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The Unique and Additive Associations of Family Functioning and Parenting Practices with Disordered Eating Behaviors in Diverse Adolescents

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Abstract

Objective—To examine the unique and additive associations of family functioning and parenting practices with adolescent disordered eating behaviors (i.e., dieting, unhealthy weight control behaviors, binge eating).

Methods—Data from EAT (Eating and Activity in Teens) 2010, a population-based study assessing eating and activity among racially/ethnically and socio-economically diverse adolescents (n = 2,793; mean age = 14.4, SD = 2.0; age range = 11–19) was used. Logistic regression models were used to examine associations between adolescent dieting and disordered eating behaviors and family functioning and parenting variables, including interactions. All analyses controlled for demographics and body mass index.

Results—Higher family functioning, parent connection, and parental knowledge about child's whereabouts (e.g. who child is with, what they are doing, where they are at) were significantly associated with lower odds of engaging in dieting and disordered eating behaviors in adolescents, while parent psychological control was associated with greater odds of engaging in dieting and disordered eating behaviors. Although the majority of interactions were non-significant, parental psychological control moderated the protective relationship between family functioning and disordered eating behaviors in adolescent girls.

Conclusions—Clinicians and health care providers may want to discuss the importance of balancing specific parenting behaviors, such as increasing parent knowledge about child whereabouts while decreasing psychological control in order to enhance the protective relationship between family functioning and disordered eating behaviors in adolescents.

Keywords

Adolescents; Family Functioning; Parenting; Weight Control Behaviors; Binge Eating; Dieting

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Disordered eating behaviors, including frequent dieting, unhealthy weight control behaviors (e.g., fasting, self-induced vomiting, and skipping meals for weight loss) and binge eating are prevalent among adolescents (Ackard, Neumark-Sztainer, Story and Perry 2003, Eaton et al, 2012). These behaviors are of public health concern due to their association with adverse physical and psychological outcomes, including depressive symptoms (Johnson, Cohen, Kasen and Brook 2002), the onset of obesity (Field et al, 2003; Neumark-Sztainer et al, 2006; Stice, Presnell, Shaw and Rohde, 2005) and eating disorders (Patton, Selzer, Coffey, Carlin, and Wolfe, 1999; Santonastoaso, Friederici, & Favaro 1999).

Historically, parents have often been blamed for their children's disordered eating behaviors and eating disorders (Ackard & Neumark-Sztainer, 2001; Bruch, 1985; Cochrane, & Brewerton, 1998; Fowler & Bulik, 1997; Garfinkel, et al., 1983; Humphrey, 1987, 1989; McCabe & Ricciardelli, 2005; Mendelson, White, & Schliecker, 1995; Minuchin, Rosman, & Baker, 1978; Neumark-Sztainer, Bauer, Friend, Hannan, & Berge, 2010; Ordman & Kirschenbaum, 1986; Pike & Rodin, 1991; Strober & Humphrey, 1987; Vincent & McCabe, 2000; Woodside, Lackstrom, Shekter-Wolfson, & Heinmaa, 1996). More recently, parents are viewed differently and are often included as partners and resources in the treatment process (Le Grange, Lock, Loeb, & Nicholls, 2009; Lock, Le Grange, Agras, & Dare, 2001). Thus, it is important to understand more about family functioning and parenting practices within families in which a child engages in disordered eating behaviors, in order to understand how to best involve parents and families in the process of helping their children to avoid and reduce these behaviors. Identifying protective factors within the home environment to address in medical and mental health care settings or to target in family-based interventions aimed at the prevention and/or treatment of disordered eating behaviors is of high importance.

Studies conducted within the last decade have identified that family functioning characteristics such as healthy communication among family members, adaptability, problem-solving, organization/structure within the family, and unconditional acceptance of family members are associated with fewer adolescent disordered eating behaviors (Benninghoven, Tetsch, Kunzendorf, & Jantschek, 2007; Haslam, Mountford, Meyer, & Waller, 2008; Latzer, Lavee, & Gal, 2009). In addition, research has suggested that parental practices such as warmth/connection in combination with parental structure/rules are associated with fewer disordered eating behaviors in adolescents (Enten & Golan, 2009). These results are consistent with the tenets of family systems theory in which both family level and dyadic level (e.g., parent/child) interactions are viewed as shaping other family members' positive (e.g., physical activity) and negative (e.g., disordered eating behaviors) health behaviors (Minuchin, Rosman, & Baker, 1978; Whitchurch & Constantine, 1999). Furthermore, family systems theory suggests that highly negative dyadic level behavior, such as parent psychological control may attenuate the positive or negative influence of family functioning. For example, a psychologically controlling parent may dampen the protective influence of high family functioning. Thus, in order to provide a more complete picture of the home environment, it is necessary to look at parenting practices and family functioning together. This combined assessment will help to identify which combinations of factors may provide increased protection against the use of disordered eating behaviors in adolescents. For example, if parental connection (e.g., warmth/closeness, communication) moderates the relationship between family functioning and adolescent disordered eating behaviors, it may be important for prevention and treatment efforts to be geared towards bolstering specific parenting practices, rather than focusing solely on overall family functioning.

