

## **Risk Factors for the Onset of Eating Disorders in Adolescents**

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### **Risk Factors for the Onset of Eating Disorders in Adolescents**

According to Hay & Claudino (2012), childhood is arguably the most vulnerable period for the development of eating disorders. Therefore, identifying the antecedents, or risk factors that lead to the development of eating disorders, is an important area of research. Two of the most common types of eating disorders are anorexia nervosa, and bulimia nervosa (O'Connor et al., 2016). Anorexia nervosa is characterised by body dysmorphia and excessive dieting, which results in an abnormally low body weight and an intense fear of gaining weight (American Psychiatric Association, 2015). Bulimia nervosa is characterised by uncontrollable episodes of binge eating followed by purging methods, such as self-induced vomiting to avoid weight gain, which leads to individuals feeling a lack of control and basing their self-worth on their weight and shape (American Psychiatric Association, 2015). Concerningly, the lifetime prevalence of anorexia nervosa for children and adolescents is 0.4-3.7%, and 1.2-4.2% for bulimia nervosa (Gonzalez et al., 2007). 'Partial syndrome' eating disorders are identified when individuals meet some of the diagnostic criteria for anorexia nervosa or bulimia nervosa, and they occur even more commonly, with the majority of onset commencing before the age of 20 (Preti et al., 2009). However, many eating disorder treatment services are underused (Darcy & Dooley, 2007) and 80% of people with eating disorders do not receive support (Swanson et al., 2011). Therefore, it is a priority in public health research to identify childhood risk factors that predict future onset of eating disorders, and implement potential methods of prevention. (Darcy & Dooley, 2007).

A desire to be perceived as attractive and accepted by society plays a significant role in the development of eating disorders and is linked to changes in body image dissatisfaction, weight, and dieting behaviours. Research suggests that individuals with negative body image are more likely to develop eating disorders (Manley et al., 2000; Micali et al., 2015) due to elevated feelings of shame and a desire to be thin and accepted by society (Ferreira et al., 2013). Brink and Ferguson (1998) found that majority of people who decide to lose weight make this decision because they want to be perceived as more attractive. This perceived attractiveness ideal also explains why weight is associated with the development of eating disorders. Evidence suggests that childhood obesity can increase the risk of later developing an eating disorder because overweight children are more likely to

want to lose weight (Erickson et al., 2000) and often engage in unhealthy weight loss methods to achieve this (Burrows & Cooper, 2002). Stice et al. (2017) suggest that a low BMI in childhood is associated with later onset of anorexia nervosa if the child is undereating due to lack of enjoyment of eating as opposed to deliberately dieting to control weight. Adolescents who purposely diet to lose weight, however, are at an increased risk of bulimia nervosa (Patton et al., 1999; Stice et al., 2017). Whilst these studies explore how body image dissatisfaction, weight, and dieting behaviours influence eating disorder development in older age groups, there is limited research which explores whether this association is present in children as young as 8-9 years old. Further, these studies examine eating disorder risk factors by measuring all the variables at one time point. Using longitudinal data to see how factors measured at one age influence the individual's outcomes at a later age, would be valuable.

The relationship between nutritional intake and eating disorders has often been looked at in the literature. Research has consistently indicated that individuals with anorexia nervosa tend to prefer low calorie, nutritious foods over high fat foods (Drewnowski et al., 1988; French et al., 1994; Kanayama et al., 2019). Other research has suggested that individuals with bulimia nervosa crave foods high in sugar more than individuals without bulimia (Drewnowski et al., 1987). Very little attention has been given to exploring diet patterns in young childhood, and how these relate to eating disorder onset later in life. One reason for this gap in the literature could be that younger children have less control over what they eat, whilst teenagers and adults tend to make their own food choices (Bassett et al., 2008). Therefore, it could be argued that a young child's diet is not an accurate reflection of their own dietary choices and preferences.

Both genetic and environmental factors can influence a child's risk of developing an eating disorder. Several parental factors may contribute to this risk such as parental mental illness (Bould et al., 2015), severe prenatal maternal stress (Su et al., 2015; 2016), and high parental expectations (Goncalves et al., 2016). Additionally, evidence suggests that women with eating disorders are more likely to have experienced negative parental weight-related attitudes in childhood and had family values that emphasised physical fitness and body image, compared to women without eating disorders

(Goncalves et al., 2016). Research has consistently found that parental encouragement for child dieting is a predictor of body dissatisfaction in children (Smolak et al., 1999; Young et al., 2004). However, the majority of the research in this field is limited in that it only focuses on females since eating disorders are much more common among women than men (Hsu, 1989).

