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The influence of psychological factors on postpartum weight retention 12 months post-birth

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ABSTRACT
Background: During the first postpartum year 20% of women retain excessive weight from pregnancy (postpartum weight retention; PPWR), which predicts long-term overweight/obesity.
Objective: The aim of this study was to explore the associations between psychological factors (depression, anxiety and stress symptoms and body attitudes) in late gestation and at 12-months postpartum with PPWR one-year post-birth.
Methods: Pregnant women (N = 176) completed questionnaires in early–mid pregnancy (Time 1; mean (SD) = 16.97 (1.35) weeks), late pregnancy (Time 2; mean (SD) = 33.33 (2.05) weeks), and one year postpartum (Time 3; mean (SD) = 53.12 (3.34) weeks). Women provided demographic characteristics, height and pre-pregnancy weight at Time 1. At Times 2 and 3, weight, depressive, anxiety and stress symptoms and body attitudes (salience of weight and shape, attractiveness, feeling fat, and strength and fitness) were assessed in addition to physiological, socio-contextual and lifestyle factors. Gestational weight gain and PPWR were calculated. Hierarchical linear regression models were conducted to explore variance in 12-month PPWR.
Results: Overall, models explained 26–39% variance in PPWR. Gestational weight gain in late pregnancy and low attractiveness at 12 months postpartum were the only variables associated significantly with 12-month PPWR.
Conclusion: While psychological factors did not appear to be important direct contributors to PPWR at 12 months, the overall contribution of all variables suggests that such factors may be implicated in a small and incremental way. Exploration of the interactions between variables will help unpack potential mechanisms of the development of PPWR at 12 months post-birth.

Introduction
Weight gain in women of reproductive age contributes to obesity in child-bearing women (Lan-Pidhainy, Nohr, & Rasmussen, 2013; Melzer & Schutz, 2010). Postpartum weight retention (PPWR) contributes to this health issue (Holland, Groth, & Kitzman, 2015; Montpetit, Plourde, Cohen, & Koski, 2012). One in five women experience substantial PPWR (Althuizen,
van Poppel, de Vries, Seidell, & van Mechelen, 2011), classified as the retention of 5 kg or more above pre-pregnancy weight at 6 months and one year after delivery (Gunderson et al., 2008; Phillips, King, & Skouteris, 2014). Excessive PPWR contributes to the development of several chronic lifestyle diseases (Kac, Benicio, Velasquez-Melendez, & Valente, 2004; Rooney, Shauberger, & Mathiasen, 2005), increases the risk of mental illness including postpartum mood disorders (Astrachan-Fletcher, Veldhuis, Lively, Fowler, & Marcks, 2008) and is implicated in higher weight status in both the short (Zilko, Rehkopf & Abrams, 2010) and long term (Linné, Dye, Barkeling, & Rossner, 2004). In order to implement effective intervention and prevention strategies to reduce the associated health outcomes of long-term obesity, it is important to understand the aetiology and perpetuating factors for PPWR within the first year post-birth.

Various physiological, sociocultural, medical and behavioural factors have been associated with PPWR. The most salient of these is excessive gestational weight gain (GWG), which is defined as weight gain above the recommended range for each BMI category according to the Institute of Medicines (IOM) guidelines (2009; Amorim, Rossner, Neovius, Lourenco, & Linné, 2007; Martin, Hure, Macdonald-Wicks, Smith, & Collins, 2014). Additional factors include high pre-pregnancy body mass index (BMI; Davis, Zyzanski, Olson, Stange, & Horwitz, 2009), poor sleep quality at 6 months postpartum (Gunderson et al., 2008), poor socioeconomic status (Shrewsbury, Robb, Power, & Wardle, 2009), reduced social support (Sterling et al., 2009), low maternal education (Siega-Riz et al., 2010), older age (Kac et al., 2004), multiparity (Gunderson & Abrams, 1999), low levels of breastfeeding (Kac et al., 2004) and decreased physical activity during both pregnancy and postpartum (Althuizen et al., 2011).