When studying the parent/child relationship it is also important to look at individual aspects of parenting behaviors such as parental connection (i.e., warmth/closeness, communication),

parental knowledge about child's whereabouts (e.g. who child is with, what they are doing, where they are at) and psychological control (i.e., coercion, manipulation) in order to identify modifiable parent practices, rather than categorizing parents into a particular style (e.g., authoritative, authoritarian, permissive, neglectful) which has been shown to be more "trait" like, or unchangeable (Barber & Schluterman, 2008; Barber, Stolz, & Olsen, 2005; Salafia, Gondoli, Bucchianeri, & Godinez, 2009; Soenens, et al., 2008). This approach is consistent with the current shift in the family and psychology field in measuring parenting practices across three main dimensions: connection (i.e., warmth/closeness, good communication), parental knowledge about child's whereabouts (e.g. who child is with, what they are doing, where they are at), and respect for psychological autonomy (i.e., not controlling), rather than characterizing parenting styles (Barber & Schluterman, 2008; Barber, et al., 2005).

In addition, research that has included fathers and/or sons when looking at relationships between family functioning and parenting practices and adolescent disordered eating behaviors is limited (Enten & Golan, 2009; Sierra-Baigrie, Lemos-Giraldez, & Fonseca-Pedrero, 2009). Including both father and son data would be useful, given research suggesting that the opposite-sex parent may be influential in relation to weight-related behaviors in adolescents (Berge, Wall, Bauer, & Neumark-Sztainer, 2010; Berge, Wall, Loth, & Neumark-Sztainer, 2010). Additionally, there is evidence to suggest that fathers may play an important role in the prevention and treatment of daughter's disordered eating behaviors (Dixon, Gill, Adair, 2003; Eme, Hynes, Danielak, 1995; Field, Camargo, Barr Taylor, Berkley, Roberts & Colitz, 2001; Field, Javaras, Aneja, 2008; Flouri, 2010; Keel, Heatherton, Harden & Hornig, 1997). Thus, in order to obtain a more comprehensive picture of the home environment that will provide key information for tailoring family-based interventions for adolescent disordered eating behaviors it is important to include both mothers and fathers and daughters and sons.

The main aim of this study is to identify the unique and additive relationships of family functioning and mother and father parenting practices (i.e., parent connection, knowledge about child's whereabouts and psychological control) with adolescent girls' and boys' disordered eating behaviors (i.e., dieting, unhealthy weight control behaviors (UWCBs), extreme UWCBs, binge eating) in a racially/ethnically (81% ethnic minority) and socio-economically diverse (60% low income) population in order to inform treatment and prevention efforts in adolescents with disordered eating behaviors. The secondary aim of this paper is to identify the independent associations between each parent's parenting practices and adolescent disordered eating outcomes, within a sub-sample of adolescents with two parents (i.e., mutually adjusted analyses). Specifically, when taking into account the other parent's parenting practices, are there still significant independent effects of parenting practices above and beyond the influence of the other parent's parenting practices and family functioning? Including both of these aims in the current paper allows for the examination of the relationship of family functioning and parenting practices with adolescent disordered eating in a representative sample including all types of families (those with or without two parents), in addition to, analyses limited to adolescents with two parents.

The hypotheses tested in the current study include: (1) high family functioning and parent connection and knowledge about child's whereabouts will be associated with lower prevalence of adolescent disordered eating behaviors (i.e., dieting, UWCBs, extreme UWCBs and binge eating), while high parent psychological control will be associated with higher prevalence adolescent disordered eating behaviors; (2) high parent connection or knowledge about child's whereabouts will enhance the protective association between high family functioning and less adolescent disordered eating behaviors, while high parent

psychological control will diminish the protective effect of high family functioning; (3) when taking into account family functioning and all other parenting behaviors including those of the other parent, higher psychological control of each parent will be associated with higher prevalence of adolescent disordered eating behaviors.

Methods

Study Design and Population

The EAT 2010 (Eating and Activity in Teens) study was designed to assess dietary intake, physical activity, weight control behaviors, and weight status in a population-based sample of adolescents. Surveys and anthropometric measures were completed by 2,793 adolescents from 20 public middle schools and high schools in the Minneapolis/St. Paul metropolitan area of Minnesota during the 2009–2010 academic year. The study was approved by the University of Minnesota's Institutional Review Board and the research boards of participating school districts.

The mean age (range = 11–19 years) of the study sample was 14.4 years (SD=2.0), with 46.1% of adolescents in middle school (6th–8th grades) and 53.9% in high school (9th–12th grades). Participants were equally divided by gender (46.8% boys, 53.2% girls). The racial/ethnic backgrounds of the participants were as follows: 18.9% white, 29.0% African American or Black, 19.9% Asian American, 16.9% Hispanic, 3.7% Native American, and 11.6% mixed or other. Participants were distributed across five socioeconomic status (SES) strata, 29.4% low SES, 24.3% low-middle SES, 33.3% middle SES, 6.4% upper-middle SES, and 2.8% high SES, based primarily on parental educational attainment. The familial/household composition of adolescents in the study included: 55% lived with two parents, 28% lived with mom only, 7% lived with mom part of the time and dad part of the time, 3% lived with dad only, 2% lived with a grandparent, and 5% lived with someone else (e.g., aunt, foster parent).

