

History of pre-pregnancy maternal symptoms of binge eating and childhood behavioral problems in girls and boys

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Abstract

Objective: To explore whether children of mothers with pre-pregnancy binge eating (BE) symptoms have more behavioral difficulties compared with those without and whether associations are moderated by ED symptoms and other maternal health and social factors measured during childhood.

Method: Pre-pregnancy BE symptoms were collected by the Australian Longitudinal Study on Women's Health at Survey 1 (in 1996) and/or at Survey 2 (in 2000) using questions mapped to DSM BE criterion 1. In 2016/7, 2180 women from the 1973–78 cohort provided data on externalizing and internalizing behavior, measured by Strengths and Difficulties Questionnaire, on 4054 of their children (2–12 years) in the Mothers and their Children's Health study. Covariates were markers of other ED symptoms, sociodemographic, social support, and mental health factors collected proximally to the child outcomes. Hierarchical multivariable regression models, using generalized estimating equations accounting for clustering of children within mothers, were used.

Results: Pre-pregnancy BE symptoms were associated with child behavior, with associations only moderated after adjustment for proximal markers of ED (girls internalizing behavior, b (95%CI) .30 (–.02, .61); boys externalizing behavior .34 (–.04, .73)) or social support (girls externalizing behavior 0.26 (–.08, .61)). Pre-pregnancy BE symptoms were not associated with boys internalizing behavior (–.27 (–.02, 0.57)).

Discussion: Studies with repeated ED measures should test hypotheses that these associations vary by timing of ED measurement. Identification of young women at risk of BE symptoms pre-pregnancy, as well as when children are older, may enable health services, treatment programs, and supports to minimize longer term effects on children.

Public significance statement: A history of binge eating symptoms up to 10 years pre-pregnancy in mothers is associated with behavior problems in their girls and boys at average age of 7. However, the association is moderated by behaviors of eating disorders and social support in the mothers during childhood. Identification of ED symptoms prior to pregnancy, and then after childbirth, might enable health services to intervene to maximize child and mother outcomes.

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KEYWORDS

child behavior, eating disorders, mothers, pre-pregnancy, symptoms of binge eating

1 | INTRODUCTION

In Australia, eating disorders (ED) including bulimia nervosa (BN), anorexia nervosa (AN) and binge eating (BE) disorder are the third most common chronic condition among young women, and interventions for ED across the lifespan are a key government health priority (Australian Government Department of Health, 2019). The Australian Child and Adolescent Survey of Mental Health and Wellbeing estimated that, in 2012–13, 2.4% of young people aged 11–17 years reported problem eating behaviors, with these behaviors reported by a higher proportion of females (3.5%) than males (1.4%) (Lawrence et al., 2015). EDs have been shown to significantly impact a woman's emotional, psychosocial, and physical well-being (Bannatyne et al., 2018; Wade et al., 2012). For example, Wade et al. (2012) found that women with a history of disordered eating showed poorer mental and physical health over a period of 10 years, with social support and depression identified as important moderators. EDs can have a range of long lasting effects across a woman's life, including during child-bearing and child-rearing (Klump et al., 2009).

Maternal psychopathology, including ED, can have a negative impact on children (Cimino et al., 2015; Martini et al., 2020). It remains unclear whether this is due to environmental or genetic factors, or a mix of both. Much of the existing literature examining the effects of maternal ED in children has focused on birth outcomes, birth weight, and infant feeding-behaviors and their consequences for child temperament and growth (Cimino et al., 2016; Lydecker & Grilo, 2016; Nguyen et al., 2017; Reba-Harrelson et al., 2010; Russell et al., 1998; Stein et al., 2006). Mothers with EDs have reported emotional problems when breastfeeding (Evans & Grange, 1995; Micali et al., 2011) and express more frequent negative emotions during mealtimes (Agras et al., 1999; Saltzman et al., 2016) and more mealtime conflict (Stein et al., 2006). There is evidence of transmission of eating difficulties to children, with higher levels of disordered eating behaviors reported in children of women with BN and BE disorder compared to controls (Reba-Harrelson et al., 2010). In a comprehensive review of the literature published between 1980 and 2018, Martini et al. (2020) found children of mothers with ED were more likely to exhibit anxiety, depression, and obsessive-compulsive symptoms and have higher incidence of psychiatric disorders, particularly emotional disorders.

