

The Pennsylvania State University
The Graduate School
College of Health and Human Development

**BIDIRECTIONAL LINKS BETWEEN SELF-ESTEEM AND WEIGHT CONCERNS IN
ADOLESCENCE AND THE MODERATING ROLES OF PARENT RESPONSIVENESS
AND YOUTH GENDER**

A Thesis in
Human Development and Family Studies

by
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Submitted in Partial Fulfillment

of the Requirements

for the Degree of

Master of Science

December 2017

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Abstract

Purpose: Weight concerns are common among adolescents and are associated with a range of negative psychological and physical health outcomes. Self-esteem is a correlate of weight concerns, yet little prospective research has been conducted to determine direction of this association over the course of adolescence, or whether this association differs by gender. Prior research also documents that parent responsiveness may act as a protective factor in the development of weight concerns. This study sought to clarify the role of self-esteem in the development of weight concerns in adolescence and investigate the potentially protective role of parental responsiveness. As the role of fathers in the development of weight concerns has been understudied, both mother and father responsiveness were examined. **Methods:** The sample was predominately Caucasian/European American and included 392 adolescents ages 11-18 (mean age at first measurement = 15 years; 49.5% female). Time lagged mixed effects models were used to examine the direction of within-person associations between self-esteem and weight concerns over a four-year period and to test mother and father responsiveness and youth gender as moderators in these associations. **Results:** Findings revealed bidirectional associations between self-esteem and weight concerns over the course of adolescence, and confirmed the moderating role of gender and father but not mother responsiveness in the prospective link between self-esteem and weight concerns such that father responsiveness buffered the effects of low self-esteem on weight concerns for girls but not boys. Only gender moderated the prospective link between weight concerns and self-esteem, such that increases in self-esteem predicted decreases in weight concerns for both boys and girls, but the magnitude of this effect was slightly greater for boys. **Conclusions:** Findings suggest that self-esteem and weight concerns are reciprocally related in adolescence and highlight the importance of examining

interactions between family processes and individual characteristics to predict adolescent psychological adjustment.

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Acknowledgments

This study was funded by a grant from the National Institute of Child Health and Human Development (R01-HD32336) to Susan M. McHale and Ann C. Crouter.

Introduction

Weight concerns include fear of weight gain, preoccupation with body shape and weight and perception of overweight, and extend to actual weight loss behaviors [1]. The prevalence of weight concerns among youth has reached alarming rates, with 34% of young adolescent girls and 21% of young adolescent boys endorsing concerns or distress about their weight [2]. Girls are disproportionately affected by weight concerns relative to boys, and this trend persists over time: Girls' weight concerns increase over the course of adolescence, whereas boys' concerns show little change [3]. Importantly, disordered eating behaviors that emerge in adolescence often persist into adulthood [4].

Although much of the prospective longitudinal research on eating disorder development has incorporated measures of body dissatisfaction, there is reason to believe that weight concerns may be a better predictor of eating disorder onset than body dissatisfaction [1,5]. Measures of body dissatisfaction capture discontent with particular body areas (e.g., "I think my thighs are too large,") or discrepancies between ideal and actual body shape and size (such as is measured by Stunkard's Figure Rating Scale) [6,7]. Body dissatisfaction has become ubiquitous in Western society as ideals of beauty for both men and women have become increasingly less possible to attain. Thus, body dissatisfaction has been described as a normative discontent [8]. In contrast, weight concerns capture both psychological and behavioral characteristics of individuals with eating disorders, including fear of weight gain, preoccupation with body weight and shape, current disordered eating behavior, body dissatisfaction, and undue influence of body weight on their life [1,8,9]. Thus, weight concerns may indicate a more pathological relation with one's body shape and weight than does body dissatisfaction.

Unsurprisingly, weight concerns have been linked with numerous adverse psychological and physical health outcomes, including the onset of eating disorders [1]. Even at subclinical levels, body image concerns and disordered eating are associated with risky behaviors, depressive symptoms, and low self-esteem in adolescence [10–12]. Weight concerns are also associated with a lower quality of life; girls who accurately perceive themselves to be overweight have lower self-reported quality of life, and those with distorted body images who overestimate their weight have poorer social, emotional, and physical functioning [13]. Overall, research suggests that weight concerns are linked to losses in both physical and psychological wellbeing.

Given the prevalence and impact of weight concerns on overall wellbeing and health, one key direction for research is to identify risk and protective factors that may prevent the onset or mitigate the severity of weight concerns in adolescence. Whereas risk factors must precede onset of weight concerns, correlates may occur simultaneously or consequently [14]. A key step is prospective research to establish temporal precedence among the correlates of weight concerns and to identify factors that may account for variability in weight concerns and their implications. Very few putative risk factors have received adequate empirical support from prospective or experimental designs, and those that have been identified were not strong predictors of eating pathology [5]. Therefore, longitudinal research that allows for distinguishing between correlates and risk factors are the next step in developing an etiologic model of eating disorder development [14].

Extant literature suggests that the family context is an important area for investigation, as characteristics of the family system contribute to the development of psychopathology, including eating disorders [15]. Both developmental psychopathology and family systems perspectives emphasize that individual family members are part of a dynamic, open system, and that the

course of development is shaped through interactions between individuals and their contexts, including the characteristics and behaviors of other family members [16]. Thus, the evolving dynamics between adolescents and their family members are a critical area for investigations of the development of weight concerns.

In light of the need to identify risk and protective factors for the development of weight concerns, the current study utilized a longitudinal design to establish the temporal relations between self-esteem, a correlate of body dissatisfaction, and weight concerns, as these develop during adolescence [17–20]. Gender was examined as a moderator of these associations as self-esteem and weight concerns have different developmental trajectories for girls and boys, with girls experiencing greater increases in weight concerns and decreases in self-esteem compared to boys during adolescence [3,21]. As adolescents develop within a family context, this study also examined the role of parent responsiveness, a component of parent-adolescent relationship quality, as a protective factor for weight concerns. A conceptual model is proposed to illustrate the associations between self-esteem, weight concerns, parent responsiveness, and gender (Figure B1).