Adolescent Survey Development

The EAT 2010 survey is a 235-item self-report instrument assessing a range of factors of potential relevance to weight status and weight-related behaviors among adolescents. Survey development was guided by a review of previous Project EAT surveys (Neumark-Sztainer, et al., 2002; Neumark-Sztainer, Story, Perry, & Casey, 1999) to identify the most salient items; a theoretical framework, which integrates an ecological perspective with social cognitive theory (Bandura, 1986; Sallis, Owen, & Fisher, 2008); expert review by professionals from different disciplines; and extensive pilot testing with adolescents. An initial draft of the EAT 2010 survey was pretested by 56 adolescents with diverse backgrounds to assess the understandability and relevance of measures. This draft survey was additionally reviewed by a team of experts in the domains of nutrition, physical activity, adolescent development, body image, family social science, and urban design. Following revisions based on initial pretesting and feedback from the expert reviewers, the survey was further pilot tested with a different sample of 129 middle school and high school students to examine the test-retest reliability of measures over a one-week period and the internal consistency of scales. The results were used to further refine the wording of measures and to inform decisions about reducing the overall length of the survey.

Measures

Exposure variables—Overall family functioning was assessed via adolescent self-report using items drawn from the general functioning scale of the *Family Assessment Device* (FAD) (Epstein, Baldwin, & Bishop, 1983; Miller, Epstein, Bishop, & Keitner, 1985) (Table 1). The general functioning scale on the *FAD* measures structural and organizational

properties of the family group and patterns of transactions such as: problem solving, communication, roles, affective responsiveness, affective involvement, and behavior control among family members. Previous research has shown high validity (r = 0.92) and test-retest reliability (r = 0.71) for the general functioning scale with racially/ethnically and socio-economically diverse populations (Epstein, Bladwin & Bishop, 1983). Parenting practices assessed via adolescent self-report in the current study were drawn from the family social science literature emphasizing the importance of measuring individual parenting practices rather than overall "parenting style" (Barber, et al., 2005). Barber's research has identified three key parenting practices: connection (e.g., warmth, caring), knowledge about child's whereabouts (e.g. who child is with, what they are doing, where they are at), and respect for psychological autonomy (e.g. not controlling) as protective factors for adolescent health and development (Barber & Schluterman, 2008; Barber, et al., 2005) (Table 1).

Outcome variables—Dieting (Neumark-Sztainer, Wall, Hannan, et al., 2003), unhealthy weight control behaviors (UWCBs) and extreme unhealthy weight control behaviors (Neumark-Sztainer, Wall, Story, & Perry, 2003), and binge eating (Yanovski, Nelson, Dubbert, & Spitzer, 1993) were assessed using self-report items from previous measures (Table 1).

Covariates—Race/ethnicity, socio-economic status (SES), and age were assessed by self-report (Table 1). Trained research staff measured adolescents' heights and weights using standardized procedures and BMI z-scores were calculated (Kuczmarski, et al., 2002).

Statistical Analysis

Differences in the distribution of demographics and disordered eating variables by gender were assessed with chi-square tests (or t-test for the continuous variable age). Analyses were stratified by gender and included fitting three sets of logistic regression models, all of which controlled for race/ethnicity, SES, age, and BMI. A priori stratification was done because of previous research suggesting gender differences in reports of parenting practices (Berge, 2010; Berge, Wall, Bauer, & Neumark-Sztainer, 2010; Berge, Wall, Loth, & Neumark-Sztainer, 2010; Enten & Golan, 2009) and disordered eating behaviors in adolescents (Dianne Neumark-Sztainer, et al., 2000; D. Neumark-Sztainer, Story, Hannan, Perry, & Irving, 2002). First, separate logistic regression models were fit to each of the four disordered eating outcomes including either the family functioning or one of the six parenting variables (three for mother, three for father).

Second, to investigate moderation between family functioning and the parenting variables, an interaction term between family functioning and each of the six parenting variables was included one at a time. When a significant interaction was found ($p<.05$), odds ratios and 95% confidence intervals were estimated for family functioning at different fixed values along the parenting variable to explicate the nature of the moderation. In total there were 24 interactions tested for each adolescent gender (six parent variables interacted with family functioning for each of four outcomes). A more liberal critical value of 0.10 is often used for interactions because there is typically less statistical power to detect interactions. Given the many interactions tested in the current study, and to limit Type 1 error, we used a more conservative critical value of 0.05.

