase over time (Walker, 1998). Postpartum depressive symptoms in particular predict body image disturbance at 12 months postpartum (Rallis et al., 2007), and higher PWR (Gjerdingen et al.,

2009).

Further investigation of the effects of psychological influences on PWR is essential, as there is a currently a paucity of research that explores such relationships, after controlling for other identified contributing factors, as outlined by Phillips et al. (2012) in Figure 5.1. Furthermore, given that the first year postpartum is a critical time-point for predicting longer-term overweight and obesity, further research is required to ascertain time-points during the first postpartum year where intervention is most likely to be of benefit.

Therefore, the aim of this study was to explore the influence of psychological factors throughout the postpartum on PWR at nine months, after accounting for the effects of maternal weight, sleep quality, sociocontextual/lifestyle, medical, and behavioural factors, as stipulated in Phillips et al.'s (2012) conceptual model. It was hypothesised that increased psychological distress, specifically, depression, anxiety, and stress, and body dissatisfaction at three and six months postpartum would result in higher levels of PWR at nine months.

Method

Participants

Pregnant women (N = 126) volunteered to participate in the study, with an age range between 21 and 41 years (M = 31.00, SD = 4.11), with average age being marginally higher than the median age of women giving birth in Australia in 2011 of 30.6 years (Australian Bureau of Statistics, 2012). Further demographic characteristics of the sample are shown in Table 5.1. At the time of recruitment, participants were 15 - 21 weeks gestation (M = 16.61, SD = .93);

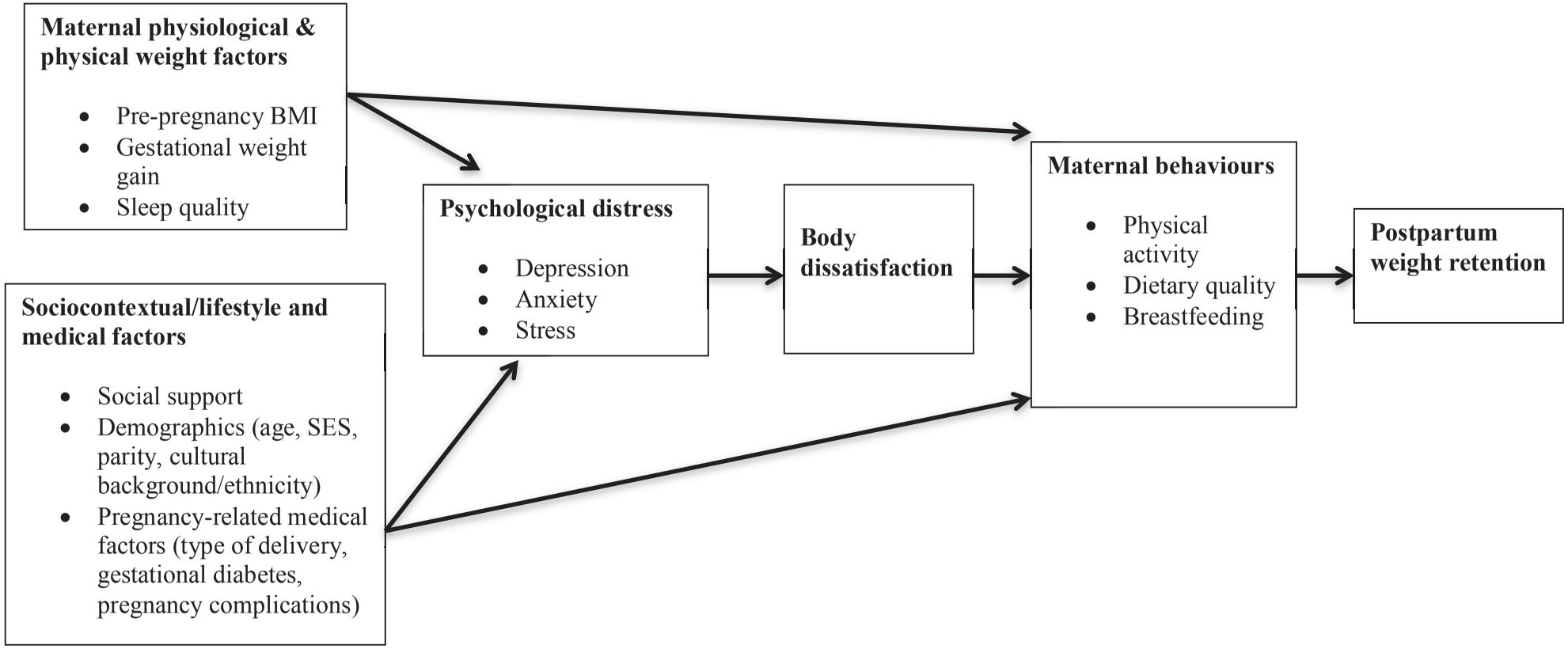

Figure 5.1. An empirically supported, multifactorial, conceptual model of psychological influences on postpartum weight retention. From "A conceptual model of psychological predictors of postpartum weight retention," by J. Phillips, R. King and H. Skouteris, 2012, *Journal of Reproductive & Infant Psychology, 30,* 278–288.

Table 5.1
Demographic Characteristics of Sample (N = 126)

	n	*%*
Education		
Tertiary level (post high school)	112	88.9%
High school or less	14	11.1%
Household income		
> A$105,000	78	61.8%
A$65,000 – A$105,000	31	24.6%
< A$65,000	17	13.5%
Employment		
In paid employment	98	77.8%
Full-time carer	28	22.2%
Parity		
Primiparous	65	51.6%
Multiparous	61	48.4%
Marital status		
Married	102	81%
De-facto	22	17.5%
Single	2	1.5%
Birth location		
Australia	109	86.5%
New Zealand	6	4.8%
United Kingdom	4	3.2%
Europe	4	3.2%
North America	2	1.6%
Asia	1	.8%
Drug use during pregnancy		
Smoking	11	9.1%
Alcohol	8	6.3%
Delivery type		
Vaginal (no complications)	95	75.4%
Emergency caesarean	13	10.3%
Elective caesarean	17	13.5%
Psychiatric history		
None	82	65.1%
Minor depression	23	18.3%
Anxiety disorder	21	16.7%
Major depression	5	4%
Postnatal depression	6	4.8%
Bipolar disorder	1	.8%
Antenatal depression	2	1.6%
Receiving current treatment	6	4.8%
Family history of mental illness	33	34.9%

Note: Average annual income for individual Australians is A$72,436 (Australian Bureau of Statistics, 2013).

participants were administered questionnaires at three time points: approximately 12 weeks (three months) (Time 1, T1) (*M* = 13.21, *SD* = 1.56), at 24 weeks (six months) (Time 2, T2) (*M* = 25.78, *SD* = 1.62), and at 36 weeks (nine months) (Time 3, T3) (*M* = 37.78, *SD* = 2.47) postpartum.

Almost half (48.4%) of the sample had been weighed by an obstetrician, general practitioner or midwife during the first trimester of pregnancy (*M* = 13.57, *SD* = 3.28 weeks), with objective height averaging 168 cm (*SD* = 7.24) and objective weight averaging 71.82 kg (*SD* = 13.92). Average self-reported height was 167 cm (*SD* = .07), and self-reported weight during the first trimester of pregnancy (*M* = 16.61, *SD* = .93 weeks) was 75.47 kg (*SD* = 16.91). At T1, average self-reported weight was 78.95 kg (*SD* = 16.91), at T2, 76.52 kg (*SD* = 17.10), and at T3, 74.81 kg (*SD* = 16.78).

Measures

Outcome variable. PWR was assessed at T3 through self-report and was calculated by subtracting pre-pregnancy weight from weight at nine months postpartum. Self-report data was used in the analyses due to limited availability of objectively measured PWR at nine months postpartum. PWR was defined as a difference in weight of at least 5 kg in comparison to self-reported pre-pregnancy BMI, as this cut-off predicts later obesity (Gunderson & Abrams, 1999), and has been frequently used in similar studies (e.g., Herring et al., 2008b; Pedersen et al., 2011; Walker, Fowles, & Sterling, 2011). 56.3% of the sample had retained less than 5 kg, and 43.7% had retained 5 or more kg at nine months postpartum. The mean amount of weight retained at nine months postpartum was 3.70 kg (*SD* = 5.04). BMI was computed as weight (kg)/height(m)^2; in accordance with the World Health Organisation's (WHO) (2000) guidelines (<18.5 kg/m^2 =

underweight, 18.5-24.9 kg/m^2 = healthy weight, 25-29.9 kg/m^2 = overweight, >30 kg/m^2 = obese). 40.8% of participants were within the healthy BMI weight range, 37.6% were within the overweight range, 20.8% were obese, and .8% were underweight.

Psychological variables. Anxiety and stress were assessed with the Depression, Anxiety, and Stress Scales - Short Form (DASS-21), and depressive symptoms were assessed using the Edinburgh Postnatal Depression Scale (EPDS) at T1 and T2. Anxiety (seven items) and stress (seven items) were rated from *did not apply to me at all – never* (0) to *applied to me very much, or most of the time – almost always* (3). Higher scores represented greater severity of symptoms. Cronbach's alpha in the current study was .91. Depressive symptoms were assessed with the 10-item Edinburgh Postnatal Depression Scale (EPDS), a widely used self-report screening measure that has been validated for antenatal and postpartum use (Murray & Cox, 1990; Thorpe, 1993). Postpartum depression was rated from *no/not at all/never* (0) to *yes/ quite a lot/most of the time* (3). Cronbach's alpha in the current study was .86.

Body dissatisfaction was assessed with the Body Attitudes Questionnaire (BAQ) at T1 and T2. The four subscales from the BAQ most suitable for pregnant and postpartum women (Ben-Tovim & Walker, 1991) assessed: feeling fat (13 items), strength and fitness (six items), salience of weight and shape issues (eight items); and attractiveness (five items). Items were rated from *definitely disagree* (1) to *definitely agree* (5). Items in each subscale were scored so that a higher score represented greater salience in each of the measured dimensions. Factor structure, test-retest reliability and construct validity have been demonstrated in a variety of samples (Ben-Tovim & Walker, 1991; 1992). Cronbach's alpha for the

Attractiveness subscale was .67; Feeling Fat, .93; Salience of Weight/Shape, .81; Strength and Fitness, .63; the mean of the four subscales was .76.

Covariates. Demographic information was collected at recruitment and included maternal age, race/ethnicity, parity, level of education (ranging from *still at secondary school* (1) to *postgraduate degree* (8)), household income (ranging from *under A$25,000* (1) to *A$105,001-A$125,000* (8)), and self-reported pre-pregnancy weight. At T1, additional information was collected, including mode of delivery (*vaginal, no complications* (1), *vaginal breech birth* (2), *elective caesarean* (3), and *emergency caesarean* (4)), self-reported recall of GWG at 36 weeks, and infant feeding practices (*exclusive breastfeeding* (1), *breastfeeding and formula* (2), *exclusively formula* (3), *breastfeeding and solids* (4), *breastfeeding, formula and solids* (5) and *formula and solids* (6)),

At T1, the majority of participants were exclusively breastfeeding (73.8%), and 21.4% were using a combination of breastfeeding and formula. At T2, 84.1% were breastfeeding in conjunction with other feeding methods such as formula and solids, and 5.6% were exclusively breastfeeding. Finally, at T3, 77.2% were breastfeeding in conjunction with other feeding methods such as formula and solids, 21.3% were exclusively feeding with formula and solids, and .8% were exclusively breastfeeding.

Pre-pregnancy BMI was calculated based on self-reported retrospective weight, and height collected at recruitment. A 10-point rating scale where participants rated their confidence in the accuracy of their report of pre-pregnancy weight was also collected (0 = *not at all confident*, 10 = *extremely confident*), with a mean of 7.99 (*SD* = 2.01). Average self-reported pre-pregnancy weight was 70.84 kg (*SD* = 14.34); mean self-reported pre-pregnancy BMI was 25.37 (*SD* =

4.69). Participants' pre-pregnancy BMI was classified in accordance with WHO (2000) guidelines; approximately half of the participants (56.1%) were within the healthy weight range prior to pregnancy, 27.6% were within the overweight range, 14.6% were obese, and 1.6% were underweight.

Pre-pregnancy weight was subtracted from self-reported weight at 36 weeks gestation, to ensure consistency with similar studies (e.g., Montpetit, Plourde, Cohen, & Koski, 2012; Siega-Riz et al., 2010). The average amount of weight gained during pregnancy was 14.63 kg (*SD* = 5.75).

At T1 and T2, participants recalled the duration of physical activity undertaken over the previous week through self-report, with average exercise duration at T1 being 129.95 minutes (*SD* = 83.83), and at T2, average duration was 143.83 minutes (*SD* = 106.33).

Social support was assessed at T1 and T2 with the Multidimensional Scale of Perceived Social Support (MSPSS), a measure of perceived social support from family, friends, and significant others over the last eight weeks. Items were rated from *very strongly disagree* (1) to *very strongly agree* (7), with higher scores representing stronger social support. Test-retest reliability and construct validity have been supported (Zimet, Dahlem, & Farley, 1988). Cronbach's alpha was .96.

Sleep quality was also assessed at T1 and T2 with the Pittsburgh Sleep Quality Index (PSQI). The PSQI (Buysee, Reynolds, Monk, & Berman, 1989) measures quality and patterns of sleep over the past month, with higher scores reflecting poorer sleep quality (Smyth, 1999). Total PSQI has demonstrated construct validity (Jomeen & Martin, 2007) and internal consistency in pregnancy (Jomeen & Martin, 2007; Skouteris, Germano, Wertheim, Paxton, & Milgrom,

2008) and postpartum Total PSQI has obtained a Cronbach's alpha of .83 (Smyth, 1999); current study alpha = .74.