Parent Responsiveness

One facet of parent-adolescent relationships that may have a protective role in the development of weight concerns is parent responsiveness, the extent to which parents are aware, accepting, and supportive of their children's needs [22]. Parent responsiveness is thought to act as a general protective factor and lead to better psychological adjustment in adolescence [23]. Dimensions of parent responsiveness including warmth, acceptance, and support appear to mitigate weight concerns. For example, adolescents who perceive their family relationships to be warm and accepting tend to have fewer weight concerns than those who perceive their family to

be lacking in love, warmth, and affection [24,25]. Using data from the current sample, May and colleagues [26] found that lower levels of maternal, but not paternal, acceptance were associated with higher levels of weight concerns among adolescent girls, though prior levels of weight concerns were not controlled for. In a follow-up study using the same data set, Lam and McHale [3] found that on occasions when youth reported lower levels of maternal acceptance or higher levels of father-adolescent conflict than usual (i.e., compared to their own cross-time average levels), they reported more weight concerns the following year. Similarly, using a cross sectional design, Ata and colleagues [27] found that adolescents with elevated weight concerns perceived their parents (combined perception of mother and father) to be low in support. In another cross sectional study, higher levels of both maternal and paternal hostility were linked with elevated weight concerns among adolescents, and high paternal hostility was associated with elevated weight concerns even when maternal hostility was low [28]. Thus, parent responsiveness may act as a protective factor for weight concerns in adolescence, and failure to examine mother and father responsiveness separately may obscure gendered differences in parent-adolescent relationships and differential effects on adolescent adjustment.

The way in which adolescents' perceptions of the quality of their relationships with their parents shape their adjustment outcomes may be best understood through the lens of family systems theory [29]. From this perspective, development is shaped through reciprocal transactions between individuals and other subsystems within the family, such as parents and siblings. These interactions are not static, and for this reason it is important to examine how family relationships change over time and how fluctuations in adolescents' characteristics, such as self-esteem and weight concerns, may be driven by changes in their family experiences. Indeed, there is evidence that adolescents' perceptions of their mothers' and fathers'

supportiveness predict their self-esteem [30]. Thus, the current study utilizes annual reports of adolescents' perceptions of their mothers' and fathers' responsiveness across three time points to illuminate how parent-adolescent relationship dynamics contribute to adolescents' psychological adjustment.

Adolescent Self-Esteem

One component of adolescent psychological adjustment that may play a role in the development or maintenance of weight concerns is self-esteem. Self-esteem is defined as a person's overall feelings of worth as a person. Self-esteem theory holds that self-esteem is informed by both individuals' feelings of competence in domains that are important to them and others' appraisals of their worth [31,32]. Thus, individuals for whom physical appearance is important should experience decreases in self-esteem following negative evaluations of their bodies. In addition, as self-esteem is shaped by the opinions of significant others, an individual's perception that family members have judged him or her as unworthy should result in decreases in self-esteem [31]. This is particularly relevant to understanding the connections between parent responsiveness, self-esteem, and weight concerns. Adolescents' overvaluation of physical appearance and perceptions that their parents do not consider them worthy based on their lack of responsiveness could both lead to low self-esteem. However, low self-esteem derived from failure to meet ideals of attractiveness could be buffered by the presence of responsive parents.

Early research on the association between body dissatisfaction and self-esteem was concordant with self-esteem theory [17–20]. Multiple studies of adolescents demonstrated that body dissatisfaction prospectively predicts self-esteem, controlling for prior levels of self-esteem [17–20]. Paxton and colleagues, for example, found that body dissatisfaction predicted self-esteem five years later among girls and boys, controlling for baseline self-esteem [17].

Tiggemann tested for bidirectional effects between self-esteem and body dissatisfaction among female high school students across a two-year period and found that body dissatisfaction both predicted and was predicted by self-esteem [18]. Once initial levels of body dissatisfaction were controlled, however, the predictive link between self-esteem and body dissatisfaction became non-significant [18]. These findings were consistent with a study of appearance satisfaction, which showed that satisfaction at age 10 predicted self-esteem four years later, but that self-esteem at age 10 did not predict appearance satisfaction at age 14 [19]. Importantly, this study also found that girls reported lower self-esteem and appearance satisfaction than boys [19]. State self-esteem also predicts body satisfaction among girls [20]. Several other studies suggest, however, that self-esteem may predict body dissatisfaction. Paxton and colleagues found a prospective link between self-esteem and body dissatisfaction among girls, but not boys [33]. In addition, Wichstrom and von Soest documented bidirectional associations between self-esteem and body dissatisfaction over a 13-year period using cross-lagged analyses [34]. These mixed findings suggest there may be a bidirectional link between body dissatisfaction and self-esteem that cannot be accounted for by tenets of self-esteem theory, and that this link may differ by gender.

Understanding these processes is further complicated by recent behavioral genetics research suggesting that body dissatisfaction and weight concerns are related but distinct constructs [8]. Although both are markers of body image, body dissatisfaction is related to the *maintenance* of disordered eating behaviors, whereas weight concerns *predict* the onset of eating disorders [1,8,35]. Despite substantial research testing the direction of effects linking body dissatisfaction and self-esteem, there is no such research on the association between weight concerns and self-esteem. Our lack of knowledge about the direction of this association merits

further investigation, as establishing temporal precedence will inform theory and etiologic models of eating disorder development.

Proposed Conceptual Model

In sum, extant research highlights that: (a) parent responsiveness is associated with higher self-esteem and lower weight concerns, (b) the link between self-esteem and weight concerns may be bidirectional, and (c) these effects may differ according to youth gender.

Together these findings suggest that there may be a feedback loop linking self-esteem and weight concerns during adolescence, such that low self-esteem predicts higher weight concerns, which in turn predict lower self-esteem (Figure B1). As a protective factor, parent responsiveness may interrupt this cycle, leading to fewer weight concerns by augmenting adolescents' self-esteem and/or by buffering effects of low self-esteem. As girls' self-esteem decreases and their weight concerns increase over the course of adolescence while boys' self-esteem increases and weight concerns remain relatively low [3,36], this model may be applicable to girls more so than boys.

Aims and Hypotheses of the Current Study

The current study aimed to test the directions of the association between self-esteem and weight concerns over the course of adolescence and examine the role of parent responsiveness in this association. As fathers' roles in the development of weight concerns are not well understood and may operate differently than mothers' [26,28], adolescents' perceptions of father and mother responsiveness were included as separate variables in the same model.