Third, for each outcome, a model that simultaneously included family functioning and all six parenting variables was fit to identify independent and mutually adjusted effects of each parenting variable (e.g., the effect of maternal psychological control above and beyond father psychological control and above all other family and parenting variables). Specifically, all seven predictors (one family functioning plus 3 mother practices plus 3

father practices) were included simultaneaoulsy in the logistic regression for each outcome. Because of the mutual adjustment, this last set of analyses included only adolescents with complete (i.e. non-missing) data for maternal and paternal parenting variables. There were 13.3% (n=372) of adolescents with missing responses for the father questions, 0.9% (n=25) missing for the mother questions, and 2.3% (n=65) missing for both mother and father questions, yielding 1224 (82%) of girls and 1107 (85%) of boys with responses for both mother and father questions. While there was no difference by gender in terms of whether or not an adolescent completed all questions regarding mothers and fathers, there were significant differences by race, SES, and age group such that more adolescents who were white, had higher SES and were younger in age had higher percentage of complete responses. Moreover, after controlling for demographics, there were no significant differences between these groups in the dieting and disordered eating variables. In all analyses, the family functioning and parenting variables were standardized within gender to facilitate interpretation and comparison of odds ratios. An additional analysis was conducted to test for differential findings between family functioning and disordered eating outcomes by BMI percentile categories of <15%, ≥85% < 95% and ≥95%. No significant interaction was found, thus results are not presented by BMI category but are adjusted for BMI z-score. All analyses were performed in SAS (V9.2, Cary NC, 2010).

Results

Descriptive Analysis

Descriptive analyses identified that adolescent girls reported significantly higher levels of disordered eating behaviors as compared to adolescent boys. Specifically, adolescent girls had higher levels of dieting (girls=46%; boys=31%), UWCBs (girls=50% boys = 38%), extreme UWCBs (girls=7%; boys=4%), and binge eating behaviors (girls=10%; boys=6%) ($p < 0.001$ on all outcomes).

Associations between Family Functioning and Parenting Practices and Adolescent Outcomes

Family functioning—Higher family functioning was associated with lower odds of dieting, unhealthy weight control behaviors (UWCBs), extreme UWCBs and binge eating in both adolescent girls and boys ($p < 0.001$ for all outcomes) (Table 2). For example, the odds ratio of 0.71 for girls' represents a 29% lower odds for engaging in UWCBs, given one standard deviation increase in family functioning, after controlling for socio-demographics and BMI z-score, compared to adolescent girls with lower family functioning.

Parental connection—Higher maternal and paternal connection were associated with lower odds for engaging in UWCBs, extreme UWCBs and binge eating in both girls and boys ($p < 0.05$ for all outcomes) and for dieting in girls ($p < 0.01$).

Parental knowledge—Higher maternal knowledge about child's whereabouts was associated with lower odds of engaging in UWCBs, extreme UWCBs, and binge eating behaviors in both girls and boys ($p < 0.01$ for all outcomes). In addition, paternal knowledge about child's whereabouts was associated with lower odds of dieting, UWCBs, extreme UWCBs and binge eating in girls ($p<0.05$ for all outcomes). There were no significant associations between paternal knowledge and boys' dieting, UWCBs, extreme UWCBs, or binge eating.

Parental psychological control—Higher maternal and paternal psychological control were associated with increased odds for engaging in UWCBs, extreme UWCBs and binge eating for girls ($p< 0.01$ for all outcomes). In addition, higher maternal psychological control

was associated with increased odds of dieting in girls ($p<0.01$). Higher maternal and paternal psychological control were associated with increased odds for engaging in dieting and UWCBs in boys ($p<0.01$ for both outcomes). Additionally, higher maternal psychological control was associated with increased odds of extreme UWCBs in boys ($p<0.01$).

Interactions between Family Functioning and Parenting Practices

Of the twenty-four interactions for each gender (Table 4a for girls 4b for boys), four interactions between family functioning and parenting practices were statistically significant; three for adolescent girls and one for adolescent boys. For adolescent girls, the association between family functioning and UWCBs ($p < 0.001$) and binge eating ($p = 0.012$) were moderated (i.e., weakened) by higher maternal psychological control. Specifically, in the presence of low maternal psychological control (i.e. at levels one standard deviation below the mean) there was a strong protective relationship of family functioning (UWCBs: OR = 0.64 (i.e., from Table 4a: exp (−0.280 – 0.175)), 95% CI = 0.53–0.75; Binge eating OR = 0.59, 95% CI = 0.44–0.79), but, in the presence of high maternal psychological control (i.e., at levels one standard deviation above the mean) observed associations between family functioning and UWCBs and binge eating were diminished to the point of not being statistically significant (UWCBs: OR = 0.90 (i.e., from Table 4a: exp(−0.280 – 0.175)), 95% CI = 0.78–1.04; Binge eating: OR = 0.89, 95% CI = 0.73–1.09). A similar antagonistic interaction between family functioning and paternal psychological control was found for extreme UWCBs ($p = 0.040$) in adolescent girls. Family functioning was protective across the spectrum of paternal psychological control, but observed associations were stronger when paternal psychological control was low (OR = 0.46, 95% CI = 0.32–0.66) and was weakened when paternal psychological control was high (OR = 0.69, 95% CI = 0.54–0.88). Thus, parents' psychologically controlling practices reduced, or moderated, the protective relationship of family functioning on disordered eating behaviors in adolescent girls.

