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Developmental Antecedents of Abnormal Eating Attitudes and Behaviors in Adolescence

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ABSTRACT

Objective: This study capitalizes on developmental data from an Australian population-based birth cohort to identify developmental markers of abnormal eating attitudes and behaviors in adolescence. The aims were twofold: (1) to develop a comprehensive path model identifying infant and childhood developmental correlates of *Abnormal Eating Attitudes and Behaviors* in adolescence, and (2) to explore potential gender differences.

Method: Data were drawn from a 30-year longitudinal study that has followed the health and development of a population based cohort across 15 waves of data collection from infancy since 1983: The Australian Temperament Project. Participants in this analysis were the 1,300 youth who completed the 11th survey at 15–16 years (1998) and who completed the eating disorder inventory at this time point.

Results: Developmental correlates of *Abnormal Eating Attitudes and Behaviors*

in mid-adolescence were temperamental persistence, early gestational age, persistent high weight, teen depression, stronger peer relationships, maternal dieting behavior, and pubertal timing. Overall, these factors accounted for 28% of the variance in *Abnormal Eating Attitudes and Behaviors* at 15–16 years of age. Depressive symptoms, maternal dieting behavior, and early puberty were more important factors for girls. Late puberty was a more important factor for boys.

Discussion: Findings address an important gap in our understanding of the etiology of *Abnormal Eating Attitudes and Behaviors* in adolescence and suggest multiple targets for preventive intervention. © 2014 Wiley Periodicals, Inc.

Keywords: eating attitudes and behaviors; adolescents; family; developmental correlates; longitudinal survey

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Introduction

The etiology of adolescent onset eating disorders is complex and poorly understood. Once established, these disorders often require intensive and costly treatment intervention. Understanding developmental pathways into eating disorders is critical to informing prevention and early intervention efforts. However, diagnosis of an eating disorder is the extreme end of a broader spectrum of abnormal

eating attitudes and behaviors. Little is known about abnormal eating attitudes and behaviors, yet these affect a large number of children and adolescents, are often pre-clinical manifestations of full threshold eating disorders, and might be more amenable to intervention.^{1–3} For these reasons, greater investment in understanding the etiology of abnormal eating attitudes and behaviors might hold considerable promise for informing investment in public health and clinical intervention around problematic eating behaviors.

Conceptualization and assessment of abnormal eating attitudes and behaviors have varied widely, with the most often used measurement tools being the eating disorder inventory (EDI)⁴; eating attitudes test (EAT)⁵; bulimic investigatory test (BITE)⁶; and the eating disorder examination questionnaire (EDE-Q).⁷ Across these various measures, there is consensus that abnormal eating attitudes and behaviors is a multifaceted construct including dimensions such as dietary restraint, binge eating, purging behaviors, body dissatisfaction, and drive for thinness. These attitudes and behaviors are

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relatively common in adolescence,² and are associated with significant distress and impairment.⁸ Abnormal eating attitudes and behaviors may indicate the presence of an eating disorder or be a precursor to the development of an eating disorder or, in some cases, another diagnosis.^{1,9,10}

To date, most etiologic research has focused on prediction of full threshold eating disorders.^{11–14} Results from this research have yielded a broad range of potential predictors related to body mass,^{15,16} timing of puberty,^{17–19} gestation and early feeding practices,^{20–24} psychological factors such as depression and anxiety,^{25–29} temperament,^{30–33} family environment,^{34–36} peers,^{37–40} parent–child relationships,^{41–43} and deficits such as poor social competence and social-emotional isolation.⁴⁴ To the extent that eating disorders emerge from earlier abnormal eating attitudes and behaviors, common pathways might be expected. However, the two constructs are not the same, so unique pathways also need to be considered and appropriately modeled.

Furthermore, associations reported to date require cautious interpretation. Most have been identified in non-representative samples (i.e., clinical), assessed cross-sectionally or over relatively short periods of time, and commonly collected data by retrospective report. In addition, most have been studied in isolation leaving important questions about collinearity between variables largely unexplored. For the field to move forward, new research is needed in mature, population-based, longitudinal data resources that provide opportunities to study multiple pathways across extensive periods of early development. Such studies provide further opportunities to describe the etiology of abnormal eating attitudes and behaviors and, in doing so, inform earlier and timelier interventions aimed at preventing eating disorders.

The objective of this study was to identify infant and child pathways to abnormal eating attitudes and behaviors by mid-adolescence. The aims were twofold: (1) to develop a path model to examine infant and childhood predictors of adolescent abnormal eating attitudes and behaviors in adolescence, and (2) to examine whether predictors differed for males and females. Data for this exploratory analysis were drawn from the Australian Temperament Project (ATP), a large-scale longitudinal community based study established in 1983, which has followed the development of a cohort of Australian children over 30 years (15 waves) from infancy to young adulthood. To explore aims 1 and 2, we derived an indicator of

Abnormal Eating Attitudes and Behaviors at 15–16 years of age based on the Drive for Thinness and Bulimia Subscales of the EDI, and an adapted version of the EDI Body Dissatisfaction Subscale suitable for administration in a (non-clinical) general population sample.

Method

Participants and Procedure

The ATP has followed the psychosocial development of a community sample from infancy to adulthood. A representative sample of 2,443 infants was recruited through selected Maternal and Child Health Centers across both urban and rural areas in the State of Victoria, Australia, during a 2-week period in 1983. Using mail survey methodology, 15 waves of data have been collected over the past 28 years from parents, primary school teachers, maternal and child health nurses, and from the age of 11 years onwards, the young people themselves (see Ref. 45). The Human Research Ethics Committee at the Australian Institute of Family Studies approved this methodology.

Participants in this study were the 1,300 youth who completed the eleventh survey at age 15–16 years in 1998 and had data on *Abnormal Eating Attitudes and Behaviors* at this time point. Participants were 668 females (51.3%) and 632 (48.7%) males, representing 78% of the youth who were still enrolled in the study at age 15–16 years.

As expected for a longitudinal study of this longevity, attrition has occurred and has proceeded at around 1% per annum. Although proportionately more families from a lower SES background, or parents who were not born in Australia, have been lost to the study, there were no significant differences on any child characteristics assessed in infancy between the retained cohort at 15–16 years and those no longer participating. Hence, while the study continues to include youth with a broad range of attributes and families living in diverse circumstances, it contains fewer families experiencing socioeconomic disadvantage than at the commencement of the study.^{46,47} This may result in a slight underestimation of the impact of disadvantage in this analysis, but overall is unlikely to have a significant impact on the results given that the sample remains broadly representative.