Higher levels of behavior problems in children have also been reported in studies of mothers with ED. Barona et al. (2016) and Micali, Stahl, et al. (2014) found more conduct, hyperactivity and emotional difficulties in children of mothers with ED measured during pregnancy. While Cimino et al. (2015) and Cimino et al. (2016) showed evidence of higher levels of externalizing and internalizing

behavior problems in two studies of children of mothers with ED measured during childhood.

Barona et al. (2016) and Micali, Stahl, et al. (2014) further found behavioral problems in children of mothers with ED measured during pregnancy to differ by child sex, although there were no consistent findings. For example, Barona et al. (2016) showed daughters of mothers with BN to be more likely to have conduct problems, and sons more likely to have conduct, hyperactivity, and peer difficulty problems compared with healthy controls. Micali, Stahl, et al. (2014) found that girls of mothers with ED had higher likelihood of hyperactivity problems, while boys were more likely to display emotional and conduct problems.

The studies cited above that have found associations between ED and children's behavior have either asked women about ED when the children were young (Cimino et al., 2015; Cimino et al., 2016; Evans & Grange, 1995) or during pregnancy. In the studies that asked questions during pregnancy about whether the women had ever experienced an ED (for eg. Barona et al., 2016; Micali, Stahl, et al., 2014; Micali, De Stavola, et al., 2014) the women were around 28 to 29 years of age, with ED considered as representing a lifetime history. It is possible that asking women about a history of ED when they are aged in their late 20s may be subject to recall bias given the peak prevalence of disordered eating is in adolescence and early adulthood (Haynos et al., 2018; Keel et al., 2007).

The timing of maternal ED relative to when child outcomes are measured is important in terms of understanding the potential long term associations maternal ED may have with children's behavioral outcomes. Maternal ED measured concurrently with, or shortly before, child behaviors are measured (i.e., since the child was born) may have stronger associations with child behavior compared with maternal ED measured before the child was born (i.e., during or before pregnancy). To our knowledge no studies have investigated the association between ED captured potentially many years prior to pregnancy with children's behavioral outcomes, and whether maternal factors measured after the children are born, such as continued ED, levels of social support, and mental health, influence these associations.

We thus aimed to explore whether 1. children of mothers with a pre-pregnancy history of ED-related symptoms have more behavioral difficulties compared with children of mothers without this history; and 2. whether such an association is moderated by ED symptoms and other maternal health and social factors measured more proximally to the children's behavioral outcomes. Given the lack of consistent findings on the associations between ED symptoms and childhood behavior by the sex of the child, we also aimed to investigate whether there are differences in these associations by child sex.

2 | METHOD

This study was an exploratory secondary analysis of a population-based dataset of a large cohort of women from across Australia who were followed for 20 years. As the study was exploratory we did not test hypotheses. The Australian Longitudinal Study on Women's Health (ALSWH) was established in 1995 and has measured the health and well-being of four cohorts of women (Dobson et al., 2015). ALSWH participants were randomly sampled from the universal health insurance system database (now known as Medicare), which includes all Australian residents, and women from rural and remote areas were intentionally over-sampled (Dobson et al., 2015). Maternal data in the present study were from the cohort born in 1973–78. Children's data were drawn from the Mothers and their Children's Health study (MatCH), a sub-study of the ALSWH focusing on the three youngest children aged under 13 years of women in the 1973–78 cohort (Mishra et al., 2018). Mothers, who were then aged 38–43, were invited in 2016–17 to complete surveys about their children's health, behavior, and development. Ethical approval for the ALSWH and MatCH studies was obtained from The University of Newcastle (H-076-0795; H-20140246, respectively) and The University of Queensland (2004000224; 2014001213, respectively). Mothers provided written informed consent for themselves and their children.