Evidence suggests that anxiety disorders are often comorbid with eating disorders (Godart et al., 2002; Kaye et al., 2004; Raney et al., 2008). Whilst research has found that generalised anxiety at age 10 may predict eating disorders at age 14-16 (Schaumberg et al., 2019), very little evidence has addressed whether younger children with anxiety are more likely to develop eating disorders later in life. This is partly due to how difficult it is to accurately measure anxiety in young children (Warren & Dadson, 2001). Some studies attempt to measure anxiety and eating disorders by collecting data from women with anorexia nervosa who report to have had anxiety in childhood (Raney et al., 2008), or by asking parents to report symptoms (Schaumberg et al., 2019). These methods can be inaccurate and prone to recall bias, and, since variables are simultaneously assessed there is little evidence to suggest a causal relationship between variables. These limitations could be reduced if longitudinal data, such as The Longitudinal Study of Australian Children (LSAC) were used. Longitudinal data is particularly useful for studying cause and effect relationships since individuals are followed over time. Further, longitudinal studies often capture self-report data close to when events actually occur. For instance, some variables in the LSAC measure events that happened “in the last 24 hours,” which makes the data more accurate and reliable (Caruana et al., 2015). There is no measure of anxiety in the LSAC for younger children. However, there is a measure of emotional development, the Strengths and Difficulties Questionnaire (SDQ): Emotional Problems Scale (Goodman, 2001), which is a very similar construct. Whilst the LSAC is a highly valuable dataset, very few studies have used it to explore eating disorders.

LSAC data has been used to estimate the prevalence of eating disorder symptoms in adolescents (Hughes et al., 2019), and to examine the association between eating disorders in adolescents with and without attention deficit hyperactivity disorder (Bisset et al., 2019). One study used the LSAC to explore whether personality traits relate to eating disorder symptomatology in

children (Allen et al., 2020). They found that children with higher levels of conscientiousness at age 12 ate more fruit and vegetables and less fat and sugar. Additionally, they skipped meals less frequently and had a lower risk of partial syndrome bulimia at age 14. Girls with higher neuroticism at age 12 were more likely to skip meals and had an increased risk of partial syndrome bulimia at age 14 (Allen et al., 2020). The researchers studied this particular age group because they believe that age 14 is when adolescent girls start to aspire to be thin and become prone to eating disorders (Herpertz-Dahlmann, 2015). However, other research suggests that children as young as 5 can start to show body dissatisfaction and dieting behaviours (Abramovitz & Birch, 2000; Braet & Wydhooge, 2000; Carper et al., 2000; Damiano et al., 2015; Davison et al., 2000). Given that some 6–12-year-olds aspire to be lean and muscular (Ricciardelli & McCabe, 2001), and some 8–12-year-olds use strategies to lose weight and build muscle (McCabe & Ricciardelli, 2005), it would be valuable to explore risk factors for eating disorders in children under the age of 10.

Eating disorder risk factors in the 8-9 age group needs more attention since some children are approaching puberty at this age (Lee et al., 2001; Pinyerd & Zipf, 2005) which can result in an increase in general stress sensitivity (Sumter et al., 2010) and changes in body satisfaction (Stice, 2003). The attractiveness ideals in society are slender/ petite for females, and tall and muscular for males (Thompson et al., 1999). Therefore, the physical changes girls go through during puberty, such as growth spurts, may contribute to body dissatisfaction for girls (Stice, 2003). Contrastingly, when boys go through puberty, they get taller and gain muscle which moves them towards the male attractiveness ideal. This theoretically increases positive body image (Tobin- Richards et al., 1984). Research has explored the relationship between puberty and eating disorders. However, findings have been inconsistent. Ackard et al. (2001) found no significant association between age of puberty onset and disordered eating, self-esteem or body satisfaction. However, females who started going through puberty at an earlier age were more likely to feel socially insecure and want to lose weight. Other findings have suggested that puberty may be a predictor for the development of eating disorders (Baker et al, 2012; Killen et al, 1992; Tremblay & Lariviere, 2009). One study suggests that puberty is a critical risk period for the development of eating disorders (Klump, 2013), whilst another suggests

that it is unclear whether there is an increased risk of developing eating disorder symptoms during puberty (Harden et al, 2014). The relationship between age of puberty onset and later development of an eating disorder is inconclusive due to conflicting findings in the literature.

Some studies look at the individual symptoms associated with eating disorders such as binge eating or unhealthy weight control behaviours (Lewinsohn et al, 2002; Striegel- Moore et al, 2009). Evidence suggests that some individual symptoms of eating disorders are significantly associated with being overweight and having worse mental health outcomes in adulthood (Herpertz- Dahlmann et al, 2015). This highlights the importance of exploring not only predictors of eating disorders, but also predictors of individual symptoms associated with eating disorders.

As previously stated, the literature demonstrates a limited understanding of risk factors for eating disorders in the 8-9 age group with the majority of research in the field of eating disorders only focusing on females and, the LSAC data in particular has been underused in this area of research. The aim of this study is to add to the literature by exploring how a range of factors, measured at age 8-9 influence the risk of children developing bulimia nervosa, anorexia nervosa, and the individual symptoms of these eating disorders (i.e., binge eating, overevaluation of weight) at age 14-15.