Materials

Abnormal Eating Attitudes and Behaviors in Adolescence were assessed by 17 items all measured by self-report at 15–16 years. Items were derived from two subscales from the EDI^{48,49}; Drive for Thinness (seven items, $\alpha = .92$, e.g., “I am terrified of gaining weight”) and Bulimia (seven items, $\alpha = .76$, e.g., “I have thought of trying

to vomit in order to lose weight”), as well as additional items assessing Body Dissatisfaction (three items in total, $\alpha = .67$; one item from the EDI Body Dissatisfaction subscale “I feel satisfied with the shape of my body” and two study-derived items “I think I am too fat,” and “I think I am not muscular enough”). The Body Dissatisfaction subscale originally contained an additional item “I think I am too skinny”; however, this item was removed from the following analyses after our preliminary investigations suggested that it was a poor fit for the subscale. The decision to use this subscale, rather than the original EDI Body Dissatisfaction subscale, was based on negative feedback from participants on the EDI items in the previous wave,⁴⁵ which resulted in a high level of missing data (yielding a variable unsuitable for analysis) and raised concern within the research team about face validity in a general (non-clinical) population. Items were rated on a six-point Likert scale (never, rarely, sometimes, often, usually, always). For clinical assessment purposes, the EDI is commonly scored by transforming responses from a six-point to a three-point scale, and summing all item scores for that particular subscale to derive a clinical classification (see Ref. 48 for further details). However, in a general population sample (such as the ATP), where the prevalence of clinical disorder is low, untransformed scales can be used to describe a distribution of abnormal eating attitudes and behaviors.⁵⁰ The latter was used in this analysis. Further details relating to the measurement characteristics of the items assessing abnormal eating attitudes and behaviors are described in relation to the confirmatory factor analysis (CFA) presented in Results section below.

Variable Classification. With the exception of SES, all variables included in our model of Abnormal Eating Attitudes and Behaviors in Adolescence measures were assessed in the 11 waves prior to administration of the EDI. However, as per Kraemer’s typology of factors,⁵¹ antecedent variables cannot be defined as “risk factors” because measures of abnormal eating attitudes across childhood were not taken. For the purposes of this analysis all variables are therefore defined as “developmental correlates” with the exception of SES which is defined as a “concomitant factor.”

In the absence of clear thresholds, all variables included in this model were entered as continuous. Variables were further grouped into five age bands: infancy (4–8 months), toddlerhood (3–4 years), mid-childhood (7–8 years), late childhood (11–12 years), and early adolescence (12–14 years). At each wave, approach, persistence, and reactivity were measured by parent-report with items based on age appropriate factor structures^{52,53} of the Thomas and Chess temperament framework.⁵⁴ Constructs are therefore best defined as parent report of child temperament. From age 11 to 12 years, participants provided self-reports on peer relationships, first rating their concept of themselves as friends,⁵⁵ and then at 12–14 years rating their attachment to peers with a

composite measurement of trust, communication, and alienation.⁵⁶ Table 1 details all measures used in this study. Further details can also be viewed at www.aifs.gov.au/atp, or see Prior et al.⁴⁵ for an overview.

Data Analysis

The modeling in this study was performed using AMOS 20 software.⁶⁸ Model estimations were based on a covariance matrix and used maximum likelihood estimates, suitable for large sample sizes.⁶⁹ The model diagrams show standardized parameter estimates, β , which represent the effect of a given predictor variable on the dependent variable after accounting for the remaining relationships in the model. Missing data in the predictor variables averaged 8.8% and were imputed using the Expectation–Maximization (EM) algorithm.

A number of fit statistics that indicate how well the model reflects the data are reported. Chi-square is the most commonly reported fit statistic and significant chi-square values suggest that the sample correlation matrix and the model correlated matrix are significantly different.⁷⁰ However, large sample sizes (over 200) tend to increase chi-square,⁷¹ and thus it is reported only as a matter of convention in this study. The root mean square error of approximation (RMSEA) with an associated 90% confidence interval is based on the non-centrality parameter, and takes particular account of the error of approximation.⁷² Brown and Cudeck⁷³ suggest that values up to .08 indicate acceptable fit. The comparative fit index (CFI) is derived from comparison of a hypothesized model with the independence (or null) model. A cut-off value of .90 to indicate an adequate model fit has been advised.⁷⁴ All path coefficients were standardized. Given the large number of predictor variables explored here, descriptive statistics and intercorrelations are not presented but are available from the authors upon request.

Results

Results are presented in three parts. First, we conducted a confirmatory factor analysis (CFA) on the EDI to derive outcome scores for *Abnormal Eating Attitudes and Behaviors in Adolescence* for use in the subsequent analysis. Second, these outcome scores were used in the path model to examine possible predictors of *Abnormal Eating Attitudes and Behaviors* at 15–16 years. Finally, we performed a gender invariance test on this model, to see whether predictors differed for males and females.

Deriving the Abnormal Eating Attitudes and Behaviors Outcome Measure at 15–16 Years

We conducted a confirmatory factor analysis (CFA) on the EDI to derive outcome scores for

TABLE 1. Summary of variables examined in this study

Construct	Age	Informant	Response Scale	Source	Number of Items	α	Example Item
Infancy Approach	4–8 months	Parent	Parents rated items on a 6-point Likert scale from 1 = “almost never” to 6 = “almost always”	Revised Infant Temperament Questionnaire ⁵⁷	7	.76	The baby is shy (turns away or clings to mother) on meeting another child for the first time (rev)
Irritability	4–8 months	Parent	Parents rated items on a 6-point Likert scale from 1 = “almost never” to 6 = “almost always”	Revised Infant Temperament Questionnaire ⁵⁷	5	.64	The baby is fretful on waking up and/or going to sleep (frowns, cries)
Gestation Breast fed	4–8 months 4–8 months	Nurse Nurse	Weeks Breast; Bottle; Breast and bottle; Breast initially, then bottle	— —	1 1	— —	Gestational age: Type of feeding
Toddlerhood Approach	3–4 years	Parent	1 = almost never; 2 = rarely; 3 = variable, usually does not; 4 = variable, usually does; 5 = frequently; 6 = almost always	Childhood Temperament Questionnaire ^{52,54}	7	.84	Is pleasant (smiles, laughs) when first arriving in unfamiliar places
Inflexibility	3–4 years	Parent	1 = almost never; 2 = rarely; 3 = variable, usually does not; 4 = variable, usually does; 5 = frequently; 6 = almost always	Childhood Temperament Questionnaire ^{52,54}	9	.79	When shopping together, if I do not buy what my child wants (e.g., sweets, clothing), he/she cries and yells
Persistence	3–4 years	Parent	1 = almost never; 2 = rarely; 3 = variable, usually does not; 4 = variable, usually does; 5 = frequently; 6 = almost always	Childhood Temperament Questionnaire ^{52,54}	7	.83	Plays continuously for more than 10 min at a time with a favorite toy
Aggression	3–4 years	Parent	1 = Does not apply, 2 = sometimes applies, 3 = certainly applies	Behar Pre-school Behavior Questionnaire ⁵⁸ Aggression Questionnaire ⁵⁹	10	.78	Destroys own or others belongings
Mid childhood Approach	7–8 years	Parent	1 = almost never; 2 = not often; 3 = variable, usually does not; 4 = variable, usually does; 5 = frequently; 6 = almost always	Childhood Temperament Questionnaire ^{52,54}	7	.84	When in park or visiting, will go up to strange children and join in their play
Inflexibility	7–8 years	Parent	1 = almost never; 2 = not often; 3 = variable, usually does not; 4 = variable, usually does; 5 = frequently; 6 = almost always	Childhood Temperament Questionnaire ^{52,54}	8	.82	When upset or annoyed with a task, throws it down, cries, slams doors, and so forth
Persistence	7–8 years	Parent	1 = almost never; 2 = not often; 3 = variable, usually does not; 4 = variable, usually does; 5 = frequently; 6 = almost always	Childhood Temperament Questionnaire ^{52,54}	7	.86	When starts a project, for example, puzzle, model; works on it without stopping until it is completed, even if it takes a long time
Aggression	7–8 years	Parent	1 = Does not apply, 2 = sometimes applies, 3 = certainly applies	Rutter Problem Behavior Questionnaire ⁶⁰	6	.76	Frequently fights with other children
Anxiety	7–8 years	Parent	1 = Does not apply, 2 = sometimes applies, 3 = certainly applies	Rutter Problem Behavior Questionnaire ⁶⁰	5	.65	Often worried, worries about many things
Family stress	7–8 years	Parent	Number of family changes, losses, or problems that have had a negative impact	Family stress ⁶¹	3		Have there been any of the following losses for family members recently?
Academic competence	7–8 years	Teacher	1 = very good 2 = so-so, and 3 = not good	ATP derived Academic Competence scale based on factor analysis of Cairns & Cairns Interpersonal Competence Scale ⁶²	2	.73	Spelling (1 = very good at spelling, 2 = so-so, and 3 = not good at spelling)
Late childhood Approach	11–12 years	Parent	Parents rated items on a 5-point scale from 1 = never/almost never to 5 = always/almost always.	School-Age Temperament Inventory ⁵³	9	.88	Approaches children his/her own age even when s/he does not know them

