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Disordered eating from pregnancy to the postpartum period: The role of psychosocial and mental health factors

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ABSTRACT

The postpartum period has been identified as high-risk period for the increase of disordered eating. This study examined the psychosocial factors-attitudes to motherhood, self-compassion and relationship satisfaction- and mental health factors-depressive and anxiety symptoms-associated with this increase. One hundred and fourteen women completed online questionnaires about their eating behaviours between: 18–24 weeks gestation (T1), 30–32 weeks gestation (T2) and 8–10 weeks postpartum (T3). A cluster analysis examined the change of disordered eating from T2 to T3. Multinomial logistic regressions examined which demographic, psychosocial and mental health factors were associated with disordered eating cluster groups, as individual factors and as a combined model of predictors at T1, T2 and T3. Four cluster groups were identified: 'lower disordered eating', 'increasing risk', 'sub-clinical' and 'clinical'. All psychosocial and mental health predictors were individually associated with a risk group, when compared to the lower disordered eating group. However, when combined, only multiparity and higher depressive symptoms were associated with the sub-clinical group. Multiparity, higher pre-pregnancy body mass index and lower self-compassion were associated with the increasing risk group. This study introduces self-compassion as a psychosocial factor worthy of further investigation and application in the field of perinatal disordered eating, with promising avenues for antenatal intervention.

1. Introduction

Pregnancy and the postpartum period are important transitional periods for women, each marked with their own milestones and challenges. Whilst these periods are for many a positive transition, for others they are marked with mental health concerns (Linna et al., 2014). Depressive and anxiety symptoms are the more recognised mental health symptoms during these periods (Linna et al., 2014). However, disordered eating symptoms, which are defined as a group of cognitions and behaviours common to a diagnosis of an eating disorder, including dietary restraint, shape and weight concern, binge eating and compensatory behaviours like purging or excessive exercise, are becoming an increasing area of concern during this transition, not just for women with a history of an eating disorder, but within the general population (Broussard, 2012). Disordered eating or poor eating habits during the perinatal period can have negative implications for the birth outcomes and physical and psychological development of the infant (Astrachan--Fletcher, Veldhuis, Lively, Fowler, & Marcks, 2008; Linna et al., 2014).

Nonetheless, several cohort and cross-sectional studies have identified an improvement or even remission of disordered eating behaviours during pregnancy for some women, including symptoms of body dissatisfaction, restrictive dieting and purging amongst women with an eating disorder prior to pregnancy (Blias et al., 2000; Crow, Agras, Crosby, Halmi, & Mitchell, 2008; Rocco et al., 2005) and amongst women without a diagnosis of an eating disorder (Chan et al., 2019; Nunes, Pinheiro, Hoffman & Schmidt, 2014). The improvement in some disordered eating behaviours have been attributed to an increasing sense of wellbeing, acceptance of the pregnancy body and motivation to protect the unborn baby (Crow et al., 2008; Fogarty, Elmir, Hay, & Schmied, 2018; Nunes, Pinheiro, Hoffmann, & Schmidt, 2014).

However, cohort studies following women across pregnancy and the postpartum period have proposed a trend, whereby some disordered eating symptoms may improve in the middle of pregnancy but increase at the end of pregnancy and during the postpartum period, particularly for women with a history of an eating disorder or active disordered eating prior to pregnancy (Crow et al., 2008; Easter et al., 2015; Rocco et al., 2005). Moreover, in a community-based study, weight and shape concerns postpartum were even higher than pre-gestation levels,

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indicating a noteworthy risk of disordered eating during this period (Nunes et al., 2014). The proposed reasons for a change in disordered eating postaprtum include the physical changes in the postpartum body and a pressure to return to pre-pregnancy weight, coupled with the stressors of a new baby and sleep deprivation (Astrachan-Fletcher et al., 2008; Mitchell & Bulik, 2006; Rocco et al., 2005). In addition, women may no longer have the motivation to maintain healthy practices or changes introduced during pregnancy and are less likely to be engaged in frequent monitoring with a health care professional as they were during pregnancy (Nunes et al., 2014; Tierney, Fox, Butterfield, Stringer, & Furger, 2011).

Another area of explanation that may underlie an increase in disordered eating postpartum is psychological related factors. This includes attitudes and beliefs about oneself and the role and responsibilities of motherhood (Baskin, Meyer, & Galligan, 2020). Cognitive distortions and unrealistic beliefs of motherhood, which develop through one's own childhood experience and subsequent experiences-including societal, have been tied to an increased risk of perinatal depression and anxiety and are now incorporated successfully into the treatment for perinatal mental illness (Milgrom, Martin, & Negri, 1999; Milgrom, Negri, Gemmill, McNeil, & Martin, 2005). The cognitive model of emotional distress posits that in the context of environmental stressors, maladaptive beliefs and attitudes are activated and drive negative affect and behaviour (Beck & Haigh, 2014). Given the numerous stressors associated with the early period of parenthood, the milieu for triggering maladaptive cognitive attitudes and beliefs is increasingly common and may extend to influence disordered eating cognitions and behaviours (Sockol & Battle, 2015).

Whilst few studies to date have explored the direct relationships between maladaptive attitudes or beliefs and disordered eating postpartum, as with eating disorders more broadly, women with an eating disorder history or eating disorder during the perinatal period, have been shown to display traits of perfectionism and are more likely to experience a sense of failure over their mistakes and express that they are not a good enough mother (Koubaa, 2008; Mazzeo et al., 2006). There is also qualitative evidence to indicate that women experiencing eating disorders during the perinatal period display negative views and core beliefs about themselves and report disappointment with motherhood and unfulfilled expectations (Tillotson, Cooper, & Turner, 2013). Woman with an eating disorder history also expressed that their inability to live up to their self-imposed expectations during motherhood, and associated negative affect, was a factor triggering disordered eating postpartum (Tierney et al., 2011).