## Method

### Participants

This study will employ data from the LSAC K cohort. The LSAC collects survey data every two years from parents, teachers and the children themselves, to provide insight into child development and wellbeing. Since 2004, the LSAC has followed over 10,000 children and their families, in two cohorts. Children in cohort K were 4-5 years old when collection of data began.

This study uses data collected at Wave 3 and Wave 6. In Wave 3, there were a total of 4331 participants with 3456 (1758 males and 1698 females) returning at Wave 6. Only individuals who returned at Wave 6 were included in the study. The mean age of participants in Wave 3 was 8.79 years old ( $SD= 2.84$ ) and 14.8 years old ( $SD = 4.17$ ) in Wave 6.

### Measures

#### *Partial Syndrome Bulimia, Partial Syndrome Anorexia*

Partial syndrome bulimia and anorexia were assessed by screening children for The Branched Eating Disorders Test (BEDT) (Selzer et al., 1996). The BEDT identifies partial syndrome eating disorders, which are recognised where the child fulfils at least two of three Diagnostic and Statistical Manual-III diagnostic criteria for either anorexia nervosa or bulimia nervosa.

The individual symptoms associated with the eating disorders were also explored following the methodology demonstrated by Hughes et al (2019). Table 1 shows the criteria used to identify the individual eating disorder symptoms using the BEDT (Selzer et al, 1996).



**Table 1.**

*Criteria for symptom identification using the branched eating disorder test*

Symptom	Criteria
<i>Anorexia Nervosa Symptoms</i>	
1) Fear of gaining weight or behaviours that interfere with weight gain	Reported at least ONE of the following behaviours, lasting at least 3 months: Self-inducing vomiting to control weight at least weekly; taking tablets, medicines, or drugs to control weight at least weekly; fasting to control weight at least 4 days per week; excessive exercise (2+ hr) to control weight at least 6 days per week OR Reported being “very” or “extremely” concerned about gaining weight.
2) Disturbance in experience of body weight or overevaluation of weight	Rated weight as “very important” to how they feel about themselves OR if underweight: rated themselves as “about the right weight,” “somewhat overweight,” or “very overweight,” if normal weight: rated themselves as “somewhat overweight” or “very overweight” if overweight: rated themselves as “very overweight” if obese: could not be rated
<i>Bulimia Nervosa Symptoms</i>	
1) Regular binge eating	Reported experiencing a loss of control over eating or overeating at least weekly for the last 3 months AND Reported that it is “very difficult” or “impossible” to stop eating after starting to eat in this way AND That the amount of food eaten in a 2-hr period is equivalent to “8 pieces of bread and half a litre of ice-cream and 5 biscuits” OR “12 pieces of bread and 1 litre of ice-cream and 10 biscuits” OR “1 loaf of bread and 2 litres of ice-cream and 1 packet of biscuits.”
2) Overevaluation of weight	Rated their weight as “very important” to how they feel about themselves.
3) Regular engagement in compensatory behaviours	Reported at least ONE of the following, lasting at least 3 months: Self-inducing vomiting to control weight at least weekly, taking tablets, medicines or drugs to control weight at least weekly; fasting to control weight at least 4 days per week; excessive exercise (2+hr to control weight at least 6 days per week).

*Note.* From “Eating disorder symptoms across the weight spectrum in Australian adolescents,” by E. K. Hughes, J. A. Kerr, G. C. Patton, S. M. Sawyer, M. Wake, D. Le Grange, & P. Azzopardi 2019, *International Journal of Eating Disorders* 52(8), p. 887 (<https://doi.org/10.1002/eat.23118>).

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### ***Gender***

Gender was measured by asking the child’s parents if the child was male or female.

### ***Body Mass Index (BMI)***

Body Mass Index was calculated by measuring the child’s weight and height, and then using the formula: weight in kg/ (height in metres)<sup>2</sup>.

### ***Emotional Development***

Emotional development was measured by asking the child’s parents to select statements from the SDQ Emotional Problems Scale (Goodman, 2001), which best describe their child’s behaviour. A higher mean score indicates more emotional development problems, which are interpreted as higher anxiety levels. The LSAC does not have a measurement of anxiety for this wave and cohort.

However, if we compare items from the SDQ Emotional Problems Scale, such as “often seems worried” and “nervous or clingy” with items from a well-established measure of child anxiety, the Spence Children’s Anxiety Scale (Spence, 1998), such as “I worry about things” and “I worry about being away from my parents,” it is plausible that the SDQ Emotional Problems Scale is measuring a construct very similar to anxiety.