Procedure

The study was longitudinal in design and followed women from early pregnancy until nine months postpartum. Relevant ethics approvals and written informed consent were obtained from all women who participated. Pregnant women were recruited via advertising on mother, child and baby forums, parenting magazines, baby and children's markets, obstetrician referrals, and general media advertising. The advertisement placed on forums and in advertising campaigns invited women to take part in a *Maternal Health & Well-Being* study that was exploring women's general experiences during pregnancy and postpartum. Interested participants were provided with a Plain Language Statement and offered the opportunity to ask any questions before providing voluntary consent.

At recruitment, women completed questionnaires to collect demographic information. This time period enabled women to consider the pregnancy certain (threat of miscarriage having subsided) prior to volunteering. Each questionnaire was code-numbered for confidentiality, and were completed at home by participants, and returned in reply-paid envelopes. Regarding attrition, 203 women agreed to take part in the study and completed T1 questionnaires, of whom 77 (26.36%) dropped off, and hence their data was not used in the final analyses. Chi-square goodness-of-fit tests ($\alpha = .05$) indicated that there were no significant differences in respect to age, education, income, pre-pregnancy BMI, and GWG between the final sample in the study ($N = 126$) and the participants who withdrew.

Results

Distributions of all variables for the 126 participants were screened through SPSS Version 21 (Statistical Package for the Social Sciences) for accuracy of data entry, missing values, non-normality and outliers. A sample size of 126 provides adequate power based on small to medium effect sizes, an alpha of .05, and 95% power to detect a relationship between psychological variables and PWR in hierarchical regression analyses (Faul, Erdfelder, Lang & Buchner, 2007). Hierarchical multiple regression was used to assess the ability of psychological variables, to predict levels of weight retention at nine months postpartum, after controlling for the influence of covariates. Logarithm transformations were conducted on the following variables: parity, delivery type, breastfeeding (T1), exercise duration (T1 and T2), the DASS anxiety subscale (T1 and T2), and the DASS stress subscale (T1).

Intercorrelations for the outcome variable (PWR) and study variables are shown in Tables 5.2 and 5.3, along with means and standard deviations. GWG was associated positively and significantly with PWR, and also feeding practices at T2. Of the psychological variables, body dissatisfaction was correlated positively and significantly with PWR, specifically, feeling fat, and salience of weight/shape. In contrast, attractiveness was negatively correlated with PWR.

Multicollinearity was observed between depression and stress at T1, r = .79, and between salience of weight/shape and feeling fat at T2, r = .78. Given recommendations that bivariate correlations of .7 or higher are sub-optimal for

Table 5.2
Means, Standard Deviations, and Intercorrelations for 9 Month PWR and Covariates

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 PWR	-	.43**	.04	.04	.02	.00	-.06	-.11	-.18*	-.10	-.17	.01	.05	.28**	.05	.01
2 GWG		-	.00	-.02	-.06	.04	-.07	-.10	-.12	-.09	-.15	.17	.01	-.03	.01	.05
3 Pre-preg BMI			-	.15	-.10	-.40**	.19	.14	-.01	.00	-.27**	-.13	.04	.19*	.14	-.09
4 Age				-	.22*	.21*	.21	.05	-.01	.11	-.17	.05	.21*	.00	-.01	-.18*
5 Education					-	.31**	-.32*	-.05	.09	.23**	-.10	.12	.03	.03	-.01	-.11
6 Income						-	-.16	-.14	.09	.19*	.05	.10	.13	.06	-.20*	-.09
7 Parity							-	.23	-.16	-.09	-.04	-.02	.00	-.04	.19	.23
8 Delivery type								-	-.11	.06	-.06	.10	-.08	-.03	.11	-.09
9 Social support (T1)									-	.53**	.22*	.07	.01	-.20*	-.54**	-.32**
10 Social support (T2)										-	.17	.18	-.15	-.11	-.25**	-.55**
11 Exercise (T1)											-	.56**	-.10	-.26**	-.10	-.16
12 Exercise (T2)												-	-.01	-.23*	-.03	-.18
13 Breastfeeding (T1)													-	.08	.05	.04
14 Breastfeeding (T2)														-	.04	-.03
15 Sleep (T1)															-	.30**
16 Sleep (T2)																-
M	3.69	14.63	25.37	31.00	6.02	5.83	.09	.13	72.83	73.34	129.95	143.83	.09	4.32	12.86	11.84
SD	5.04	5.75	4.69	4.11	1.60	1.74	.16	.23	7.00	7.10	83.83	106.33	.15	1.08	2.36	2.93
Range of possible scores					1-8	1-8		1-8	0-100	0-100	30-540	0-600	1-6	1-6	0-21	0-21

Note: Cases were excluded pairwise and correlations performed on transformed variables. PWR = postpartum weight retention, GWG= gestational weight gain, BMI = body mass index, T1 = 3 months postpartum, T2 = 6 months postpartum, $^{**}p < 0.01$, $^{*}p < 0.05$ (2-tailed)

Table 5.3
Means, Standard Deviations, and Intercorrelations for 9 Month PWR and Psychological Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 PWR	-	.10	.07	-.06	.07	.12	.09	-.15	-.23**	.19*	.30**	.27**	.27**	-.12	-.14
2 Depression (T1)		-	.47**	.32*	.21	.70**	.39**	-.44**	-.29**	.31**	.14	.19*	.10	-.33**	-.36**
3 Depression (T2)			-	-.06	.43**	.37**	.79**	-.28**	-.37**	.28**	.29**	.21*	.31**	-.39**	-.36**
4 Anxiety (T1)				-	-.01	.58**	.00	-.07	-.02	-.10	-.06	-.02	.03	.11	.15
5 Anxiety (T2)					-	.18	.61**	-.24	-.09	.14	.11	.16	.13	-.19	-.18
6 Stress (T1)						-	.33**	-.39**	-.17	.34**	.19*	.28**	.22*	-.26**	-.26**
7 Stress (T2)							-	-.36**	-.42**	.29**	.32**	.23**	.31**	-.40**	-.46**
8 Attractiveness (T1)								-	.40**	-.54**	-.32**	-.37**	-.17	.43**	.24**
9 Attractiveness (T2)									-	-.23**	-.49**	-.20*	-.27**	.25**	.34**
10 Feeling fat (T1)										-	.46**	.74**	.26**	-.25**	-.22*
11 Feeling fat (T2)											-	.40**	.78**	-.15	-.14
12 Salience of weight/shape (T1)												-	.42**	-.23*	-.21*
13 Salience of weight/shape (T2)													-	-.12	-.09
14 Strength/fitness (T1)														-	.53**
15 Strength/fitness (T2)															-
M	3.69	6.63	9.16	.55	.65	1.05	10.67	15.92	15.98	39.60	36.28	12.78	12.02	18.00	19.04
SD	5.04	4.31	4.65	.28	.32	.19	6.06	3.16	2.77	10.28	10.16	3.91	3.63	2.62	3.33
Range of possible scores		0-21	0-21	0-21	0-21	0-21	0-21	5-25	5-25	12-60	12-60	5-25	5-25	6-30	6-30

Note: Cases were excluded pairwise and correlations performed on transformed variables. PWR = postpartum weight retention, GWG = gestational weight gain, T1 = 3 months postpartum, T2 = 6 months postpartum, $^{**}p < 0.01$, $^{*}p < 0.05$ (2-tailed)

regression analyses (Pallant, 2010), the variables with the lowest correlation with the outcome variable (depression and salience of weight/shape) were omitted from the analysis.

Two hierarchical multiple regressions were performed; the first regression included variables from T1, and the second used variables from T2. Nine variables were selected for entry into both regression analyses to meet the requirements of sample size where $N > 50 + 8m$ is optimal for generalisability of results (Tabachnick & Fidell, 1996). In accordance with the conceptual model proposed by Phillips et al. (2012), maternal weight and physiological factors (pre-pregnancy BMI, GWG, and sleep quality), were entered at step 1, sociocontextual variables (social support, age, and maternal education) at step 2, maternal behaviours (breastfeeding and physical activity), including at step 3, psychological distress (stress) at step 4, and body dissatisfaction (feeling fat/salience of weight/shape) at step 5.

As shown in Table 5.4, entry of GWG, pre-pregnancy BMI, and sleep quality at step 1 resulted in 17% of the variance being predicted, R^2 change of 0.19, $F\triangle$ (3, 102) = 8.00, $p < .001$. At step 2, social support, age, and education were entered, but did not contribute any additional variance ($\triangle R^2 = .02$, $F\triangle$ (3, 99) = .88, $p = .45$). Similarly, exercise and feeding practices at step 3, and stress at step 4 did not offer any additional unique variance ($\triangle R^2 = .01$, $F\triangle$ (2, 97) = .34, $p = .71$, and $\triangle R^2 = .00$, $F\triangle$ (1, 96) = .13, $p = .72$ respectively). At step 5, salience of weight/shape was entered, adding a further 5% of unique variance to the model ($\triangle R^2 = .05$, $F\triangle$ (1, 95) = 6.32, $p = .01$). Therefore, of the covariates, only GWG contributed to the prediction of PWR at nine months, and of the psychological variables, only body dissatisfaction, specifically salience of weight/shape, was a unique predictor.

Table 5.4

Hierarchical Regression Predicting Relationships Between Psychological Variables at 3 Months Postpartum and 9 Month PWR.

Predictors	R^2 change	*B*	*SE B*	β
Step 1	.19 (*p*<.001)			
GWG		.38	.08	.43**
Pre-preg BMI		.04	.10	.04
Sleep		.09	.19	.04
Step 2	.02 (*n.s.*)			
Social support		-.12	.08	-.16
Age		.03	.11	.02
Education		.17	.29	.05
Step 3	.01 (*n.s.*)			
Exercise		-1.31	2.10	-.06
Feeding practices		1.45	3.08	.04
Step 4	.00 (*n.s.*)			
Stress		1.05	2.94	.04
Step 5	.05 (*p*=.01)			
Salience of weight/ shape		.32	.13	.25*

Note: B – unstandardised coefficients, β = standardised coefficients, *n.s.* = not significant (*p* >.05), GWG = gestational weight gain, BMI = body mass index
* *p* < .05**, *p* < .001

A second hierarchical regression was performed to explore the influence of predictors at six months postpartum on PWR at nine months. As can be seen in Table 5.5, GWG, pre-pregnancy BMI, and sleep quality (step 1) accounted for 19% of the variance, R^2 change of 0.19, $F\triangle$ (3, 105) = 8.15, $p < .001$. At step 2, social support, age, and education were entered, but did not contribute to any additional variance ($\triangle R^2$ = .01, $F\triangle$ (3, 102) = .44, p =.72). Entry of exercise and feeding practices at step 3 added an additional 8% of unique variance ($\triangle R^2$ = .08, $F\triangle$ (2, 100) = 5.45, $p < .01$). At step 4, stress did not offer any additional unique variance ($\triangle R^2$ = .01, $F\triangle$ (1, 99) = 1.28, p =.26). At step 5, feeling fat was entered, adding a further 5% of unique variance to the model ($\triangle R^2$ = .05, $F\triangle$ (1, 98) = 6.98, p = .01). Therefore, at six months postpartum, GWG continued to contribute to the prediction

of PWR at nine months, in addition to feeding practices, and of the psychological variables, body dissatisfaction, specifically, feeling fat also added unique variance.

Table 5.5

Hierarchical Regression Predicting Relationships Between Psychological Variables at 6 Months Postpartum and 9 Month PWR.

Predictors	R^2 change	*B*	*SE B*	β
Step 1	.19 (*p*<.001)			
GWG		.38	.08	.43**
Pre-preg BMI		.05	.10	.04
Sleep		-.02	.15	-.01
Step 2	.01 (*n.s.*)			
Social support		-.08	.08	-.11
Age		.03	.11	.03
Education		.18	.30	.06
Step 3	.08 (*p*=.01)			
Exercise		.12	1.66	.01
Feeding practices		1.36	.42	.29**
Step 4	.01 (*n.s.*)			
Stress		.10	.09	.12
Step 5	.05 (*p*=.01)			
Feeling fat		.13	.05	.26*

Note: *B* – unstandardised coefficients, β = standardised coefficients, *n.s.* = not significant ($p > .05$), GWG = gestational weight gain, BMI = body mass index
* $p < .05$**, $p < .001$

Discussion

The hypothesis that psychological distress during the postpartum would result in higher levels of PWR at nine months, was partially supported. Early postpartum stress and depression did not influence PWR, however, body dissatisfaction, specifically salience of weight and shape at three months, and feeling fat at six months postpartum, predicted PWR at nine months. This supported previous findings where postpartum body dissatisfaction predicted PWR at six (Huang & Dai, 2007) and nine months (Gjerdingen et al., 2009), and that women

with more positive body image during early postpartum may be more successful at losing weight in the postpartum (Huang et al., 2010).

GWG was a salient predictor of PWR, but pre-pregnancy BMI was not (Linne et al., 2004; Maddah & Nikooyeh, 2009), providing further support that GWG is a more stable and reliable predictor of PWR than pre-pregnancy BMI (Pedersen et al., 2011). Sleep quality did not influence PWR, which is consistent with previous findings where sleep duration did not influence 12 month PWR (Siega-Riz et al., 2010). Exclusive breastfeeding at six months postpartum predicted the amount of weight retained at nine months. This is consistent with previous studies, where longer duration of breastfeeding, i.e., at least six months, predicted lower PWR (Kac et al., 2004; Krause, Lovelady, Peterson, Chowdhury, & Ostbye, 2010).