3 | MEASURES

3.1 | Outcome

In the MatCH study, mothers completed the parent-report version of the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997). For this analysis, the externalizing and internalizing domain scores were used as they are the most appropriate SDQ scales for research in population-based low risk samples of children (Goodman et al., 2010) and they show very good factorial validity compared to the original five factor SDQ (Goodman et al., 2010; Hoffmann et al., 2020). The externalizing behavior domain score is the sum of the hyperactivity and conduct scales, while the internalizing behavior domain score is the sum of the emotional and peer problems scales. Each domain is scored from 0 to 20 with higher scores indicating more problematic behavior in that domain. In this study, the reliability statistics (Cronbach's Alpha) of the internalizing and externalizing subscales were .7 and .8, respectively.

3.2 | Exposure

As a population-based study, the ALSWH does not have clinical measures of ED. Instead, more generic questions capturing disordered eating behaviors were asked and these were used to represent maternal pre-pregnancy symptoms of BE. The questions were derived from ALSWH Survey 1 (in 1996, mothers aged 18–23 years) and Survey

2 (in 2000, 22–27 years). The first question on eating behavior was: 'Have there been times when you felt that you have eaten what other people would regard as an unusually large amount of food given the circumstances?' with the response options 'yes, in the past month', 'yes, more than one month ago' or 'no'. If women answered using the two yes responses, they were directed to a second question which asked: 'During these times of overeating did you have a sense of having lost control over your eating, that is, feeling that you couldn't stop eating once you had started?' with the response options 'yes' or 'no'. Table 1 shows how they map to DSM-5 criteria (American Psychiatric Association, 2013) for Binge Eating Disorder Criterion 1. Women were characterized as having pre-pregnancy symptoms of BE if they reported 'yes, in the past month' or 'yes, more than one month ago' to the first question and 'yes' to the second question, at Survey 1 and/or 2.

3.3 | Covariates

Markers of ED-related symptoms measured more proximally to the child behavior outcomes were included. As we did not have repeat measures of the questions used to create the pre-pregnancy symptoms of BE exposure (as they were only asked in Survey 1 and 2), we used questions about weight loss/management practices and dissatisfaction with weight from Surveys 5 (in 2009, 31–36 years), 6 (in 2012, 34–39 years) and 7 (in 2015, 37–42 years) as these proximal markers. These were chosen as research has linked dieting practices and weight perception with ongoing ED over time (Keel et al., 2007). The weight loss/management practices question was 'Have you used any of these methods to lose weight or to control your weight or shape in the last twelve months? Laxatives, diuretics or diet pills (e.g., Xenical®, Reductil®)' with the response option 'yes' or 'no'. Women were also asked 'In the past month, how dissatisfied have you felt about your weight?' with the response options 'not at all dissatisfied', 'slightly dissatisfied', 'moderately dissatisfied', or 'markedly dissatisfied'. If at Surveys 5, 6 or 7, women reported 'yes' for the weight loss/management practice question or they answered 'moderately or markedly dissatisfied' to the weight dissatisfaction question, this was taken to represent proximal markers of ED-related symptoms.

All other maternal covariates came from the ALSWH Survey 7 in 2015, which was the survey closest to when the child behavior outcomes were measured. Women reported their highest level of education (up to 12 years, diploma/certificate/trade, degree/higher degree) and current labor force participation (full-time, part-time, not in labor force). Alcohol intake (non-drinker, rarely drinks, low risk, risky drinker) was measured using Australian guidelines (National Health and Medical Research Council, 2009). Social support (All of the time, most of the time, some of the time, none/little of the time) was measured using the 6-item Medical Outcomes Study Social Support Survey (Holden et al., 2014). Maternal depression and anxiety were based on reports of diagnosis or treatment in the last 3 years. Child covariates were age and area of residence (major city, inner regional, outer regional, remote), measured in the MatCH survey (in 2016/17).