### ***Pubertal development***

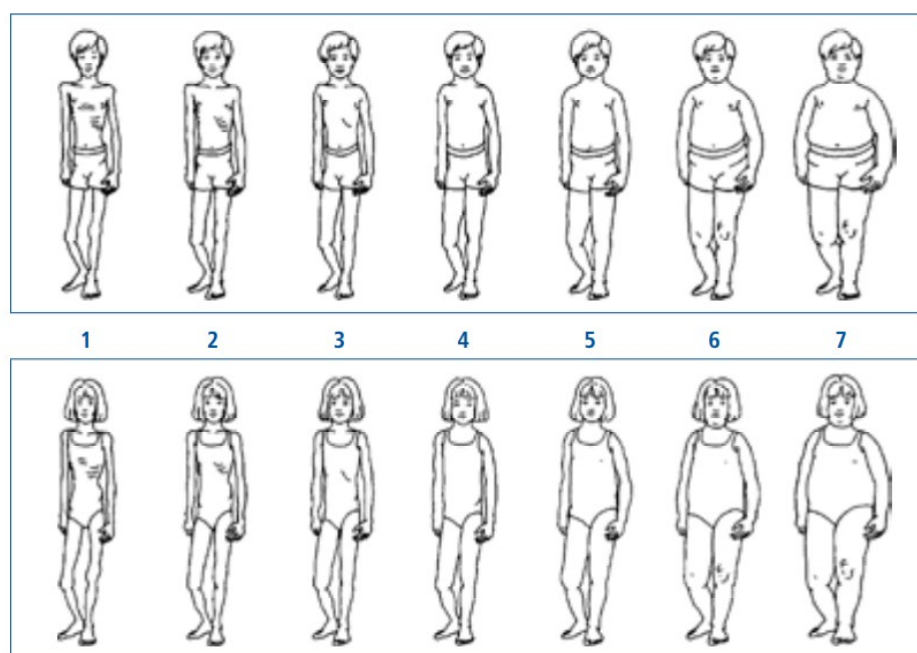
Pubertal development was assessed by asking parents to report whether they had noticed any early signs of puberty in their child. Higher scores indicate that the child has shown more signs of pubertal development.

### ***Body Image Dissatisfaction***

Body image dissatisfaction was measured using the Pictorial Body Image Instrument (Collins, 1991). Children were presented with drawings of children of varying body sizes (Figure 1). The child was asked to select which image most represented their own body size. This was a measure of *perceived body image*. Then, the child was asked to select the image that showed the way he/ she wanted to look. This was a measure of *desired body image*. The discrepancy between the two measures, was used to measure the degree of *Body image dissatisfaction*.

**Figure 1.**

*The Children's Pictorial Body Image Scale (Collins, 1991)*



### ***Child's Diet***

Fat and sugar consumption is constructed using the mean of two measures, (1) serves of high fat foods, (2) serves of high sugar drinks. Higher scores indicate that the child has consumed more of fat and sugar over the last 24 hours.

Fruit and Vegetable consumption was measured by asking parents how many serves of fruit and vegetables the child had consumed over the last 24 hours. Higher scores indicate more serves of fruit and vegetables.

#### ***Parental concern over child's weight***

Parental concern over child's weight was measured by asking parents how concerned they felt about their child's weight. Higher scores indicated elevated levels of concern.

#### ***Parental mental illness***

Parental mental illness was measured using the K-6 Depression scale (Kessler et al., 2002) which is a valid and reliable measure of depression, anxiety and general distress (Staples et al., 2019). The primary caregiver answered 6 questions about their emotional state, each with a five- level response scale from 1 'none of the time' to 5 'all of the time.' Higher mean scores indicate elevated levels of distress.

#### ***Stressful life events***

Stressful life events were measured using the Stressful Life Events Scale which asked the primary care giver if they experienced any stressful life events (such as; suffered serious illness, death of a close friend/ relative) in the last 12 months. A higher mean score indicates that the parent has experienced more stressful life events.

## Results

### Descriptive Statistics

Table 2 provides a summary of descriptive statistics for the sample. The results indicate that most respondents' BMI scores were on the lower end of the range. The majority of respondents had very low scores for emotional development problems and pubertal development. Most of the sample were satisfied with their body image, consumed low amounts of sugar and fat, and consumed average amounts of fruit and vegetables. The majority of parents had no mental illness, low levels of concern over their child's weight, and minimal stressful life events.

**Table 2.**

*Descriptive Statistics for predictor variables (n = 3456)*

Measure	<i>M</i>	<i>SD</i>	Min	Max
BMI	17.49	2.73	11.31	31.79
Emotional Development	1.54	1.74	0	10
Pubertal Development	1.17	0.33	1	3.25
Body Image Dissatisfaction	0.41	1.05	-6	6
Sugar and Fat	1.61	0.99	0	7.5
Fruit and Vegetables	3.52	1.75	0	9
Parental concern over child's weight	2.29	0.61	1	5
Parental mental illness	9.36	3.45	6	30
Stressful life events	0.97	1.28	0	16

Table 3 shows the prevalence of bulimia nervosa and anorexia nervosa based on gender. Of the total sample, more participants met the criteria for bulimia nervosa than met the criteria anorexia nervosa, and both types of eating disorders were more common in females than males.