In addition, for adolescent boys, there was a synergistic protective association for engaging in extreme UWCBs from the combination of higher family functioning and higher paternal knowledge about child's whereabouts ($p = 0.004$). Specifically, the protective association of family functioning for extreme UWCBs (OR = 0.48 (i.e., from Table 4b: exp(−0.72)), 95% CI = 0.33, 0.71) at mean levels of father's knowledge about child's whereabouts (i.e., standardized father's knowledge fixed at 0) was enhanced (OR = 0.28 (i.e., from Table 4b: exp(−0.72 – 0.54)), 95% CI = 0.15, 0.52) when father's knowledge about child's whereabouts was one standard deviation above average. Thus, fathers who were knowledgeable about their child's whereabouts, such as who they were with, what they were doing, and where they were at enhanced the protective association between family functioning and extreme UWCBs in adolescent boys.

Mutually Adjusted Results

In order to take into account each parent's potential influence on the other parent's parenting practices and account for associations among the different practices, mutually adjusted analyses were conducted for the sub-sample of adolescents with responses to questions for both mother and father. Specifically, all seven predictors (one family functioning, 3 mother practices, and 3 father practices) were included in the logistic regression simultaneously. Results indicated that adolescent girls with higher family functioning had reduced odds of dieting ($p = 0.018$), engaging in UWCBs ($p = 0.002$) and extreme UWCBs ($p = 0.003$) (Table 3). For example, the odds ratio of .66 for adolescent girls represents a 34% reduced odds of extreme UWCBs, given one standard deviation increase in family functioning, above and beyond the effect of each parent's parenting practices, and after controlling for adolescent socio-demographics and BMI z-score.

In addition, higher maternal psychological control was associated with increased odds for engaging in UWCBs and extreme UWCBs for girls and boys ($p < 0.05$ for both outcomes) and higher maternal knowledge about child's whereabouts was associated with higher odds of engaging in binge eating behaviors for girls ($p = 0.019$), above and beyond the effect of fathers' parenting practices, and after controlling for adolescent socio-demographics and BMI z-score.

Discussion

Results indicated that there were several unique, and some additive relationships between family functioning and parenting practices and adolescent disordered eating behaviors. Results from the current study support previous research showing significant individual associations of family functioning and parent connection with adolescent dieting, UWCBs and binge eating. This study extends past research by showing that higher levels of parent knowledge about child's whereabouts and lower levels of parent psychological control were associated with less dieting and fewer disordered eating behaviors in adolescents (Enten & Golan, 2009). Thus, our results suggest that high family functioning (e.g., good communication, problem-solving, unconditional acceptance) and parenting practices that include warmth, parent knowledge about child's whereabouts, and low psychological control may be important when trying to address adolescent disordered eating behaviors.

Results also suggest the importance adolescents' perceptions of their father's parenting practices in regards to adolescent girls' disordered eating behaviors. For example, paternal connection and knowledge about child's whereabouts was associated with lower odds of engaging in all disordered eating behaviors and paternal psychological control was associated with higher odds of engaging in all disordered eating behaviors for adolescent girls. This is consistent with Family Systems Theory which suggests that opposite-sex parents may be highly influential during the developmental stage of adolescence. Likewise, previous research has identified the importance of father involvement in prevention and treatment of youth disordered eating behaviors (Dixon, Gill, Adair, 2003; Eme, Hynes, Danielak, 1995; Field, Camargo, Barr Taylor, Berkley, Roberts & Colitz, 2001; Field, Javaras, Aneja, 2008; Flouri, E, 2010; Keel, Heatherton, Harden & Hornig, 1997).

Only four of the interactions between family functioning and parenting practices were significant, with the majority being significant for adolescent girls. Thus, the overall lack of significant interactions suggests that the association between family functioning and parenting practices and disordered eating behaviors in adolescents do not depend on each other, with a few exceptions. The significant interactions found in the current study for adolescent girls suggest that in family environments where mothers and fathers use psychologically controlling practices (e.g., criticize child), the protective relationship of high family functioning may be reduced and adolescent girls may be more likely to engage in more UWCBs (e.g., fasting, skip meals, use food substitutes, smoke), extreme UWCBs (e.g., take diet pills, vomit, use laxatives) and binge eating behaviors as compared to high functioning homes where parents do not use psychologically controlling practices. In other words, in the face of high parent psychological control, high family functioning does not have the same protective effect on dieting and disordered eating behaviors in adolescent girls. This finding is theoretically consistent with Family Systems Theory. For example, maternal psychological control in the context of family closeness may be experienced as constraining by an adolescent and may impair self-esteem, self-regulation, coping, and perceived autonomy. In turn, problems with self-esteem and self-regulation may underlie dieting and other restrictive, essentially dysregulated behaviors that may lead to disordered eating behaviors.