TABLE 1 Mapping of the ALSWH eating disorder symptom questions used to create exposure variables to relevant DSM-5 binge eating disorder criterion 1

Binge eating disorder (DSM-5 criterion 1)	Relevant ALSWH survey question	Derived exposure
Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:		
1 Eating, in a discrete period of time (e.g., within any 2 hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances	'Have there been times when you have felt that you have eaten what other people would regard as an unusually large amount of food given the circumstances?'	Binge eating (episodes of overeating with lost control).
2 The sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)	'During these times of overeating did you have a sense of having lost control over your eating, that is, feeling that you could not stop eating once you had started?'	Exposure used in analysis: symptoms of binge eating at Survey 1 or 2

3.4 | Statistical analysis

Associations between the exposure and the SDQ internalizing and externalizing scores were analyzed separately for girls and boys based on existing evidence that some outcomes differ by sex (Barona et al., 2016; Micali, Stahl, et al., 2014). Hierarchical multivariable regression models, using generalized estimating equations to account for clustering of children within mothers, were used to study associations between the exposure and outcomes. The regression models were adjusted for potential covariates identified a priori. The first model included child age. The second model included child age, maternal education, labor force participation, alcohol intake, and area of residence. The third model had the same variables as the second model together with maternal social support. The fourth model also included maternal depression and maternal anxiety. The fifth model also included proximal markers of ED-related symptoms. Complete case analyses were conducted. Around 14% of data were missing for the exposures due to a participant having missing data at either ALSWH Survey 1 and/or 2. Percentages of missing data for covariates ranged from <1% for area of residence to 2–8% for maternal depression, anxiety, education, alcohol intake, and social support. The regression analyses were then rerun using multiple imputation (using chained equations, $N = 25$ runs). Statistical analyses were conducted using STATA version 16 (StataCorp, 2019).

4 | RESULTS

4.1 | Sample characteristics

The MatCH study recruited 3048 mothers and their 5799 children. Of the 5799 children, 5471 children aged between two and 12 (90% of total sample), and their 2948 mothers were eligible for inclusion in the current study. Children aged less than two were not eligible as SDQ data were not available for these children. At ALSWH Survey 1 and 2 when questions on symptoms of BE were recorded the 2948

mothers were a mean (SD) 20.8 (1.4) and 24.5 (1.4) years of age, respectively. The mothers were a mean 32.7 years (SD 3.0) of age at the birth of their children. Around 28% of mothers reported overeating and BE episodes at either Survey 1 and/or 2. Table 2 shows socio-demographic characteristics of the 5471 eligible children stratified by their sex. The child mean age was 7.4 (SD 2.9) years, 52% were boys, 59% lived in major cities and 64% had a mother with a university education. Sociodemographic and maternal variables were similar across girls and boys. Of the 5471 eligible children, 1417 were excluded due to missing data on the exposure, outcome or covariates, leaving 4054 children (74% of eligible children) included in the complete case analysis from 2180 mothers (see Figure 1). A comparison of the included and excluded children on the BE exposure, behavior outcomes, and covariates is shown in Table S1, while Table S2 shows the descriptive characteristics of the included 4054 children stratified by sex. There was very little difference between the included and excluded children on the prevalence of maternal pre-pregnancy BE symptoms, the behavior outcomes or covariates.

4.1.1 | Associations between maternal pre-pregnancy symptoms of binge eating and child internalizing and externalizing behavior

In girls, pre-pregnancy symptoms of BE were associated with higher internalizing behavior after adjusting for maternal sociodemographic characteristics, social support, depression, and anxiety (Table 3). However, once proximal markers of ED-related symptoms were added the standardized regression estimate showed little change from the previous model but the lower confidence interval was below 1. Similarly, pre-pregnancy symptoms of BE were associated with higher externalizing behavior until the addition of social support, which led to a reduction in the standardized regression estimate by a third (Table 3).