A related attitudinal factor that is gaining popularity in the eating disorder literature is self-compassion, which consists of the ability to display a positive attitude towards oneself in the face of suffering or failure, being able to see suffering as part of the common human experience and acceptance of one's painful experience in a non-judgmental way, with its polar opposite being self-judgement, self-criticism and isolation in human experience (Costa, Marôco, Pinto-Gouveia, Ferreira, & Castilho, 2016; Neff, 2003). A recent systematic review examining self-compassion and disordered eating identified that self-compassion was consistently linked to lower levels of eating pathology and was a protective factor against the development of disordered eating (Braun, Park, & Gorin, 2016). Additionally, low self-compassion is associated with increased depressive and anxiety symptoms during pregnancy and the postpartum period (Felder, Lemon, Shea, Kripke, & Dimidjian, 2016). However, no known studies to date have examined self-compassion in relation to disordered eating during the perinatal period.

Given the interpersonal nature of parenting, however, it is unlikely that attitudinal factors alone account for an increase in disordered eating postpartum. In fact, assessing relational satisfaction and support are a key aspect in ascertaining the psychosocial risk profile of women in the perinatal period (Austin, Fisher, & Reilly, 2015). Further, relational support may mitigate the stressful environmental triggers of attitudinal factors (Sockol & Battle, 2015). Relational strain is common during the early postpartum period, particularly for multiparous women (Sockol & Battle, 2015). Whilst many women manage the adjustment until a new equilibrium is formed, others may turn to disordered eating to manage the stress and isolation, especially for women with a history of poor emotion regulation (Knoph Berg et al., 2011; Lai, Tang, & Tse, 2006; Svaldi, Griepenstroh, Tuschen-Caffier, & Ehring, 2012). Studies examining relationship factors and disordered eating have indicated that decreased instrumental spousal support during pregnancy and poor relationship satisfaction postpartum were both associated with increased disordered eating postpartum (Knoph et al., 2013; Lai et al., 2006).

Overall, literature investigating the factors associated with disordered eating during the postpartum period is scarce (Baskin & Galligan, 2019). More specifically, the end of pregnancy and early postpartum are periods that have been identified as high-risk periods for the triggering or worsening of disordered eating (Abraham, Taylor, & Conti, 2001; Easter et al., 2015; Rocco et al., 2005). Trying to understand the change in disordered eating during these periods is an important first step that will identify women at risk already during pregnancy and inform early interventions and education to support them prior to the birth of their baby or during the postpartum period. Pregnancy has also been described as opportune time for intervention due to the increased motivation to protect the baby and engagement in health services (Fogarty et al., 2018). Nonetheless, the factors which may require intervention, psychological or social, remain unknown.

Therefore, the aims of this of this study were: (1) Identify the change of disordered eating from pregnancy to the postpartum period, (2) identify whether psychosocial factors-attitudes to motherhood, self-compassion and relationship satisfaction-during pregnancy are associated with the change of disordered eating from pregnancy to the postpartum period and (3) identify whether psychosocial factors during the postpartum period are associated with the change of disordered eating from pregnancy to the postpartum period. Previous studies have confirmed that there is a significant association between perinatal depressive and/or anxiety symptoms and disordered eating and recommend that to gain a full understanding of the complex relationships between psychosocial factors and disordered eating, these symptoms be included in the exploration (Baskin & Galligan, 2019). Therefore, a final aim of this study was to examine (4) whether adding depressive and anxiety symptoms to a model of psychosocial factors and disordered eating improves prediction of disordered eating.

2. Method

2.1. Participants

The findings from this study came from an Australian prospective cohort study that recruited pregnant women between October 2016 and September 2017 from social media and flyers placed at universities, hospitals and shopping centres (Baskin et al., 2020). Women who were living in Australia, aged 18 years and over and between 18 and 24 weeks gestation during the recruitment period were eligible to participate. No other exclusion criteria applied. Women were asked to complete online questionnaires between three periods: 18–24 weeks gestation (T1), 30–32 weeks gestation (T2) and 8–10 weeks after their due date (T3). Participants who completed questionnaires at each period included $n = 273$ (T1), $n = 167$ (T2) and $n = 135$ (T3), resulting in a retention rate of 61.17% (T2) and 49.45% (T3). A total of $n = 115$ participants completed questionnaires at all time points.

2.2. Procedures

Participants completed an initial online questionnaire between 18 and 24 weeks gestation via a link that was placed on the advertisement of the study. Women who agreed to follow up were emailed the link to

the further questionnaires to complete within the T2 and T3 periods. This study was approved by Swinburne's Human Research Ethics Committee.

2.3. Measures

2.3.1. Demographics

At T1, participants were asked to provide information about their age, marital status, parity, pre-pregnancy weight (kg) and height (m), education level, current working status and a history of a diagnosed eating disorder. Parity was defined as the number of pregnancies beyond 20 weeks gestation experienced, with zero categorised as primiparous and one or more as multiparous (Australian Institute of Health and Welfare, 2019). At T3, participants were asked to again report on their current employment, marital status and their weight when baby was born (Kg). Pre-pregnancy body mass index (BMI) was calculated as pre-pregnancy weight Kg/m^2. Gestational weight gain was calculated as the difference between their weight when baby was born and pre-pregnancy weight

2.3.2. Dependant variable

2.3.2.1. Disordered eating symptoms. The eating disorder examination-questionnaire (EDE-Q) examines self-reported disordered eating cognitions and behaviours over the previous 28 days (Fairburn & Beglin, 2008). Four subscales can be computed from 22 of the items: restraint, eating concerns, weight concerns and shape concerns with a score ranging from zero to six. An average total score is calculated from the four subscales, with higher scores indicating increased disordered eating. Additionally, a score of 2.5 or above on the EDE-Q has been used to indicate clinically elevated symptoms (Rø, Reas, & Stedal, 2015). This paper examined disordered eating total scores at T2 and T3 only. Good reliability estimates were obtained using McDonald's Omega, 0.91 (T2) and 0.86 (T3)

2.3.3. Independent variables

2.3.3.1. Depressive symptoms. The Edinburgh Postnatal Depression Scale (EPDS) is a widely used self-report scale to assess depressive symptoms in pregnancy and the postpartum period (Cox, Holden, & Sagovsky, 1987; Murray & Cox, 1990). The EPDS includes 10 items that ask participants to rate the intensity of symptoms over the previous seven days. Total scores range from 0 to 30, with higher scores representing increased depressive symptoms. Good reliability estimates were obtained using McDonald's Omega, 0.95 (T1), 0.95 (T2) and 0.94 (T3)

2.3.3.2. Anxiety symptoms. The Depression, Anxiety and Stress scale (DASS)-Anxiety subscale is a widely used self-report measure of anxiety in Australia (Lovibond & Lovibond, 1995). It has been used to assess anxiety symptoms in the perinatal period in clinical and research settings (Austin & Highet, 2017). The anxiety subscale includes seven items, which are summated to compute a total anxiety score ranging from 0 to 21. Good reliability estimates were obtained using McDonald's Omega, 0.92 (T1), 0.88 (T2) and 0.93 (T3).