Hypothesis 1. I hypothesized that there would be bidirectional relations between self-esteem and weight concerns, such that self-esteem would negatively predict weight concerns and weight concerns would negatively predict self-esteem.

Hypothesis 2. I expected higher levels of parent responsiveness from either parent, regardless of parent gender, to buffer the effects of low self-esteem on weight concerns and weight concerns on self-esteem.

Hypothesis 3. As females generally experience more weight concerns and lower self-esteem than males [3,21], I expected that gender would interact with self-esteem and weight concerns such that girls would exhibit stronger links between self-esteem and weight concerns than would boys.

Method

Participants

Participants were 392 adolescents ages 11-18 (mean age at first measurement = 15 years, $SD = 1.63$; 49.5% female) and their mothers and fathers from 196 families. Participants were part of a longitudinal study of development and family relationships that began in 1995-1996 and originally was designed to follow the family until the oldest child graduated from high school. Families were recruited through letters distributed to students from 16 school districts in the Northeast. Eligibility criteria were that parents were married and employed and that their firstborn child was in 4th or 5th grade with a sibling 1-4 years younger. At Year 6, the last year that all families were originally scheduled to participate, the retention rate was 95%. The current study used self-report data from both youth in each family and demographic data collected from their parents in Years 6, 8, and 9 as both siblings were adolescents during this time period. Year 7 was not included because weight concerns were not measured at that time point. Hereafter, Years 6, 8, and 9 will be referred to as Times 1, 2, and 3 respectively. The sample was almost exclusively Caucasian/European American, which is representative of the region from which participants were recruited. However, this sample was slightly more educated than typical adults

of the region: mothers' mean education was 14.78 ($SD = 2.18$), and fathers, 14.84 ($SD = 2.45$) of on a scale where 12 = high school degree, 14 = some college, and 16 = bachelor's degree, whereas the median level of education in the state for adults was a high school degree, or 12 years [37]. The mean annual family income in this sample at Time 1 was \$38,552 ($SD = \$18,011$, range = \$0-101,500).

Procedure

Trained interviewers conducted individual home interviews with adolescents and their parents at Times 1, 2, and 3 to collect information on family background, family relationships, and youth characteristics. Interviews with parents lasted 2-3 hours, and those with youth, 1-2 hours. Participants provided informed consent and assent and the Pennsylvania State University's Institutional Review Board approved all study procedures.

Measures

Weight Concerns. Adolescents completed the Stanford Weight Concerns Scale [38] at Times 1, 2, and 3. The scale includes six items measuring body image concerns and disordered eating behaviors (e.g., "How afraid are you of gaining three pounds?"). Response scales for the items varied, with one item on a 2-point scale (yes/no), one item on a 4-point scale (1 = *My weight is not important compared to other things in my life*, 4 = *My weight is the most important thing in my life*), three items on 5-point scales (1 = *Never*, 5 = *Always*), and one item on a 6-point scale (1 = *I have never been on a diet*, 6 = *I was on a diet less than one month ago*). Therefore, scores were standardized prior to calculating mean weight concern scores. Higher scores indicate higher weight concerns. The scale was reliable for older and younger girls ($\alpha = .84$, $\alpha = .86$) and older and younger boys ($\alpha = .78$, $\alpha = .77$).

Parent Responsiveness. Adolescents reported separately on their mothers' and fathers' responsiveness at Times 1 and 2 using the five-item Responsiveness subscale of the Parenting Style Inventory [39]. A sample item is "My mother/father praises me for doing well." Items were rated on a 4-point scale (1 = *Really unlike*; 4 = *Really like*), with higher scores indicating greater mother/father responsiveness. The scale was reliable for older and younger siblings for mothers ($\alpha = .82$, $\alpha = .78$) and for fathers ($\alpha = .85$, $\alpha = .76$).

Self-Esteem. Adolescents reported on their self-esteem at Times 1, 2, and 3 using the five-item Self-Worth subscale of Harter's Perceived Competence Scale [40]. Self-esteem and self-worth are considered equivalent, as Harter equated the two terms [31]. Adolescents first chose which one of two statements best described them, and then indicated whether the statement was really true or sort of true for them. A sample item is, "Some teenagers are happy with themselves most of the time but other teenagers are often not happy with themselves." Mean scores were calculated, with higher scores corresponding to higher self-esteem, $\alpha = .85$ for older siblings, $\alpha = .83$ for younger siblings.

Body Mass Index. Adolescents' body mass index (BMI) was calculated from their self-reports of height and weight collected at Time 1. As BMI is associated with weight concerns, it was included as a control.

Parent Education. Mothers and fathers reported their highest level of education at Time 1, with 12 years = high school degree, 14 years = some college, and 16 years = bachelor's degree. Mothers' and fathers' levels of education were correlated, $r = .49$, $p < .001$, thus their scores at Time 1 were averaged to create a global measure of parent education, which was included as a proxy for socioeconomic status.

Adolescent Gender and Age. Mothers' report of their children's ages was included as a lagged control, as weight concerns and self-esteem change over the course of development [3,36]. Mothers' report of their children's gender was included as a moderator to test whether the links between self-esteem and weight concerns differed for girls versus boys.

Analysis Plan

The MIXED procedure in SAS (version 9.4) was used to accommodate the clustered study design (i.e., siblings within families with repeated measurements across three time points) and unbalanced (i.e., time intervals between years of measurement varied) nature of the data. Restricted maximum likelihood estimation, which utilizes all available data rather than excluding cases with any missing data or imputing missing data, was used (130 missing observations in Model 1 and one in Model 2). A time-lagged design was selected to test within-person changes over time while controlling for each person's cross time average. This approach estimates the residual change from year to year in the dependent variable that can be explained by the predictor variables, controlling for the influence of the dependent variable in the prior year. Thus, it is a rigorous test of association that enables examination of the direction of effects of self-esteem and weight concerns over three time points, as well as interactions with other variables of interest, specifically youth gender and mother and father responsiveness.