In boys, pre-pregnancy symptoms of BE were associated with higher externalizing behavior after adjusting for maternal sociodemographic characteristics, social support, depression and anxiety.

TABLE 2 Descriptive characteristics of the 5471 children eligible for the study stratified by child sex

	Boys (N=2831)		Girls (N=2638)	
	N	%	N	%
Exposures (n, %)				
Symptoms of binge eating at survey 1 and/or 2 ^a				
Yes	631	22	603	23
No	1738	61	1595	60
Missing	462	16	440	17
Outcomes (mean, SD)				
SDQ Internalizing score ^b	2692	2.67 (2.78)	2497	2.65 (2.67)
Missing	139	5	141	5
SDQ Externalizing score ^b	2690	5.39 (3.61)	2496	4.24 (3.28)
Missing	141	5	142	5
Covariates				
Child age ^a (mean, SD)				
	2831	7.30 (2.91)	2638	7.49 (2.86)
Missing	0	0	0	0
Maternal depression ^c				
Yes	299	11	299	12
No	2357	89	2160	88
Missing	135	6	60	7
Maternal anxiety ^c				
Yes	258	9	229	9
No	2398	84	2230	85
Missing	175	6	179	7
Weight loss practices ^d (n, %)				
Yes	188	7	167	7
No	2643	93	2471	94
Missing	0	0	0	0
Weight dissatisfaction ^d (n, %)				
Yes	1897	67	1736	66
No	934	33	902	34
Missing	0	0	0	0
Highest qualification ^c (n, %)				
Up to 12 years	319	11	364	14
Trade/certificate/diploma	613	22	575	22
Degree or higher degree	1862	66	1646	62
Missing	37	1	53	2
Labor force participation ^c (n, %)				
Not in labour force	349	12	304	12
Part-time	2236	79	2087	79
Full-time	56	2	55	2
Missing	190	7	192	7
Alcohol intake ^c (n, %)				
Low risk drinker	1682	59	1544	59
Non-drinker	252	9	215	8
Rarely drinks	550	19	531	20
Risky drinker	145	5	149	6
Missing	202	7	199	8

(Continues)

TABLE 2 (Continued)

	Boys (N=2831)		Girls (N=2638)	
	N	%	N	%
Residence ^b (n, %)				
Major city	1673	59	1544	59
Inner regional	738	26	682	26
Outer regional	334	12	329	12
Remote	82	3	74	3
Missing	4	0	9	0
Social support ^{c,e} (n, %)				
All of the time	1570	55	1382	52
Most of the time	700	25	704	27
Some of the time	246	9	227	9
None/little of the time	79	3	88	3
Missing	236	9	237	9

Note: Two children had missing data on child sex.

^aData from ALSWH Survey 1 and 2.

^bData from MatCH study in 2016/17.

^cData from ALSWH survey 7 in 2015.

^dData from ALSWH survey 5 (2009), 6 (2012) or 7 (2015).

^eMeasured using the MOS 6-item social support scale.