2.3.3.3. Attitudes to motherhood. The Attitudes Towards Motherhood scale (AToM) is a 12-item self-report questionnaire that measures maladaptive beliefs about motherhood related to others' judgment, maternal responsibility and maternal role idealisation (Sockol, Epperson, & Barber, 2014). Total scores are computed from all items and range from 12 to 72, with higher scores reflecting increased maladaptive attitudes related to motherhood and parenting. Adequate reliability estimates were obtained using McDonald's Omega, 0.74 (T1), 0.75 (T2) and 0.70 (T3).

2.3.3.4. Self-compassion. Self-compassion was assessed using the Self Compassion Scale-Short Form (SCS-SF; Raes, Pommier, Neff, & Van Gucht, 2011). High concordance between the short form and full form has been demonstrated (Raes et al., 2011). The SCS-SF is a self-report questionnaire that includes 6 positive items to assess self-kindness, common humanity and mindfulness and 6 negative items to examine self-judgement, isolation, and over-identification (Neff, 2003). Items on the negative subscales are reversed to compute a total score of all items ranging from 12 to 60, with higher scores indicating higher self-compassion. Recent studies have identified that the self-compassion scale is more accurately represented as two dimensions: positive and negative (Costa et al., 2016; López et al., 2015). As this has only been identified with the full scale, the total score was used for the main analyses. However, in a post hoc analysis, the two dimensions of self-compassion were examined regarding their relative contribution. Good reliability estimates of the SCS-SF total score were obtained using McDonald's Omega, 0.89 (T1), 0.88 (T2) and 0.91 (T3). For the positive components, McDonald's Omega estimates were, 0.81 (T1), 0.87 (T2) and 0.88 (T3). For the negative components, McDonald's Omega estimates were, 0.86 (T1), 0.86 (T2) and 0.88 (T3).

2.3.3.5. Relationship satisfaction. Participants were asked at each time point if they had a current partner. Women that indicated affirmative were asked to complete the 10 item self-report Relationship Satisfaction scale (RS10; Røysamb, Vittersø, & Tambs, 2014). Total scores range from 10 to 60, with higher scores indicating increased satisfaction in one's relationship. Good reliability estimates were obtained using McDonald's Omega, 0.91 (T1), 0.93 (T2) and 0.91 (T3).

2.4. Statistical analyses

Statistical analyses were performed using the IBM Statistical Package for the Social Sciences, Version 26. This study analysed data from participants who completed the T1, T2 and T3 questionnaires. One participant reported a stillbirth and was excluded from the final analyses, resulting in a final sample size of $n = 114$. Attrition of participants from T1 were examined by comparing participants who completed all time points to participants who did not compete either T2 and/or T3. The relationship between the attrition variable and T1 demographic variables was tested using a Chi Squared crosstab test for categorical variables and Mann-Whitney tests for continuous variables. A binomial logistic regression was used to examine the relationship between the attrition variable and the T1 independent and dependant variables considered in this study.

The remaining sample were screened for missing data. The proportion of missing items from independent and dependant variables was 0.22% (T1), 0.02% (T2) and 0.25% (T3). Little's MCAR test revealed that scale items were missing completely at random, χ^2 (914) = 889.91, $p > 0.05$ (T1), χ^2 (239) = 251.12, $p > 0.05$ (T2) and χ^2 (651) = 687.39, $p > 0.05$ (T3). Therefore, prior to the computation of variable total scores, missing scale items, excluding where participants were missing a full scale, were imputed using the Expectation Maximisation algorithm (Tabachnick & Fidell, 2007).

A data analysis plan and research hypotheses were specified prior to the commencement of the prospective study. However, due to non-linearity in the model examined in this study, a hierarchical clustering technique was applied to examine the change of disordered eating, instead of the parametric analyses as previously planned. This is a technique that examines the existing subgroups in the data and was used in this study to cluster participants based on their disordered eating total scores at T2 and T3. Ward's method of hierarchical clustering and the Squared Euclidian Distance was used to assign participants to a cluster group. To refine group membership, an aggregate procedure provided initial cluster centres for the Wards clusters and was followed by a K-means clustering analysis. A discriminant analysis was used to confirm correct classification of participants to clusters. Finally, the differences

between cluster groups were summarised by examining the mean EDE-Q total score at T2 and T3 for each cluster. Significant differences between mean EDE-Q total scores at T2 and T3 were examined using related-samples Wilcoxon signed rank test.

The next stage examined whether independent variables were significantly associated with cluster group membership. First, demographic and independent variable total scores were converted to Z scores for uniformity in scales. A series of univariate multinomial logistic regressions were then conducted with a psychosocial or mental-health factor at T1, T2 and T3 entered as individual predictors and cluster group membership as the outcome, with the reference group as the group with the lowest disordered eating. Demographic variables were also examined, excluding those with little variability (e.g. marital status). Next, the odds ratios for significant predictors of each cluster group, were interpreted. An odds ratio over one indicated an increased likelihood of belonging to the cluster group, compared to the group with the lowest disordered eating, that was associated with a one standardised unit increase on the predictor variable. An odds ratio below one indicated a decreased likelihood of belonging to the cluster group, compared to the group with the lowest disordered eating, that was associated with a one standardised unit increase on the predictor variable.

A hierarchical multinomial logistic regression then examined a combined model of predictors, for each time point; T1, T2 and T3. First, independent and dependant variables were examined for multivariate outliers and multicollinearity amongst variables in each model. There were two multivariate outliers for the models examining T1 and T2 predictors, however as the findings did not change when deleting these participants, it was decided that they be retained in the final analyses (Tabachnick & Fidell, 2007). There were no issues of multicollinearity amongst variables.