A series of two-level random intercept models were used to test hypotheses. Heterogeneous compound symmetry was used to adjust for the non-independence of residuals between siblings. See Appendix C for equations for each model. Model 1 ("Weight Concerns") tested self-esteem as a predictor of weight concerns and two and three-way interactions between gender, parent responsiveness, and self-esteem in predicting weight concerns. Model 2 ("Self-Esteem") tested weight concerns as a predictor of self-esteem and the two and three-way

interactions between gender, weight concerns, and parent responsiveness in predicting self-esteem. In both of these models, predictors were lagged within-person levels of the independent variables the previous year, and between-person variables were the participants' cross time average of the independent variables. Between-person variables and time invariant controls were centered on the grand mean (i.e., sample mean), and lagged predictors in each model were person centered. Time invariant predictors were included in Level 2; that is, parent education, body mass index, gender, and cross time averages of mother and father responsiveness, and cross time averages of self-esteem in Model 1 and weight concerns in Model 2. The time varying predictors were included in Level 1; that is, age, lagged weight concerns, lagged self-esteem, and lagged father and mother responsiveness. Including participants' cross time averages of predictors at Level 2 made it possible to test whether residual change from year to year predicted the change in the dependent variable beyond adolescents' average level of the predictors. The lagged versions of the dependent variables (i.e., weight concerns in Model 1 and self-esteem in Model 2) were included to control for prior levels of the dependent variables.

Preliminary analyses revealed that body mass index, parent education, self-esteem, weight concerns, and mother and father responsiveness were normally distributed for females and males, with skewness and kurtosis at acceptable levels for all variables across time points (skewness < 2, kurtosis < 3). Descriptive statistics are presented in Table A1.

For both Model 1 and Model 2, an empty model was estimated, then a main effects model, followed by a two-way interaction model, and then a three-way interaction model. Terms that were both not significant at an alpha level of .05 and not necessary for interpretation of lagged or higher order effects were dropped [41].

Results

Coefficients for fixed effects for Model 1 are presented in Table A2. The control variables age, body mass index, weight concerns the previous year, and participants' cross time average of self-esteem were statistically significant predictors of weight concerns. Parent education and participants' cross time averages of mother and father responsiveness were not statistically significant, but because participants' cross time averages of mother and father responsiveness were necessary for interpretation of coefficients in the lagged design, only parent education was excluded from subsequent analyses. Adolescent self-esteem was a significant negative predictor of weight concerns the following year, such that, higher self-esteem than usual (relative to the adolescent's own cross-time average) in a given year predicted lower than usual weight concerns the following year. Neither levels of mother nor father responsiveness were statistically significant predictors of weight concerns the following year. A final main effect revealed that females reported significantly more weight concerns than males. Neither the two-way interaction between gender and self-esteem nor the two-way interactions between gender and mother or father responsiveness were significant. The two-way interaction between self-esteem and father responsiveness, but not mother responsiveness, was statistically significant, but was qualified by a significant three-way interaction with youth gender. This self-esteem X father responsiveness X gender interaction was probed at one standard deviation above and below the mean of adolescent self-esteem. Results revealed that only the simple slope for females with low father responsiveness was statistically significant, $\gamma = -4.90, p < .001$, indicating that for every one unit increase in self-esteem, there was a 4.9 unit decrease in weight concerns among girls with low father responsiveness (see Figure B2).

Coefficients for fixed effects for Model 2 are presented in Table A3. Among the control variables, only self-esteem the previous year and participants' cross time average of weight concerns were statistically significant predictors of self-esteem the following year. Thus, parent education, body mass index, and age were dropped from subsequent analyses. Youth gender and the cross time averages of mother and father responsiveness were retained due to their theoretical importance. There was a statistically significant negative association between lagged weight concerns and self-esteem, such that higher weight concerns than usual in a given year (compared to the adolescent's cross-time average) predicted lower self-esteem the following year. There was also a statistically significant positive association between lagged mother responsiveness, but not father responsiveness, and self-esteem the following year, such that, on occasions when mother responsiveness was higher than usual, youth's self-esteem the following year was also higher than usual. The only statistically significant interaction was between gender and lagged weight concerns. When probed at one standard deviation above and below the mean of weight concerns, this interaction revealed that the prospective, within-individual association between self-esteem and weight concerns was significant for both males and females, but that the slope was steeper for males; $\gamma = -0.04, p < .001$ and $\gamma = -0.02, p < .05$ for males and females respectively (see Figure B3).

Discussion

The primary goal of this study was to test the directions of the association between self-esteem and weight concerns during adolescence. Findings supported the hypothesis that a bidirectional link exists between self-esteem and weight concerns, such that increases in self-esteem are associated with decreases in weight concerns, and conversely, that increases in weight concerns are associated with decreases in self-esteem the following year. Notably, this

bidirectional association was observed after controlling for prior levels of the dependent variable, participants' cross time averages of the primary independent variables in each model, gender, age, body mass index, and socioeconomic status. Together these findings suggest that weight concerns influence adolescents' overall feelings of self-esteem, and that adolescents' self-esteem influences weight concerns. The bidirectional nature of the association between weight concerns and self-esteem partially supports self-esteem theories, which suggest that adolescents who overvalue physical appearance experience decreases in self-esteem when they have negative evaluations of their bodies. However, self-esteem theories do not account for the prospective link between self-esteem and weight concerns, suggesting that revisions are needed to describe the reciprocal association between self-esteem and weight concerns.

This study also extends prior research examining the direction of association between self-esteem and body image concerns during adolescence by utilizing weight concerns as a measure of body image and eating pathology instead of body dissatisfaction. As weight concerns are better predictors of future eating disorders than body dissatisfaction, this bidirectional link may represent an important process in the development of eating disorders that was not fully captured by previous studies.

In addition to testing the direction of association between self-esteem and weight concerns, this study examined parent responsiveness and youth gender as moderators. The hypothesis that responsiveness from either parent would moderate the link between self-esteem and weight concerns was partially supported, and the moderating role of gender was fully supported. Father, but not mother, responsiveness moderated the prospective link between self-esteem and weight concerns, such that high father responsiveness buffered the effects of low self-esteem on weight concerns for females only. Females with low self-esteem and low father

responsiveness had the highest weight concerns, whereas males with high self-esteem and high father responsiveness had the fewest weight concerns. In addition, father responsiveness interacted with adolescent self-esteem to predict adolescent weight concerns the following year. Neither father nor mother responsiveness moderated the prospective association between weight concerns and self-esteem. However, there was a significant, within-person main effect for mother responsiveness, suggesting that higher than usual mother responsiveness predicted adolescents' higher than usual self-esteem the following year. It may be that parent responsiveness, particularly mother responsiveness, has a direct effect on adolescents' self-esteem and an indirect effect on weight concerns through self-esteem, but does not directly affect weight concerns. Mother responsiveness was higher than father responsiveness on average, which may account for this differential effect between mothers and fathers. Youth gender moderated the prospective association between weight concerns and self-esteem, such that the negative association between weight concerns and self-esteem was slightly stronger for males than females. However, as males generally had higher self-esteem than females and the difference in effect size was small, this pattern may not be clinically meaningful.