TABLE 1. *Continued*

Construct	Age	Informant	Response Scale	Source	Number of Items	α	Example Item
Negative reactivity	11–12 years	Parent	Parents rated items on a 5-point scale from 1 = never/almost never to 5 = always/almost always.	School-Age Temperament Inventory ⁵³	12	.91	Gets upset when cannot find something
Persistence	11–12 years	Parent	Parents rated items on a 5-point scale from 1 = never/almost never to 5 = always/almost always.	School-Age Temperament Inventory ⁵³	11	.91	Switches from one activity to another before finishing the first
Aggression	11–12 years	Parent	0 = does not apply 1 = applies somewhat 2 = certainly applies	Rutter Problem Behavior Questionnaire ⁶⁰	6	.72	Often destroys others' belongings
Anxiety	11–12 years	Parent	0 = does not apply 1 = applies somewhat 2 = certainly applies	Rutter Problem Behavior Questionnaire ⁶⁰	5	.68	Often worried, worries about many things
Depression	11–12 years	Parent	0 = does not apply 1 = applies somewhat 2 = certainly applies	Rutter Problem Behavior Questionnaire ⁶⁰	5	.74	Often miserable, unhappy, tearful, distressed
Social skills	11–12 years	Parent	1 = rarely or never 2 = sometimes 3 = very often	Social Skills Rating System ⁶³	40	.91	Makes friends easily
Poor peer relationships	11–12	Child	5-point Likert scale ranging from 1 = true to 5 = false	Self-Description Questionnaire ⁵⁵	8	.87	I have lots of friends
Family stress	11–12 years	Parent	5-point Likert scale ranging from 1 = Good effect, 4 = Very bad effect	Family stress ⁶¹			Please comment on any changes, losses or problems for your family over the past year. List them below, and circle the number which shows their effects on the family overall
Poor parent relationships	11–12 years	Child	5-point Likert scale ranging from 1 = true to 5 = false	Self-Description Questionnaire ⁵⁵	8	.82	My parents and I have fun together
Parental monitoring	11–12 years	Parent	1 = never/almost never, 5 = always/almost always	ATP devised item	1	—	Most afternoons I know exactly where my child is when school is out
Academic competence	11–12 years	Teacher rated	5-point scale where 1 = lowest 10%, 2 = next lowest 20%, 3 = middle 40%, 4 = next highest 20%, and 5 = highest 10%	Social Skills Rating System ⁶³	8	.94	In reading, how does this child compare with other classmates?
Early adolescence Approach	13–14 years	Parent	1 = never, almost never 2 = rarely 3 = half the time 4 = frequently 5 = always, almost always	School-Age Temperament Inventory ⁵³	9	.89	Prefers to play with someone s/he already knows rather than meeting someone new
Reactivity	13–14 years	Parent	1 = never, almost never 2 = rarely 3 = half the time 4 = frequently 5 = always, almost always	School-Age Temperament Inventory ⁵³	12	.92	Gets upset when cannot find something
Persistence	13–14 years	Parent	1 = never, almost never 2 = rarely 3 = half the time 4 = frequently 5 = always, almost always	School-Age Temperament Inventory ⁵³	11	.92	Returns to responsibilities (homework, chores) after friends phone or visit
Emotional competence	13–14 years	Child	1 = strongly agree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree	ATP devised scale	5	.57	I know how to relax when I am feeling tense
Aggression	12–13 years	Parent	0 = does not apply 1 = applies somewhat 2 = certainly applies	Rutter Problem Behavior Questionnaire ⁶⁰	10	.74	Destroys own or other's belongings
Anxiety	13–14 years	Child	0 = rarely or never 1 = sometimes 2 = very often	ATP adapted items ⁶⁴	5	.71	I get anxious and scared
Depression	13–14 years	Child	0 = rarely or never 1 = sometimes 2 = very often	Short Moods and Feelings Questionnaire ⁶⁵	12	.80	I feel miserable or unhappy

TABLE 1. Continued

Construct	Age	Informant	Response Scale	Source	Number of Items	α	Example Item
Alcohol use	13–14 years	Child	Number of days drank alcohol in the past month	ATP devised item	1	—	If (consumed >2 alcoholic drinks in life-time), think back over the last 30 days (month): On how many days did you have an alcoholic drink?
Social skills	13–14 years	Child	1 = rarely or never 2 = sometimes 3 = very often	Social Skills Rating System ⁶³	39	.68	I make friends easily
Peer relationships	13–14 years	Child	1 = almost always true 2 = often true 3 = sometimes true 4 = seldom true 5 = almost never true	Inventory of Parent and Peer Attachment ⁵⁶	8	.76	My friends respect my feelings
Group participation	13–14 years	Parent	0 = rarely/never 1 = sometimes 2 = very often	ATP devised scale of participation in organized peer group activities	4	.64	Participates in extra-curricular activities at school
Family attachment problems	13–14 years	Child	1 = almost always true 2 = often true 3 = sometimes true 4 = seldom true 5 = almost never true	Inventory of Parent and Peer Attachment ⁵⁶	8	.85	My parents accept me as I am
Family stress	13–14 years	Parent	As at 11–12 years	ATP devised scale	6	.47	How often do you find out where s/he is going when s/he goes out with friends?
Parental monitoring	13–14 years	Parent	1 = always/almost always 2 = often 3 = about half the time 4 = occasionally 5 = never/almost never 6 = do not know	ATP devised scale	6	.71	Here is a list of things that parents often do when teenagers misbehave. Circle the number that show how often you use each method: yell
Harsh discipline	13–14 years	Parent	1 = always/almost always 2 = often 3 = about half the time 4 = occasionally 5 = never/almost never 6 = do not know	ATP devised scale	4	.74	When I want my child to do something, I explain my reasons for asking
Inductive reasoning	13–14 years	Parent	1 = always/almost always 2 = often 3 = about half the time 4 = occasionally 5 = never/almost never 6 = do not know	ATP devised item	1	—	Does the ATP child's mother diet to lose weight or be thinner?
Mother dieting	12–13 years	Parent	1 = yes, 2 = no	ATP devised item	1	—	If your ATP child is a girl, has she had her first menstrual period? years if your ATP child is a boy, has his voice broken? . . . years
Early pubertal timing	13–14 years	Parent	1 = early (12 years 0 months or less) 0 ≤ 12 years, 0 months	ATP devised item	1	—	If your ATP child is a girl, has she had her first menstrual period? years if your ATP child is a boy, has his voice broken? . . . years
Late pubertal timing	13–14 years	Parent	1 = Not yet reached puberty by 13–14 years 0 = has reached puberty by 13–14 years	ATP devised item	1	—	If your ATP child is a girl, has she had her first menstrual period? years if your ATP child is a boy, has his voice broken? . . . years
Persistent high weight	Infancy and 12–13 years	Parent	Weight in grams, weight and height	Composite variable reflecting the average of standardized weight at birth and body mass index at 12–13 years	4	—	Mothers and fathers current occupation
Mid-adolescence SES	15–16 years	Parent		Composite of both parents' occupational level and educational levels ^{66,67}	4	—	