For the hierarchical logistic regression, demographic control variables that were significant in the univariate logistic regressions were entered at step one. Psychosocial factors were entered at step two. Depressive and anxiety symptoms were entered at step three to examine whether their entry would improve the prediction of cluster group membership above that achieved with the psychosocial factors. Interactions were not investigated due to the limited sample size. The model Chi-square and its significance were examined at each step, followed by the chi square difference between the steps to assess improvement in the model fit. In the final models, a deviance estimate was used to test goodness of fit, with non-significant values indicating that predicted values did not significantly differ from observed values. Nagelkerke (1991) methods for R^2_N estimates were also used to examine effect sizes, with a higher percentage indicating improved model prediction. The significance of individual predictors, for each cluster group, were then examined and the odds ratios for significant predictors interpreted. Lastly, a post-hoc analysis examined whether the positive and/or negative components of self-compassion were significant predictors of the various cluster groupings.

3. Results

3.1. Attrition analyses

Participants who completed questionnaires at all time points did not differ significantly from women who did not complete either T2 and/or T3 on T1 demographics including: parity, χ^2 (1) = 0.08, $p > 0.05$, current employment, χ^2 (3) = 5.64, $p > 0.05$, pre-pregnancy BMI, U = 8285.00, $p > 0.05$ and a history of an eating disorder, χ^2 (1) = 0.28, $p >$ 0.05. However, women who completed all three time points were slightly older ($M = 30.62$, $SD = 5.36$) than women who did not complete either T2 and/or T3 ($M = 28.37$, $SD = 4.83$), $U = 11217.50$, $p < 0.01$. Additionally, participants with a bachelor or postgraduate degree were more likely to complete all three time points, χ^2 (2) = 8.83, $p < 0.05$. There were no significant differences between women who did not complete a questionnaire at T2 and/or T3 and women who completed all timepoints on the mean values of T1 independent and dependant variables examined in this study, χ^2 (6) = 9.21, $p > 0.05$. This suggested no attrition bias in the final sample regarding the independent and dependant variables considered in this study.

3.2. Descriptive statistics

Demographic characteristics of participants at 18–24 weeks gestation (T1) and 8–10 weeks postpartum (T3) are presented in Table 1. The age of participants ranged from 18 to 48. Parity was split equally across the sample, with 52.63% pregnant with their first child. A larger percentage of participants held a bachelor or postgraduate degree, in comparison to the general female Australian population (62.28% and 41.41% respectively; Australian Bureau of Statistics, 2018). This may have been due to the advertisement of the study on university campuses and social media groups and the increased attrition of participants of other educational levels. At T1, 8.77% of participants reported a diagnosed eating disorder. This is close to the estimate of nine percent in the general population (The National Eating Disorder Collaboration NEDC, 2015).

Pre-pregnancy BMI varied across the sample, including 50.88% of women with a healthy weight, 3.51% of women with underweight, 17.54% of women with overweight and 24.56% of women with obesity, prior to pregnancy (Better Health Channel, 2019). Additionally, amongst women who reported a healthy BMI prior to pregnancy, 29.31% gained above, 24.14% gained within, and 36.21% gained below the recommended guidelines for gestational weight gain (Institute of Medicine, 2009). Amongst women with reported underweight prior to pregnancy, 75.00% gained above the recommended guidelines, with the remainder missing a gestational weight gain score (Institute of Medicine, 2009). For women with reported overweight prior to pregnancy, 45.00% gained above, 10.00% gained within, and 35.00% gained below

Table 1
Demographic characteristics of participants at 18–24 weeks gestation (T1) and 8–10 weeks postpartum (T3), Total $n = 114$.

	18–24 weeks gestation (T1)	8–10 weeks postpartum (T3)
n, Mean (Standard Deviation)		
Age in years	114, 30.67 (5.36)	
Gestation in weeks	114, 20.28 (2.33)	
Weeks postpartum		114, 9.05 (1.77)
Pre-pregnancy BMI[a]	110, 26.03 (6.20)	
Gestational weight gain		102, 11.13 (7.44)
n (%)		
Parity		
Primiparous	60 (52.63)	
Multiparous	54 (47.37)	
Marital status		
Married	89 (78.07)	91 (79.82)
De facto	20 (17.54)	17 (14.91)
Divorced	1 (0.88)	2 (1.75)
Non-partnered	4 (3.51)	4 (3.51)
Education level		
Year 12 or below	21 (18.42)	
Certificate or diploma	22 (19.30)	
Bachelor or above	71 (62.28)	
Currently Employed		
No	22 (19.30)	69 (60.53)
Full time	47 (41.23)	15 (13.16)
Part time/casual	45 (39.47)	30 (26.32)
Eating disorder history diagnosed		
No	104 (91.22)	
Anorexia Nervosa	7 (6.14)	
Bulimia nervosa	4 (3.51)	
Binge eating disorder	3 (2.63)	
Other eating disorders	0 (0.00)	

[a] BMI = Body Mass Index.

Table 2
Mean, standard deviation and Wilcoxon signed rank test of significance for EDE-Q total score at 30–32 weeks gestation (T2) and 8–10 weeks postpartum (T3) by cluster groups.

Cluster Group	n	EDE-Q T2	EDE-Q T3	Standardized U value
1 Lower disordered eating	69	0.30 (0.32)	0.55 (0.34)	$U = 5.41$**
2 Increasing risk	26	0.81 (0.46)	2.01 (0.62)	$U = 4.28$**
3 Sub-clinical	14	2.31 (0.60)	2.51 (0.77)	$U = 0.60$
4 Clinical	5	3.64 (0.81)	3.91 (0.35)	$U = 0.67$
Total sample	114	0.81 (0.98)	1.27 (1.08)	$U = 6.41$**

*Significant at the 0.05 level (two tailed), ** significant at the 0.01 level (two tailed).

the recommended guidelines (Institute of Medicine, 2009). Lastly, amongst women with reported obesity prior to pregnancy, 35.71% gained above, 25.00% gained within and 35.71% gained below the recommended guidelines (Institute of Medicine, 2009).

3.3. Cluster analysis

In the hierarchical cluster analysis of disordered eating at T2 and T3, a dendrogram and scatter plot supported a four-cluster solution. The K mean cluster analysis resulted in 9.64% case reassignment into different clusters. The final cluster solution was confirmed using discriminant analysis, which revealed that 99.10% of participants were classified correctly using the four-cluster solution. Thus, participants were assigned to a cluster between 1 and 4, which represented a different pattern of change in disordered eating from the middle-end of pregnancy (T2) to early postpartum (T3).