The moderating role of gender in the bidirectional link between self-esteem and weight concerns is consistent with gender differences in developmental trajectories of self-esteem and weight concerns [3,36]. This result is also consistent with prior research that has demonstrated gender differences in the links between self-esteem and body dissatisfaction, specifically that the prospective link between self-esteem and body dissatisfaction is apparent for girls but not boys [33]. The finding that both girls' and boys' weight concerns predicted their self-esteem the following year contradicts the idea that appearance is more central to girls' self-esteem than boys' due to gender socialization processes that occur throughout development and inconsistent

with some prior results that White girls overvalue a desirable body weight more so than White boys [42]. However, it is important to note that even though both girls' and boys' weight concerns predicted their respective levels of self-esteem, on average boys' weight concerns were significantly lower than girls', and boys' self-esteem was higher than girls'. Thus, although a one-unit increase in weight concerns corresponded to a slightly greater decrease in self-esteem for boys than girls, girls still experienced worse weight concerns and self-esteem.

Gender socialization processes may explain the differential influence of mother and father responsiveness in the link between self-esteem and weight concerns. Although mothers had higher mean responsiveness scores than fathers, only fathers' responsiveness had a buffering effect on the prospective link between low self-esteem and weight concerns. This may be explained by the greater variance in responsiveness among fathers, which reflects gendered differences in the way that parents interact with their adolescents. Gender socialization theory suggests that both parent and child gender shape parent-child interactions: Mothers tend to have closer relationships with their children than do fathers, and mother-child interactions are characterized by more responsiveness and disagreements than father-child interactions [43]. Mothers and fathers also tend to spend more time with their same sex child [44]. Thus, it may be that girls are accustomed to receiving warmth, support, and acceptance from their mothers, and so the expression of warmth, support, and acceptance from their fathers is particularly salient and meaningful. Fathers' attitudes may also serve as an important reference for girls during adolescence as girls navigate relationships with the other sex and inform girls' attitudes toward their bodies. Mothers' responsiveness may be more relevant for adolescents' self-esteem than fathers' responsiveness because mothers generally have closer relationships and are more responsive toward their children than fathers. It may be that the observed effect is driven by the

frequency and intensity of mothers' positive feedback, which contributes to adolescents' self-concepts. Taken together, these results indicate that father responsiveness buffers the effects of low self-esteem on girls' weight concerns and mother responsiveness bolsters self-esteem for both boys and girls.

Overall, the results from this study support the proposed conceptual model. The bidirectional links between weight concerns and self-esteem provided support for a feedback loop linking self-esteem and weight concerns during adolescence. Again, there was also evidence that parent responsiveness acts as a protective factor to interrupt this cycle, leading to fewer weight concerns by augmenting adolescents' self-esteem and by buffering effects of low self-esteem. In addition, the proposed conceptual model was found to describe girls better than boys, with the exception that both boys' and girls' self-esteem benefitted from maternal responsiveness. This model may aid researchers to conceptualize the role of weight concerns, self-esteem, and parent responsiveness in the development of eating disorders.

This study also makes important contributions to research on risk and protective factors for eating disorders. First, this study was the first to test for a prospective relation between weight concerns and self-esteem. The finding of bidirectional linkages between self-esteem and weight concerns among female adolescents suggests that theories of eating disorder development and self-esteem may need to be revised to account for this previously unknown complexity. That is, there is now preliminary evidence for low self-esteem as a risk factor for weight concerns, and weight concerns as a risk factor low self-esteem. Second, this study lends support for high parent responsiveness, high self-esteem, and male gender as protective factors for weight concerns. Third, this study highlights the utility of considering both family systems and developmental psychopathology as frameworks for understanding risk and protective factors in the development

of eating disorders. A family systems framework recognizes that individuals develop within a family context, and that interactions between family members are reciprocal and evolve over time. Developmental psychopathology also emphasizes that individuals are part of an open system, and that family dynamics and individual characteristics may interact to contribute to the development of psychopathology, including eating disorders. These perspectives aid in understanding how the quality of parent-adolescent interactions can both influence and interact with adolescents' characteristics to shape adolescents' psychological adjustment, and how family variables may serve as risk or protective factors.

Findings from this study prompt further research. Given the variation in body ideals, eating behaviors, and parenting behaviors across ethnic groups, replication in ethnically diverse samples is warranted. In addition, although the longitudinal, lagged design permits inferences about the direction of association, causality cannot be inferred; replication is needed, including using experimental designs. Further research is also needed to examine whether there are age or pubertal timing effects on the bidirectional association between self-esteem and weight concerns. Although this study controlled for age, more sophisticated analyses using a longer time scale and more closely spaced measurements are needed to determine the developmental timing of when the bidirectional association emerges. Additional research also is needed to determine whether parent responsiveness is consistently protective throughout adolescence. As adolescents spend considerable amounts of time with their peers it will be important to examine whether peer evaluations of adolescents' worth are similarly protective or destructive to adolescents' self-esteem and weight concerns.

In short, many questions still need to be addressed. Nonetheless, this study advanced understanding of the development of weight concerns and self-esteem during adolescence and

the role that parents play in shaping adolescents' psychological adjustment. Findings underscore the need to consider how family processes interact with individual characteristics to influence risk for eating disorders. Identifying modifiable risk and protective factors, such as parent responsiveness and self-esteem, and uncovering how these factors differentially affect individuals will refine theories of eating disorder development and may enhance effectiveness of tailored prevention programs.

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Appendix A

Table A1.

Descriptive statistics and correlations between study variables averaged across time points.