In contrast to research on physiological, sociocultural, medical and behavioural factors, the contribution and importance of psychological factors measured during pregnancy and in the late postpartum period to PPWR one year post-birth is comparatively less understood (Siega-Riz et al., 2010). Symptoms of depression, stress and anxiety during pregnancy and the early postpartum (up to 6 months) are associated with PPWR (Herring et al., 2008; Pederson et al., 2011; Phillips, King, & Skouteris, 2013; Phillips et al., 2014; Whitaker, Young-Hyman, Vernon, & Wilcox, 2014). Moreover, body image concerns among postpartum women are reportedly associated with depression, stress and anxiety (Walker, 1998). It has been argued that postpartum women may experience psychological distress due to an inability to return to their pre-pregnancy weight quickly (Walker, Timmerman, Kim, & Sterling, 2002), and when the perception of their weight is no longer attributed to pregnancy, body dissatisfaction ensues (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009b; Gjerdingen et al., 2009; Rallis, Skouteris, Wertheim, & Paxton, 2007). Among investigations of psychological correlates of PPWR at 12 months postpartum, research has been limited to observing only depressive symptoms (Siega-Riz et al., 2010), only depressive and stress symptoms (Whitaker et al., 2014), or excluding psychological factors altogether (He, Hu, Chen, Wang, & Qin, 2014).

In order to deepen our understanding of the role psychological factors have with PPWR, Phillips, King, and Skouteris (2012) proposed a conceptual, multifactorial model to outline the contribution of maternal physiological and physical, socio-contextual and lifestyle, psychological and behavioural factors to PPWR (Figure 1). The model asserts that psychological constructs such as depressive, anxiety and stress symptoms and body dissatisfaction are implicated in women’s ability to partake in healthful behaviours, which directly impact PPWR. Phillips et al. (2013, 2014) have evaluated the contribution of these factors to PPWR at 3, 6 and 9 months postpartum, reporting that stress at 3 months postpartum was positively
correlated with excessive PPWR at the same time point, and higher body dissatisfaction at both 3 and 6 months postpartum was associated with greater PPWR at 9 months. Evaluations of the model include exploration of the association between psychological factors experienced both during pregnancy and the postpartum period and their impact on PPWR because pregnancy represents a transition period where body changes occur rapidly (Park, Senior, & Stein, 2003) and persist into the postpartum (Herring et al., 2008).

Given that past studies have not simultaneously explored the contribution of psychological factors (depression, stress, anxiety, and body image) to postpartum weight retention at 12 months, the overall aim of this study was to evaluate the contribution of psychological factors to PPWR at 12 months as proposed in the model by Phillips et al. (2012). Specifically, we aimed to: (1) explore the relationship between psychological factors (depressive, anxiety and stress symptoms and body image) during late gestation with PPWR at 12 months, after controlling for the influences of socio-contextual, maternal lifestyle, physiological and physical weight factors; and (2) investigate the concurrent associations between psychological factors and PPWR at 12 months, after controlling for the above variables.

**Method**

*Participants and procedure*

Pregnant women between 16 and 18 weeks gestation were recruited via advertisements in the media, parenting magazines, online forums and an antenatal clinic in the Western area of metropolitan Melbourne, Australia to take part in a postal questionnaire study exploring maternal psychosocial well-being during pregnancy and the first 12 months post-birth. Data were collected early on in pregnancy (Time 1; T1; \(M (SD) = 16.97 (1.35)\) weeks gestation), late pregnancy (Time 2; T2; \(M (SD) = 33.33 (2.05)\) weeks gestation) and at 12 months post-birth (Time 3; T3; \(M (SD) = 53.12 (3.34)\) weeks postpartum). Of 467 women recruited, 386 (83%) provided data at 32 weeks pregnant, and 246 (53%) provided data at 12 months postpartum. Participants were excluded due to no height and weight data (\(n = 7\)), substantial missing data (\(n = 34\)) and univariate/multivariate outliers (\(n = 27\)). Thus, 178 women were included.
in the current analyses. There were no significant differences with respect to demographics and weight variables between the final sample and those excluded. Ethics approval was obtained from the relevant Human Research Ethics committees.

**Measures**

Pre-pregnancy BMI and demographics were recorded at T1 (early gestation), GWG at T2 (approximately 33 weeks gestation) and PPWR at T3 (12 months post-partum). The additional predictor variables including anxiety and distress, depression, body dissatisfaction, physical activity, social support and sleep quality were assessed at both T2 and T3. Measures are presented in the categories indicated in Phillips et al.’s (2012) model.