An examination of the mean values of the EDE-Q total scores for each cluster group is presented in Table 2. Cluster one participants had low disordered eating at T2 and T3 and was labelled the 'Lower disordered eating' group. Cluster two participants had low disordered eating at T2 but increased to a sub-clinical level of disordered eating at T3 and was labelled the 'Increasing risk' group. Cluster three participants had sub-clinical disordered eating at T2 and just above clinical cut off (>2.5) at T3 and was labelled the 'Sub-clinical' group. Lastly, cluster four participants had disordered eating scores above the clinical cut off (>2.5) at T2 and T3 and was labelled the 'Clinical' group. There was a significant increase in the mean EDE-Q total score from T2 to T3 in the lower disordered eating group, the increasing risk group and the total sample (Table 2).

3.4. Univariate multinomial regression analyses

A series of logistic regression analyses examined which demographic, psychosocial and/or mental health factors were individually associated with cluster group membership, using the lower disordered

Table 3
Odds ratio and 95% confidence intervals of standardised demographic, mental health and psychosocial factors at 18–24 weeks gestation (T1), 30–32 weeks gestation (T2) and 8–10 weeks postpartum (T3) individually predicting disordered eating cluster groups, with the lower disordered eating group as the reference group.

Cluster Group		Measure [a]	T1	T2	T3
Demographic factors					
2	Increasing risk	Age	1.07 (0.68, 1.68)		
3	Sub-clinical		1.33 (0.75, 2.38)		
4	Clinical		1.04 (0.42, 2.60)		
2	Increasing risk	Parity (primiparous) [b]	0.47 (0.19, 1.18)		
3	Sub-clinical		0.26 (0.07, 0.90)[d]		
4	Clinical		0.96 (0.15, 6.15)		
2	Increasing risk	Education	0.67 (0.13, 3.46)		
3	Sub-clinical	(year 12 or below) [c]	0.67 (0.19, 2.31)		
4	Clinical		1.50 (0.13, 17.83)		
2	Increasing risk	Education	1.08 (0.25, 4.58)		
3	Sub-clinical	(certificate or diploma) [C]	0.72 (0.21, 2.50)		
4	Clinical		3.23 (0.41, 25.26)		
2	Increasing risk	Pre-pregnancy BMI	1.70 (1.08, 2.68)[d]		
3	Sub-clinical		1.16 (0.62, 2.15)		
4	Clinical		1.29 (0.52, 3.22)		
2	Increasing risk	Gestational weight gain			0.61 (0.37, 1.01)
3	Sub-clinical				1.56 (0.83, 2.95)
4	Clinical				0.76 (0.27, 2.18)
Psychosocial factors					
2	Increasing risk	AToM	1.28 (0.79, 2.08)	1.43 (0.87, 2.35)	1.19 (0.74, 1.91)
3	Sub-clinical		1.94 (1.04, 3.62)[d]	2.10 (1.11, 3.98)[d]	2.22 (1.19, 4.14)[d]
4	Clinical		4.18 (1.46, 12.00)[d]	5.51 (1.87, 16.22)**	1.98 (0.77, 5.06)
2	Increasing risk	SCS-SF	0.28 (0.14, 0.53)**	0.36 (0.20, 0.64)**	0.27 (0.14, 0.51)**
3	Sub-clinical		0.37 (0.18, 0.77)[d]	0.29 (0.13, 0.63)**	0.44 (0.21, 0.89)[d]
4	Clinical		0.03 (0.00, 0.26)**	0.02 (0.00, 0.25)**	0.02 (0.00, 0.21)**
2	Increasing risk	RS10	0.72 (0.45, 1.14)	0.70 (0.43, 1.15)	0.74 (0.45, 1.21)
3	Sub-clinical		0.64 (0.37, 1.08)	0.49 (0.29, 0.83)[d]	0.50 (0.29, 0.86)[d]
4	Clinical		0.84 (0.32, 2.19)	0.77 (0.29, 1.99)	0.54 (0.25, 1.17)
Mental health factors					
2	Increasing risk	EPDS	2.56 (1.51, 4.34)**	2.36 (1.36, 4.08)**	2.06 (1.23, 3.43)[d]
3	Sub-clinical		3.65 (1.91, 6.98)**	5.41 (2.55, 11.49)**	3.06 (1.63, 5.74)**
4	Clinical		2.99 (1.20, 7.48)[d]	6.82 (2.22, 20.92)**	4.48 (1.74, 11.49)**
2	Increasing risk	DASS-Anxiety	1.90 (1.15, 3.14)[d]	1.40 (0.84, 2.33)	1.92 (1.15, 3.19)[d]
3	Sub-clinical		2.42 (1.36, 4.32)**	2.26 (1.27, 4.01)[d]	2.04 (1.13, 3.68)[d]
4	Clinical		2.79 (1.27, 6.13)[d]	3.36 (1.52, 7.42)**	3.17 (1.51, 6.65)**

[a] BMI = Body Mass Index, EPDS = Edinburgh Postnatal Depression Scale, DASS-Anxiety = Depression, Anxiety and Stress Scale- Anxiety subscale, SCS-SF= Self Compassion Scale- Short Form, AToM = Attitudes Towards Motherhood scale, RS10 = Relationship Satisfaction scale.
[b] Reference category = multiparous women.
[c] Reference category = Bachelor or above.
[d] Significant at the 0.05 level (two tailed), ** significant at the 0.01 level (two tailed).

eating group as the reference category.

3.4.1. Pregnancy predictors

Table 3 presents the odds ratios for demographic, psychosocial and mental health factors at T1 and T2. For the increasing risk group, when compared to the lower disordered eating group, a higher pre-pregnancy BMI, higher depression at T1 and T2 and higher anxiety at T1, increased the likelihood of belonging to the increasing risk group. Conversely, higher self-compassion at T1 and T2 decreased the likelihood of belonging to the increasing risk group. For the sub-clinical group, when compared to the lower disordered eating group, multiparity, maladaptive attitudes to motherhood at T1 and T2 and higher depressive and anxiety symptoms at T1 and T2, increased the likelihood of belonging to the sub-clinical group. In contrast, higher self-compassion at T1 and T2 and higher relationship satisfaction at T2 decreased the likelihood of belonging to the sub-clinical group. For the clinical group, demographic factors were not associated with an increased risk of belonging to this group. However, when compared to the lower disordered eating group, maladaptive attitudes to motherhood at T1 and T2 and depressive and anxiety symptoms at T1 and T2 were associated with an increased likelihood of belonging to the clinical group. Alternatively, higher self-compassion at T1 and T2 was associated with a decreased likelihood of belonging to the clinical group.