**Table 3.***Eating Disorder Prevalence by Gender*

	Bulimia Nervosa		Anorexia Nervosa	
	n	%	n	%
Male	23	0.67	3	0.087
Female	50	1.4	6	0.17
Total sample	73	2.1	9	0.26

**Correlations between variables**

Table 4 shows the Pearson's correlations between the eating disorder measures. Anorexia nervosa was positively correlated with both of the anorexia nervosa symptoms and not significantly correlated with bulimia nervosa and two bulimia nervosa symptoms (regular binge eating and regular engagement in compensatory behaviours). Bulimia nervosa was positively correlated with all three bulimia nervosa symptoms.

**Table 4.***Pearson's correlations between eating disorder measures*

Measure	1	2	3	4	5	6	7
1) Bulimia Nervosa							
2) Anorexia Nervosa	-0.01						
3) Fear of gaining weight or behaviours that interfere with weight gain	0.33*	0.04*					
4) Disturbance in experience of body weight or overevaluation of weight	0.25*	0.06*	0.37*				
5) Regular Binge Eating	0.23*	-0.01	0.53*	0.21*			
6) Overevaluation of Weight	0.33*	0.09*	0.40*	0.78*	0.08*		
7) Regular engagement in compensatory behaviours	0.43*	-0.01	0.53*	0.21*	0.13*	0.21*	

*Note.* \* $p < .05$ .

## Logistic Regression

Due to the small number of cases of bulimia nervosa and anorexia nervosa in the sample, conventional logistic regression output is likely to suffer from small-sample bias (Nemes et al., 2009). A rare events logistic regression was created using the Zelig package in R studio (Choirat et al., 2020) to observe the predictors of eating disorders. Predictors of bulimia nervosa are presented in Table 5. Findings indicate that being female is associated with a 10 greater probability of having bulimia nervosa which is interpreted as a very strong effect based on guidelines suggested by Chen et al. (2010). Additionally, every one-unit increase in BMI is associated with a 3.1 increased probability of having bulimia nervosa which is a small to medium effect. Predictors for anorexia nervosa are presented in Table 6. Findings indicate that every one-unit increase in sugar and fat intake is associated with 6.2 increased odds of having anorexia nervosa which is a strong effect.

**Table 5.**

*Predictors of Bulimia Nervosa using rare events logistic regression*

Variable	Odds Ratio	S. E	Z value	P- value
Gender	10	0.63	3.0	0.0025**
BMI	3.1	0.056	2.4	0.016*
Emotional Development	3.0	0.076	0.72	0.47
Pubertal Development	3.6	0.41	0.79	0.43
Body image dissatisfaction	2.5	0.12	-0.60	0.55
Concern over child's weight	2.3	0.20	-0.76	0.45
Parental mental illness	2.6	0.040	-0.64	0.52
Parental Stressful life event	2.7	0.10	0.31	0.76
Sugar and fat	3.0	0.14	0.51	0.61
Fruit and Vegetables	3.0	0.075	0.99	0.32

*Note.* \* $p < .05$ . \*\* $p < .01$ .



**Table 6.***Predictors of Anorexia Nervosa using rare events logistic regression*

Variable	Odds Ratio	S. E	Z value	P- value
Gender	2.0	2.6	1.3	0.20
BMI	2.3	0.17	-0.99	0.32
Emotional Development	3.0	0.23	0.46	0.65
Pubertal Development	5.5	1.8	0.49	0.63
Body image dissatisfaction	2.5	0.36	-0.19	0.85
Concern over child's weight	1.9	0.57	-0.53	0.60
Parental mental illness	3.0	0.10	0.75	0.45
Parental Stressful life event	1.7	0.27	-1.3	0.21
Sugar and fat	6.2	0.53	2.1	0.038*
Fruit and vegetables	2.2	1.2	-1.1	0.29

Note. \*p < .05.

To explore eating disorders rates in the sample further, the prevalence of the individual symptoms of eating disorders were explored (Table 7). Findings indicate that a larger percentage of individuals meet the criteria for individual eating disorder symptoms than those who meet the criteria for bulimia nervosa or anorexia nervosa. The larger number of cases indicate that it is appropriate to use conventional logistic regression to observe which factors predict the individual symptoms of eating disorders.

**Table 7.***Prevalence of Eating Disorder Symptoms*

	Bulimia Nervosa						Anorexia Nervosa			
	1		2		3		1		2	
	n	%	n	%	n	%	n	%	n	%
Gender										
Male	11	0.32	188	5.4	105	3.0	142	4.1	261	7.6
Female	22	0.64	398	12	122	3.5	372	11	550	16
Total Sample	33	0.95	586	17	227	6.6	964	28	811	23.5

*Note.* Bulimia symptoms: 1. Regular binge eating. 2. Overevaluation of weight. 3. Regular engagement in compensatory behaviours.

Anorexia symptoms: 1. Fear of gaining weight or behaviours that interfere with weight gain. 2.

Disturbance in experience of body weight or overevaluation of weight.