**Outcome variable**

**PPWR at 12 months**

PPWR was calculated by subtracting weight at T1 (baseline) from weight at T3 (12 months post-birth). Postpartum weight retention was defined as the difference in weight of at least 5 kg compared to pre-pregnancy weight (Pederson et al., 2011).

**Predictor variables**

**Psychological variables**

**Psychological distress.** The Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987) was used to assess depressive symptoms over the past month. The EPDS has been validated for use in the gestational and postpartum periods (Thorpe, 1993). Items were summed to achieve a global score. Cronbach’s alphas in the current study were .82 for T2 and .65 for T3.

The Depression, Anxiety, and Stress scale – Short form (DASS-21; Lovibond & Lovibond, 1995) subscales were used to assess symptoms of anxiety and stress. Symptoms were evaluated over the past month, with higher scores signifying greater severity. Relevant items for each subscale were summed to create total subscale scores. Cronbach’s alpha for anxiety were .71 (T2) and .75 (T3), and for stress were.76 (T2) and .83 (T3).

**Body attitudes.** The Ben-Tovim Walker Body Attitudes Questionnaire (BAQ) was used to assess body image constructs (Ben-Tovim & Walker, 1991). Four subscales appropriate for pregnant and postpartum women were used: attractiveness, salience of weight and shape, strength and fitness and feeling fat. Scores were summed to compute a subscale score for each construct with higher scores representing greater support for each component. Cronbach’s alphas for each scale in the current study were: feeling fat .85 (T2) and .90 (T3); attractiveness .65 (T2) and .80 (T3); salience of weight and shape .71 (T2) and .85 (T3); strength and fitness .78 (T2) and .83 (T3).

**Covariates**

Covariates in the model were based on the factors considered to contribute to psychological distress in Phillips et al.’s (2012) conceptual model, and were classified as maternal physiological and physical weight factors, socio-contextual and lifestyle factors, and behaviours.
Maternal physiological and physical weight factors
Pre-pregnancy weight was assessed via self-report at T1. Weight at T2 was assessed via self-report. At T3, 10.7% of weight measures were collected objectively by a researcher during a home visit and the remaining were self-reported.

Pre-pregnancy BMI. Pre-pregnancy BMI was computed as kg/m². Pre-pregnancy BMI was classified in accordance with World Health Organisation (World Health Organisation (WHO), 2000) guidelines.

Gestational weight gain. Gestational weight gain was calculated by subtracting pre-pregnancy weight (T1) from T2 weight (32 weeks gestation). Women were classified according to IOM (2009) recommendations for total GWG.

Sleep quality. Sleep quality was assessed at T2 and T3 with the Pittsburgh Sleep Quality Index (PSQI; Buysee, Reynolds, Monk, & Berman, 1989). The PSQI quantifies patterns and quality of sleep over the past month with a total indicating overall sleep quality. The scale has been validated in both pregnancy and the postpartum (Jomeen & Martin, 2007).

Socio-contextual and lifestyle factors
Social support. Social support was assessed at T2 and T3 using the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, & Farley, 1988). The MSPSS measures perceived social support from family, friends and significant others. Items were summed to obtain a total score of perceived social support. Construct validity and test–retest reliability have been supported (Zimet et al., 1988). Cronbach’s alphas for the current study were .92 (T2) and .92 (T3).

Demographics. Demographic information included maternal age, ethnicity, educational attainment, household income and parity.

Behaviours
At T2 and T3, participants reported duration (in minutes) of physical activity (low to high intensity exercise) over the past week, based on one self-reported item. Exclusive breast-feeding was not included in the current study given recommendations do not exceed 6 months (WHO, 2016). As per Phillips et al.’s (2014) study at 9 months postpartum, fruit and vegetable intake was not included.

Statistical analyses and power calculation
Data were analysed using IBM SPSS Version 23.0. A total of 262 cases with substantial missing data, including incomplete time points, were removed. Data were not missing completely at random; recruitment from the general population (vs. antenatal clinic) was associated with missingness (>5%). Missing data (<5%) were found for physical activity at 12 months and GWG, which was replaced with expectation maximisation. Regression assumptions and preliminary analyses were conducted to ensure no violation of normality, linearity, multicollinearity and homoscedasticity. Transformations did not address skew or kurtosis issues, hence multivariate and univariate outliers (according to Mahalanobis’ distance) were removed (27 cases) to improve skew/kurtosis. The final sample size was 178.
As per the approach by Phillips et al. (2014) at 3 months postpartum, two hierarchical regressions were conducted. In the first model, 12-month PPWR was regressed on 14 variables from gestation (T2). In the second model, 12-month PPWR was regressed on 14 variables at 12 months post-birth (T3). Recruitment source (antenatal clinic or general population) was entered at step 1 to account for missingness. In each model, GWG, pre-pregnancy BMI and sleep quality were entered at step 2 due to GWG’s strong relationship with PPWR. At step 3, demographic variables were entered, followed by maternal behavioural factors at step 4. Stress, anxiety and depressive symptoms were entered at step 5, and body attitudes at step 6.