Furthermore, the mutually adjusted results suggest that after accounting for the potential influence of the other parent's parenting practices, family functioning continued to be significantly associated with fewer disordered eating behaviors in adolescent girls. In addition, psychologically controlling practices on the part of the mother, above and beyond father parenting practices and family functioning, were associated with more dieting and disordered eating behaviors in adolescent girls and boys. These are new findings and have the potential to inform the field of eating disorder treatment and prevention. For example, results from the current study may inform clinical work and/or intervention research with the families of adolescents with eating disorders by suggesting the need to balance the dance between using specific parenting practices (e.g. decreasing psychological control while increasing knowledge of child's whereabouts), in particular for mothers, while also attending to overall family functioning.

Study strengths and limitations should be taken into account when interpreting the study findings. The current study had several strengths, including the use of a large, racially/ethnically and socio-economically diverse population. In addition, this study had a high participant response rate, included data on fathers and sons, made statistical adjustments for possible third variable confounding of results (age, SES, race/ethnicity, BMI), and looked at important interactions between family functioning and parenting practices.

One limitation of this study is the cross-sectional design. Because we were unable to examine longitudinal associations, we cannot determine causality or temporality of the observed relationships of family functioning and parenting practices with adolescent disordered eating behaviors. Although we may assume that the direction goes from the family to the child, it may also be the case that in families in which a child engages in disordered eating, parents may feel a need to be more psychologically controlling and family functioning may be impaired. Thus, longitudinal studies are needed to confirm current findings and we hope to follow this sample over time. Second, important mediating factors such as adolescent depression, anxiety, or self-esteem/worth were not examined in this analysis and may be important to consider in order to more fully understand the nature of the relationship between parenting practices and family functioning and adolescent disordered eating behaviors (Rojo-Moreno, Livianos-Aldana, Conesa-Burguet, & Cava, 2006; Salafia, Gondoli, Bucchianeri, & Godinez, 2009). A third limitation of the study is that brief measures were used to assess both family measures and adolescent outcomes (e.g., dieting) in order to decrease participant burden. Specifically, the family functioning measure used in the survey was not the full measure (Epstein, et al., 1983; Miller, et al., 1985) and may not have been inclusive of all family interactions and behaviors that contribute to measuring family functioning. We used six of the 12 potential items on the scale, thus we may have underestimated the association between family functioning and adolescent disordered eating behaviors. In addition, while the family functioning measure has been rigorously tested in diverse racial/ethnic samples, the parenting measure has not. Both the family functioning and parenting measures were also adolescent report and may not represent parents' perception of their own parenting. While this may be a limitation, it may also be a strength, because previous research has shown that it is important to measure adolescents' perception of their family and parental relationships when examining these variables in relation to adolescent behavior outcomes (Agnihotri, Awasthi, Singh, Chandra & Thakur 2010; Williams, Lindsey, Joe, 2011).

Conclusion

In recent years, the focus within the field of eating disorders has greatly shifted, such that parents are considered true partners in the prevention and treatment of eating disorders in their children. Thus, a balance needs to be found in guiding families toward more effective

parenting, while not blaming parents whose children are engaging in disordered eating behaviors. The current study identified a number of family and parenting factors that were significantly associated with less disordered eating behaviors in a highly racially/ethnically and socioeconomically diverse population. Similar factors have been found to be protective for youth in regards to other high-risk behaviors (e.g., substance use) (Annunziata, Hogue, Faw, & Liddle, 2006; Dinsmore & Stormshak, 2003; Gerbino, Patorelli, Vecchio, Paciello, & Tramontano, 2005; Hanna & Bond, 2006; Hanna, Juarez, Lenss, & Guthrie, 2003; Johnson, 2010; Kim, Viner-Brown, & Garcia, 2007; Leonard, Jang, Savik, & Plumbo, 2005). Clinicians, such as physicians, mental health providers and dietitians that work with families and adolescents may want to discuss the importance of balancing specific parenting behaviors, such as increasing parent knowledge about child's whereabouts (e.g. who child is with, what they are doing, where they are at) while decreasing psychological control, in order to enhance the protective relationship between family functioning and disordered eating behaviors in adolescents. It is incumbent upon our society to find ways to support families of adolescents, in order to promote healthy family functioning, strong parent-child connectedness, appropriate levels of parent knowledge about child's whereabouts, and less psychologically controlling parenting practices.