Regarding the individual symptoms for bulimia nervosa, logistic regression indicated that the only predictor that was significantly associated with regular binge eating was pubertal development (Table 8), and that the strength of this effect was small. For overevaluation of weight (Table 9), gender, BMI, emotional development, and body image dissatisfaction were significant and had small to medium strength effects. For regular engagement in compensatory behaviour (Table 10) BMI and parental mental illness were significant and had small effect sizes.

**Table 8.***Predictors of Regular Binge Eating*

Variable	Odds Ratio	S. E	Z value	P- value
Gender	2.0	0.40	1.729	0.084
BMI	1.0	0.076	0.180	0.86
Emotional Development	1.1	0.095	1.0	0.31
Pubertal Development	2.2	0.40	2.0	0.045 *
Body image dissatisfaction	1.0	0.19	-0.092	0.93
Concern over child's weight	0.93	0.32	-0.23	0.82
Parental mental illness	1.0	0.048	0.78	0.44
Parental Stressful life event	1.2	0.11	1.4	0.16
Sugar and fat	1.2	0.18	1.0	0.31
Fruit and vegetables	1.0	0.10	-0.42	0.68

*Note.* \* $p < .05$ .

**Table 9.***Predictors of Overevaluation of weight*

Variable	Odds Ratio	S. E	Z value	P- value
Gender	2.4	0.11	8.3	<0.01**
BMI	1.1	0.021	4.6	<0.01**
Emotional Development	1.1	0.029	2.3	0.020*
Pubertal Development	1.1	0.14	0.86	0.389
Body image dissatisfaction	1.1	0.052	2.5	0.012*
Concern over child's weight	0.85	0.095	-1.7	0.097
Parental mental illness	1.0	0.016	-0.64	0.52
Parental Stressful life event	1.1	0.039	1.6	0.11
Sugar and fat	1.1	0.051	1.2	0.23
Fruit and vegetables	1.0	0.029	-0.27	0.79

*Note.* \* $p < .05$ . \*\* $p < .01$ .

**Table 10.***Predictors of regular engagement in compensatory behaviour*

Variable	Odds Ratio	S. E	Z value	P- value
Gender	1.2	0.15	1.1	0.27
BMI	1.1	0.030	3.9	<0.01**
Emotional Development	1.0	0.045	-0.55	0.58
Pubertal Development	1.3	0.21	1.1	0.26
Body image dissatisfaction	0.97	0.078	-0.42	0.68
Concern over child's weight	0.85	0.14	-1.2	0.24
Parental mental illness	1.0	0.021	2.0	0.044*
Parental Stressful life event	1.1	0.054	1.2	0.23
Sugar and fat	1.0	0.077	0.17	0.87
Fruit and vegetables	1.0	0.042	0.76	0.44

*Note.* \* $p < .05$ . \*\* $p < .01$ .

Regarding the individual symptoms for anorexia nervosa, logistic regression indicated that gender, BMI, parental mental illness and parental stressful life events were significant predictors associated with fear of gaining weight or behaviours that interfere with weight gain (Table 11). The strength of these effects was small to medium. For disturbance in experience of body weight or overevaluation of weight (Table 12) gender, body image dissatisfaction, concern over child's weight and parental stressful life events were all significant predictors. The strength of these effects was small to medium.

**Table 11.***Predictors of fear of gaining weight or behaviours that interfere with weight gain*

Variable	Odds Ratio	S. E	Z value	P- value
Gender	3.3	0.12	9.7	<0.001**
BMI	1.2	0.023	6.7	<0.001**
Emotional Development	1.1	0.031	1.8	0.077
Pubertal Development	1.2	0.15	1.3	0.18
Body image dissatisfaction	1.0	0.057	0.70	0.48
Concern over child's weight	0.89	0.10	-1.2	0.23
Parental mental illness	1.0	0.016	2.4	0.017*
Parental Stressful life event	1.1	0.040	2.1	0.034*
Sugar and fat	0.96	0.058	-0.79	0.43
Fruit and vegetables	1.0	0.031	0.90	0.37

*Note.* \* $p < .05$ . \*\* $p < .01$ .

**Table 12.***Predictors of Disturbance in experience of body weight or overevaluation of weight*

Variable	Odds Ratio	S. E	Z value	P- value
Gender	2.8	0.094	11	<0.001 **
BMI	1.0	0.020	1.8	0.075
Emotional Development	1.0	0.027	1.4	0.18
Pubertal Development	1.1	0.14	0.47	0.64
Body image dissatisfaction	1.2	0.048	3.5	0.00039**
Concern over child's weight	0.83	0.089	-2.2	0.029*
Parental mental illness	1.0	0.014	-0.024	0.98
Parental Stressful life event	1.1	0.036	2.0	0.041*
Sugar and fat	1.1	0.047	1.5	0.13
Fruit and vegetables	1.0	0.026	0.088	0.93

*Note.* \* $p < .05$ . \*\* $p < .01$ .