The sample size (\(N = 178\)) gave sufficient power based on an alpha level of .05, a moderate effect size of 0.15 and 97.7% power to identify an association between psychological variables and PPWR (G*Power (Version 3.1.9.2); Faul, Erdfelder, Lang, & Buchner, 2007). Furthermore, according to Green (1991), \(50 + 8k\) where \(k\) is the number of predictors is the minimum acceptable sample size for the regression model to be a total fit. Fourteen predictor variables were included in each model, thus a minimum of 162 participants were required.

**Results**

Demographic characteristics of the current sample are shown in Table 1. Participants were largely Caucasian, married, educated sample, in paid employment and an average household income greater than AUD$105,000 (average yearly income in Australia in 2016–17 was approximately $80,278; Australian Bureau of Statistics, 2017). Mean age was 31.4 years (SD = 4.64; range 19–43). Pre-pregnancy BMI, GWG and PPWR are displayed in Table 1. Approximately half the women were classified as overweight/obese (\(n = 94; 52.8\%\)) and 54 (30.3%) exceeded GWG recommendations. Thirty-six women (20.2%) retained greater than 5 kg at 12 months postpartum (\(M = 0.5\) kg; SD = 6.49).

Intercorrelations for PPWR and study variables at T2 and T3 are shown in Tables 2 and 3 and results of the hierarchical linear regressions are presented in Table 5. The first regression model explored statistical predictors at T2 (late gestation) of PPWR (Table 4). At step 1, entry of recruitment source contributed no significant variance (\(p = .81\)). At step 2, physiological facets including GWG, pre-pregnancy BMI and sleep quality explained 17.7% of the variance in PPWR (\(\Delta R^2 = .20, F(3, 153) = 12.54, p < .001\)), with GWG the only unique predictor (\(\beta = .46, p < .001\)). Social support, age and education (step 3), contributed no significant additional variance (\(p = .70\)). Similarly, physical activity duration at step 4 (\(p = .47\)), depression, anxiety and stress symptoms at step 5 (\(p = .50\)) and body attitude constructs at step 6 (\(p = .16\)) offered no additional significant contribution to variance in PPWR. Overall, this model explained 25.6% of the total variance of PPWR at 12 months postpartum.

A second hierarchical regression was conducted to explore predictors at T3 (postpartum) of PPWR at 12 months post-birth (Table 5). Recruitment source (step 1) was not associated with 12-month PPWR (\(p = .83\)). At step 2, GWG, pre-pregnancy BMI and sleep quality accounted for 21.7% of the variance in PPWR (\(\Delta R^2 = .21, F(3,153) = 14.15, p < .001\)). At step 3, social support, age, and education offered no additional unique variance (\(p = .72\)). Entry of physical activity (step 4) along with depression (\(p = .65\)), anxiety and stress symptoms (\(p = .86; \text{step } 5\)), explained no further variance in PPWR. At step 6, feeling fat, attractiveness, salience of weight and shape and feelings of strength and fitness added 15.7% variance
(Δ$R^2 = .04$, $F(4,142) = 9.12, p < .001$), with attractiveness contributing uniquely to the model ($β = -.32, p < .001$). Overall, the model explained 38.7% of the total variance of PPWR at 12 months postpartum.
Table 2. Correlations of T2 (gestational) variables (N = 178).

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<th>M (range) SD</th>
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<td>.42**</td>
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<td>.07</td>
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<td>-.08</td>
<td>.01</td>
<td>.54 (20.5, 28.5)</td>
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<td>.115</td>
<td>.04</td>
<td>.16*</td>
<td>-.09</td>
<td>.27**</td>
<td>.14</td>
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<td>26.50 (15.51, 50.88) 5.22</td>
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<td>.04</td>
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<td>.14</td>
<td>-.24**</td>
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<td>7 Attractiveness</td>
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<td>-.51**</td>
<td>-.34**</td>
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<td>8 Feeling fat</td>
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*p < .01; **p < .05.
Table 3. Correlations of T3 (postpartum) variables (N = 178).