None of the demographic variables were associated with PWR at nine months. The influence of demographic variables on PWR has had varying levels of consistency across studies, with some studies finding low associations between factors such as age (Lee, Hwang, Liou, & Chien, 2011), and race (Walker et al., 2011), and other studies finding that demographic effects on PWR become more salient at different time-points in the postpartum than others (Pedersen et al., 2011; Siega-Riz et al., 2010). Such discrepancies may be attributed to sampling; for example, the sample in the present study was relatively homogenous in respect to race (Caucasian), and moderate-to-high income. Comparative sample characteristics of previous studies included lower SES (Walker et al., 2011), lower income and increased ethnic diversity (Kac et al., 2004).

There are a few limitations in this study that need to be considered in interpreting these results. Firstly, a lack of variability in the study population, coupled with the possibility of measurement error could have impacted upon the

findings. Secondly, as GWG is a particularly influential factor in predicting PWR, there was a reduced likelihood of detectable relationships between the remaining factors and PWR. Thirdly, this study was limited to only following participants up to nine months postpartum, as opposed to an ideal follow-up of 12 months. This was a consequence of time constraints in data collection, resulting in insufficient data at 12 months postpartum to warrant inclusion in the study. Given that one year postpartum is a critical time-point for predicting long-term overweight and obesity (Linne et al., 2004), and that the salience of psychological factors varies across the first postpartum year (Phillips et al., 2013; Siega-Riz et al., 2010), future research should aim to explore such influences up to, and beyond the first year postpartum.

Finally, as the majority of weight-related data and physical activity were self-reported, it was subject to recall error (Bell et al., 2013; Pedersen et al., 2011) and other errors inherent with this mode of data collection (Siega-Riz et al., 2010). Some objective measures of weight were collected, and were comparable to self-reported weight, however the availability of such objective measurements was limited, therefore only self-reported weight data was used in analyses. Although previous research supports a strong correlation between self-reported and objectively measured weight during pregnancy (Cameron et al., 1996), and the postpartum (Hinkle et al., 2012), in interpreting the results, it is important to note that accuracy of self-reported weight during pregnancy and postpartum is associated with body size. Excessive GWG is higher in obese or overweight women who under-report pre-pregnancy BMI, and in healthy weight women who over-assess pre-pregnancy BMI, which could be at least partially attributable to increased body dissatisfaction (Herring et al., 2008a). Further research is required to clarify the relationship between body dissatisfaction and increased weight retention in the postpartum. If reporting bias was present in this study, it is assumed that the bias is similar in

reporting pre-pregnancy weight, GWG and PWR (Keppel & Teffel, 1993). Despite the limitations, a major strength of the study is that a wealth of information was collected including various predictors that allowed for comprehensive exploration.

Overall, the findings of this study provide additional evidence of the salience of GWG in predicting longer-term PWR, and reiterate the importance of designing interventions that focus on the prevention of excessive weight gain during pregnancy. These findings also provide additional evidence that longer durations of breastfeeding can result in lower PWR. Given the salience of GWG in predicting PWR, interventions should ideally be implemented during pregnancy as a preventative measure (IOM, 2009). Since pregnant women have more frequent interactions with the health care system, they may be more receptive to behaviour change recommendations during this time (Duncombe, Wertheim, Skouteris, Paxton, & Kelly, 2008).

In respect to psychological factors, body dissatisfaction during postpartum appears to play a key role in influencing PWR, with women with increased postpartum body dissatisfaction at both three and six months postpartum, retaining more weight. Therefore, interventions that target postpartum body dissatisfaction may play a key role in the prevention of PWR and the promotion of maternal health and well-being. Body image concerns should be routinely monitored during pregnancy and early postpartum as part of gynaecologic and obstetric care in conjunction with weight gain and retention (Hill et al., 2013). As pregnancy offers a temporary reprieve from body image concerns, and the postpartum represents a period where body dissatisfaction progressively worsens (Rallis et al., 2007), the antenatal period could be an optimal time to target body image interventions, which should include the provision of information to mothers about postpartum weight changes (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009a; Rallis et al.,

2007), including education about the length of time it takes women to return to their pre-pregnancy weight (Olds, London, Ladewig, & Davidson, 2010). As body dissatisfaction is often associated with maladaptive behaviours such as unhealthy eating and extreme weight loss behaviours (Skouteris, 2012), this is an area that warrants further attention in future pregnancy and postpartum research, and should be a key component in the development (Hill, Skouteris, McCabe, & Fuller-Tyskiewicz, 2012) and implementation of appropriate interventions, an area well within the practice of the health psychologist.

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Chapter Six

Conclusions and Future Directions

The postpartum represents a period of increased risk for long-term overweight and obesity with, amongst other known influences, psychological factors being a contributor (Herring et al., 2008b; Pedersen et al., 2011). However, to date, few studies have investigated the predictive nature of psychological factors on postpartum weight retention (PWR) whilst accounting for the complex and multifactorial nature of other known influences such as physiological, sociocontextual and behavioural factors. Furthermore, there is a paucity of research that prospectively investigates the influence of psychological factors at various stages throughout the postpartum on PWR. Therefore, the current research explored the extent to psychological factors could predict PWR by first proposing a multifactorial, conceptual model which argued that psychological factors, in combination with other known influences, contribute to PWR. Second, two empirical studies prospectively explored the role of psychological influences on PWR, and identified specific time-points during the perinatal period where such factors are most salient. A detailed summary of the findings from each of the studies presented in the thesis is provided in this chapter. Limitations of the current studies are also presented, in addition to clinical and theoretical implications, directions for future research, and conclusions.

Summary of the Findings

The aim of the first paper, which presented a conceptual model based on empirically supported psychological predictors of PWR, was to foster further understanding of how psychological factors combine with other influences to lead to and maintain excessive PWR. It was argued that sociocontextual influences, including demographics, social support, and medical factors, coupled with maternal physiological and physical weight characteristics, including maternal weight prior to

and during pregnancy, and sleep quality, each influence levels of psychological distress and body dissatisfaction, which in turn, predict PWR. This conceptual model provided the theoretical framework upon which the two empirical studies were based, and aimed to provide increased clarity of how psychological factors may combine with other known influences to produce and maintain excessive PWR given the complexity of factors likely to exert an influence.

The first year postpartum is a critical time-point for predicting longer-term overweight and obesity (Linne, Dye, Barkeling, & Rossner, 2004), and the salience of psychosocial predictors of PWR varies over the first postpartum year (Siega-Riz et al., 2010). Therefore, the studies described in this thesis aimed to capture the impact of such influences at various stages during the postpartum (three and nine months, respectively). Furthermore, the two empirical studies enhance understanding of the predictive nature of psychological factors on PWR at various stages of the postpartum after controlling for other known factors. The first empirical study aimed to examine the relationship between psychological factors during pregnancy and early postpartum, and PWR at three months, after controlling for the influences of maternal weight, medical, sleep quality, sociocontextual, and behavioural factors as outlined in the conceptual model. The second empirical study extended upon this, with the aim of investigating whether postpartum psychological distress predicted PWR later in the postpartum; specifically, at nine months.

Collectively, the two empirical studies provide additional support to existing research that gestational weight gain (GWG) is the most salient and stable predictor of weight retention during the first postpartum year (Linne et al., 2004; Maddah & Nikooyeh, 2009; Pedersen et al., 2011). GWG predicted PWR during early postpartum (i.e., three months) and later in the first postpartum year (i.e., nine months), supporting previous findings on the salience of GWG at these time-points

(e.g., Kac, Benicio, Velassquez-Melendez, Valente, & Struchiner, 2004; Siega-Riz et al., 2010). The first empirical study, in particular, demonstrates how the potency of GWG significantly limits psychological factors, in addition to other factors such as sleep, sociocontextual/lifestyle factors, and maternal behaviours, from exerting any notable association with early PWR. This is consistent with Walker, Sterling, Kim, Arheart, and Timmerman (2006), who found that after factoring in GWG, variables such as depression, stress, breastfeeding, dietary intake, and physical activity were not associated with early PWR.

Although GWG was particularly influential on early PWR, the association between psychological and other sociocontextual influences on early PWR should not necessarily be dismissed (Walker et al., 2006). Modest associations were observed between body dissatisfaction, specifically feeling fat and salience of weight and shape during pregnancy and early postpartum, and PWR, in addition to early postpartum maternal stress. In light of these findings, it was argued that three months postpartum may be too early to identify relationships between psychological factors and PWR, and they may play a more influential role in later stages. Siega-Riz et al. (2010) found that psychological factors and other sociocontextual influences varied in salience across the first postpartum year. Similarly, psychological distress predicted PWR at six to 18 months (Herring et al., 2008a), but not at six weeks postpartum (Walker et al., 2006). Therefore, the second empirical study aimed to investigate the predictive nature of such factors on longer-term PWR, i.e., nine months.

The second empirical study also did not show strong associations between early postpartum psychological factors and longer-term PWR. Specifically, early postpartum stress and depression did not predict PWR at nine months. This lack of association was surprising, given that numerous longitudinal studies in non-pregnant women have found that depressive symptoms predict obesity onset (Goodman &

Whitaker, 2002; Pine, Goldstein, Wolk, & Weissman, 2001; Stice, Presnell, Shaw, & Rhode, 2005). Similarly, in other studies with pregnant and postpartum samples, new onset postpartum depression predicted PWR at 12 months (Herring et al., 2008a), and psychological distress during the first six months postpartum predicted excessive PWR at 18 months (Pedersen et al., 2011).

Of note, however, was the association between postpartum body dissatisfaction; specifically, salience of weight and shape at three months and feeling fat at six months postpartum; and PWR at nine months. This supports previous research showing postpartum body dissatisfaction to be predictive of longer-term PWR (Gjerdingen et al., 2009; Harris, Ellison, & Clement, 1999a; Huang & Dai, 2007; Walker, 2007; Walker et al., 2004). Harris, Ellison, and Clement (1999b) found that mothers who were most dissatisfied with their bodies postpartum had significantly greater long-term weight gain (i.e., greater than two years) than mothers who described no increase in body dissatisfaction. A shortcoming of the study, however, was that the direction of such pathways between weight retention and body dissatisfaction could not be determined as the design was cross-sectional. The authors proposed two possible explanations for these findings; one, that higher body dissatisfaction may predispose women to gain more weight, or two, women who gain more weight after pregnancy are more dissatisfied with their bodies. The results of the current research lend support to the former explanation that higher levels of body dissatisfaction in early postpartum predicts higher body mass index (BMI) later in the postpartum.

In explaining the specific mechanisms in which high body dissatisfaction may predict higher levels of weight gain and retention, Harris et al. (1999b) proposed that postpartum changes in body dissatisfaction lead to depression, resulting in increased energy intake, which in turn, leads to higher levels of PWR. However, the

results of the current research do not necessarily support this argument, as postpartum body dissatisfaction was not associated with either depressive symptoms or psychological distress. Rather, the results are more consistent with Huang, Wang, and Dai (2010), where women with lower body dissatisfaction during the postpartum were more successful in losing pregnancy-related weight, independent of psychological distress.

Similar results have been found in samples of non-pregnant women (Morin, Brogen, & Flavin, 2002), post-menopausal women (Pimenta, Maroco, Ramos, & Leal, 2013), and pregnant women (Mehta, Siega-Riz, & Herring, 2010). Non-pregnant women with a more positive body image are more successful at losing weight (Morin et al., 2002; Texeira et al., 2006), whilst women with high body dissatisfaction during pregnancy are more likely to gain weight outside of the recommended ranges (Mehta et al., 2010). Similarly, post-menopausal women with higher body weight concern have higher weight gain in comparison to women with less body dissatisfaction (Pimenta et al., 2013). This could be due to the women's misperceptions or unrealistic expectations about weight and body changes, thereby creating increased body dissatisfaction (Pimenta et al., 2013). Furthermore, body dissatisfaction is associated with binge eating and low self-esteem (Johnson & Wardle, 2005), which could offer an explanation of how body dissatisfaction might predict weight gain (Pimenta et al., 2013).

Of the other psychological factors explored in the current research, depression, anxiety, or stress were not strong predictors of early or longer-term PWR. In empirical study one, only early postpartum stress was moderately associated with early PWR, supporting the findings by Siega-Riz et al (2010), where stress associated with having an infant hospitalised was related to PWR at three months. The observed relationship between stress and PWR may be explained by overeating for comfort,

therefore leading to larger energy intake and higher weight gain (Hurley, Caulfield, Sacco, Costigan, & DiPietro, 2005). However, this relationship was not apparent in empirical study one, with dietary quality during pregnancy not influencing PWR. Given the inconsistencies in findings, coupled with the paucity of existing research, further investigation of the effects of early postpartum stress on PWR is clearly warranted.

Consistent with previous research, an association between depressive symptoms and anxiety was not observed in either of the empirical studies (Harris et al., 1999a; Walker et al., 2004). A recent review of studies between depressive symptoms and obesity by Milgrom, Skouteris, Worotniuk, Henwood, and Bruce (2012) concluded that such associations are, so far, inconclusive. This could be attributed to inconsistent findings in the effects of depression on weight gain, and may reflect the divergent ways that depressive experiences may be manifested in eating and related behaviours (DiPietro, Anda, Williamson, & Stunkard, 1992; Preskorn, 1999). For example, depressive symptoms may be associated with lack of energy and loss of appetite, resulting in a negative association with PWR, as proposed by Huang et al. (2010).