3.4.2. Postpartum predictors

Table 3 presents the odds ratios for T3 demographic, psychosocial and mental health factors. When compared to the lower disordered eating group, gestational weight gain was not significantly associated with any risk group. For the increasing risk group, when compared to the lower disordered eating group, postpartum depressive and anxiety symptoms increased the likelihood of belonging to the group. Conversely, higher self-compassion at T3 decreased the likelihood of belonging to the increasing risk group. For the sub-clinical group, when compared to the lower disordered eating group, postpartum depressive and anxiety symptoms were associated with an increased likelihood of belonging to the group. In contrast, higher self-compassion and higher relationship satisfaction at T3 decreased the likelihood of belonging to the sub-clinical group. For the clinical group, when compared to the lower disordered eating group, postpartum depressive and anxiety symptoms increased the likelihood of belonging to the group. Alternatively, higher self-compassion decreased the likelihood of belonging to the clinical group.

Table 4
Parameter estimates of standardised demographic, psychosocial and mental health factors at 18–24 weeks gestation (T1), 30–32 weeks gestation (T2) and 8–10 weeks postpartum (T3), predicting disordered eating cluster groups, with the lower disordered eating group as the reference category.

ClusterGroup		Measure[a]	B	SE	Odds Ratio (95% confidence interval)	Wald
T1						
2	Increasing risk	Parity (primiparous)[b]	−1.39	0.63	0.25 (0.07, 0.86)	4.87[c]
3	Sub-clinical		−1.90	0.77	0.15 (0.03, 0.68)	6.05[c]
2	Increasing risk	Pre-pregnancy BMI	0.48	0.28	1.62 (0.94, 2.81)	2.96
3	Sub-clinical		0.17	0.37	1.18 (0.58, 2.44)	0.21
2	Increasing risk	AToM	−0.10	0.31	0.91 (0.50, 1.65)	0.10
3	Sub-clinical		0.45	0.38	1.57 (0.74, 3.34)	1.40
2	Increasing risk	SCS-SF	−1.54	0.42	0.21 (0.09, 0.49)	13.30**
3	Sub-clinical		−0.92	0.47	0.40 (0.16, 1.00)	3.85
2	Increasing risk	RS10	−0.09	0.34	0.92 (0.47, 1.77)	0.07
3	Sub-clinical		−0.21	0.32	0.81 (0.43, 1.53)	0.41
T2						
2	Increasing risk	Parity (primiparous)[b]	−0.93	0.59	0.39 (0.13, 1.25)	2.52
3	Sub-clinical		−2.73	1.09	0.07 (0.01, 0.56)	6.24[c]
2	Increasing risk	Pre-pregnancy BMI	0.83	0.32	2.28 (1.23, 4.25)	6.77[c]
3	Sub-clinical		−0.21	0.47	0.81 (0.32, 2.06)	0.19
2	Increasing risk	AToM	−0.13	0.35	0.87 (0.44, 1.75)	0.14
3	Sub-clinical		0.11	0.50	1.11 (0.42, 2.94)	0.05
2	Increasing risk	SCS-SF	−1.20	0.47	0.30 (0.12, 0.75)	6.59[c]
3	Sub-clinical		−0.01	0.61	0.99 (0.30, 3.23)	0.00
2	Increasing risk	RS10	0.19	0.32	1.21 (0.65, 2.27)	0.36
3	Sub-clinical		−0.55	0.34	0.58 (0.30, 1.12)	2.67
2	Increasing risk	EPDS	0.63	0.53	1.88 (0.66, 5.34)	1.40
3	Sub-clinical		1.58	0.65	4.84 (1.36, 17.22)	5.93[c]
2	Increasing risk	DASS-Anxiety	−0.61	0.47	0.54 (0.22, 1.37)	1.69
3	Sub-clinical		0.34	0.57	1.41 (0.46, 4.32)	0.35
T3						
2	Increasing risk	Parity (primiparous)[b]	−1.47	0.66	0.23 (0.06, 0.84)	4.95[c]
3	Sub-clinical		−2.06	0.88	0.13 (0.02, 0.71)	5.55[c]
2	Increasing risk	Pre-pregnancy BMI	0.62	0.30	1.86 (1.04, 3.34)	4.36[c]
3	Sub-clinical		0.08	0.44	1.09 (0.46, 2.55)	0.04
2	Increasing risk	AToM	−0.20	0.34	0.82 (0.42, 1.60)	0.33
3	Sub-clinical		0.48	0.42	1.61 (0.71, 3.69)	1.28
2	Increasing risk	SCS-SF	−1.62	0.57	0.20 (0.06, 0.61)	7.99[c]
3	Sub-clinical		0.71	0.68	2.03 (0.53, 7.77)	1.08
2	Increasing risk	RS10	0.32	0.36	1.38 (0.69, 2.78)	0.81
3	Sub-clinical		−0.57	0.42	0.57 (0.25, 1.29)	1.84
2	Increasing risk	EPDS	0.24	0.45	1.28 (0.53, 3.06)	0.30
3	Sub-clinical		1.67	0.63	5.31 (1.54, 18.34)	6.97[c]
2	Increasing risk	DASS-Anxiety	0.01	0.46	1.01 (0.42, 2.47)	0.00
3	Sub-clinical		−0.09	0.52	0.92 (0.33, 2.53)	0.03

[a] BMI= Body Mass Index, EPDS = Edinburgh Postnatal Depression Scale, DASS-Anxiety = Depression, Anxiety and Stress Scale- Anxiety subscale, SCS-SF= Self Compassion Scale- Short Form, AToM = Attitudes Towards Motherhood scale, RS10 = Relationship Satisfaction scale.
[b] Reference category = multiparous women.
[c] Significant at the 0.05 level (two tailed), ** significant at the 0.01 level (two tailed).