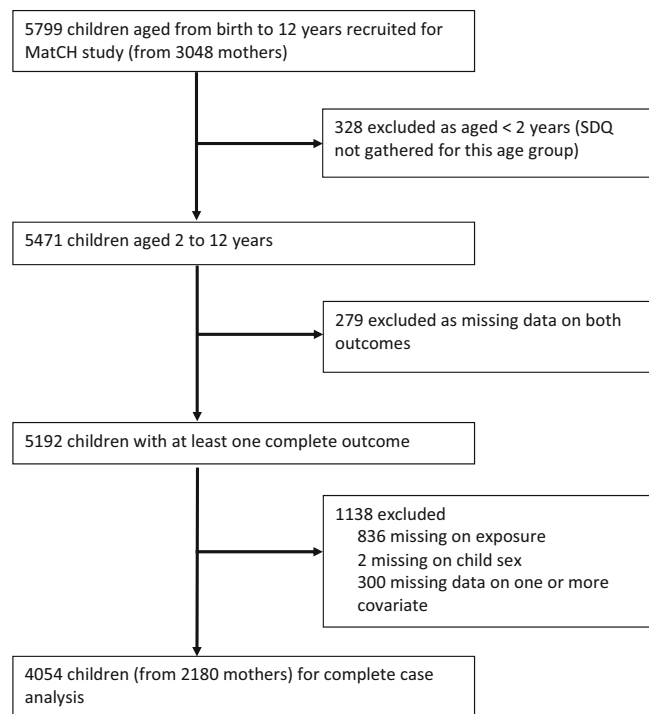


FIGURE 1 Study flow diagram

However, once proximal markers of ED-related symptoms were added the standardized regression estimate was reduced by 20%. There was no association between pre-pregnancy symptoms of BE and internalizing scores (Table 3). The full regression results for each variable for girls and boys are shown in Tables S3 and S4, respectively.

5 | DISCUSSION

The principal finding of this study is that a history of symptoms of BE in the mother around 10 years before pregnancy was associated with externalizing behavioral problems (which reflect hyperactivity and conduct scales) in boys and internalizing behavior (emotional and peer problem scales) in girls, at an average age of 7 years, after adjustment for proximal measures of maternal sociodemographic characteristics, social support and mental health. However, these associations were weakened after adjustment for proximal markers of ED-related symptoms. The next main finding is that the size of the association between pre-pregnancy symptoms of BE and externalizing behavior in girls was reduced by around a third by the adjustment for maternal social support. Finally, there was no association between pre-pregnancy symptoms of BE and internalizing behavior in boys. Together these results indicate that while symptoms of maternal BE measured many years before pregnancy do continue to have long term associations with behavioral outcomes in girls and boys, maternal factors including ED symptoms and social support measured during childhood may have stronger associations.

These findings show some consistency with previous studies. Using data from the Danish National Birth Cohort, Barona et al. (2016) compared 906 women with BN (asked at 12 weeks gestation whether they had ever suffered from BN), 931 women with anorexia nervosa (AN), 360 with both BN and AN and 46,206 women with no history of ED. Child behavior data were collected when the children were an average of 7 years. They found girls of women with a history of BN (including AN + BN) had more conduct problems, while boys had more conduct, hyperactivity, and peer problems, when compared

TABLE 3 Hierarchical multiple regression results of the association between maternal pre-pregnancy symptoms of binge eating on internalizing and externalizing scores in 4054 girls and boys: B and 95% confidence interval (CI)

Exposure	Model 1, b (95% CI)	Model 2, b (95% CI)	Model 3, b (95% CI)	Model 4, b (95% CI)	Model 5, b (95% CI)
Externalizing score (girls)					
Symptoms of binge eating at survey 1 and/or 2	.49 (.14, .85)	.41 (.06, .75)	.26 (−.08, .61)	.23 (−.11, .57)	.17 (−.17, .52)
Internalizing score (girls)					
Symptoms of binge eating at survey 1 and/or 2	.47 (.16, .78)	.44 (.13, .75)	.34 (.03, .66)	.32 (.002, .63)	.30 (−.02, .61)
Externalizing score (boys)					
Symptoms of binge eating at survey 1 and/or 2	.63 (.24, 1.03)	.56 (.17, .96)	.45 (.06, .84)	.42 (.03, .80)	.34 (−.04, .73)
Internalizing score (boys)					
Symptoms of binge eating at survey 1 and/or 2	.31 (.01, .61)	.27 (−.02, .57)	.19 (−.10, .47)	.17 (−.12, .45)	.14 (−.15, .42)

Note: Model 1: Adjusted for age. Model 2: Adjusted for model 1 + maternal education, maternal labor force participation, maternal alcohol intake, area of residence. Model 3: Adjusted for model 2 + social support. Model 4: Adjusted for model 3 + maternal depression, maternal anxiety. Model 5: Adjusted for model 4 and proximal weight loss practices, weight dissatisfaction.