Abnormal Eating Attitudes and Behaviors for subsequent analysis. In the CFA, a second-order *Abnormal Eating Attitudes and Behaviors* latent factor incorporated the three first-order latent constructs of Drive for Thinness, Bulimia, and Body Dissatisfaction. All items loaded significantly on their associated factor (with a minimum loading of .2 taken to indicate that the item contributed meaningfully to that factor), and all three first-order latent factors loaded highly on the *Abnormal Eating Attitudes and Behaviors* construct (at .83, .92, and .99), indicating that they all contributed substantially to the underlying *Abnormal Eating Attitudes and Behaviors* construct. Examination of modification indices did not suggest any issues with cross-loading of items on more than one factor. This CFA was an acceptable fit for the data by all fit measures examined, with the exception of chi-square which is known to be affected by sample size ($\chi^2 = 813.74$, $p < .01$; RMSEA = .07, 90%CI = .07–.08; CFI = .95).

A gender invariance test suggested that the structure of this model was similar for males and females. Only one item loaded differently, with “I have thought of trying to vomit in order to lose weight” loading more highly on the Bulimia factor for females than males (loading of .71 and .32, respectively; $\Delta\chi_{(16)}^2 = 170.27(16)$, $p < .001$). All second-order loadings were similar for both young men and women. Given the overwhelming picture of similarity rather than difference, data for both genders were analyzed together rather than segregated.

Using model-based imputation in AMOS, a latent factor score was computed from the second-order *Abnormal Eating Attitudes and Behaviors* factor in this model, and this score was used as the outcome measure in the subsequent path analysis ($M = .00$, $SD = .63$). Deriving latent factor scores in this way can provide a more accurate and robust indication of an underlying construct than more traditional techniques such as calculating the mean item response. We chose to use this higher order construct as the outcome rather than examining pathways to each of the first-order factors (Bulimia, Drive for Thinness, and Body Dissatisfaction), because they were highly interrelated, making it unlikely that unique pathways to bulimia and anorexia subtypes could be teased out.

Prediction of Abnormal Eating Attitudes and Behaviors at 15–16 Years

Next, we performed path analysis to identify developmental correlates of *Abnormal Eating*

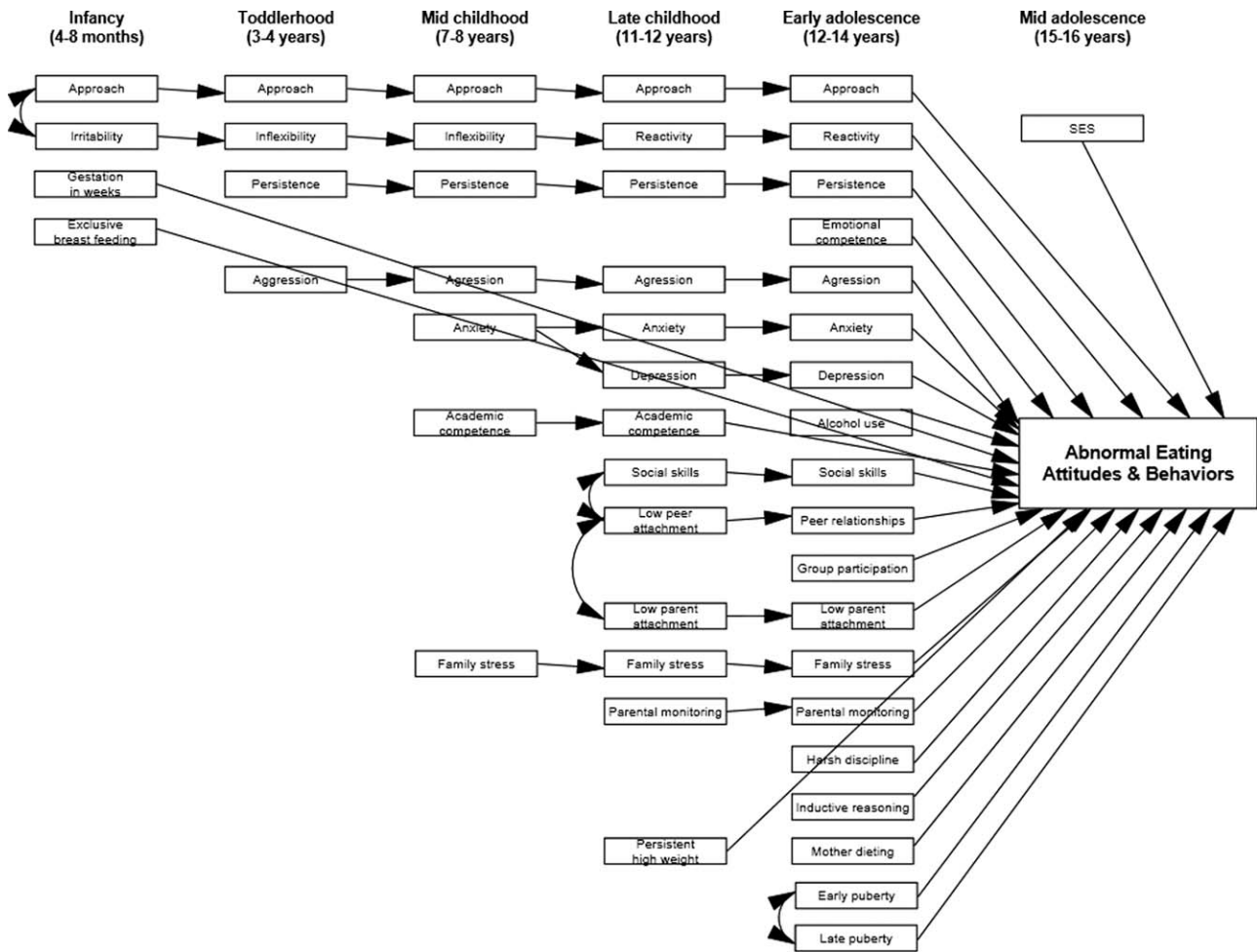
Attitudes and Behaviors at 15–16 years. Expected relationships are illustrated in a model shown in **Figure 1**. In developing this hypothesized model, we were mindful that a number of antecedent variables were likely to be interrelated (e.g., social skills and peer attachment). Hence, the hypothesized model incorporates both relationships of antecedents to *Abnormal Eating Attitudes and Behaviors*, and correlations between the antecedent constructs. In this model, predictors measured at multiple time points are expected to show continuity, so that the influence of early factors is expected to proceed through later measures of the factor. This hypothesized model was estimated and found to be a poor fit for the data, particularly according to the CFI that favors model parsimony ($\chi^2(1,123) = 10874.69$, $p < .001$; RMSEA = .08, 90%CI = .08–.083; CFI = .55).