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<td>2.115.39 (8, 24) 2.81</td>
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<td>8 Feeling fat</td>
<td>-</td>
<td>-.48**</td>
<td>-.31**</td>
<td>.47**</td>
<td>-.09</td>
<td>-.18*</td>
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<td>2.115.39 (8, 24) 2.81</td>
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<td>9 Salience of weight and shape</td>
<td>-</td>
<td>.79**</td>
<td>-.33**</td>
<td>.11</td>
<td>-.22**</td>
<td>.13</td>
<td>-.03</td>
<td>33.78 (12, 55) 10.13</td>
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<td>10 Strength and fitness</td>
<td>-</td>
<td>-.23**</td>
<td>.05</td>
<td>.19*</td>
<td>.03</td>
<td>-.01</td>
<td>13.43 (8, 20) 2.58</td>
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<td>11 Physical activity</td>
<td>-</td>
<td>.05</td>
<td>-.09</td>
<td>.02</td>
<td>.13</td>
<td>16.44 (9, 24) 2.76</td>
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<td>12 Perceived social support</td>
<td>-</td>
<td>.02</td>
<td>-.08</td>
<td>-.03</td>
<td>214.30 (0, 990) 175.91</td>
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<tr>
<td>13 Age</td>
<td>-</td>
<td>.08</td>
<td>.02</td>
<td>73.84 (45, 84) 8.57</td>
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<td>14 Education</td>
<td>-</td>
<td>.02</td>
<td>31 (19,43) 4.65</td>
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*p < .01; **p < .05.
Discussion

The aim of this study was to explore the relationship between psychological factors (body image and symptoms of depression, anxiety and stress) during late gestation and concurrently with PPWR at 12 months using Phillips et al.'s (2012) conceptual model as a guide. Consistent with past research, GWG at 32 weeks pregnant was found to be the strongest predictor of PPWR one year postpartum (Amorim et al., 2007; Linné et al., 2004; Pederson...
et al., 2011; Siega-Riz et al., 2010). Of the psychological factors, feeling less attractive at 12 months postpartum was the only variable associated with 12-month PPWR. Only two previous studies (Clark et al., 2009b; Rallis et al., 2007) have explored the association between body image with PPWR at 12 months. Rallis et al. (2007) reported no association between body image and PPWR, whilst Clark et al. (2009b) reported feeling fat and salience of weight and shape to be associated with increased PPWR. Investigation of how body image is associated with PPWR throughout the first postpartum year is similarly contradictory. For instance, Phillips et al. (2014) reported that salience of weight and shape (but not strength and fitness, feeling fat or attractiveness) at 3 and 6 months was associated with 9-month PPWR. At 9 months postpartum, Gjerdingen et al. (2009) found global body dissatisfaction to be related to PPWR. Collectively, this body of research suggests that body dissatisfaction may contribute to PPWR in complex and unique ways across the reproductive life phase. For instance, women may experience dissatisfaction with their body due to changes associated with pregnancy and childbirth (Rallis et al., 2007), diminishing the resolve to return to a pre-pregnancy weight and contributing to PPWR (Amorim et al., 2007). In contrast, the lack of association between body image during gestation with weight retention at 12 months postpartum reported here corresponds with research suggesting a temporary reprieve from body image concerns during pregnancy as a result of acceptance of the change in functionality of the pregnant body (Rallis et al., 2007; Watson, Fuller-Tyszkiewicz, Broadbent, & Skouteris, 2015) and therefore body image concerns in pregnancy are not directly related to PPWR. Additionally, the lower Cronbach’s alpha of attractiveness in the present study (α = 0.65) at the end of gestation may indicate women’s varied experiences of attractiveness during pregnancy, whereby some women may feel unattractive in later stages of pregnancy and other women may embrace a new type of attractiveness associated with pregnancy. Consequently, the pregnancy period where some women are more ‘accepting’ of their body could be an opportunity to educate women about body image concerns that may be experienced in the postpartum, including elements surrounding realistic weight and emotional changes likely to occur (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009a).