## Discussion

### Overview of the findings

The aim of this study was to investigate how factors measured at age 8-9 predict development of bulimia nervosa, anorexia nervosa, and the individual symptoms associated with these eating disorders at age 14-15. Whilst other research has focused on predictors of eating disorders in older samples, the current findings add to the literature by suggesting that some predictors of eating disorders can be detected at a much younger age (8-9 years old). The most prevalent predictors are gender, BMI and body image dissatisfaction. It is also worth noting that whilst certain variables (e.g., parental mental illness) did not predict bulimia nervosa or anorexia nervosa, they did predict some of the individual symptoms of the eating disorders which has important implications.

### Explanation of predictors of bulimia nervosa

Being female and having a higher BMI were associated with developing bulimia nervosa which is consistent with studies that have investigated predictors of bulimia nervosa (Berkowitz et al., 2016; Fairburn et al., 2003; Hay & Mitchison., 2019; Leal et al., 1995). Evidence suggests that females typically have higher rates of bulimia since they experience pressure from society to conform to the slender attractiveness ideal for women (Cox, 1987). The current results indicate that this effect is present even in 8–9-year-olds. Evidence indicates that elevated BMIs predict the development of bulimia because overweight children are more likely to be teased about their appearance, feel lonely, and have poor body satisfaction, which is associated with bulimic behaviours (Hayden- Wade et al., 2005).

Interestingly, body image dissatisfaction was not a significant predictor for bulimia nervosa in this sample which differs to other findings (Hayden-Wade et al., 2005; Mohr et al., 2011; Sattler et al., 2019). There is evidence to suggest that body image dissatisfaction at age 13-16 predict eating disorder onset 4 years later (Rohde et al., 2015). The current findings are inconsistent with this which indicates that a relationship between body image dissatisfaction and bulimia nervosa might not be present in children under the age of 10. This could be because children go through numerous



developmental changes between the ages of 8-9 and 13-16 such as increasing levels of body image dissatisfaction (Thelen et al., 1992). In other words, perhaps the children in Wave 3 were too young for an association to be recognised.

### **Explanation of predictors of anorexia nervosa**

Consuming more fat and sugar was the only variable associated with an increased probability of developing anorexia nervosa which was surprising since other research has suggested that individuals with anorexia typically avoid high fat and sugar content foods (Hadigan et al., 2000; Mayer et al., 2012; Walsh, 2011). The reason behind this association is not entirely clear. However, evidence suggests that being overweight is associated with later developing anorexia nervosa in older samples (Berkowitz et al., 2016; Burnette et al., 2018). This could explain the association between high fat and sugar and anorexia nervosa. Perhaps children who consume high levels of fat and sugar subsequently become overweight later in life and, therefore, are likely to be bullied, have low self-esteem and are encouraged to lose weight (Hayden- Wade et al., 2005). This could lead to the development of anorexia nervosa. Further research is needed to explore this relationship.

### **Explanation of predictors of individual bulimia nervosa symptoms**

Results suggest that pubertal development predicted regular binge eating which is generally consistent with findings from other research (Killen et al., 1992; Klump et al., 2017) since hormonal changes are thought to be linked to increases in stress sensitivity (Sumter et al., 2010) and binge eating (Zehr et al., 2007).

For overevaluation of weight, gender, BMI, emotional development and body image dissatisfaction were significant predictors, which is in accordance with other findings. Studies have indicated that both females and people who are overweight were more likely to endorse overevaluation of weight (Santana et al., 2021) because of societal pressure to conform to attractiveness ideals as previously discussed (Connor-Greene, 1988; Pierce & Wardle, 1997; Ross, 1994). Evidence suggests that emotional developmental problems are associated with overevaluation of weight (Harrison et al., 2016) because those with emotional problems, like anxiety disorders, often

have low self-esteem. This can result in individuals fixating on their shape and weight (Forrest et al., 2019) and being perfectionistic which may lead to striving for a “perfect” body (Bardone- Cone et al., 2007). Evidence suggests that body dissatisfaction is a predictor for overevaluation of weight (Lydecker et al., 2021; Sharpe et al., 2018; Walker et al., 2018) which is consistent with the current findings since both behaviours are similar in nature and are linked to body shame and social appearance anxiety (Ko, 2010).

For regular engagement in compensatory behaviour, BMI and parental mental illness were significant predictors which supports other evidence. Research suggests that overweight adolescents are more likely to engage in unhealthy weight control behaviours such as laxative use, than non-overweight adolescents (Boutelle et al., 2002; Kennedy et al., 2019). This is because individuals who are overweight often aspire to lose weight and be accepted by society (Brink & Ferguson, 1998; O’Brien et al., 2007) and, often these weight loss techniques are unhealthy attempts to ‘undo’ food consumption (Ferraro et al., 2015). Very little research has explored the relationship between parental mental illness and offspring engagement in compensatory behaviour specifically. However, research indicates that parental mental illness predicts eating disorders (Bould et al., 2015) and obesity in offspring (Morris et al., 2020). This is thought to arise as a result of reduced parental emotional availability (Paul, 2010) and support (Geerling et al., 2019). Drawing on attachment theory (Bowlby, 1979), a lack of parent-child connectedness has been linked to developmental problems in children including disordered eating (Turner et al., 2005; Orzolek- Kronner, 2002).