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Table 1

Exposure, outcome and control variables used in analyses

Measure	Description
Family Functioning	Family functioning was assessed using six items drawn from the general functioning scale of the *Family Assessment Device* (FAD)(Epstein, Baldwin, & Bishop, 1983; Miller, Epstein, Bishop, & Keitner, 1985) Adolescents were asked, "How strongly do you agree with the following statements? For these questions, think about your family in general (including your parents and your brothers and sisters)… [Strongly disagree, Somewhat disagree, Somewhat agree, Strongly agree] (a) Family members are accepted for who they are; (b) Making decisions is a problem for the family; (c) We don't get along well together; (d) We can express feelings to each other; (e) Planning family activities is difficult because we misunderstand each other; (f) We confide in each other (By 'confide' we mean to trust your family members enough to tell them something that is important to you)." Responses were assigned values 1–4 and all statements were converted to the positive form before the values were summed. The range of responses for this scale was 6–24, with higher scores representing higher family functioning (Cronbach's alpha = .70).
Parenting Practices:	
Parent Connection	Adolescents were asked the following questions separately for mothers and fathers:(Blum, McKay, & Resnick, 1989; Resnick, Harris, & Blum, 1993) (1) "How much do you feel your mother/father cares about you?" and (2) "How much do you feel you can you talk to your mother/father about your problems?". Both questions had response options ranging from "not at all" to "very much" on a 5-point scale. Adolescents' responses to these two questions were summed together for each parent (Mother: Cronbach's alpha = 0.61, r=0.79; Father: Cronbach's alpha = 0.60, r=0.83).
Parental Knowledge	Adolescents were asked the following questions separately for mothers and fathers:(Barber & Schluterman, 2008; Barber, Stolz, & Olsen, 2005) How much does your mother/father REALLY know…(1) who your friends are?; (2) where you go at night?; (3) where you are most afternoons after school?. Response options included: doesn't know, knows a little, knows a lot. The responses to these three items were summed together for each parent (Mother: Cronbach's alpha = 0.75, r=0.79; Father: Cronbach's alpha = 0.87, r=0.85).
Psychological Control	Adolescents were asked the following questions separately for mothers and fathers:(Barber & Schluterman, 2008; Barber, et al., 2005) My mother/father is a person who… (1) is always trying to change how I feel or think about things; (2) brings up past mistakes when she/he criticizes me; (3) is less friendly with me if I do not see things her/his way. Response options included: not like her/him, somewhat like her/him, and a lot like her/him. The responses to these three items were summed together for each parent (Mother: Cronbach's alpha = 0.67, r=0.70; Father: Cronbach's alpha = 0.72, r=0.68).
Dieting	Dieting was assessed with the question (Javaras, Austin, Field, 2011; Neumark-Sztainer, Wall, Hannan, et al., 2003) "How often have you gone on a diet during the last year? By "diet" we mean changing the way you eat so you can lose weight." Responses included: never, one to four times, five to 10 times, more than 10 times, and I am always dieting. Responses were dichotomized as never versus ever during last year (Test-retest agreement [nondieter versus dieter] = 82%).
Unhealthy Weight Control Behaviors (UWCBs) and Extreme Unhealthy Weight Control Behaviors	Unhealthy and extreme weight control behaviors were assessed with the question (Neumark-Sztainer, Wall, Story, & Perry, 2003): "Have you done any of the following things in order to lose weight or keep from gaining weight during the past year? (yes or no for each method)." Unhealthy weight control behaviors (UWCBs) included: (1) fasted, (2) ate very little food, (3) used a food substitute (powder or a special drink), (4) skipped meals, and (5) smoked more cigarettes. Extreme weight control behaviors included: (1) took diet pills, (2) made myself vomit, (3) used laxatives, and (4) used diuretics. Responses were used to create two dichotomous indicators of having done any of the UWCBs (Test-retest agreement = 85%) and any of the extreme UWCBs (Test-retest agreement=96%).
Binge Eating	Binge eating with loss of control was assessed using items adapted from a scale by Yanovski (Yanovski, Nelson, Dubbert, & Spitzer, 1993). The two questions included: "In the past year, have you ever eaten so much food in a short period of time that you would be embarrassed if others saw you (binge-eating)?" [Yes/No] (Test-retest agreement = 90%), and "During the times when you ate this way, did you feel you couldn't stop eating or control what or how much you were eating?" [Yes/No] (Test-retest agreement = 75%). Binge eating with loss of control was coded as a dichotomous indicator; values for adolescents responding yes to both questions were coded as 1 and all others were coded as 0.
Race/Ethnicity	Race/ethnicity was assessed with one survey item: 'Do you think of yourself as 1) white, 2) black or African-American, 3) Hispanic or Latino, 4) Asian-American, 5) Native Hawaiian or other Pacific Islander, 6) American Indian or Native American, or 7) Other. Respondents were asked to check all that apply. The responses "Native Hawaiian or other Pacific Islander" and "Other" were coded as "mixed/other" due to small numbers.
SES	Classification tree methodology(Breiman, Friedman, Olshen, & Stone, 1984) was used to generate five categories of SES (Neumark-Sztainer, Story, Hannan, & Croll, 2002). The prime determinant of SES was the higher education level of either parent. Subsidiary variables were family eligibility for free/reduced lunch, family receipt of public assistance, and parent employment status.
Age	Age was calculated using self-reported birth date and survey completion date.

Measure	Description
BMI z-score	Students' heights and weights were measured at school by trained research staff in a private area with standardized equipment and procedures. Body Mass Index (BMI) z-score was calculated according to the following formula: weight (kg)/height (meters)^2 and converted to z-scores, standardized for gender and age (Kuczmarski, et al., 2002).