To improve model fit, we first performed model-trimming, removing non-significant variables one at a time starting from the smallest loading path. Given the large sample size, we took a conservative critical value of $p < .001$ to indicate significance of a predictor. Following this procedure, the paths from the following developmental correlates for *Abnormal Eating Attitudes and Behaviors* were removed: academic competence, aggression, temperamental approach and reactivity, alcohol use, emotional competence, social skills, group participation, family SES, parent attachment, family stress, breast feeding, and parental monitoring, harsh discipline, and inductive reasoning. However, fit was still judged to be relatively poor despite the removal of these predictors ($\chi^2(118) = 1722.15$, $p < .001$; RMSEA = .10, 90%CI = .10–.11; CFI = .68).

To further improve model fit, we performed model building. The modification indices indicated that the model would be improved by the addition of a number of paths between predictor variables, and those that were judged to be conceptually coherent were added to the model, including paths between: depression and anxiety, depression and peer relationships, anxiety and peer relationships; and covariances between: gestational age and persistent high weight, and early puberty and persistent high weight. At this point, the relationship between anxiety and *Abnormal Eating Attitudes and Behaviors* became non-significant and this predictor was removed from the model. Following these modifications, the model was judged to be an acceptable fit for the data ($\chi^2(73) = 442.26$, $p < .001$; RMSEA = .06, 90%CI = .057–.068; CFI = .89).

The final model is presented in **Figure 2**, and shows that *Abnormal Eating Attitudes and Behaviors* at 15–16 years were predicted by a range of

FIGURE 1 Hypothesized model presenting relationships between infant, child, and early adolescent factors and *Abnormal Eating Attitudes and Behaviors* at 15–16 years.



individual, interpersonal, and family factors, specifically: early gestational age, temperamental persistence, persistent high weight, depression, stronger peer relationships, mother dieting, and pubertal timing. The only putative correlate (SES) was removed in the final model. Overall, these factors accounted for 28% of the variance in disordered eating at 15–16 years of age.

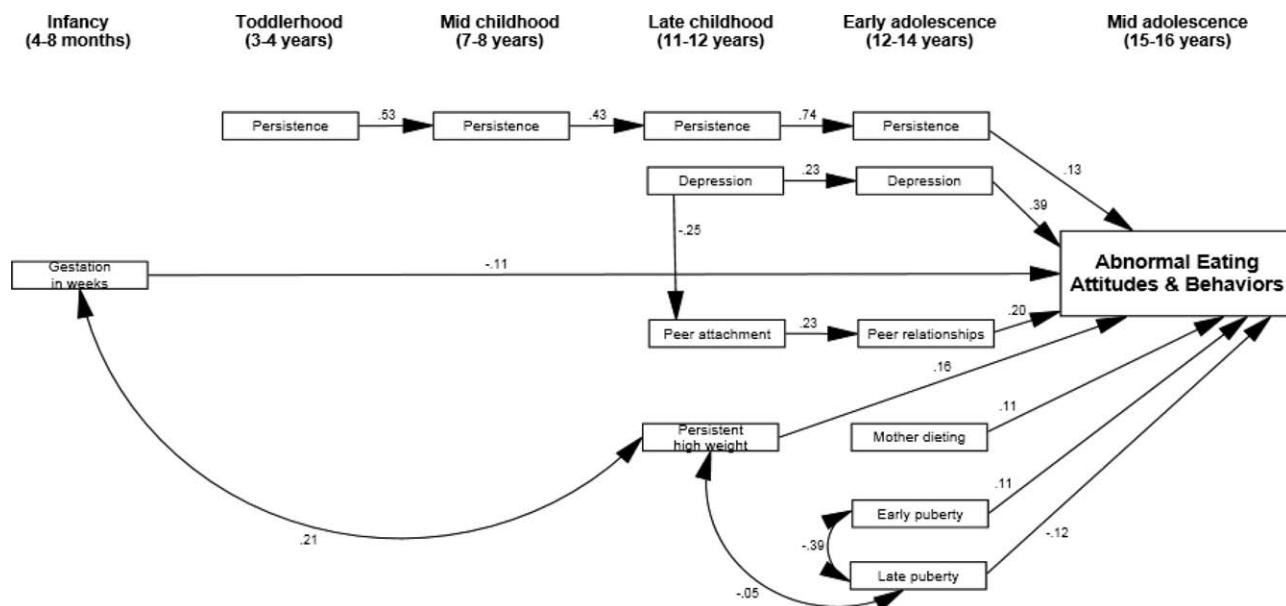
Gender Invariance

We next examined the gender invariance of the final model using Byrne’s⁷⁵ method to test whether developmental correlates of *Abnormal Eating Attitudes and Behaviors* were similar for young men and young women. The chi-square difference test is known to be overly sensitive to small differences when sample size is large.⁷⁶ Therefore, a conservative critical value of $p < .001$ was used to indicate significance. Initially, the model was examined

separately for each gender group, providing the baseline chi-square value of 530.24 ($df = 146$), against which subsequent tests for invariance were compared.

Model comparison showed that the constraints did not hold for the two genders ($\Delta\chi_{(16)} = 85.49, p < .001$). The relationship between depression and *Abnormal Eating Attitudes and Behaviors* was stronger for girls than boys ($\beta = .18$ boys, $\beta = .37$ girls; $\Delta\chi_{(6)} = 38.32, p < .001$). Similarly, mother dieting was also more strongly related to *Abnormal Eating Attitudes and Behaviors* for girls than for boys ($\beta = .08$ boys, $\beta = .16$ girls; $\Delta\chi_{(13)} = 39.83, p < .001$). Late puberty was associated with a decrease in *Abnormal Eating Attitudes and Behaviors* for girls, but an increase for boys ($\beta = .10$ boys, $\beta = -.05$ girls; $\Delta\chi_{(13)} = 38.67, p < .001$), whereas early puberty was associated with an increase in *Abnormal Eating Attitudes and Behaviors* for girls but not boys ($\beta = .00$ boys, $\beta = .07$ girls;

FIGURE 2 Final path model showing developmental correlates (infant, child and early adolescent) of *Abnormal Eating Attitudes and Behaviors* at 15–16 years. All relationships are significant at $p < .001$.



$\Delta\chi_{(13)} = 34.63, p < .001$). Finally, we also observed a gender difference in one of the interrelationships between predictor variables, with depression a slightly stronger predictor of peer attachment problems for males than females ($\beta = .27$ boys, $\beta = .22$ girls; $\Delta\chi_{(6)} = 8.22, p < .001$).

Discussion

This study addresses an important conceptual gap in our understanding of the developmental origins of abnormal eating attitudes and behaviors in adolescence. We drew on prospective longitudinal data from the ATP, which has followed a representative community sample from infancy to adulthood. We found that an *Abnormal Eating Attitudes and Behaviors* construct, that incorporates attitudes and behaviors relating to drive for thinness, bulimia, and body dissatisfaction, could be reliably modeled in mid-adolescence. In addition, we found that *Abnormal Eating Attitudes and Behaviors* were predicted by multiple factors over infancy, childhood and early adolescence, a number of which differed for boys and girls.