3.5. Multivariate multinomial regression analyses

A hierarchical multinomial logistic regression examined a combined model of predictors, for T1, T2 and T3 factors, using the lower disordered eating group as the reference group (Table 4). The clinical group was removed for these analyses due to large standard errors resulting from a small sample size. Demographic factors, parity and pre-pregnancy BMI were included as control variables as they were significant in section 3.4.

3.5.1. Pregnancy predictors

When examining a model of T1 predictors, psychosocial factors significantly improved the fit of the model over the demographic variables alone, χ^2 (6) change = 26.95, $p < 0.01$. However, adding mental health symptoms did not improve the fit of the model, χ^2 (4) change = 8.43, $p > 0.05$, and were therefore excluded from the final model. The final model of demographic and psychosocial factors at T1 significantly distinguished between the lower disordered eating group and the risk groups, χ^2 (10) = 39.50, $p < 0.01$, and demonstrated good fit to the data, χ^2 (186) *Deviance* = 141.17, $p > 0.05$. Demographic and psychosocial factors accounted for 39% (R^2_N) of the total variance in disordered eating cluster groups. The individual parameter estimates for T1 predictors are presented in Table 4. When compared to the lower disordered eating group, primiparous women were less likely than multiparous women to belong to the increasing risk and sub-clinical groups. Self-compassion was the only psychosocial factor significantly associated with a risk group, with lower self-compassion at T1 associated with an increased likelihood of belonging to the increasing risk group.

When examining a model of T2 predictors, psychosocial predictors significantly improved the fit of the model over the demographic variables alone, χ^2 (6) change = 25.01, $p < 0.01$. Mental health symptoms further improved the fit of the model, χ^2 (4) change = 13.51, $p < 0.01$). The final model of demographic, psychosocial and mental health factors at T2 significantly distinguished between the lower disordered eating group and the risk groups, χ^2 (14) = 51.07, $p < 0.01$, and described the data well, χ^2 (186) *Deviance* = 133.31, $p > 0.05$. Demographic, psychosocial and mental health factors accounted for 47% (R^2_N) of the total variance in disordered eating cluster groups. The individual parameter estimates for T2 predictors are presented in Table 4. When compared to the lower disordered eating group, a higher pre-pregnancy BMI and lower self-compassion significantly increased the likelihood of belonging to the increasing risk group. In contrast, multiparity and postpartum depressive symptoms significantly increased the likelihood of belonging to the sub-clinical group.

3.5.2. Postpartum predictors

When examining a model of T3 predictors, psychosocial predictors significantly improved the fit of the model over the demographic variables alone, χ^2 (6) change = 29.84, $p < 0.01$. Mental health symptoms further improved the fit of the model, χ^2 (4) change = 9.61, $p < 0.05$. The final model significantly differentiated between the lower disordered eating group and the risk groups, χ^2 (14) = 52.00, $p < 0.01$, and demonstrated good fit to the data, χ^2 (184) *Deviance* = 131.40, $p > 0.05$. Demographic, psychosocial and mental health factors accounted for 48% (R^2_N) of the total variance in disordered eating cluster groups. The individual parameter estimates for T3 predictors are presented in Table 4. When compared to the lower disordered eating group, multiparity, a higher BMI and lower self-compassion were significantly associated with an increased likelihood of belonging to the increasing risk group. Multiparity and postpartum depressive symptoms were significantly associated with an increased likelihood of belonging to the sub-clinical group.

3.6. Post-hoc analyses

A post-hoc analysis of self-compassion split into its positive and negative components, with the increasing risk group compared to the lower disordered eating group, revealed that it was the negative component of self-compassion that increased the likelihood of belonging to the increasing risk group at all three time points (Table 5). The positive aspects of self-compassion were not significantly associated with membership to the increasing risk group, when compared to the lower disordered eating group.

4. Discussion

In this cohort study that examined women during pregnancy and the postpartum period, disordered eating increased on average from the middle-end pregnancy (T2) to the early postpartum period (T3) in the total sample. An increase in disordered eating during the postpartum period agrees with previous literature and confirms the necessity of studies exploring factors associated with this increase (Crow et al., 2008; Easter et al., 2015; Rocco et al., 2005). Two patterns of increasing disordered eating were noteworthy: the 'sub-clinical' group consisting of women who presented with sub-clinical disordered eating at T2 and disordered eating above clinical cut off at T3, and the 'increasing risk' group, including women with low disordered eating at T2 but a significant increase to sub-clinical levels at T3. These two risk groups represent women in the general population who may not receive a diagnosis of an eating disorder, nor come to the attention of a health professional with sub-clinical symptoms, which may in turn increase the progression of poor eating behaviours over time, as well as comorbid mental health difficulties (Astrachan-Fletcher et al., 2008; Mitchell & Bulik, 2006).

When investigating which factors were associated with the increase of disordered eating in the sub-clinical and increasing risk groups, univariate analyses indicated that higher self-compassion and relationship satisfaction reduced the likelihood of belonging to a risk group, whilst mental health symptoms and maladaptive attitudes to motherhood increased the likelihood of belonging to a risk group, when compared to a group of women with lower disordered eating at T2 and T3. Whilst previous studies examining attitudinal factors indicate that women with a history of an eating disorder are more likely to display negative attitudes and adjustment to pregnancy and motherhood (Easter, 2011; Koubaa, 2008), this study demonstrates that attitudinal factors can in turn influence the change in perinatal disordered eating symptoms. Previous findings similarly support a heightened risk of disordered eating postpartum associated with poor relationship satisfaction and higher depressive and anxiety symptoms (Easter et al., 2015; Knoph et al., 2013; Lai et al., 2006).

It is possible that relationship satisfaction may provide a limited buffer against increased disordered eating by reducing stress, isolation and negative affect (Svaldi et al., 2012), however this may only be effective when there are no other factors impacting the system, as relationship satisfaction was no longer associated with disordered eating when combined in a model with other predictors. In contrast, depressive symptoms continued to be associated with the sub-clinical group when

Table 5
Parameter estimates of standardized positive and negative self-compassion at 18–24 weeks gestation (T1), 30–32 weeks gestation (T2) and 8–10 weeks postpartum (T3) predicting the increasing risk group, with the lower disordered eating group as the reference category.