	Self-Esteem	Father Responsiveness	Mother Responsiveness	Weight Concerns	Age	Gender	Body Mass Index	Parent Education	<i>M</i>	<i>SD</i>	Range
Self-Esteem	---								3.23	0.62	1.00-4.00
Father Responsiveness	.27***	---							15.04	3.38	5.00-20.00
Mother Responsiveness	.29***	.50***	---						16.92	2.97	5.00-20.00
Weight Concerns	-.34***	-.15***	-.06	---					13.85	6.61	6.00-34.75
Age	-.08*	.05	.09**	.04	---				16.45	1.90	11.06-20.09
Gender	.11***	.06	-.09**	-.36***	.04	---			---	---	---
Body Mass Index	-.09**	-.06	.00	.27***	.26***	.02	---		21.14	3.71	12.96-36.87
Parent Education	.11***	.05	.11***	.02	.02	.03	-.05	---	14.81	2.00	11.50-20.00

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table A2.

Model 1: The Prospective Link between Self-Esteem and Weight Concerns

	Adolescent Weight Concerns					
	Main Effects		Two Way Interactions		Full Model	
	γ	t -value	γ	t -value	γ	t -value
Intercept	15.19***	26.43	15.19***	26.43	14.84***	25.21
Age	0.44*	2.31	0.44*	2.31	0.47*	2.47
Body Mass Index	0.31***	3.89	0.31***	3.89	0.32***	4.05
Gender	-4.77***	-6.19	-4.77***	-6.19	-4.61***	-5.85
Parent Education	---	---				
T-1 WC	-0.57***	-7.92	-0.57***	-7.92	-0.54***	-7.87
BP SE	-2.15**	-2.71	-2.15**	-2.71	-2.07*	-2.70
BP FR	-0.11	-0.71	-0.11	-0.71	-0.15	-1.02
BP MR	-0.11	-0.53	-0.11	-0.53	-0.08	-0.38
T-1 SE	-2.82***	-5.68	-2.82***	-5.68	-3.11***	-5.71
T-1 FR	-0.18*	-1.81	-0.18*	-1.81	-0.11	-0.94
T-1 MR	0.07	0.57	0.07	0.57	0.09	0.68
Gender*T-1 SE			---	---	2.11	1.89
T-1 SE*T-1 FR			---	---	0.54***	4.12
T-1 SE*T-1 MR			---	---	---	---
Gender*T-1 FR			---	---	-0.14	-0.75
Gender*T-1 MR			---	---	---	---
Gender*T-1 SE*T-1 FR					-0.70*	-2.81
Gender*T-1 SE*T-1 MR					---	---

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. T-1 = lagged; SE = self-esteem; BP = between person; WC = weight concerns; FR = father responsiveness; MR = mother responsiveness.

Table A3.

Model 2: The Prospective Link between Weight Concerns and Self-Esteem

	Adolescent Self-Esteem					
	Main Effects		Two Way Interactions		Full Model	
	γ	t -value	γ	t -value	γ	t -value
Intercept	3.19***	64.65	3.17***	62.92	3.17***	62.92
Age	---	---				
Body Mass Index	---	---				
Gender	0.05	0.72	0.03	0.34	0.03	0.34
Parent Education	---	---				
T-1 SE	-0.54***	-7.98	-0.54***	-8.01	-0.54***	-8.01
BP WC	-0.03***	-4.11	-0.03***	-4.08	-0.03***	-4.08
BP FR	0.01	0.69	0.01	0.70	0.01	0.70
BP MR	0.03	1.43	0.03	1.62	0.03	1.62
T-1 WC	-0.02***	-4.22	-0.02*	-2.75	-0.02*	-2.75
T-1 FR	0.02	1.54	0.01	1.44	0.01	1.44
T-1 MR	0.04	3.29	0.04**	3.48	0.04**	3.48
Gender*T-1 WC			-0.02*	-2.14	-0.02*	-2.14
T-1 WC*T-1 FR			---	---	---	---
T-1 WC*T-1 MR			---	---	---	---
Gender*T-1 FR			---	---	---	---
Gender*T-1 MR			---	---	---	---
Gender*T-1 WC*T-1 FR					---	---
Gender*T-1 WC*T-1 MR					---	---

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. T-1 = lagged; SE = self-esteem; BP = between person; WC = weight concerns; FR = father responsiveness; MR = mother responsiveness.

Appendix B

Figure B1. Conceptual model of links between self-esteem and weight concerns in adolescence and the moderating roles of gender and parent responsiveness

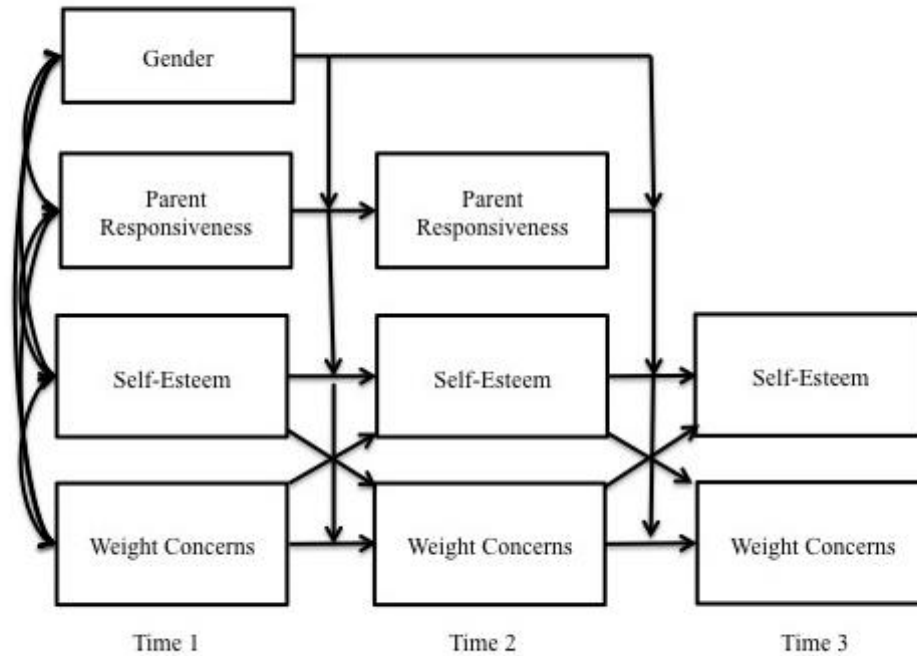


Figure B1. A bidirectional relation is hypothesized between self-esteem and weight concerns during adolescence, such that Time 1 self-esteem predicts Time 2 weight concerns controlling for Time 1 weight concerns, and Time 1 weight concerns predicts Time 2 self-esteem controlling for Time 1 self-esteem, and so on across the three time points. Parent responsiveness and gender are expected to moderate the relationship between self-esteem and weight concerns and also predict self-esteem the following year. The variables body mass index, age, and parent education are not pictured here for clarity.