The final model revealed a set of factors, including temperamental persistence, early gestational age, pubertal timing, persistent high weight, depression, stronger peer relationships, and mother dieting. Overall, these factors accounted for nearly a third of the variance in *Abnormal Eating*

Attitudes and Behaviors at 15–16 years of age. Findings from this study are in keeping with those of other recent reports (e.g., Refs. 11,18,21,25,77), and add to our understanding of the range of factors that may play a role in the etiology of *Abnormal Eating Attitudes and Behaviors*. Given the salience of both individual characteristics and environmental factors, this study highlights the importance of taking an ecological approach that considers the developing child within the contexts in which they are operating.

Interestingly, one factor was in the opposite direction to that expected, that is, stronger peer relationships predicted higher, rather than lower, levels of *Abnormal Eating Attitudes and Behaviors*. This contrasts to prior work suggesting that peer alienation is correlated with eating disorder symptoms, whereas strong peer attachment is protective (e.g., Ref. 42). A possible reason for our finding is that we did not assess attachment to specific types of peers; for example, strong attachment to deviant peers or peers who also express *Abnormal Eating Attitudes and Behaviors*. Studies show that peer influence plays a role in problematic eating behaviors, with friends' dieting behaviors related to disordered eating.^{37,38,78} Young people may also select friends with similar underlying vulnerabilities to themselves. Zalta and Keel⁷⁹ found that peer selection for traits that match on higher risk for eating disorders, for example, perfectionism, self-esteem, was associated with bulimic behaviors. Further

research is needed to more fully understand these effects and the potential role that strong peer bonds could play in promoting *Abnormal Eating Attitudes and Behaviors* under some conditions.

Several factors often argued to play a significant role in the development of eating disorders were not predictive of *Abnormal Eating Attitudes and Behaviors* in this analysis. These were academic competence, aggression, temperamental approach and reactivity, alcohol use, emotional competence, social skills, group participation, and family factors such as SES, parent attachment, family stress, breastfeeding, parental monitoring, inductive reasoning, and harsh discipline. Given these results, of interest here are the findings of Spanos et al.⁸⁰ In their longitudinal design of monozygotic twins, these authors show that differences in parent-child conflict may be a consequence of differences in disordered eating, rather than antecedent factors. It also again highlights the importance of taking a broad ecological approach when examining etiologic variables, as single variables might appear to be important when examined in isolation but have a relatively weak relationship with disordered eating when other factors in the young person's life are taken into account. This is a helpful reminder that much of what we observe in families in which a child has an eating disorder is perhaps in response to the eating disordered behavior rather than a cause of these behaviors.⁸¹

We also found that the effect of some factors differed for males and females. It has long been argued that gender confers differential vulnerability to disordered eating in females versus males.¹⁴ In this study, the relationship between depression and *Abnormal Eating Attitudes and Behaviors* was stronger for girls than boys. Similarly, mother dieting was more strongly related to *Abnormal Eating Attitudes and Behaviors* for girls but not for boys. Although earlier work on pubertal timing and the development of disordered eating has been inconclusive (e.g., Refs. 17,82), our findings were consistent with more recent research demonstrating that differences in pubertal timing may underlie individual differences in the development of disordered eating.^{18,19} Our findings show that delayed puberty is associated with an increase in *Abnormal Eating Attitudes and Behaviors* in boys but a decrease in girls. In contrast, early puberty is associated with an increase in *Abnormal Eating Attitudes and Behaviors* in girls, and no significant association in boys. Although these relationships may be attributable to the psychosocial impacts of early and late puberty (e.g., negative self-comparison to peers), they may also relate to biological processes underway earlier in life (cf., Ref. 83).

This study had several strengths. Data for 1,300 male and female were available for this longitudinal prospective study. Multiple sources were available to inform this study, which included a variety of individual, interpersonal and familial measures that were administered at several waves from birth through adolescence. As for most studies of this nature, there were also important limitations. We were not able to control for earlier *Abnormal Eating Attitudes and Behaviors* and hence, although the predictor variables were all antecedent in time to the outcome, it is possible that they could have arisen as consequences of previous *Abnormal Eating Attitudes and Behaviors*. However, we think this is unlikely because disordered eating mostly tends to emerge around early adolescence, whereas we examined predictors from as early as infancy, through childhood and the transition to adolescence. Nevertheless, future research that is designed to identify longitudinal pathways of *Abnormal Eating Attitudes and Behaviors*, and causal influences on these trajectories, will be able to further extend the developmental picture.

It was also outside the scope of the original study to include structured eating disorder diagnostic interviews, such as the Eating Disorder Examination.⁸⁴ This focused this study on *Abnormal Eating Attitudes and Behaviors* rather than eating disorder diagnoses. Furthermore, while data across several domains were collected at each wave of this study, biological measures were under-represented. Consequently, our study allows us to make inferences on potential individual, interpersonal, and familial developmental factors that could contribute to *Abnormal Eating Attitudes and Behaviors* in adolescence, but does not allow us to speculate on any possible genetic or biological determinants of such attitudes and behaviors.

We can also not conclude that the developmental correlates identified are specific to *Abnormal Eating Attitudes and Behaviors*. Indeed, many of the factors examined are likely non-specific and increase risk for the development of other forms of psychopathology.¹¹ Variables may also interact with one another across development. The only interaction explored in this study addressed the seminal question of gender invariance. However, the model we have developed has considerable potential to stimulate consideration of a broader range of interactions in future analyses.

Finally, the ATP was not originally designed to track the development of *Abnormal Eating Attitudes and Behaviors* per se, which would explain the absence of some factors that may play an

antecedent role in the development of these behaviors. Clearly, there is still much work to be done in untangling the developmental origins of problematic eating patterns, and this study provides a springboard for future investigation.

Eating disorders are highly prevalent among adolescents,⁸⁵ and rank among the leading causes of disability among young women.⁸⁶ Striegel-Moore and Bulik¹⁴ argue persuasively why it is important to identify the antecedent pathways for these serious disorders. Yet, despite many efforts, the etiology of eating disorders remains largely unknown. The present longitudinal study addresses this gap in the literature and sheds light on some of the individual and familial factors that may play a role in the development of *Abnormal Eating Attitudes and Behaviors* in the teens. It also demonstrates that developmental factors differently impact upon males and females, and that some of these factors are protective or increase vulnerability depending on gender. This study still leaves us with pressing and unanswered questions, such as the role of individual differences in biology and/or genes in the development of problematic eating attitudes and behaviors. Additional developmental work using longitudinal study designs will be critical in coming to a fuller understanding of these pathways.