Of the studies that have found associations between postpartum psychological factors and PWR, some caution needs to be taken in their interpretation. Although Herring et al. (2008a) found an association between postpartum depressive symptoms and PWR of more than 5 kg at one year postpartum, the authors noted that when their models were fully adjusted, the association was no longer significant. This was consistent with other studies (e.g., Siega-Riz et al., 2010).

The unique variance that psychological factors during the perinatal period and sociodemographic variables contribute to PWR is also worthy of further exploration. Pedersen et al. (2011) found that psychological distress during pregnancy predicted

higher PWR; however, when all psychosocial factors, including demographic factors, were included in an additional analysis, SES and maternal level of education were the strongest risk factors for PWR. It was concluded that women who felt burdened by their economic situation, or who had the least education, were more likely to experience psychological distress (Pedersen et al., 2011). Therefore, to some extent, social inequity may explain the findings. Indeed, studies have found that lower socioeconomic status (SES) is related to higher levels of psychological distress during pregnancy (Glazier, Elgar, Goel, & Holzapfel, 2004; Walker, 1996), and postpartum depressive symptoms are associated with low social support, lower income, and multiparity among postpartum samples (Walker, Timmerman, Kim, & Sterling, 2002). However, given the samples used in the current research were mostly highly educated and were of high SES, it was not possible to explore such relationships.

Furthermore, sleep quality did not predict PWR at three months or nine months postpartum. This finding was unexpected, particularly in empirical study one, where it could be argued that early postpartum typically represents a period of reduced sleep quality (Gunderson et al., 2008). Siega-Riz et al. (2010) found a relationship between sleep and PWR at three months post-birth; however sleep duration (i.e., number of hours slept per night) was examined rather than sleep quality, which incorporates a much broader conceptualisation of sleep, including sleep duration, efficiency, latency, use of sleep medication, and so forth (Buysee, Reynolds, Monk, & Berman, 1989). Furthermore, sleep duration in Siega-Riz et al.'s (2010) study only predicted moderate PWR at three months (i.e., weight retention of between 0.45 - 4.5 kg). Therefore, these results should be interpreted with caution, particularly given the relative paucity of studies examining the relationship between sleep quality and early PWR.

Studies that have explored the influence of sleep disturbance on PWR at later stages in the postpartum have been inconsistent. Gunderson et al. (2008) found an association between sleep quality at six months postpartum and PWR at 12 months. However, Siega-Riz et al. (2010) found no association between early postpartum sleep duration and PWR at 12 months. This could be attributed to women's sleeping patterns improving as the infant grows older, thereby contributing to less weight retention as the first postpartum year progresses (Siega-Riz et al., 2010).

Of the maternal behavioural factors explored, namely, dietary quality, physical activity, and breastfeeding, only breastfeeding predicted PWR. Specifically, exclusive breastfeeding at six months postpartum predicted amount of weight retained at nine months. This is consistent with previous studies, where longer duration of breastfeeding, (i.e., at least six months) predicts lower PWR (Kac et al., 2004; Krause, Lovelady, Peterson, Chowdhury, & Ostbye, 2010; Pedersen et al., 2011).

Dietary quality and exercise did not predict PWR in the current research. While some studies have indicated a relationship between physical activity and PWR (Harris et al., 1999a; Olson, Strawderman, Hinton, & Pearson, 2003), this association has not been consistent (Janney, Zhang, & Sowers, 1997; Walker & Freeland-Graves, 1997; Walker et al., 2004). This may reflect the low physical activity found for postpartum women compared to other adult populations (Wilkinson, Huang, Walker, Sterling, & Kim, 2004). Similarly, studies examining the influence of dietary intake on PWR have yielded mixed results. Total dietary intake has been associated with higher levels of PWR at 12 months (Olson et al., 2003; Siega-Riz et al., 2010); however, other studies have found no relationship (Montpetit, Plourde, Cohen, & Koski, 2012; Walker et al., 2006). Such inconsistencies could be explained by misreporting of dietary intake in pregnant (Rodrigues, Lacerda, Schlussel, Spyrides, & Kac, 2008) or weight conscious (Macdiarmid & Blundell, 1998) women.

Furthermore, dietary quality was only measured during pregnancy in empirical study one; therefore, it may not have provided an accurate representation of how dietary intake affects PWR, particularly in light of other factors, such as lifestyle alterations, making it difficult to establish a regular eating routine during the postpartum (Patel, Lee, Wheatcroft, Barnes, & Stein, 2005). Furthermore, Olson et al. (2003) found that dietary intake during the first six to 12 months postpartum resulted in higher PWR at 12 months, compared to food intake during the first six months postpartum. Therefore, it is possible that dietary quality has more impact on PWR at later stages in the postpartum, in comparison to pregnancy and early postpartum.

None of the sociocontextual/lifestyle variables were associated with PWR at three or nine months. Demographic factors did not predict PWR in either of the empirical studies, which is in contrast to previous findings where factors such as multiparity (Walker, Fowles, & Sterling, 2011), lower income (Pedersen et al., 2011), age (older than 30 or younger than 23 for first child) (Kac et al., 2004), black race, and higher maternal education (Siega-Riz et al., 2010) influenced PWR. The influence of demographic variables on PWR has had varying levels of consistency across studies, with some studies finding low associations between factors such as age (Lee, Hwang, Liou, & Chien, 2011), and race (Walker et al., 2011), and other studies finding that demographic effects on PWR become more salient at different time-points in the postpartum than others (Pedersen et al., 2011; Siega-Riz et al., 2010). For example, age, parity, and SES, influence PWR six to12 months postpartum but not during early postpartum (Pedersen et al., 2011; Siega-Riz et al., 2010). Similar findings exist for behavioural factors such as diet, physical activity (Siega-Riz et al., 2010), and breastfeeding (Krause et al., 2010).

Low social support was a further factor that did not predict PWR in the current research, in contrast to previous findings (Harris et al., 1999a; 1999b;

Pedersen et al., 2011). Given that low social support has been demonstrated to be associated with higher levels of postpartum depression (Harris et al., 1999a), and there were low levels of depressive symptoms and high levels of social support in the samples used in the current studies, it is perhaps unsurprising that no associations between social support, depressive symptoms, and PWR were apparent. Finally, there were no associations between pregnancy-related medical factors, such as giving birth via caesarean section, and PWR. This could be attributed to relatively few women in both samples giving birth via caesarean section, thereby making it difficult to detect an association.

Overall, the findings outlined in the two empirical studies have implications for the current understanding of how psychological factors predict both early and later PWR, and can assist in guiding future research. However, before considering these implications and directions for future research, the limitations and strengths of the current studies must be considered.

Strengths and Limitations of the Current Research

Limitations. Several limitations in the design and methods of the current research should be taken into account when interpreting the findings. These include the use of self-reported weight, homogeneity of the study population, the use of cross-sectional analysis in empirical study one, and some limitations associated with the instruments used to measure psychological distress. Each of these limitations will be discussed in turn in the following section.

Overall, only a small number of the participants in both empirical studies had been objectively weighed, therefore, only self-reported weight was used in the analyses. Well-documented limitations of self-report include questions being misunderstood, participants not being able to accurately recall past events, and response bias such as social desirability or response acquiescence (Singleton, Straits,

& Miller Straits, 1993). Social desirability is particularly problematic with sensitive questions such as weight or obesity and can be influenced by this method of data collection (Walker, 1996).

Interestingly, accuracy of self-reported weight is associated with the amount of weight women gain during pregnancy. McClure, Bodnar, Ness and Catov (2011) assessed the accuracy of recalled GWG at four to 12 years postpartum compared with medical-record documented GWG. Women who gained the greatest amounts of weight during pregnancy were more likely to under-report GWG, and women gaining the least amount were more likely to over-report GWG (McClure et al., 2011), which is consistent with findings by Schieve et al. (1999). Reporting error of GWG four to 12 years postpartum was greater in non-white, less educated and unmarried women (McClure et al., 2011; Schieve et al., 1999). However, these factors were not representative of the participants in the current empirical studies.

In a similar study that compared self-reported pre-pregnancy weight and delivery weight with documented pre-pregnancy and delivery weight, women of healthy weight tended to correctly classify BMI, whereas overweight and obese women tended to under-classify BMI (Mandujano, Huston-Presley, Waters, & Catalano, 2012). Furthermore, excessive GWG is higher in obese or overweight women who under-report pre-pregnancy BMI, and in normal weight women who over-assess pre-pregnancy BMI (Herring et al., 2008b).

An additional limitation that impacts upon the generalisability of findings is the relative homogeneity of the study population. The majority of participants were white Australian women who were married, highly educated, and had moderate-to-high family income. Comparative sample characteristics of previous studies included less homogenous samples, comprising more women with lower SES (Walker et al., 2011), lower income and increased ethnic diversity (Kac et al., 2004). Given that low

SES and different ethnic populations experience different body image attitudes and different rates of PWR (Shrewsbury, Robb, Power, & Wardle, 2009; Walker et al., 2011; Walker et al., 2002), the results of the current research need to be interpreted in light of the relatively homogenous nature of the samples.

The finding of early postpartum stress being associated with early PWR in empirical study one should also be interpreted with caution due to it being based on cross-sectional analyses. As a result, causality cannot be established and further exploration through a prospective research design would be worthwhile.

There were also some limitations with the selection of instruments used to measure psychological distress. The measures used for stress and depression were very strongly correlated, resulting in depression at three months postpartum being omitted from the analysis in the second empirical study. Although the Edinburgh Postnatal Depression Scale (EPDS) has been validated in a broad range of populations (Cox, Holden, & Sagovsky, 1987), it is a screening tool, rather than a measure for clinical diagnosis (Herring et al., 2008a), and it remains possible that cultural and/or economic factors may have caused women to over-report or under-report depressive symptoms (Herring et al., 2008a). Certainly within the current research, there were comparatively few women who self-reported symptoms of depression or anxiety, thereby limiting the ability to make estimates of how such factors may influence PWR. This could be attributed to the sample comprising women of high levels of SES and education, and having higher levels of social support.

There are also limitations in respect to the use of the Body Attitudes Questionnaire (BAQ) to measure postpartum dissatisfaction. Despite the BAQ often being used to assess body attitudes in perinatal research (e.g., Duncombe, Wertheim, Skouteris, Paxton, & Kelly, 2008; Kamysheva, Skouteris, Wertheim, Paxton, &

Milgrom, 2008; Skouteris, 2011; Skouteris, Carr, Wertheim, Paxton, & Duncombe, 2005), comparisons between samples of pregnant and non-pregnant women indicate measurement bias, highlighting a need to develop a body image screening tool that is specific to the perinatal period (Fuller-Tyskiewicz, Skouteris, Watson, & Hill, 2012).

Strengths. This research was the first of its kind to prospectively explore the predictive nature of psychological factors on PWR using the theoretical framework of a multifactorial conceptual model. Other studies (e.g., Pedersen et al., 2011; Siega-Riz et al., 2010) have examined PWR in the context of a multifactorial framework, but do not explicitly examine the influence of psychological factors in the context of other known influences. A wealth of information with respect to demographic, medical, behavioural and psychological factors were collected in the present study, which allowed for a comprehensive exploration of the relationship between the variables, as well as adequate statistical power to detect associations.

Despite the shortcomings in using self-reported weight, such a method of data collection has the advantages of practicality and low cost, and is effective for sampling large numbers of individuals (Gorber, Tremblay, Moher, & Gorber, 2007). Furthermore, due to the difficulty in recruiting women prior to pregnancy and following them until they become pregnant, subjective weight is considered to be acceptable in perinatal research (IOM, 2009). Should reporting bias have occurred, it is likely to have been similar for pre-pregnancy, GWG, and postpartum weight (Herring et al., 2008b; Keppel & Teffel, 1993; Pedersen et al., 2011). Objectively measured weights were used where possible in this research.

Implications and Future Directions

The current findings have several important theoretical and clinical implications, and offer directions for future research regarding the association between psychological factors and PWR. The conceptual model proposed pathways

of the inter-relationships between a range of sociodemographic, maternal weight and behavioural influences, psychological factors and PWR. Such a multi-faceted approach is required in postpartum weight research, as contributing factors are numerous and complex. Whilst the conceptual model proposed in the current research provided a theoretical foundation on which the two empirical studies were based upon, there was little empirical support for the proposed pathways. Such findings do not necessarily indicate that the conceptual model is an insufficient or inaccurate representation of predictors of PWR, but rather point to a need to test the conceptual model in a more rigourous manner, which would include the use of a more heterogenous sample. Mediation analyses could provide some additional information about the direct effects of individual variables on PWR, as opposed to focusing solely on the combined contribution of the predictor variables. Future research could also employ causal modelling strategies such as path analysis, to explore causality as opposed to focusing upon the predictive utility of the model. Further, the longitudinal design of the study provides future opportunity for evaluation of longer-term trajectories of PWR.

In respect to clinical implications, the findings of both empirical studies provide important information for the development and timing of interventions aimed towards reducing PWR. Of note, a major finding of the current research was that GWG is the most salient predictor of PWR, which is consistent with previous research (Herring et al., 2008; Siega-Riz et al., 2010) and highlights the urgent need for effective interventions that prevent excessive GWG. Given the salience of GWG in PWR, it is optimal that interventions are conducted during pregnancy as a preventative measure (Olson, 2007). Additionally, this would be more viable as pregnant women have more frequent interactions with the health care system and may also be more receptive to behaviour change recommendations during pregnancy

(Duncombe et al., 2008), as evidenced by anti-smoking campaigns (Skouteris et al., 2012). Therefore, the delivery of interventions during this phase, as opposed to the postpartum, may be optimal. Guidelines by the IOM (2009) regarding appropriate weight gain during pregnancy also highlight the importance of targeting interventions in pregnancy as a means of preventing both PWR and childhood obesity.