to children of women with no such history. They found that mothers with ED tended to report their children as having a more difficult temperament compared with mothers without an ED history, and posited that a mother's perception may impact her own sense of being a mother and negatively impact the child's development. Similarly, Micali, Stahl, et al. (2014) used data from the Avon Longitudinal Study of Parents and Children to examine associations between a lifetime history (asked at 12 weeks gestation) of BN (158 mothers), AN (193 mothers) or no ED history (8271 mothers) and child behavior at age 3.5 years. Girls of mothers with BN were more likely to have hyperactivity and boys to have emotional and conduct problems compared with children of mothers without an ED history. In a mediation analysis, these authors tested these associations with the inclusion of active ED symptoms, depression, and anxiety measured at 18 weeks gestation. While the authors found evidence of both direct and indirect effects of a lifetime history of BN, the indirect effect of active ED asked later in pregnancy on child behavior was larger.

The study by Barona et al. (2016) did not adjust for a more proximal measure of ED, while the study by Micali, Stahl, et al. (2014) adjusted for a second measure of ED asked 6 weeks later and still during pregnancy. The inclusion of a more proximal pregnancy measure of active ED by Micali, Stahl, et al. (2014) may suggest that these more proximal measures are more important than those asked earlier. A few studies have compared the associations of a maternal history of ED together with more proximal measures of maternal ED, outside of pregnancy, on child feeding or neurodevelopmental outcomes (e.g., see Allen et al., 2014; Micali et al., 2011), but no studies have examined whether a similar association exists for behavioral outcomes in later childhood. Including proximal measures of symptoms of EDs, as well as anxiety and depression, enabled us to explore whether associations between historical ED symptoms and child behavior are in fact due to more current maternal pathology. Our findings suggest a pre-pregnancy history of BE symptoms does have an ongoing association with child behavior, and that these associations may not just be limited to situations where ED symptoms co-occur with pregnancy or child rearing.

Mother mental illness has been linked with child emotional and social functioning (Watson et al., 2018). Mothers with EDs have also been found to rate their children as having more emotional and behavioral problems and report difficulties looking after their children (Watson et al., 2018). There is also evidence linking maternal depression and anxiety and children's behavior (Cimino et al., 2015; Moss et al., 2020). This is important, as few studies looking at the relationship between maternal symptoms of BE and children's outcomes control for the effects of maternal depression and anxiety. The inclusion of maternal depression and anxiety as covariates in this study reduced the size of the estimates only by a small amount. The inclusion of social support had a larger effect on the estimates, in particular reducing the association between pre-pregnancy symptoms of BE and girls externalizing behavior by a third. Women with EDs may find it more difficult to develop healthy interpersonal relationships and social networks due to disordered thinking and emotions and low self-esteem (Leonidas & dos Santos, 2014). Potentially from adolescence, these women may perceive their families to be emotionally distant and restrictive, and have difficulty establishing trusting relationships displaying affection and attachment. All of which may affect how they parent and perceive their children's temperament and behavior (Barona et al., 2016).

The exploratory nature of this study enables the generation of hypotheses that could be tested in future studies. First, that associations between maternal symptoms of BE and child behavior outcomes vary by when maternal BE and other maternal health and social factors are measured. Second, that associations between maternal symptoms of BE and child behavior outcomes vary by the timing of recovery, continuation, and relapse of maternal ED. Third, long term associations of maternal symptoms of BE and behavior are also found for symptoms of other, potentially more severe ED including AN and BN. To test these hypotheses, future studies should include a comprehensive measure of ED symptoms, ideally first measured during adolescence and which is repeated over time, so that recovery, continuation, relapse or development of new ED can be more precisely assessed and the contribution of EDs measured at different

time points on child behavior outcomes more robustly tested. These studies should also include a large range of maternal and child covariates that are associated with child behavior.