### **Explanation of predictors of individual anorexia nervosa symptoms**

Gender and BMI predicted fear of gaining weight or behaviours that interfere with weight gain, which is consistent with findings from other studies (Ambwani et al., 2008; Boutelle et al., 2002).

In regards to disturbance in experience of body weight or overevaluation of weight, gender, body image dissatisfaction, concern over child’s weight, and parental stressful life events were significant predictors, which adds to the findings of other studies. Evidence suggests that females are

more likely to exaggerate their body weight than males (Bhurtun & Jeewon, 2013; Cash & Brown, 1989; Garner et al., 1980; Strauss, 2000) and that body image dissatisfaction is likely to lead to individuals overestimating their size due to low self-esteem and feelings of insecurity regarding appearance (Tiggemann, 2005).

The association between parental concern and anorexia symptoms is inconclusive. Some research suggests that there is a relationship between critical and judgemental parenting styles and eating disorders (Haworth- Hoepfner, 2000). However, very little evidence explores parental concern, and the term itself is quite vague. Asking a parent if they are concerned over their child's weight indicates very little about their parenting style or attitudes towards their child. A caring, attentive parent could report being concerned, but so could a judgmental parent. Therefore, even though parental concern over child's weight significantly predicted disturbance in experience of body weight or overevaluation of weight, it is difficult to interpret what this means and what the implications of this association are. Measuring parenting behaviours and parental characteristics would be more helpful (Decaluwé et al, 2006).

Very little research has explored how parental stressful life events effect offspring disturbance in experience of body weight or overevaluation of weight specifically. However, there is evidence that prenatal stress is associated with low infant birth weight (Brown et al., 2011; Witt et al., 2014), accelerated childhood weight gain, and risk of obesity (Bräuner et al., 2021). Schwerdtfeger et al. (2013) suggests that mothers who had experienced trauma were more likely to have authoritarian parenting styles which predicted negative outcomes in offspring.

### **Methodological strengths and limitations**

This study has several strengths such as the use of a large, diverse sample, the narrow age ranges which allows predictors of eating disorders to be identified at a more precise period, and the use of the BEDT. The BEDT uses specific DSM- 5 diagnostic criteria to assess eating disorders and is particularly useful at identifying eating disorders in nonclinical samples (Selzer et al., 1996). Despite

this, the BEDT is limited as it relies on self-reported data and only assesses bulimia and anorexia and ignores other eating disorders.

Further limitations include the use of BMIs to assess someone's weight category since BMIs give a very poor estimation of percentage of body fat in children under the age of 9 (Vanderwall et al., 2017). Additionally, several variables relied heavily on participant's recollection of foods that the child had consumed, which makes them less reliable.

Whilst this study used the same sample and methodology as Hughes et al. (2019), there were discrepancies between the prevalence rates of the individual symptoms of the eating disorders. The LSAC BMI data is coded so that all the participants at the extreme ends of the scale have the same BMI for confidentiality purposes. An email correspondence (J. Kerr, personal communication, September, 6, 2021) confirmed that Hughes et al. (2019) used the confidential dataset which allowed them to remove participants who had implausible BMI values. The current study used the general release of the LSAC which limits the reliability of results.

### **Future directions and implications**

Interestingly, some variables (i.e. body image dissatisfaction) predicted the individual symptoms of an eating disorder but did not actually predict a full diagnosis of anorexia nervosa or bulimia nervosa. This does not mean that the findings should be ignored. Children who meet the criteria for one of these symptoms are still at risk for developing an eating disorder, becoming overweight, and developing a mental illness (Herpertz- Dahlmann et al., 2015; Micali et al., 2014). Therefore, future research should explore predictors of the individual symptoms further and how the individual symptoms can develop into more serious conditions.

Further, research is needed to focus on parental factors. It would be valuable to explore how parents with mental illnesses communicate and support their children and the mediating effect this has on the development of an eating disorder. Additionally, future studies should explore how parents demonstrate concern over their child's weight and the effect this has on child eating disorder development.

Another area of interest is the relationship between childhood diet and later eating disorder onset. Importantly, the relationship between fat and sugar consumption and anorexia nervosa needs to be explored further since it is unclear why this relationship exists. Not only should the types of foods a child is consuming be explored, but also whether these food choices are a result of the child's own decisions. It would be interesting to determine at what age children start to make their own dietary choices and what role this plays in the development of eating disorders.

### **Conclusions**

In sum, this study provides data surrounding predictors of anorexia nervosa, bulimia nervosa and individual symptoms of these eating disorders in adolescent Australians. Findings can be used to understand how factors measured at age 8-9 influence eating disorder development at age 14-15 and thus, can be used to guide future research and preventative measures to reduce the risk of eating disorder development. Exploration into parenting styles and childhood diet form an important next step for research in this area.

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