A shortcoming of many existing interventions that aim to reduce excessive GWG is that they tend to focus primarily on behavioural changes in relation to physical activity and eating (Skouteris et al., 2010). This is surprising given that previous findings emphasise the importance of targeting both behavioural and psychological factors in order to maintain postpartum weight loss and prevent maternal overweight and obesity (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009a; 2009b; Duncombe et al., 2008; Rallis, Skouteris, Wertheim, & Paxton, 2007). Relatively few behavioural-based interventions have been successful or effective in helping women gain within the appropriate range (Claesson et al., 2008; Wolff, Legarth, Vangsgaard, Toubro, & Astrup, 2008), or in successfully reducing PWR (Amorim, Rossner, Neovius, Lourenco, & Linne, 2007), a finding which could be attributed to psychological factors not being incorporated (IOM, 2009; Walker, 2007). Therefore, interventions to prevent GWG and PWR need to incorporate psychological barriers to change, in addition to behavioural and situational constraints (IOM, 2009; Walker, 2007).

The second major finding of the current research is that high body dissatisfaction during the postpartum predicts higher levels of PWR and this relationship increases in salience over the first postpartum year. This supports previous research, where pregnancy confers a respectability and acceptance of weight gain and respite from body image concerns, whilst in contrast, the postpartum represents a period where women perceive pressure to lose pregnancy-related weight

gain quickly and, as a result, body dissatisfaction increases (Clark et al., 2009b). As body dissatisfaction is more salient during the postpartum, and is associated with maladaptive behaviours such as unhealthy eating, extreme weight loss behaviours (Skouteris, 2012) and higher PWR, this is an area that requires further attention in future pregnancy and postpartum research and should play a key role in the development of appropriate interventions (Hill, Skouteris, McCabe, & Fuller-Tyskiewicz, 2012; Walker et al., 2002).

At present, less than one-third of physicians assess for body image concerns during routine gynaecologic and obstetric care (Leddy, Jones, Morgan, & Schulkin, 2009). Midwives, obstetricians and allied health professionals should routinely monitor body image in conjunction with weight gain and retention (Hill et al., 2013), and screen for body dissatisfaction, extreme weight loss behaviours, and/or a history of eating disorders (Skouteris, 2011). Specifically, women should be provided with information about what will happen to their bodies postpartum (Clark et al., 2009a; Rallis et al., 2007), and expectations related to body weight and shape during the postpartum should be explored (Walker et al., 2002). Women who are concerned about their weight may be surprised that they are not returning to their pre-pregnancy weight as quickly as they had expected after the first few weeks postpartum (Walker et al., 2006); therefore, giving new mothers realistic information about weight loss patterns is important (Walker et al., 2006), particularly given the accessibility of inaccurate and unrealistic information about the length of time it takes women to return to their pre-pregnancy weight (Olds, London, Ladewig, & Davidson, 2004).

Skouteris et al. (2012) have proposed a novel and innovative intervention that targets behavioural changes in relation to eating and physical activity as well as changes in psychological factors including mood and body image concerns, with the aim of preventing excessive GWG and 12 month PWR. The pregnancy health

coaching intervention is comprised of two components; firstly, the provision of individualised health coaching that promotes the adoption of health weight management behaviours during pregnancy, and addressing mood concerns and body image issues that commonly arise during pregnancy, and secondly, educational group sessions that aim to provide mothers with additional information relating to healthy behaviours and psychological well-being. Future research should focus on rigourous evaluation of such an intervention, which could also be extended upon to incorporate postpartum body dissatisfaction.

Overall, the results of the empirical studies indicate that the relationship between body image and weight gain provides a basis for future studies to explore this prospectively and suggests clinical relevance in addressing body image concerns as a method to help reduce excessive PWR.

Conclusions

Given that approximately half of Australian adult women of childbearing age are overweight or obese (Access Economics, 2008) and that childbearing is a key factor in the development of obesity in women (Billington et al., 2000; Herring et al., 2008a), the impact of pregnancy on women's weight status represents a major health concern (Walker, 2007). The incidence of excessive PWR is an increasing problem in Western societies, with just under one quarter of women retaining at least five kilograms of GWG six to 18 months post-birth (Kinnunen et al., 2007; Gunderson & Abrams, 2000), and excessive PWR at one year postpartum predicting long-term overweight and obesity and associated health problems (Linne et al., 2004).

The results of this research reaffirm the salience of GWG as a predictor of PWR, and also indicate that, to a lesser degree, early postpartum stress and body dissatisfaction is associated with higher PWR. GWG should be monitored closely throughout pregnancy due to its significant influence on the amount of weight

retained in the early postpartum, and interventions should focus upon the prevention of excessive weight gain during pregnancy.

In respect to psychological factors, body dissatisfaction during postpartum plays a key role in influencing PWR, with women with increased postpartum body dissatisfaction at both three and six months postpartum retaining more weight. Therefore, interventions that target the reduction of GWG and PWR must incorporate the role of body dissatisfaction if a holistic approach to weight management is deemed important for the long-term health of women and offspring (Hill et al., 2012). Further research is required to describe the complex relationship between body image and other psychosocial influences and how these affect the antenatal health and wellbeing of women (Hill et al., 2012), including the association with PWR. The goal would be to provide clinical recommendations and resources that allow health care professionals to target these issues (Hill et al., 2012) in their standard postnatal care.

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APPENDIX A

ETHICS APPROVAL

Deakin University Human Ethics Research
Office of Research Integrity
70 Elgar Road Burwood Victoria
Postal: 221 Burwood Highway
Burwood Victoria 3125 Australia
Telephone 03 9251 7123 Facsimile 03 9244 6581
research-ethics@deakin.edu.au

Research Ser

Memorandum

To: A/Prof Helen Skouteris, School of Psychology B

cc: Sofia Rallis, Briony Hill, Jo Phillips

From: Deakin University Human Research Ethics Committee (DUHREC)

Date: 13 May, 2011

Subject: 2009-036

Maternal and infant wellbeing: Pre and post birth

Please quote this project number in all future communications

The modification to this project, submitted on 6/05/2011 has been approved by the committee executive on 13/05/2011.

Approval has been given for A/Prof Helen Skouteris, School of Psychology, to continue this project as modified to 11/05/2012.

The approval given by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the approval. It is your responsibility to contact the Human Research Ethics Unit immediately should any of the following occur:

- Serious or unexpected adverse effects on the participants
- Any proposed changes in the protocol, including extensions of time.
- Any events which might affect the continuing ethical acceptability of the project.
- The project is discontinued before the expected date of completion.
- Modifications are requested by other HRECs.

In addition you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

DUHREC may need to audit this project as part of the requirements for monitoring set out in the National Statement on Ethical Conduct in Human Research (2007).

Human Research Ethics Unit

research-ethics@deakin.edu.au

APPENDIX B

STUDY ADVERTISEMENTS & FLYERS

PREGNANT WOMEN REQUIRED FOR A STUDY ON MATERNAL AND INFANT WELLBEING: PRE- AND POST BIRTH.

"Are you between 10-16 weeks pregnant? Would you like to contribute to a world first study on maternal and infant wellbeing pre- and post birth?"

Pregnant women who are between 10-16 weeks gestation are invited to take part in a study that examines maternal and infant wellbeing throughout pregnancy and the first 12 months post birth. This is a confidential study, being conducted by Ms Sofia Rallis and Dr Helen Skouteris in the School of Psychology, Deakin University. The findings of this study will contribute invaluable information to the literature about maternal and infant wellbeing during pregnancy and the first year post birth.

Participation will entail completing a set of questionnaires on a monthly basis from early pregnancy, through to 12 months post birth. While this may sound like a lot, most of the questionnaires will take less than 20 minutes to complete at each time.

We are also inviting partners to take part in a concurrent project examining the psychological well-being of men throughout pregnancy and the first 12 months post birth. Participation for dads-to-be will entail 3 questionnaires through pregnancy and 4 post birth, with questionnaires taking approximately 20 minutes to complete each time.

If you and/or your partner are interested in participating in this vital research or would like more information about either study, please contact:

Ms Sofia Rallis

School of Psychology

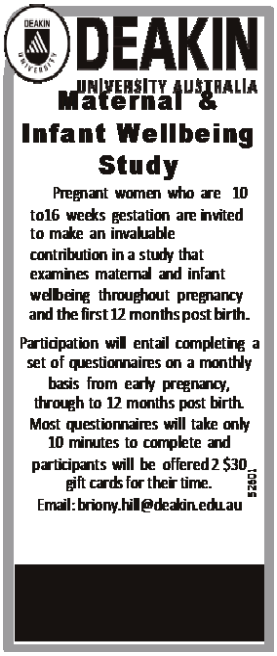
Deakin University

Victoria 3125

Phone: (03) 9244-6538

Email: sofia.rallis@deakin.edu.au

We look forward to hearing from you!


DEAKIN
UNIVERSITY AUSTRALIA
Maternal &
Infant Wellbeing
Study
Pregnant women who are 10 to16 weeks gestation are invited to make an invaluable contribution in a study that examines maternal and infant wellbeing throughout pregnancy and the first 12 months post birth.
Participation will entail completing a set of questionnaires on a monthly basis from early pregnancy, through to 12 months post birth.
Most questionnaires will take only 10 minutes to complete and participants will be offered 2 $30 gift cards for their time.
Email: briony.hill@deakin.edu.au
52801

DEAKIN UNIVERSITY

ARE YOU 10-16 WEEKS PREGNANT?

MATERNAL AND INFANT WELLBEING STUDY: PRE- AND POST BIRTH.

PREGNANT WOMEN WHO ARE 10-16 WEEKS GESTATION ARE INVITED TO MAKE AN INVALUABLE CONTRIBUTION IN A STUDY THAT EXAMINES MATERN AND INFANT WELLBEING THROUGHOUT PREGNANCY AND THE FIRST 12 MONTHS POST BIRTH.

Participation will entail completing a set of questionnaires on a monthly basis from early pregnancy, through to 12 months post birth. While this may sound like a lot, most of the questionnaires will take less than 15 minutes to complete at each time. **As a small token of our appreciation, participants will receive two $30 gift cards for their time. These questionnaires will take less than 20 minutes to complete at each time.**

If you are interested in participating in this vital research or would like more information, please contact: Briony Hill on (03) 9244 6538 or email bhill@deakin.edu.au

We look forward to hearing from you!

APPENDIX C

PLAIN LANGUAGE STATEMENT, CONSENT FORMS & COVER LETTERS

DEAKIN UNIVERSITY
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Prospective participants

PLAIN LANGUAGE STATEMENT

Date: July 2011

Full Project Title: Maternal and Infant Wellbeing: Pre and Post Birth

Principal Researcher: Associate Professor Helen Skouteris (School of Psychology, Deakin University, Burwood)

Student Researchers: Miss Sofia Rallis, Ms Briony Hill, and Ms Jo Phillips (School of Psychology, Deakin University, Burwood)

Associate Researchers: Professor Marita McCabe, (School of Psychology, Deakin University, Burwood) and Professor Jeannette Milgrom (School of Psychology, The University of Melbourne).

1. Your Consent

You are invited to take part in this research project being conducted by Deakin University.

This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project so that you can make a fully informed decision about whether you are going to participate.

Once you understand what the project is about and if you agree to take part in it, you will be asked to sign the Consent Form. By signing the Consent Form, you indicate that you understand the information and that you give your consent to participate in the research project. Please do this prior to completing the questionnaires.

You will be given a copy of the Plain Language Statement and Consent Form to keep as a record.

2. Purpose and Background

The purpose of this project is to investigate women's general experiences during pregnancy and the first 12 months following birth. This includes issues associated with general mood as well as experiences related to self esteem, body image, relationship quality and parental stress.

The project aims to provide some insight into questions regarding the level and type of distress experienced by women across pregnancy and the first postpartum year, and whether any 'critical periods' can be identified where early intervention may be most effective. The identification of risk factors and

consequences to maternal distress during pregnancy and the postpartum will also be explored.

As part of investigation into mood and body image changes during and after pregnancy, body weight is assessed; this is because pregnancy is a time of significant physical and emotional change in a woman's life.

In order to obtain accurate and meaningful results, we aim to recruit 250 women into the project who will complete a series of questionnaires on a monthly basis throughout pregnancy and the first postpartum year. You are invited to participate in this research project because you are currently in your first trimester of pregnancy.

3. Funding

This project is being funded through two student PhD budgets provided by the School of Psychology, Deakin University, as well as a National Health and Medical Research Council (NHMRC) PhD scholarship budget.

4. Procedure

If you agree to participate, you will be required to complete a short series of questionnaires once a month for approximately 18 months (6 months across pregnancy and 12 months following birth). While this may sound like a lot, most of the questionnaires will take approximately 5-10 minutes to complete. Once every 3 months the questionnaire pack may take approximately 30-40 minutes to complete and will include questions about maternal and infant health and wellbeing, weight and height, as well as demographic information such as age and family income.

Examples of questions that will be asked are "I found it difficult to relax" and "In the past 7 days I have been able to laugh and see the funny side of things". Participants will receive all the questionnaires in the mail and will be asked to return these to the University using the reply paid envelopes which will be provided.