Adolescent girls and young women interact with the health care system more than boys and young adult men, for example, around contraception, sexual health, and menstrual problems. These provide potential opportunities for assessments/questions to be asked about symptoms of ED (dieting practices, body weight/shape perception, exercise habits). The identification of women in adolescence and early adulthood with symptoms of BE and other ED before pregnancy may enable health practitioners to refer women to specialist treatments that target ED cognitions and behaviors, provide general nutritional advice, educate women about pre-conception health and nutrition and refer to other support and counseling services (Ward, 2008). If women identified as being at risk then become pregnant health practitioners may have opportunities to provide specialist support during pregnancy including education about normal weight gain and nutrition and growth of the fetus, as well as counseling and support post-natally, during breastfeeding and parenting. Support services and practitioners should monitor mothers with a history of pre-pregnancy ED for ongoing symptoms that may potentially impact their children's growth and development.

Study strengths include a large population sample, prospective measurement of maternal symptoms of BE prior to pregnancy and adjustment for potential sociodemographic, social support, mental health and weight control behaviors/weight satisfaction covariates measured more proximally to when the child outcomes were collected. Limitations include that the ALSWH is a large-scale epidemiological study with a predetermined dataset not specifically designed to study symptoms of BE. As such we cannot empirically identify the reasons for behavior problems in children whose mothers had pre-pregnancy history of symptoms of BE. Also, symptoms of BE were assessed using maternal self-report rather than clinical interview, although self-report of ED has been found to be sensitive and specific (Keski-Rahkonen et al., 2007; Micali et al., 2012). There may be factors that were not available in our dataset including genetics and whether mothers had BE during pregnancy and/or very early childhood. If the mothers had longstanding continued symptoms of BE throughout these developmental stages this may have led to poorer fetal, infant, and childhood nutrition (Sadeh-Sharvit et al., 2016). We also did not have measures of child temperament (Barona et al., 2016), maternal psychopathology apart from anxiety and depression, or specific markers of food insecurity which may impact child development. Another limitation is that data on the children were obtained from mothers which could introduce bias and misclassification. Effect estimates may have been underestimated as the ALSWH, as a population-based study, would be more likely to include women with less severe symptoms of BE. The lack in our study of a repeat assessment of the same ED questions asked at Survey 1 and 2 means it is possible some women developed symptoms of BE after Survey 2, but before having children, and were not included as exposed. Further, some of the mothers may have developed proximal ED symptoms in the context of another serious ED, which we could

not capture. Finally, the study design and variables in the dataset meant we could not disentangle genetic, environmental factors or epigenetic effects.

In conclusion, this exploratory study suggests there may be ongoing associations between maternal symptoms of BE measured in early adulthood and before pregnancy on child behavior but that ongoing symptoms of EDs in mothers and other social factors may be more important. Studies with repeated measures of ED are needed to test the hypotheses that these associations vary by timing of ED measurement. Contact by young women with the health care system before they are pregnant offers opportunities for potential symptoms of EDs to be identified and treatment and support services put in place to optimize outcomes for mothers and their children.

AUTHOR CONTRIBUTIONS

Caley Tapp: Conceptualization; formal analysis; methodology; writing – original draft; writing – review and editing. **Gita Devi Mishra:** Conceptualization; funding acquisition; methodology; writing – review and editing. **Annette Jane Dobson:** Conceptualization; methodology; writing – review and editing. **Katrina Moss:** Conceptualization; methodology; writing – review and editing. **Leigh Tooth:** Conceptualization; methodology; supervision; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST

The authors have no conflict to declare.

DATA AVAILABILITY STATEMENT

The ALSWH data are available free of charge on request to bona fide researchers. The process is documented on the website [<http://www.alswh.org.au/>], which includes all the survey questionnaires, data books of frequency tables for all surveys, meta-data, conditions of data access and request forms. Restrictions are imposed by some of the human research ethics committees (both national and state-based) and some data custodians on where some of the linked data may be analysed. MatCH survey data will be freely available in the same

manner as for ALSWH survey data from late 2022. In the interim, all enquiries to access MatCH data should be made to Professor Gita Mishra.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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