References

- Stice E, Marti CN, Shaw H, Jaconis M. An 8-year longitudinal study of the natural history of threshold, subthreshold, and partial eating disorders from a community sample of adolescents. *J Abnorm Psychol* 2009;118:587–597.
- Neumark-Sztainer D, Wall M, Story M, Standish AR. Dieting and unhealthy weight control behaviors during adolescence: Associations with 10-year changes in body mass index. *J Adolesc Health* 2012;50:80–86.
- Stice E, Becker CB, Yokum S. Eating disorder prevention: Current evidence-base and future directions. *Int J Eat Disord* 2013;46:478–485.
- Garner DM. *Eating Disorder Inventory-3*. Lutz, FL: Psychological Assessment Resources, 2005.
- Garner DM, Garfinkel PE. The eating attitudes test: An index of the symptoms of anorexia nervosa. *Psychol Med* 1979;9:273–279.
- Henderson M, Freeman CPL. A self-rating scale for bulimia: The BITE. *Br J Psychiatry* 1987;150:18–24.
- Fairburn CG, Belgin S. *Eating Disorder Examination Questionnaire (EDE-Q 6.0)* 2008.
- Ackard DM, Fulkerson JA, Neumark-Sztainer D. Psychological and behavioral risk profiles as they relate to eating disorder diagnoses and symptomatology among a school-based sample of youth. *Int J Eat Disord* 2010;44:440–446.
- Stice E, Hayward C, Cameron RP, Killen JD, Taylor CB. Body-image and eating disturbances predict onset of depression among female adolescents: A longitudinal study. *J Abnorm Psychol* 2000;109:438–444.
- Stice E, Marti CN, Durant S. Risk factors for onset of eating disorders: Evidence of multiple risk pathways from an 8-year prospective study. *Behav Res Ther* 2011;49:622–627.
- Jacobi C, Hayward C, de Zwaan M, Kraemer HC, Agras W. Coming to terms with risk factors for eating disorders: Application of risk terminology and suggestions for a general taxonomy. *Psychol Bull* 2004;130:19–65.
- Micali N. Childhood risk factors: Longitudinal continuities and eating disorders. *J Mental Health* 2005;14:567–574.
- Steiner H, Kwan W, Shaffer TG, Walker S, Miller S, Sagar A, et al. Risk and protective factors for juvenile eating disorders. *Eur Child Adolesc Psychiatry* 2003;12(Suppl1):i38–i46.
- Striegel-Moore RH, Bulik CM. Risk factors for eating disorders. *Am Psychol* 2007;62:181–198.
- Mond J, van den Berg P, Boutelle K, Hannan P, Neumark-Sztainer D. Obesity, body dissatisfaction, and emotional well-being in early and late adolescence: Findings from the Project EAT Study. *J Adolesc Health* 2011;48:373–378.
- Stice E. Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychol Bull* 2002;128:825–848.
- Graber JA, Lewinsohn PM, Seeley JR, Brooks-Gunn J. Is psychopathology associated with the timing of pubertal development? *J Am Acad Child Adolesc Psychiatry* 1997;36:1768–1776.
- Zehr JL, Culbert KM, Sisk CL, Klump KL. An association of early puberty with disordered eating and anxiety in a population of undergraduate women and men. *Horm Behav* 2007;52:427–435.
- McNicholas F, Dooley B, McNamara N, Lennon R. The impact of self-reported pubertal status and pubertal timing on disordered eating in Irish adolescents. *Eur Eat Disord Rev* 2012;20:355–362.
- Foley DL, Thacker LR II, Aggen SH, Neale MC, Kendler KS. Pregnancy and perinatal complications associated with risks for common psychiatric disorders in a population-based sample of female twins. *Am J Med Genet* 2001;105:426–431.
- Nosarti C, Reichenberg A, Murray RM, Cnattingius S, Lambe MP, Yin L, et al. Preterm birth and psychiatric disorders in young adult life. *JAMA Psychiatry* 2012;69:E1–E8.
- Lindberg L, Hjern A. Risk factors for anorexia nervosa: A national cohort study. *Int J Eat Disord* 2003;34:397–408.
- Steiner H, Smith C, Rosenkranz RT, Litt I. The early care and feeding of anorexics. *Child Psychiatry Hum Dev* 1991;21:163–167.
- Iron-Segev S, Peterson KE, Gillman MW, Williams CM, Austin SB, Field AE. Associations of breastfeeding with bulimic behaviors and eating disorders among adolescents. *Int J Eat Disord* 2013;46:834–840.
- Hughes EK. Comorbid depression and anxiety in childhood and adolescent anorexia nervosa: Prevalence and implications for outcome. *Clin Psychol* 2012;16:15–24.
- Ivarsson T, Råstam M, Wentz E, Gillberg I, Gillberg C. Depressive disorders in teenage-onset anorexia nervosa: A controlled longitudinal, partly community-based study. *Compr Psychiatry* 2000;41:398–403.
- Lucka I. Depressive disorders in patients suffering from anorexia nervosa. *Arch Psychiatry Psychother* 2006;8:55–61.
- Godart NT, Flament M, Lecrubier Y, Jeammot P. Anxiety disorders in anorexia nervosa and bulimia nervosa: Co-morbidity and chronology of appearance. *Eur Psychiatry* 2000;15:38–45.
- Keel PK, Klump KL, Miller KB, McGue M, Iacono WG. Shared transmission of eating disorders and anxiety disorders. *Int J Eat Disord* 2005;38:99–105.
- Klump KL, Bulik CM, Pollice C, Halmi KA, Fichter MM, Berrettini WH, et al. Temperament and character in women with anorexia nervosa. *J Nerv Ment Dis* 2000;188:559–567.
- Fassino S, Abbate-Daga G, Amianto F, Leombruni P, Boggio S, Rovera GG. Temperament and character profile of eating disorders: A controlled study with the temperament and character inventory. *Int J Eat Disord* 2002;32:412–425.
- Kerremans A, Claes L, Bijttebier P. Disordered eating in adolescent males and females: Associations with temperament, emotional and behavioral problems and perceived self-competence. *Pers Individ Dif* 2010;49:955–960.
- Martin GC, Wertheim EH, Prior M, Smart D, Sanson A, Oberklaid F. A longitudinal study of the role of childhood temperament in the later development of eating concerns. *Int J Eat Disord* 2000;27:150–162.
- Wade TD, Gillespie N, Martin NG. A comparison of early family life events amongst monozygotic twin women with lifetime anorexia nervosa, bulimia nervosa, or major depression. *Int J Eat Disord* 2007;40:679–686.