You will also be invited to attend a 15-20 minute appointment at 16 weeks' gestation, and 12 months post birth. The appointment will take place in a private room at Deakin University Burwood campus, or alternatively, in the comfort of your own home. At the 16 weeks' gestation and 12 months post birth appointment, your height, weight, body composition measures (skinfolds of arm, back, and waist), and waist circumference will be measured by a trained researcher.

If you live too far from the research centre in Melbourne, you will be required to ask your GP/obstetrician/midwife to take your height and weight measurements as close to 16 weeks' gestation as possible. You will also be required to ask your GP/obstetrician/midwife to measure your weight at each antenatal visit and on the day of delivery if possible. You can record these measures on the questionnaires that will be sent to you monthly.

5. Possible Benefits

By participating in this project, you will be making an invaluable contribution to a very important area of research concerning maternal and infant health and wellbeing. The results obtained at the conclusion of the study will potentially have implications for numerous health professions, expectant mothers as well as the general community.

Attaining a thorough and comprehensive understanding into women's experiences in the first postpartum year can potentially indicate when early intervention would be most helpful so as to alleviate, or at least lessen, the distress experienced by a significant number of women both in Australia and overseas.

6. Possible Risks

There are no anticipated risks outside the normal day-to-day activities. However, given that the questionnaires will include questions regarding issues such as anxiety and stress, there is a slight possibility that you may experience some concern about your responses. Thus, you are invited to examine the questionnaire material before agreeing to participate. If you do participate and find that you are uncomfortable or overly worried about your responses to any of the questionnaire items, or if you find participation in the project distressing, you should contact the Principal Researcher (Sofia Rallis on: 03 9244-6538) as soon as convenient. You will have the opportunity to discuss your concerns in a confidential manner and appropriate follow-up will be suggested if necessary. You may also like to contact a government or community organisation specialising in dealing with distress. You can contact BeyondBlue on 1300 22 4636 or the Post and Ante Natal Depression Association (PANDA) on 1300 726 306.

If considerable distress is revealed in the data obtained by the Principal Researcher during the course of the study, you will be contacted by the Principal Researcher and referred to someone who can be of assistance.

7. Privacy, Confidentiality and Disclosure of Information

You can be assured that you will not be identified by name in any way in the reporting of our results in publications and conference presentation. Any information we collect from you that can identify you will remain confidential and will be stored in a locked cabinet within the School of Psychology at Deakin University for a minimum of 5 years from the date of publication.

8. Results of Project

A summary of the findings will be provided to the school and available for any interested participants to read at the completion of the study. Please email briony.hill@deakin.edu.au if you would like to receive a copy of this report.

9. Participation is voluntary

Participation in any research project is voluntary. ***If you do not wish to take part you are not obliged to.*** If you decide to take part and later change your mind, you are free to withdraw from the project *at any stage*. Any information obtained from you to date will not be used and will be destroyed. Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your relationship with Deakin University in any way.

Before you make your decision, a member of the research team will be available to answer any questions you have about the research project. You can ask for any information you want. Sign the Consent Form only after you have had a chance to ask your questions and have received satisfactory answers.

If you decide to withdraw from this project, please notify a member of the research team so they can inform you if there are any special requirements linked to withdrawing.

10. Ethical Guidelines

The study will be carried out in accordance with the National Statement on Ethical Conduct in Human Research (2007). This statement has been developed to protect the interests of people who agree to participate in human research studies.

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Deakin University. The research will be carried out in the School of Psychology Deakin University, 221 Burwood Highway, Burwood Victoria.

11. Complaints

Should you have any concerns about the conduct of this research project, please contact the Manager, Research Integrity, Research Services Division, Deakin University, 221 Burwood Highway, Burwood Victoria, 3125. Telephone: (03) 9251-7129, Facsimile: (03) 9244-6581; research-ethics@deakin.edu.au Please quote project number EC 36- 2009.

12. Reimbursement for your costs

You will not be paid for your participation in this project. However, if you remain a participant in this study you will receive a $30 Coles Group Gift Card after the return of your first post-birth questionnaire, and another $30 Coles Group Gift Card after the return of your final questionnaire at 12 months post birth, as a small token of appreciation for your participation.

13. Further Information:

Contact Ms Briony Hill in the School of Psychology, Deakin University, 221 Burwood Highway, Burwood, Victoria, 3125, on (03) 9244-6538 or email: briony.hill@deakin.edu.au

DEAKIN UNIVERSITY
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Participants

Consent Form
Participant's Copy

Date: July 2011

Full Project Title: Maternal and Infant Wellbeing: Pre and Post Birth

Researchers: Miss Sofia Rallis, Ms Briony Hill, Ms Jo Phillips, Associate Professor Helen Skouteris, Professor Marita McCabe, (School of Psychology, Deakin University, Burwood) and Professor Jeannette Milgrom (School of Psychology, The University of Melbourne).

I have read and I understand the attached Plain Language Statement.

I freely consent to participate in this project according to the conditions in the Plain Language Statement.

I have been given a copy of the Plain Language Statement and Consent Form to keep.

The researchers have agreed not to reveal my identity and personal details, including where information about this project is published, or presented in any public form.

Participant's Name (Printed)

Participant's Signature **..Date** **..**

Participant's Contact Details

Address: **. .**

.

Home Phone: **. .**

Mobile: **.. ...**

Email Address: **. .**

The researchers will be applying for further funding to continue their research longer term. If you agree to be contacted for research studies of this type in the future please sign below.

I consent to the researchers named here contacting me for future research studies that I am not obliged to take part in.

Participant's name: .

Signature: .

*Please **keep** this signed form for your records.*

DEAKIN UNIVERSITY
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Participants

Consent Form
Researcher's Copy

Date: July 2011

Full Project Title: Maternal and Infant Wellbeing: Pre and Post Birth

Researchers: Miss Sofia Rallis, Ms Briony Hill, Ms Jo Phillips, Associate Professor Helen Skouteris, Professor Marita McCabe, (School of Psychology, Deakin University, Burwood) and Professor Jeannette Milgrom (School of Psychology, The University of Melbourne).

I have read and I understand the attached Plain Language Statement.

I freely consent to participate in this project according to the conditions in the Plain Language Statement.

I have been given a copy of the Plain Language Statement and Consent Form to keep.

The researchers have agreed not to reveal my identity and personal details, including where information about this project is published, or presented in any public form.

Participant's Name (Printed) .

Participant's Signature **..Date** **..**

Participant's Contact Details

Address: **..**

.

Home Phone: **. .**

Mobile: **.. ...**

Email Address: . .

The researchers will be applying for further funding to continue their research longer term. If you agree to be contacted for research studies of this type in the future please sign below.

I consent to the researchers named here contacting me for future research studies that I am not obliged to take part in.

Participant's name: . **Signature:** .

*Please **return** the signed form to: Ms Briony Hill, School of Psychology, Deakin University, 221 Burwood Highway. Burwood, Victoria 3125.*

School of Psychology
Deakin University
221 Burwood Highway
Burwood, Victoria 3125

Hello and welcome to the first time-point of our study: *"Maternal and Infant Wellbeing: Pre and Post Birth".*

We would like to thank you once again for your participation in this study. Studies such as this contribute immensely to the knowledge base about women's wellbeing during pregnancy and the postpartum period. As this knowledge base expands, clinicians in the field will be better informed about how to best help women during these times.

The present questionnaire pack should take approximately 45 minutes to complete. Please note that this is the longest questionnaire for the entire study, and that future questionnaire packs will be much briefer. For example, the next questionnaire pack you will receive (next month) will be comprised of only 2 pages and should take less than 5 minutes to complete.

If you begin filling out the questionnaires and feel you do not wish to continue further you can stop at anytime. If the questionnaires raise any personal concerns for you, you can call Miss Sofia Rallis on (03) 9244-6538 or Associate Professor Helen Skouteris on (03) 9251-7699 to discuss these concerns.

As part of this study, we request that you ask your health professional (e.g., GP, obstetrician, midwife) to measure your height at your next visit, and weigh you objectively at each visit. Please record your measurements in the questionnaire each month.

Please fill in the questionnaires as completely and accurately as possible and return them in the reply paid envelope provided. Please do this within the next 1-2 weeks if possible. All your responses will remain strictly confidential.

We hope that you are keeping well over this time and thank you once again for your time.

Yours Sincerely,

The Research Team

Project Manager/PhD Candidate: Sofia Rallis
Research Students: Briony Hill (PhD Candidate) and Jo Phillips (DPsych)

Principal Researchers: Dr Helen Skouteris, Professor Marita McCabe and Professor Jeannette Milgrom.

School of Psychology
Deakin University
221 Burwood Highway
Burwood, Victoria 3125

Hello and welcome to the next time-point of our study: *"Maternal and Infant Wellbeing".*

We would like to thank you once again for your participation in this study. Studies such as this contribute immensely to the knowledge base about pregnancy. As this knowledge base expands, clinicians in the field will be better informed about women's feelings in relation to themselves during pregnancy.

The present questionnaire pack should take approximately 25 minutes to complete. If you begin filling out the questionnaires and feel you do not wish to continue further you can stop at anytime. If the questionnaires raise any personal concerns for you, you can call Miss Sofia Rallis 9244-6538 or Dr Helen Skouteris on 9251-7699 to discuss these concerns.

Please fill in the questionnaires as accurately as possible and return them in the reply paid envelope provided. Please do this within the next 1-2 weeks if possible. All your responses will remain strictly confidential.

As part of this study, we request that you ask your health professional (e.g., GP, obstetrician, midwife) to weigh you objectively at each visit. Please record your measurements in the questionnaire each month.

Given that we are trying to track how your feelings change over the course of your pregnancy, some of the questionnaires may seem repetitive, but we do ask that you please answer all questions.

We hope that you are keeping well over this time and thank you once again.

Yours Sincerely,
The Research Team

Project Manager/PhD Candidate: Sofia Rallis

Research Students: Briony Hill (PhD Candidate) and Jo Phillips (DPsych)

Principal Researchers: Dr Helen Skouteris, Professor Marita McCabe and Professor Jeannette Milgrom.

APPENDIX D

STUDY QUESTIONNAIRES

As previously shown in the text, this table shows the schedule for data collection. Questionnaires are presented in the appendices in the order that they appear in this table.

Table 3

Data collection schedule

	Pregnancy phase (weeks)		Postpartum phase (months)			
Measure	16	32	1	3	6	9
Demographics	*					
Self-reported weight	*	*		*	*	*
Physical activity		*		*	*	
Dietary quality		*				
Birth details			*			
Breastfeeding				*	*	
DASS-21		*		*	*	
EPDS		*		*	*	
BAQ		*		*	*	
MSPSS		*		*	*	
PSQI		*		*	*	
Approx completion time (min)	45	25	10	25	25	10

Note: DASS-21 – Depression Anxiety Stress Scales (21 item version), EPDS – Edinburgh Postnatal Depression Scale, BAQ – Body Attitudes Questionnaire, MSPSS – Multidimensional Scale of Perceived Social Support, PSQI – Pittsburgh Sleep Quality Index.

ID: …….

★

Maternal and Infant Wellbeing Study

(T1 – 16wks Preg)

Thank you for taking the time to complete the following information.

Your responses will remain strictly confidential.

Today's date is: …….

Age ……..

Date of birth

……..

How many weeks pregnant are you at present? ……

Estimated due date ……

General and Background Information

1. Was your height and weight measured by a health professional at around 16 weeks' gestation?

a) (1) yes (2) no If no, please go to Question 2

b) Height ……..centimetres

c) Current weight……..kilograms

d) Measured by (please circle)

(1) GP (2) Midwife (3) Obstetrician

(4) Other…….

e) Date measures taken……/……/……

Please go to Question 3.

2. If you did not have your height and weight measured by a health professional at around 16 weeks' gestation, please indicate your measurements.

a) Self-reported height…….centimetres

b) Self-reported current weight…….kilograms

3. Were you previously being weighed by your obstetrician/doctor/midwife during pregnancy?

(please circle) (1) Yes (2) No

If Yes:

b) At how many weeks pregnant was your *first* weighing? ……. weeks

c) What did you weigh at that *first* weighing?…….kilograms

d) At how many weeks was your *last* weighing? .....weeks

e) What did you weigh at that *last* weighing? …….kilograms

4. Current marital status: (please circle one)

(1) Married (2) Divorced

(3) De Facto (4) Separated

(5) Widowed (6) Never Married/Single

5. Are you an Aboriginal or Torres Strait Islander?
(1) Yes (2) No

6. Location of *<u>your</u>* birth:

(1) Australia (2) New Zealand

(3) United Kingdom (4) Europe

(5) North America (6) South America

(7) Africa (8) Middle East

(9) Asia

7. Where were <u>your parents</u> born? (Name of country please):

Father: .....
Mother: .....

8. Main language spoken at home:

(1) English (2) Other (please specify):**.....**

9. Please indicate the highest level of education you have completed.

(1) Still at secondary school (2) Did not finish secondary school

(3) Year 12 or equivalent (4) Certificate Level

(5) Advanced Diploma/Diploma (6) Graduate Diploma/ Certificate

(7) Bachelor Degree (8) Postgraduate Degree

10. Are you currently in paid employment? (1) Yes (2) No (<u>If **No**</u>, please go to Q13)

If **Yes**, do you work full time/part time? **.....**

What is your occupation? **.....**

11. Do you intend to return to work after the birth of your baby?

(1) Yes (2) No

If Yes, what length of maternity leave do you intend to take? ……
(number of weeks)

12. Does your employer provide work-based child care?

(1) Yes (2) No

13. Please indicate your approximate annual family income:

(1) Under 25,000 (2) 25,001- 45,000
(3) 45,001- 65,000 (4) 65,001- 85,000
(5) 85,001- 105,000 (6) 105,001- 125,000
(7) 125,001- 145,000 (8) Over 145,001

14. Is this your first pregnancy? (1) Yes (2) No

15. Did you require any assistance conceiving this pregnancy? (i.e., IVF treatment)

(1) Yes please state: …….. (2) No

16. Number of children you have, not including current pregnancy (please circle)

(0) zero (1) one (2) two
(3) three (4) four (5) five or more

17. If this is not your first pregnancy, did you experience any complications in your other pregnancies? (1) Yes (2) No (3) N/A

If yes, please describe

briefly……

……

18. Are you a smoker? (1) Yes (2) No (If **No**, please go to Q19)

b) If yes, how many cigarettes did you normally smoke a day when not pregnant? ……

c) Are you smoking during this pregnancy? (1) Yes (2) No

If yes, please complete the statement below that is relevant to you:

d) How many cigarettes are you smoking per day? ……..

e) How many cigarettes are you smoking per week? ……..