Figure B2. Three-way interaction of self-esteem, father responsiveness, and gender in predicting youth weight concerns

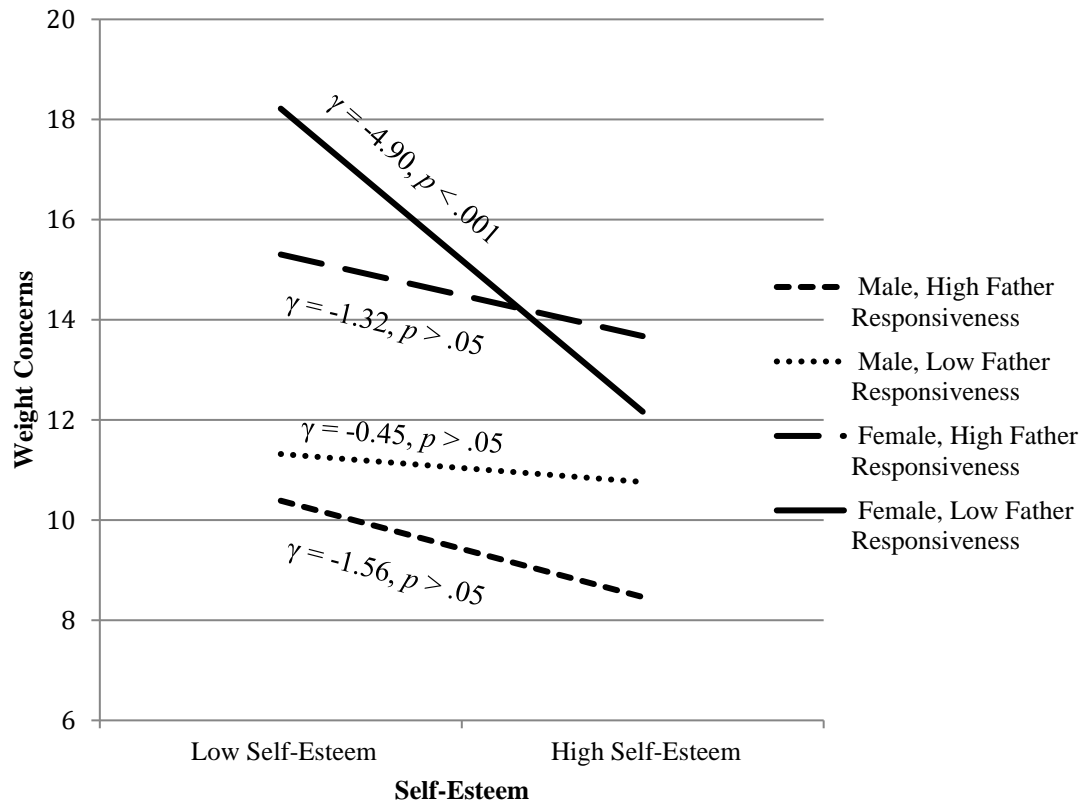
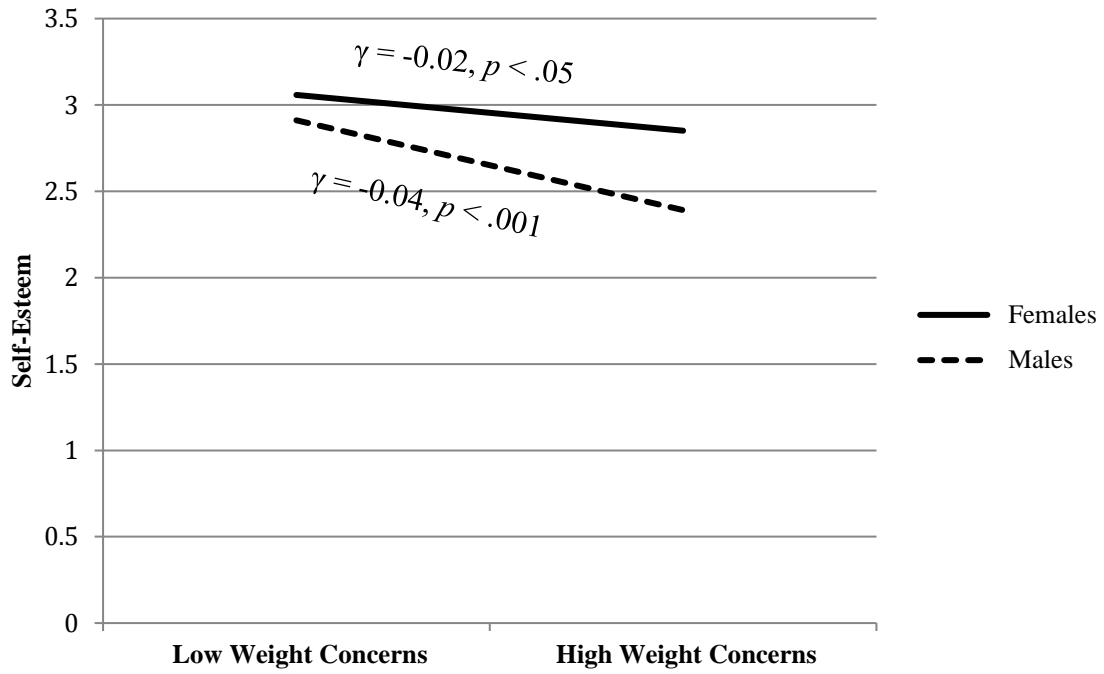


Figure B3. Two-way interaction between youth weight concerns and gender in predicting self-esteem