35. Haycraft E, Blissett J. Eating disorder symptoms and parenting styles. *Appetite* 2010;54:221–224.
36. Neumark-Sztainer D, Bauer KW, Friend S, Hannan PJ, Story M, Berge JM. Family weight talk and dieting: How much do they matter for body dissatisfaction and disordered eating behaviors in adolescent girls? *J Adolesc Health* 2010;47:270–276.
37. Eisenberg ME, Neumark-Sztainer D. Friends' dieting and disordered eating behaviors among adolescents five years later: Findings from Project EAT. *J Adolesc Health* 2010;47:67–73.
38. Gravener JA, Haedt AA, Heatherton TF, Keel PK. Gender and age differences in associations between peer dieting and drive for thinness. *Int J Eat Disord* 2008;41:57–63.
39. Keel PK, Forney KJ, Brown TA, Heatherton TF. Influence of college peers on disordered eating in women and men at 10-year follow-up. *J Abnorm Psychol* 2013;122:105–110.
40. Zalta AK, Keel PK. Peer influence on bulimic symptoms in college students. *J Abnorm Psychol* 2006;115:185–189.
41. Ward A, Ramsay R, Treasure J. Attachment research in eating disorders. *Br J Med Psychol* 2000;73:35–51.
42. Schutz HK, Paxton SJ. Friendship quality, body dissatisfaction, dieting and disordered eating in adolescent girls. *Br J Clin Psychol* 2007;46:67–83.
43. Burge D, Hammen C, Davila J, Daley SE. The relationship between attachment cognitions and psychological adjustment in late adolescent women. *Dev Psychopathol* 1997;9:151–167.
44. Zaitsoff SL, Fehon DC, Grilo CM. Social competence and social-emotional isolation and eating disorder psychopathology in female and male adolescent psychiatric inpatients. *Int J Clin Health Psychol* 2009;9:219–228.
45. Prior M, Sanson A, Smart D, Oberklaid F. Pathways from Infancy to Adolescence: Australian Temperament Project 1983–2000. Melbourne, Victoria: Australian Institute of Family Studies, 2000.
46. Ruschena E, Prior M, Sanson A, Smart D. A longitudinal study of adolescent adjustment following family transitions. *J Child Psychol Psychiatry* 2005;46:353–363.
47. O'Connor M, Hawkins M, Toumbourou J, Sanson A, Letcher P, Olsson C. The relationship between social capital and depression over the transition to adulthood. *Aust J Psychol* 2011;63:26–35.
48. Garner DM, Olmstead MP, Polivy J. Development and validation of a multi-dimensional eating disorder inventory for anorexia nervosa and bulimia. *Int J Eat Disord* 1983;2:15–34.
49. Garner DM. *Eating Disorder Inventory-2. Professional manual.* Odessa, FL: Psychological Assessment Resources, 1991.
50. Schoemaker C, van Strien T, van der Staak C. Validation of the Eating Disorders Inventory in a non-clinical population using transformed and untransformed responses. *Int J Eat Disord* 1994;15:387–393.
51. Kraemer HC, Kazdin AE, Offord DR, Kessler RC, Jensen PS, Kupfer DJ. Coming to terms with the terms of risk. *Arch Gen Psychiatry* 1997;54:337–343.
52. Sanson A, Smart DF, Prior M, Oberklaid F, Pedlow R. The structure of temperament from age 3 to 7 years: Age, sex, and sociodemographic influences. *Merrill-Palmer Q* 1994;40:233–252.
53. McCloskey SG. The development of the school-age temperament inventory. *Merrill-Palmer Q* 1995;41:271–285.
54. Thomas A, Chess S. *Childhood Temperament Questionnaire. Temperament and Development.* NY: Brunner/Mazel, 1977.
55. Marsh HW, Barnes J, Cairns L, Tidman M. Self-description questionnaire: Age and sex effects in the structure and level of self-concept for preadolescent children. *J Educ Psychol* 1984;76:940–956.
56. Armsden GC, Greenberg MT. The inventory of parent and peer attachment: Individual differences and their relationship to psychological well-being in adolescence. *J Youth Adolesc* 1987;16:427–454.
57. Sanson A, Prior M, Garino E, Oberklaid F, Sewell J. The structure of infant temperament: Factor analysis of the revised infant temperament questionnaire. *Infant Behav Dev* 1987;10:97–104.
58. Behar L, Stringfield S. A behavior rating scale for the preschool child. *Dev Psychol* 1974;10:601–610.
59. Arnold G. *Aggression Questionnaire.* Melbourne, Australia: La Trobe University, 1984.
60. Rutter M. Rutter problem behaviour questionnaire. In: Michael R, Jack T, Kingsley W, editors. *Education, Health and Behaviour.* London: Longmans, 1970, pp. 437–462.
61. Smith J, Prior M. Temperament and stress resilience in school-age children: A within-families study. *J Am Acad Child Adolesc Psychiatry* 1995;34:168–179.
62. Cairns RB, Cairns BD. Predicting aggressive patterns in girls and boys: A developmental study. *Aggress Behav* 1984;10:227–242.
63. Gresham FM, Elliott SN. *Manual for the Social Skills Rating System.* Circle Pines MN: American Guidance Service, 1990.
64. Quay HC, Peterson DR. *Manual for the Revised Behavior Problem Checklist.* Odessa, FL: PAR Inc., 1987.
65. Angold A, Costello EJ, Messer SC, Pickles A, Winder F, Silver D. Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents. *Int J Methods Psychiatr Res* 1995;5:237–249.
66. Broom L, Jones F, Zubrzycki J. *Opportunity and Attainment in Australia.* Canberra: ANU Press, 1974.
67. Brotherton PL, Kotler T, Hammond SB. Development of an Australian index of social class. *Aust Psychol* 1979;14:77–83.
68. Arbuckle J. *Amos 16.0 user's guide.* USA: Amos Development Corporation, 2007.
69. Tabachnick B, Fidell L. *Using Multivariate Statistics,* 4th ed. Boston: Allyn & Bacon, 2001.
70. Schermelleh-Engel K, Moosbrugger H, Muller H. Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods Psychol Res Online* 2003;8:23–74.
71. Hair JF, Anderson RE, Tatham RL, Black WC. *Multivariate Data Analysis,* 5th ed. Upper Saddle River, NJ: Prentice-Hall International, 1998.
72. Zubrick S, Lawrence D. *Testing the Reliability of a Measure of Aboriginal Children's Mental Health.* Canberra: Australian Bureau of Statistics, 2006.
73. Brown B, Cudeck R. Alternative ways of assessing model fit. In: Bollen K, Long J, editors. *Testing Structural Equation Models.* Thousand Oaks, CA: Sage, 1993.
74. Hu L, Bentler PM. Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychol Methods* 1998;3:424–453.
75. Byrne BM. *Structural equation modeling with AMOS: Basic concepts, applications, and programming.* Mahwah, NJ: Lawrence Erlbaum Associates, 2001.
76. Schumacker R, Lomax R. *A Beginner's Guide to Structural Equation Modeling,* 2nd ed. Mahwah, NJ: Lawrence Erlbaum Associates, 2004.
77. Hertzog ME. Temperament: Then and now. *J Nerv Ment Dis* 2012;200:659–663.
78. Keel PK, Forney KJ, Brown TA, Heatherton TF. Influence of college peers on disordered eating in women and men at 10-year follow-up. *J Abnorm Psychol* 2013;122:105–110.
79. Zalta AK, Keel PK. Peer influence on bulimic symptoms in college students. *J Abnorm Psychol* 2006;115:185–189.
80. Spanos A, Burt SA, Klump KL. Do weight and shape concerns exhibit genetic effects? Investigating discrepant findings. *Int J Eat Disord* 2010;43:29–34.
81. Le Grange D, Eisler I. Family interventions in adolescent anorexia nervosa. *Child Adolesc Psychiatr Clin N Am* 2009;18:159–173.
82. Killen JD, Taylor CB, Hayward C, Wilson DM, Haydel KF, Hammer LD, et al. Pursuit of thinness and onset of eating disorder symptoms in a community sample of adolescent girls: A three-year prospective analysis. *Int J Eat Disord* 1994;16:227–238.
83. Mensah FK, Bayer JK, Wake M, Carlin JB, Allen NB, Patton GC. Early puberty and childhood social and behavioral adjustment. *J Adolesc Health* 2013;53:118–124.
84. Cooper Z, Fairburn C. The eating disorder examination: A semi-structured interview for the assessment of the specific psychopathology of eating disorders. *Int J Eat Disord* 1987;6:1–8.
85. Swanson SA, Crow SJ, Le Grange D, Swendsen J, Merikangas KR. Prevalence and correlates of eating disorders in adolescents: Results from the national comorbidity survey replication adolescent supplement. *Arch Gen Psychiatry* 2011;68:714–723.
86. Mathers CD, Vos ET, Stevenson CE, Begg SJ. The Australian Burden of Disease Study: Measuring the loss of health from diseases, injuries and risk factors. *Med J Aust* 2000;172:592–596.