19. **Over the past month how many glasses of alcohol have you consumed (on average) per week? (please circle one)**

    (1) none (2) one to two (3) three to four (4) five to six

    (5) more than seven

20. **Have you consumed more than two glasses of alcohol at any one time during this pregnancy?**

    (1) Yes (2) No

    b) If Yes, how often has this occurred? (please circle one)

    (1) once (2) twice (3) three times

    (4) four or more times

21. **Over the past month how many cups of coffee have you consumed a day?**

    (please circle one).

    (1) none (2) one (3) two (4) three

    (5) four or more

22. **a) During the past month, have you engaged in any form of exercise?**

    (1) Yes (2) No (If **No**, please go to Q23)

    b. If yes, please describe your exercise type (you may choose more than one):

    (1) Power-walking (2) Walking (3) Yoga

    (4) Aerobics (5) Gym Circuit (6) Team Sports

    (7) Swimming (8) Other: ……

    c. Please estimate your average total weekly exercise duration (for the past month) ……..minutes per week

    d. Please describe the intensity of your exercise (over the past month) by circling one of the following:

(1) I am slightly puffed out at the end of my exercise session

(2) I am moderately puffed out at the end of my exercise session

(3) I am very puffed out at the end of my exercise session

23. a) <u>What was your pre-pregnancy</u> weight? (i.e., at 1 month prior to pregnancy)

….……kilograms

b) <u>How confident</u> are you that you have noted your pre-pregnancy weight accurately? (please circle)

Not at all Confident										**Extremely Confident**
◄										►
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

24. Have <u>you</u> ever been diagnosed with any of the following psychiatric or psychological conditions? (please circle all that apply)

(1) No previous psychiatric history (<u>please go to **Q27**</u>)

(2) Minor Depression

(3) Major Depression (excluding Postnatal Depression)

(4) Antenatal Depression

(5) Postnatal Depression

(6) Bipolar Disorder

(7) Anxiety Disorder

(8) Eating Disorder

(9) Substance or Alcohol related Disorder

(10) Other

…….Please Specify

25. <u>If yes</u>, what treatment did you receive? (please circle all that apply)

(1) None

(2) Medication (i.e., Antidepressants or Anti-Anxiety tablets)

(3) Counselling or psychological therapy

(4) Other ……..(Please Specify)

26. <u>If yes</u>, how long ago was this? (please circle)

(1) Within the last 12 months

(4) 4-5 years ago

(2) 1-2 years ago
(3) 3-4 years ago
(5) 6-10 years ago
(6) more than 10 years ago

27. Are you currently receiving any of the following? (please circle all that apply)

(1) Counselling or psychological therapy
<u>If yes,</u> how frequently?
(a) Once (i.e., single visit)
(b) Occasionally (i.e., once a month, or every few months)
(c) Regularly (weekly or fortnightly). If so, for how long?……

(2) Antidepressants

(3) Other medication (please specify): ……..

(4) Herbal or natural remedies (please specify): ……..

(5) Other (please specify): ……..

(6) None of the above

28. a) Has anyone in <u>your family</u> ever been diagnosed with any of the following psychiatric or psychological conditions? (please circle all that apply)

(1) No previous psychiatric history
(2) Minor Depression
(3) Major Depression (excluding Postnatal Depression)
(4) Antenatal Depression
(5) Postnatal Depression
(6) Bipolar Disorder
(7) Anxiety Disorder
(8) Eating Disorder
(9) Substance related Disorder
(10) Other ……Please Specify

b) If yes, which family member(s)

……

……

Food Frequency Questionnaire

Please read this page before completing the questionnaire

Background:
This questionnaire is designed to estimate your **usual** pattern of food intake by providing us with information on how often, **on average**, you consumed certain foods and beverages **during the last 3 months**.

How to fill in the questionnaire:
Please put a tick in one box for every food listed. In you never eat a particular food, fill in the box for 'Never, or less than once a month'. Should you need to change an answer, please completely erase the incorrect tick or cross it out and place a new tick in your chosen box.

Example Please answer the following questions by **placing a tick in the box** that applies to you for that item. Please fill in **only** one box per row.	Average number of times consumed **in the last 3 months**								
	Never, or less than once a month	**1-3 times per month**	**Once per week**	**2-4 times per week**	**5-6 times per week**	**Once per day**	**2-3 times per day**	**4-5 times per day**	**6+ times per day**
Pineapple		✓							

For each food item listed, place a tick in the box that **best** represents your average pattern of consumption of that food over the previous 3 months. For example:

- If you usually eat two slices of wholemeal toast at breakfast, a sandwich using two slices of wholemeal bread at lunch, and a white roll at dinner time and you usually eat no other bread during the day, tick the box '4-5 times per day' for wholemeal/mixed grain bread etc and the 'Once per day' box for white bread etc.
- If you usually eat a banana at breakfast seven times a week and an apple at lunch three times a week, and you usually eat no other bananas or apples during the week, tick the box for 'Once per day' for the banana and the '2-4 times per week' box for apple.

Think about all eating occasions
When reading through the list of foods, please think back over the previous 3 months. Think carefully about foods and beverages consumed away from home and when on holidays as well as those foods prepared and consumed at home. Also think about foods

and beverages consumed on special occasions such as Christmas, Easter and birthdays as well as those you eat more often.
Some commonly consumed mixed foods, such as salads, stir-fried vegetables etc, have been listed as distinct terms.
Other foods, such as sandwiches, are not listed as distinct items as their composition varies depending on how they are made up. Think about separate ingredients that make up these foods and answer accordingly. For example:

- If you usually eat a ham and mixed salad sandwich once a week, and you usually eat no other ham or mixed salad during the week, tick the 'Once per week' box for ham and the 'Once per week' box for green/mixed salad in a sandwich.

Seasonal foods

There may be some foods that you eat only when in season. For very seasonal fresh fruits, such as stone fruits, melons, etc, you should estimate your average consumption when the fruits are in season. For example:

- If you eat fresh plums once a week during summer, and eat no plums for the rest of the year you should tick the box for 'Once per week'.
- If you eat fresh plums once a week during summer and tinned plums once a week for the rest of the year you should also tick the box for 'Once per week'.

For each food listed, place a tick in the box indicating how often **on average** you consumed that food in the **past 3 months.** Please **tick a box for each food** listed, even if you never eat it.	**Average number of times consumed in the last 3 months:**								
	Never, or less than once a month (0)	**1-3 times per month** (1)	**Once per week** (2)	**2-4 times per week** (3)	**5-6 times per week** (4)	**Once per Day** (5)	**2-3 times per day** (6)	**4-5 times per day** (7)	**6+ times per day** (8)
Dairy Foods Flavoured milk drink (eg milkshake, iced coffee, hot chocolate)									
Milk as a drink									
Milk on breakfast cereals									
Milk in hot beverages (eg in coffee, tea)									
Cream or sour cream									
Ice-cream									
Yoghurt, plain or flavoured (including fromage frais)									
Cottage or ricotta cheese									
Cheddar and other cheeses									
Bread and Cereal Foods White bread, toast or rolls									
Wholemeal/mixed grain bread, toast or rolls									
English muffin, bagel or crumpet									

Dry or savoury biscuits, crispbread, crackers									
Muesli									
Cooked porridge									
Breakfast cereal									
Rice (including white or brown)									
Pasta (including filled), noodles									
Meat, Fish, Eggs Mince dishes (eg. rissoles, meatloaf)									
Mixed dishes with beef, veal (eg casserole, stir-fry)									
Beef, veal – roast, chop or steak									
Mixed dishes with lamb (eg casserole, stir-fry)									
Lamb – roast, chop or steak									
Mixed dishes with pork (eg casserole, stir-fry)									
Pork – roast, chop or steak									
Sausage, frankfurter									
Bacon									
Ham									
Luncheon meats, salami									
Liver (including pate)									

SECTION ONE

For each food listed, place a tick in the box indicating how often **on average** you consumed that food in the **past 3 months.** Please **tick a box for each** food listed, even if you never eat it.	**Average number of times consumed in the last 3 months:**								
	Never, or less than once a month (0)	**1-3 times per month** (1)	**Once per week** (2)	**2-4 times per week** (3)	**5-6 times per week** (4)	**Once per Day** (5)	**2-3 times per day** (6)	**4-5 times per day** (7)	**6+ times per day** (8)
Other offal (eg kidneys)									
Mixed dishes with chicken, turkey, duck (eg casserole, stir-fry)									
Chicken, turkey, duck – roast, steamed, BBQ									
Canned tuna, salmon, sardines									
Fish, steamed, baked, grilled									
Fish, fried									
Other seafood (eg prawns)									
Egg									
Sweets, Baked Goods and Snacks									

Cakes, sweet muffins, scones or pikelets									
Sweet pies or sweet pastries									
Other puddings or desserts									
Plain sweet biscuits									
Cream, chocolate biscuits									
Meat pie, sausage roll or other savoury pastries									
Pizza									
Hamburger									
Chocolate (including chocolate bars eg Mars bars™									
Other confectionary									
Jam, marmalade, syrup or honey									
Peanut butter, or other nut spreads									
Vegemite™, Marmite™, Promite™									
Nuts									
Potato chips, corn chips, Twisties™, etc									
Dressings Oil and vinegar dressing									
Mayonnaise or other creamy dressing									
Non-dairy Beverages Fruit juice									
Vegetable, tomato juices									
Fruit juice drink or fruit drink									
Low-joule cordial									
Cordial									

For each food listed, place a tick in the box indicating how often **on average** you consumed that food in the **past 3 months.** Please **tick a box for each food** listed, even if you never eat it.	**Average number of times consumed in the last 3 months:**								
	Never, or less than once a month (0)	**1-3 times per month** (1)	**Once per week** (2)	**2-4 times per week** (3)	**5-6 times per week** (4)	**Once per Day** (5)	**2-3 times per day** (6)	**4-5 times per day** (7)	**6+ times per day** (8)
Low-joule soft drink									
Soft drinks (including flavoured mineral water)									
Water (including unflavoured mineral water, soda water, tap water)									
Coffee									
Tea									
Soy beverages									
Beer - low alcohol									
Beer – ordinary									
Red wine									
White wine or champagne/sparkling wine									
Wine cooler									
Sherry or port									
Spirits, liqueurs									
Vegetables (including frozen and tinned) Green/mixed salad (including lettuce, tomato etc) In a sandwich									
As a side salad/with a main meal									
Stir-fried or mixed vegetables									
Vegetable casserole									
Excluding their use in the above mixed									

dishes, please indicate how often you eat the following vegetables. Potato, boiled, mashed, baked									
Hot chips									
Pumpkin									
Sweet potato									
Peas									
Green beans									
Silverbeet, spinach									
Broccoli									
Cauliflower									
Brussels sprouts, cabbage, coleslaw									
Carrots									

For each food listed, place a tick in the box indicating how often **on average** you consumed that food in the **past 3 months.** Please **tick a box for each food** listed, even if you never eat it.	**Average number of times consumed in the last 3 months:**								
	Never, or less than once a month (0)	**1-3 times per month** (1)	**Once per week** (2)	**2-4 times per week** (3)	**5-6 times per week** (4)	**Once per Day** (5)	**2-3 times per day** (6)	**4-5 times per day** (7)	**6+ times per day** (8)
Zucchini, eggplant, squash									
Capsicum									
Sweetcorn, corn on the cob									
Mushrooms									
Tomatoes									
Lettuce									
Celery, cucumber									
Onion or leeks									
Soybeans, tofu									
Baked beans									
Other beans, lentils									

Fruits (including dried, frozen, tinned) Apple or pear									
Orange, mandarin or grapefruit									
Banana									
Peach, nectarine, plum or apricot									
Mango or paw paw									
Pineapple									
Grapes or berries									
Melon (eg watermelon, rock melon, honeydew melon)									
Vitamin and Mineral Supplements (including tablets, capsules or drops) Multivitamin with iron or other minerals									
Multivitamin									
Vitamin A									
Vitamin B									
Vitamin C									
Vitamin E									
B-carotene									
Calcium									
Folic acid/Folate									
Iron									
Zinc									

Section Two

1. What type of milk do you usually consume? (please choose one option only)

1 ☐ Whole
2 ☐ Low / reduced fat
3 ☐ Skim
4 ☐ Evaporated or sweetened condensed
5 ☐ None of the above
6 ☐ Don't know

2. How often do you use any of the following products? (please choose one option for each food)

	Never/Rarely	Sometimes	Usually
	1	2	3
a Light cream	☐	☐	☐
b Sour light cream	☐	☐	☐
c Low / reduced fat ice-cream	☐	☐	☐
d Low / reduced fat cheddar-type cheese	☐	☐	☐
e Low / reduced oil salad dressing	☐	☐	☐
f Low / reduced fat spreads	☐	☐	☐

3. How often is the meat you eat trimmed of fat either before or after cooking?

1 ☐ Never / Rarely
2 ☐ Sometimes
3 ☐ Usually/Always
4 ☐ Don't eat meat

4. How many serves of vegetables do you usually eat each day? (a 'serve' = ½ cup cooked vegetables or 1 cup of salad vegetables).