The lack of association between depressive and anxiety symptoms during gestation and at 12 months postpartum may indicate that the salience of psychological distress and its potential impact on weight retention reduces throughout the postpartum period. Phillips et al. (2013) found stress to contribute a significant amount of variance to 3-month PPWR. Previous studies have found women experience higher depression and anxiety symptoms at 3 and 6 months postpartum compared to 12 months (McCall-Hosenfeld, Phiri, Shaefer, Zhu, & Kjerulff, 2016).

Maternal physiological, socio-contextual and medical factors were proposed to influence PPWR in the model described by Phillips et al. (2012). Contrary to previous findings, we found no associations between these factors either during pregnancy or at 12 months postpartum with 12-month PPWR (Kac et al., 2004; Siega-Riz et al., 2010). Hence, it is possible that these factors are implicated in late PPWR indirectly (Riley, 2011; e.g. by influencing factors that are more closely related to PPWR such as physical activity or dietary behaviours) or that other factors not included in Phillips et al. (2012) model have stronger associations with PPWR. Maternal behaviour, specifically physical activity, proposed to directly influence PPWR was not found to be significantly associated with 12-month PPWR in this study. This could be due to the brevity of the measure used and its insensitivity in picking up small changes in activity levels (Australian Institute of Health and Wellbeing, 2003). Past research has indicated
structured physical activity is associated with reduced 12-month PPWR (O’Toole, Sawicki, & Artal, 2004). It has been suggested that pregnant women disengage from healthy lifestyles (such as physical activity) and develop poor maternal behaviours, which may transfer into the postpartum, creating suboptimal behaviours, thus preventing successful weight loss (van der Pligt et al., 2016). Atkinson, Shaw, and French (2016) explored women's decisions regarding behaviours throughout pregnancy and found women act upon bodily signals and perception of acceptable behaviour, which were often contrary to what health professionals advised and tended to follow a view of a temporary respite from a healthful lifestyle. While not possible in the current study due to the large number of predictor variables and restrictive sample size, other analysis methods such as path analysis will allow this possibility to be tested and may provide insight into the mechanisms implicated in the development of 12-month PPWR.

One quarter of the variance in 12-month PPWR was explained by the variables in late pregnancy included in the model, and concurrently measured predictors explained almost 40% of the variance in 12-month PPWR. Whitaker et al. (2014) tested a model of stress, GWG and demographic factors on PPWR, finding that 23% of the variance in 12-month PPWR was explained by their model. Given the additional variables included in our model these findings appear consistent, but suggest that comprehensive models of determinants of PPWR have added value when variables are evaluated together rather than independently.

Limitations

Firstly, the study's sample is relatively homogeneous; the majority of participants reported characteristics commensurate with a high socioeconomic status. As such, the findings cannot be generalised to more diverse populations given individuals with alternate ethnicities or lower socioeconomic status may experience different psychosocial concerns (Huang, Wang, & Dai, 2010) and PPWR (Shrewsbury et al., 2009). In addition to this, although it is possible that women who dropped out of the study differed from women who were retained (albeit this was not apparent when comparing included and excluded women), the high drop-out rate when going from pregnancy (T2) to postpartum (T3) is a limitation of the study. Secondly, the majority of weight data were reported subjectively. However, the accuracy of self-reported weight in perinatal populations has been found to be satisfactory (Herring et al., 2008; McPhie et al., 2011). Thirdly, dietary variables could not be included in our model due to substantial missing data. Consequently, the contribution of dietary behaviours to 12-month PPWR could not be ascertained. Past research has identified poor dietary intake with high levels of total energy intake is associated with increased weight retention (Oken, Taveras, Popoola, Rich-Edwards, & Gillman, 2007). Finally, early postpartum predictors of 12-month PPWR were not explored due to sample size restrictions.

Conclusion

While depression, anxiety and stress symptoms during late pregnancy or at 12 months postpartum were not associated with 12-month PPWR, feelings of attractiveness were significantly and concurrently related to 12-month PPWR. This was the first study to explore the concurrent associations at this time point. The value of comprehensive and multifactorial models understanding weight outcomes (e.g. Phillips et al., 2012) are important to consider.
in future research due to the collective value of variables associated with PPWR. Furthermore, unpacking and exploring the changes of body image throughout pregnancy and postpartum is essential; support and education regarding acceptance of the bodily changes occurring during the reproductive life phase may assist in curbing weight gain associated with childbearing.

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