Appendix C

Model 1 Equations*

$$\text{Level 1: } Y_{ij} = \beta_{0i} + \beta_{1i}\text{Age}_{ti} + \beta_{2i}\text{SE}_{t-1i} + \beta_{3i}\text{WC}_{t-1i} + \beta_{4i}\text{FR}_{t-1i} + \beta_{5i}\text{MR}_{t-1i} + \beta_{6i}(\text{SE}_{t-1i} * \text{MR}_{t-1i}) + \beta_{7i}(\text{SE}_{t-1i} * \text{FR}_{t-1i}) + e_{ti}$$

$$\begin{aligned} \text{Level 2: } \beta_{0i} &= \gamma_{00} + \gamma_{01}\text{Gender}_i + \gamma_{02}\text{BMI}_i + \gamma_{03}\text{EDU}_i + \gamma_{04}\text{BPSE}_i + \gamma_{05}\text{BPFR}_i + \gamma_{06}\text{BPMR}_i + u_{0i} \\ \beta_{1i} &= \gamma_{10} \\ \beta_{2i} &= \gamma_{20} + \gamma_{21}\text{Gender}_i \\ \beta_{3i} &= \gamma_{30} \\ \beta_{4i} &= \gamma_{40} + \gamma_{41}\text{Gender}_i \\ \beta_{5i} &= \gamma_{50} + \gamma_{51}\text{Gender}_i \\ \beta_{6i} &= \gamma_{60} + \gamma_{61}\text{Gender}_i \\ \beta_{7i} &= \gamma_{70} + \gamma_{71}\text{Gender}_i \end{aligned}$$

$$\begin{aligned} \text{Combined Model: } Y_{ti} &= \gamma_{00} + \gamma_{01}\text{Gender}_i + \gamma_{02}\text{BMI}_i + \gamma_{03}\text{EDU}_i + \gamma_{04}\text{BPSE}_i + \gamma_{05}\text{BPFR}_i + \\ &\gamma_{06}\text{BPMR}_i + \gamma_{10}\text{Age}_{ti} + \gamma_{20}\text{SE}_{t-1i} + \gamma_{21}(\text{Gender}_i * \text{SE}_{t-1i}) + \gamma_{30}\text{WC}_{t-1i} + \gamma_{40}\text{FR}_{t-1i} + \\ &\gamma_{41}(\text{Gender}_i * \text{FR}_{t-1i}) + \gamma_{50}\text{MR}_{t-1i} + \gamma_{51}(\text{Gender}_i * \text{MR}_{t-1i}) + \gamma_{60}(\text{SE}_{t-1i} * \text{MR}_{t-1i}) + \\ &\gamma_{61}(\text{Gender}_i * \text{SE}_{t-1i} * \text{MR}_{t-1i}) + \gamma_{70}(\text{SE}_{t-1i} * \text{FR}_{t-1i}) + \gamma_{71}(\text{Gender}_i * \text{SE}_{t-1i} * \text{FR}_{t-1i}) + u_{0i} + e_{ti} \end{aligned}$$

Model 2 Equations*

$$\text{Level 1: } Y_{ij} = \beta_{0i} + \beta_{1i}\text{Age}_{ti} + \beta_{2i}\text{SE}_{t-1i} + \beta_{3i}\text{WC}_{t-1i} + \beta_{4i}\text{FR}_{t-1i} + \beta_{5i}\text{MR}_{t-1i} + \beta_{6i}(\text{WC}_{t-1i} * \text{MR}_{t-1i}) + \beta_{7i}(\text{WC}_{t-1i} * \text{FR}_{t-1i}) + e_{ti}$$

$$\begin{aligned} \text{Level 2: } \beta_{0i} &= \gamma_{00} + \gamma_{01}\text{Gender}_i + \gamma_{02}\text{BMI}_i + \gamma_{03}\text{EDU}_i + \gamma_{04}\text{BPWC}_i + \gamma_{05}\text{BPFR}_i + \gamma_{06}\text{BPMR}_i + u_{0i} \\ \beta_{1i} &= \gamma_{10} \\ \beta_{2i} &= \gamma_{20} \\ \beta_{3i} &= \gamma_{30} + \gamma_{31}\text{Gender}_i \\ \beta_{4i} &= \gamma_{40} + \gamma_{41}\text{Gender}_i \\ \beta_{5i} &= \gamma_{50} + \gamma_{51}\text{Gender}_i \\ \beta_{6i} &= \gamma_{60} + \gamma_{61}\text{Gender}_i \\ \beta_{7i} &= \gamma_{70} + \gamma_{71}\text{Gender}_i \end{aligned}$$

$$\begin{aligned} \text{Combined Model: } Y_{ti} &= \gamma_{00} + \gamma_{01}\text{Gender}_i + \gamma_{02}\text{BMI}_i + \gamma_{03}\text{EDU}_i + \gamma_{04}\text{BPWC}_i + \gamma_{05}\text{BPFR}_i + \\ &\gamma_{06}\text{BPMR}_i + \gamma_{10}\text{Age}_{ti} + \gamma_{20}\text{SE}_{t-1i} + \gamma_{30}\text{WC}_{t-1i} + \gamma_{31}(\text{Gender}_i * \text{WC}_{t-1i}) + \gamma_{40}\text{FR}_{t-1i} + \\ &\gamma_{41}(\text{Gender}_i * \text{FR}_{t-1i}) + \gamma_{50}\text{MR}_{t-1i} + \gamma_{51}(\text{Gender}_i * \text{MR}_{t-1i}) + \gamma_{60}(\text{WC}_{t-1i} * \text{MR}_{t-1i}) + \\ &\gamma_{61}(\text{Gender}_i * \text{WC}_{t-1i} * \text{MR}_{t-1i}) + \gamma_{70}(\text{WC}_{t-1i} * \text{FR}_{t-1i}) + \gamma_{71}(\text{Gender}_i * \text{WC}_{t-1i} * \text{FR}_{t-1i}) + u_{0i} + e_{ti} \end{aligned}$$

*Note. The “BP” prefix denotes a between-person, or cross-time average, variable. SE = self-esteem; WC = weight concerns; FR = father responsiveness; MR = mother responsiveness; BMI = body mass index; EDU = parent education. The subscripts “t” and “i” refer to time and individual, respectively. The “t-1” subscript denotes a lagged variable.