1 ☐ 1 serve or less
2 ☐ 2-3 serves
3 ☐ 4-5 serves
4 ☐ 6 serves or more
5 ☐ Don't eat vegetables

5. How many serves of fruit do you usually eat each day? (a 'serve' = 1 medium piece or 2 small pieces of fruit or 1 cup of diced pieces).

1 ☐ 1 serve or less
2 ☐ 2-3 serves
3 ☐ 4-5 serves
4 ☐ 6 serves or more
5 ☐ Don't eat fruit

6. When cooking, how often do you or the person who cooks your food, use the following?

	Never/Rarely	Sometimes	Usually	Don't Know
	1	2	3	4
a Olive oil	☐	☐	☐	☐
b Canola oil	☐	☐	☐	☐
c Vegetable oil	☐	☐	☐	☐
d Butter	☐	☐	☐	☐
e Margarine	☐	☐	☐	☐
f Dairy blend	☐	☐	☐	☐
g Lard or dripping	☐	☐	☐	☐

BIRTH DETAILS QUESTIONNAIRE

ID no:

★

Maternal & Infant Wellbeing Study

Date Completed: ___/___/___

1. Baby's date of birth ___/___/___

2. Baby's name _____

1. **Was your labour spontaneous or induced?** Spontaneous ( ) Induced ( )

2. What type of delivery did you have? Please select one of the following:

Vaginal no complications ( )
Vaginal breech birth ( )
Elective Caesarean ( )
Emergency Caesarean ( )

3. **Were forceps used during the delivery?** Yes ( ) No ( )

4. **Was other intervention used during the delivery?** Yes ( ) No ( )

If Yes, what was the intervention?
……

5. **Did you use pain relief during labour/birth?** Yes ( ) No ( )

If Yes, what type of pain relief did you use? (e.g., pethadine, epidural, nitrous oxide, etc.). ……

6. **Did your baby arrive on his/her due date?** Yes ( ) No ( )

If No, how many days or weeks did your baby's arrival differ from the due date?

_____ day(s) _____week(s).

Did your baby arrive earlier or later than his/her due date? earlier ( ) later ( )

7. **Did you have twins?** Yes ( ) No ( )

8. **What was the APGAR score for your baby at 1 minute after birth?**
_____
(This information can be found in your yellow Child Health Record Book in the "Birth/1-2 Weeks Review Section" where the Birth Details are documented).
_____ (Baby 2 if applicable)

9. **What was the APGAR score for your baby at 5 minutes after birth**?
_____

_____
(Baby 2 if applicable)

10. **What was your baby's birth weight (in grams)?** _____ _____
(Baby 2 if applicable)

11. **What was your baby's length at birth (in cms)?** _____ _____
(Baby 2 if applicable)

12. **How long was your labour?** _____

13. **What was your last weight prior to delivery (in kilos)?** _____

14. **Was your weight prior to delivery measured objectively by a health professional**? Yes ( ) No ( )

15. **When was your last weighing prior to delivery?** _____ weeks
Day of delivery ( )

16. **What was the total amount of weight gained across your pregnancy (in kilos)?**
_____

17. **Please feel free to use the space below to make any other comments you would like share about the birth experience.**
_____
_____
_____
_____
_____

What feeding practices have you been using **over the past month**? (please circle one)

(1) Exclusively Breastfeeding

(2) Breastfeeding & Formula

(3) Exclusively Formula

(4) Breastfeeding & Solids

(5) Breastfeeding, Formula & Solids

(6) Formula & Solids

DEPRESSION ANXIETY STRESS SCALES (DASS-21)

Please read each statement and **place a tick in the appropriate bracket** to indicate how much of the statement applied to you ***over the past month.*** There are no right or wrong answers. Please do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all

1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of the time
3 Applied to me very much, or most of the time

		0	**1**	**2**	**3**
1	I found it hard to wind down	( )	( )	( )	( )
2	I was aware of dryness in my mouth	( )	( )	( )	( )
3	I couldn't seem to experience any positive feeling at all	( )	( )	( )	( )
4	I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)	( )	( )	( )	( )
5	I found it difficult to work up the initiative to do things	( )	( )	( )	( )
6	I tended to over-react to situations	( )	( )	( )	( )
7	I experienced trembling (e.g., in the hands)	( )	( )	( )	( )
8	I felt that I was using a lot of nervous energy	( )	( )	( )	( )
9	I was worried about situations in which I might panic and make a fool of myself	( )	( )	( )	( )
10	I felt that I had nothing to look forward to	( )	( )	( )	( )

11	I found myself getting agitated	( )	( )	( )	( )
12	I found it difficult to relax	( )	( )	( )	( )
13	I felt down-hearted and blue	( )	( )	( )	( )
14	I was intolerant of anything that kept me from getting on with what I was doing	( )	( )	( )	( )
15	I felt I was close to panic	( )	( )	( )	( )
16	I was unable to become enthusiastic about anything	( )	( )	( )	( )
17	I felt I wasn't worth much as a person	( )	( )	( )	( )
18	I felt that I was rather touchy	( )	( )	( )	( )
19	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)	( )	( )	( )	( )
20	I felt scared without any good reason	( )	( )	( )	( )
21	I felt that life was meaningless	( )	( )	( )	( )

EDINBURGH POSTNATAL DEPRESSION SCALE (EDPS)

*Please place a tick **in the bracket** next to the answer which comes closest to how you have felt **over the past month**, not just how you feel today.*

1. I have been able to laugh and see the funny side of things. As much as I always could ( ) Not quite so much now ( ) Definitely not so much now ( ) Not at all ( )	**6. Things have been getting on top of me.** Yes, most of the time I haven't been able to cope at all ( ) Yes, sometimes I haven't been coping as well as usual ( ) Not, most of the time I have coped quite well ( ) No, I have been coping as well as ever ( )
2. I have looked forward with enjoyment to things. As much as I ever did ( ) Rather less than I used to ( ) Definitely less than I used to ( ) Hardly at all ( )	**7. I have been so unhappy that I have had difficulty sleeping.** Yes, most of the time ( ) Yes, sometimes ( ) Not very often ( ) No, not at all ( )
3. I have blamed myself unnecessarily when things went wrong. Yes, most of the time ( ) Yes, some of the time ( ) Not very often ( ) No, never ( )	**8. I have felt sad or miserable.** Yes, most of the time ( ) Yes, quite often ( ) Not very often ( ) No, not at all ( )
4. I have been anxious or worried for no good reason. No, not at all ( ) Hardly ever ( ) Yes, sometimes ( ) Yes, very often ( )	**9. I have been so unhappy that I have been crying.** Yes, most of the time ( ) Yes, quite often ( ) Only occasionally ( ) No, never ( )

5. I have felt scared or panicky for no very good reason. Yes, quite a lot ( ) Yes, sometimes ( ) No, not much ( ) No, not at all ( )	**10. The thought of harming myself has occurred to me.** Yes, quite often ( ) Sometimes ( ) Hardly ever ( ) Never ( )

BODY ATTTITUDES QUESTIONNAIRE (BAQ)

*Please tick **ONE** set of brackets to indicate how much you agree/disagree with each statement in relation to how you have felt **over the past month.***

		Definitely Disagree (1)	Mostly Disagree (2)	Neutral (3)	Mostly Agree (4)	Definitely Agree (5)
1.	I usually felt physically attractive	( )	( )	( )	( )	( )
2.	People hardly ever found me sexually attractive.	( )	( )	( )	( )	( )
3.	I got so worried about my shape that I felt I ought to diet	( )	( )	( )	( )	( )
4.	I felt fat when I couldn't get clothes over my hips.	( )	( )	( )	( )	( )
5.	I felt satisfied with my face.	( )	( )	( )	( )	( )
6.	I worried that other people could see rolls of fat around my waist and stomach.	( )	( )	( )	( )	( )
7.	I thought I deserved the attention of the opposite sex.	( )	( )	( )	( )	( )
8.	I hardly ever felt fat.	( )	( )	( )	( )	( )
9.	There were more important things in life than the shape of my body.	( )	( )	( )	( )	( )
10.	I felt fat when I wore clothes that were tight around the waist.	( )	( )	( )	( )	( )
11.	I quickly became exhausted if I overdid it.	( )	( )	( )	( )	( )
12.	When I wore loose clothing it made me feel thin.	( )	( )	( )	( )	( )
13.	I hardly ever thought about the shape of my body.	( )	( )	( )	( )	( )
14.	I was proud of my physical strength	( )	( )	( )	( )	( )
15.	When I ate sweets, cakes or other high calorie food, it made me feel fat.	( )	( )	( )	( )	( )
16.	I had a strong body.	( )	( )	( )	( )	( )
17.	I felt fat when I had my photo taken.	( )	( )	( )	( )	( )
18.	I tried to keep fit.	( )	( )	( )	( )	( )
19.	When I thought about the shape of my body, it stopped me from concentrating.	( )	( )	( )	( )	( )
20.	I was preoccupied with the desire to be lighter.	( )	( )	( )	( )	( )
21.	I often felt fat.	( )	( )	( )	( )	( )
22.	I spent a lot of time thinking about my weight.	( )	( )	( )	( )	( )
23.	I was a bit of an ‘Iron-Woman’.	( )	( )	( )	( )	( )
24.	I felt fat when I was lonely.	( )	( )	( )	( )	( )
25.	People often complimented me on my looks.	( )	( )	( )	( )	( )

26.	I felt fat when I could no longer get into clothes that used to fit me.	**( )**	**( )**	**( )**	**( )**	**( )**
27.	I was never strong.	**( )**	**( )**	**( )**	**( )**	**( )**
28.	I tried to avoid clothes that make me feel especially aware of my shape.	**( )**	**( )**	**( )**	**( )**	**( )**

MULTIDIMENSIONAL SCALE OF PERCEIVED SOCIAL SUPPORT (MSPSS)

The following statements relate to the way you feel about the people in your life. Please read each statement and then **place a tick in the bracket** that correspond to how strongly you agree with the statement.

		Very Strongly Agree (7)	**Agree (6)**	**Mildly Agree (5)**	**Neutral (4)**	**Mildly Disagree (3)**	**Disagree (2)**	**Very Strongly Disagree (1)**
1.	There is a special person who is around when I am in need	( )	( )	( )	( )	( )	( )	( )
2.	There is a special person with whom I can share my joys and sorrows	( )	( )	( )	( )	( )	( )	( )
3.	My family really tries to help me	( )	( )	( )	( )	( )	( )	( )
4.	I get the emotional help and support I need from my family	( )	( )	( )	( )	( )	( )	( )
3.	I have a special person who is a real source of comfort to me	( )	( )	( )	( )	( )	( )	( )
6.	My friends really try to help me	( )	( )	( )	( )	( )	( )	( )
7.	I can count on my friends when things go wrong	( )	( )	( )	( )	( )	( )	( )
8.	I can talk about my problems with my family	( )	( )	( )	( )	( )	( )	( )
9.	I have friends with whom I can	( )	( )	( )	( )	( )	( )	( )

	share my joys and sorrows						
10.	There is special person in my life who cares about my feelings	( )	( )	( )	( )	( )	( )	( )
11.	My family is willing to help me make decisions	( )	( )	( )	( )	( )	( )	( )
12.	I can talk about problems with my friends	( )	( )	( )	( )	( )	( )	( )

PITTSBURGH SLEEP QUALITY INDEX (PSQI)

The following questions relate to your usual sleep habits **during the past month only.** Your answers should indicate the most accurate reply for the majority of days and nights in the **past month.**

During the past month:

1. What time have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night?_____
3. What time have you usually gotten up in the morning? _____
4. How many hours of actual sleep do you usually get that night? (This may be different than the number of hours you spend in bed) _____

5.	**During the past month, how often have you had trouble sleeping because you:**	**Not during the past month (1)**	**Less than once a week (2)**	**Once or twice a week (3)**	**Three or more times a week (4)**
a.	Cannot get to sleep within 30 minutes	( )	( )	( )	( )
b.	Wake up in the middle of the night or early morning	( )	( )	( )	( )
c.	Have to get up to use the bathroom	( )	( )	( )	( )
d.	Cannot breathe comfortably	( )	( )	( )	( )
e.	Cough or snore loudly	( )	( )	( )	( )
f.	Feel too cold	( )	( )	( )	( )
g.	Feel too hot	( )	( )	( )	( )
h.	Have bad dreams	( )	( )	( )	( )
i.	Have pain or physical discomfort	( )	( )	( )	( )
j.	Other reason(s), please describe, including how often you have had trouble sleeping because of this:				
	_____	( )	( )	( )	( )
	_____	( )	( )	( )	( )

		Not during the past month (1)	Less than once a week (2)	Once or twice a week (3)	Three or more times a week (4)
6.	During the past month, how often have you taken medicine (prescribed or 'over the counter') to help you sleep?	( )	( )	( )	( )
7.	During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activities?	( )	( )	( )	( )
8.	During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?	( )	( )	( )	( )

		Very Good (1)	Fairly Good (2)	Often Bad (3)	Always Bad (4)
9.	During the past month, how would you rate your sleep quality <u>overall</u>?	( )	( )	( )	( )