Time	Measure [a]	B	SE	Odds Ratio (95% CI)	Wald
T1	SCS-SF Positive	−0.26	0.38	0.77 (0.37, 1.63)	0.46
	SCS-SF Negative	1.08	0.36	2.94 (1.45, 5.98)	8.93**
T2	SCS-SF Positive	0.25	0.39	1.28 (0.59, 2.78)	0.40
	SCS-SF Negative	1.42	0.44	4.14 (1.74, 9.86)	10.33**
T3	SCS-SF Positive	−0.15	0.37	0.86 (0.42, 1.79)	0.16
	SCS-SF Negative	1.30	0.41	3.66 (1.64, 8.15)	10.08**

*Significant at the 0.05 level (two tailed), ** significant at the 0.01 level (two tailed).
[a] SCS-SF= Self Compassion Scale-Short Form.

combined with other predictors at T2 and T3. This finding provides a further reminder that disordered eating must be examined in conjunction with depressive symptoms in both clinical and research settings, as ignoring the frequent comorbidity between them is likely to lead to limited outcomes (Micali, Simonoff, & Treasure, 2011).

Additionally, this study indicates that self-compassion is a psychosocial factor worthy of further investigation and application within the field of perinatal eating pathology. Specifically, lower self-compassion at all time points was associated with an increased likelihood of belonging to all disordered eating risk group. Moreover, self-compassion was the only psychosocial factor that remained significantly associated with the increasing risk group when combined with other predictors. A post-hoc examination of self-compassion split into the positive and negative components revealed that it was the negative components of self-judgement, isolation and over-identification that were associated with the increasing risk group.

Emergent evidence exploring self-compassion in relation to eating disorders, suggests that disordered eating may serve as an affect regulatory tool for a negative or critical inner voice, particularly in women who demonstrate a history of poor emotion regulation (Braun et al., 2016). The tripartite model of disordered eating proposes three pathways that influence disordered eating and poor body image-societal, parental and peer influences-via social comparison and internalisation of social ideals and norms (Braun et al., 2016). During pregnancy and the postpartum period, these influences may be particularly salient, triggering maladaptive attitudes and beliefs about the self and motherhood. Interventions aimed at building self-compassion during pregnancy may provide women at risk of disordered eating postpartum with an alternative regulation tool (Goss & Allan, 2010).

Moreover, this may be more important for women with a higher pre-pregnancy BMI and multiparity, as this study demonstrated that these demographic factors were associated with an increased likelihood of belonging to the increasing risk group. Previous research has similarly revealed that a model including pre-pregnancy BMI, gestational weight gain and negative body attitudes was associated with disordered eating during pregnancy (Gonçalves, Freitas, Freitas-Rosa, & Machado, 2015). Women with a higher pre-pregnancy BMI are more at risk of social stigma, weight shame and body dissatisfaction, which increases vulnerability to disordered eating (Kelly, Vimalakanthan, & Miller, 2014). However, women with lower self-compassion and higher BMI were more likely to cope using disordered eating behaviours (Kelly et al., 2014). Fewer studies have investigated parity and disordered eating, however, multiparous women often face a complex re-organisation of family roles which may be moderated by attitudinal factors (Gameiro, Moura-Ramos, & Canavarro, 2009). As the present study did not examine the interactions between BMI or parity and psychosocial factors, this remains to be investigated.

Finally, this study demonstrated that mid-end pregnancy (T2) and early postpartum (T3) predictors explained a larger percentage of variance in disordered eating cluster groups than early-mid pregnancy (T1) predictors. This may indicate that factors closer to the postpartum period have a stronger influence on disordered eating postpartum. However, this may also be because the associations between T2 and T3 predictors and the change of disordered eating at T2 and T3 were concurrent, whilst at T1 they were predictive. Further studies are required to delineate the direction of causality between disordered eating and psychosocial and mental health factors. In reality, a bidirectional association is likely, with disordered eating, psychosocial factors and mental health factors influencing each other.

Further limitations in this study included the small sample size which resulted in fewer participants in each cluster group, and overall low retention rate, which may have reduced significant findings. Additionally, this study only included one follow up during the early postpartum period. Previous studies have indicated that postnatal adjustment can occur beyond the initial six months (Easter et al., 2015; Knoph et al., 2013; Micali et al., 2011) and therefore an extension of future studies beyond the early postpartum period is recommended. Finally, the limitations of generalisability, due to a higher education level amongst the final sample, have been discussed in a previous study examining this cohort (Baskin et al., 2020). Additionally, this study included a small percentage of single women who may have a different perinatal experience than married women (Bilszta et al., 2008; Farbu, Haugen, Meltzer & Brantsaeter, 2014). Whilst it is unlikely that including these women would have confounded results, a larger cohort study could examine the difference between these groups of women.

5. Conclusions

This study is an important first step in understanding the mental health and psychosocial factors associated with the significant increase in disordered eating postpartum. Importantly, some of these associations were already apparent from early-mid pregnancy (T1) predictors. This signals that it may be possible to intervene proactively during pregnancy to reduce the risk of disordered eating and poor eating behaviours postpartum. Specifically, antenatal interventions aimed at building positive self-compassion and reducing the negative components of self-compassion appears to be a promising line of investigation, with initial evidence of its success demonstrated in preventing postpartum depressive and anxiety symptoms (Guo, Zhang, Mu & Ye, 2020). Moreover, targeting women with specific demographic characteristics, like a higher BMI or multiparity may be optimal. The importance of studies, such as these, in informing early intervention for improved outcomes in maternal mental health and infant development continues to be at the forefront of perinatal mental health research (Mitchell & Bulik, 2006).

Author contributions

Rachel Baskin designed and collected the data used in this study, analysed the findings and authored this manuscript. Roslyn Galligan provided guidance in the project design and data analysis and edited this manuscript. Denny Meyer provided guidance in data analysis and edited this manuscript. All authors approved the final version of this manuscript.

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Data availability statement

The data that supports findings of this study are available, upon reasonable request, from Dr Roslyn Galligan (rgalligan@swin.edu.au), for the duration of her employment at Swinburne University of Technology OR until the deletion of the data as stipulated in the ethics approval of this study by Swinburne's Human Research Ethics Committee.

Ethical statement

This study was approved by Swinburne's Human Research Ethics Committee (SUHREC number 2016/182) and conformed to its standards. Participants were informed prior to taking part in the study that completion of the questionnaires implied consent.

Declaration of competing interest

None applicable.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2020.104862.

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