Table 2

Associations between family functioning, mother and father parenting practices and adolescent girls' and boys' dieting and disordered eating behaviors

	Adolescent Girls (n = 1486) Adjusted[a] OR[b] (95% CI)			Adolescent Boys (n = 1307) Adjusted[a] OR[b] (95% CI)		
	Family Functioning:			***Family Functioning:***		
Dieting	**0.76 (0.68, 0.84)*****			**0.77 (0.67, 0.89)*****		
UWCB[b]	**0.71 (0.64, 0.79)*****			**0.55 (0.40, 0.77)*****		
Extreme UWCB	**0.61 (0.50, 0.74)*****			**0.71 (0.62, 0.81)*****		
Binge Eating	**0.71 (0.60, 0.84)*****			**0.60 (0.47, 0.78)*****		
	Mother Parenting Practices:			***Mother Parenting Practices:***		
	Connection	Knowledge	Psychological Control	Connection	Knowledge	Psychological Control
Dieting	**0.80, (0.71, 0.90)*****	0.91 (0.80, 1.03)	**1.27 (1.13, 1.42)*****	0.93, (0.82, 1.07)	0.99 (0.86, 1.12)	**1.23 (1.06, 1.42)****
UWCB[b]	**0.84 (0.75, 0.94)****	**0.82 (0.73, 0.92)****	**1.39 (1.24, 1.55)*****	**0.76 (0.67, 0.86)*****	**0.86 (0.76, 0.97)***	**1.34 (1.17, 1.52)*****
Extreme UWCB	**0.74 (0.62, 0.90)****	**0.74 (0.61, 0.91)****	**1.94 (1.57, 2.40)*****	**0.62 (0.48, 0.81)*****	**0.71 (0.54, 0.91)****	**1.57 (1.15, 2.15)****
Binge Eating	**0.81 (0.69, 0.95)***	**0.72 (0.61, 0.85)*****	**1.40 (1.18, 1.67)*****	**0.72 (0.58, 0.89)****	**0.75 (0.61, 0.92)****	1.24 (0.97, 1.58)
	Father Parenting Practices:			***Father Parenting Practices:***		
	Connection	Knowledge	Psychological Control	Connection	Knowledge	Psychological Control
Dieting	**0.84 (0.74, 0.95)****	**0.87 (0.77, 0.99)***	1.12 (0.99, 1.27)	0.90 (0.78, 1.04)	0.96 (0.83, 1.11)	**1.24 (1.08, 1.43)****
UWCB[b]	**0.76 (0.67, 0.86)*****	**0.76 (0.67, 0.86)*****	**1.17 (1.04, 1.32)****	**0.81 (0.71, 0.92)****	0.90 (0.79, 1.03)	**1.23 (1.09, 1.42)****
Extreme UWCB	**0.77 (0.61, 0.96)***	**0.73 (0.58, 0.92)****	**1.33 (1.08, 1.65)****	**0.74 (0.56, 0.967)***	0.83 (0.61, 1.12)	1.16 (0.87, 1.57)
Binge Eating	**0.77 (0.63, 0.93)****	**0.75 (0.62, 0.91)****	**1.33 (1.11, 1.58)****	**0.79 (0.63, 0.98)***	0.93 (0.73, 1.19)	1.22 (0.97, 1.56)

[a] Adjusted for SES, race, age, and BMI

[b] Odds Ratio = reduced odds of engaging in given behavior, given one standard deviation increase in family functioning and after controlling for socio-demographics and BMI. Separate logistic regression models fit for each predictor and each outcome.

[c] UWCB = Unhealthy Weight Control Behaviors

* Statistically significant at $p < 0.05$

** Statistically significant at $p < 0.01$

*** Statistically significant at $p < 0.001$

Table 3

Mutually adjusted results for adolescent girls and boys in a subsample with non-missing data for both mothers and fathers

	Adolescent Girls (n = 1224) Mutually Adjusted OR[a] (95% CI)			**Adolescent Boys (n = 1107) Mutually Adjusted OR[a] (95% CI)**		
	***Family Functioning*[b]:**			***Family Functioning*[b]:**		
Dieting	**0.83 (0.71, 0.97)***			0.84 (0.70, 1.02)		
UWCB[c]	**0.78 (0.67, 0.91)****			0.85 (0.71, 1.01)		
Extreme UWCB	**0.65 (0.50, 0.86)****			0.73 (0.47, 1.12)		
Binge Eating	0.84 (0.67, 1.05)			0.73 (0.52, 1.01)		
	***Mother Parenting Practices*[d]:**			***Mother Parenting Practices*[d]:**		
	Connection	Knowledge	Psychological Control	Connection	Knowledge	Psychological Control
Dieting	0.89, (0.75, 1.05)	1.08 (0.92, 1.28)	1.14 (0.98, 1.31)	1.10, (0.91, 1.33)	1.02 (0.86, 1.21)	1.13 (0.95, 1.34)
UWCB[c]	1.13 (0.96, 1.34)	0.91 (0.77, 1.06)	**1.31 (1.14, 1.52)*****	0.93 (0.78, 1.10)	0.96 (0.82, 1.12)	**1.19 (1.02, 1.40)***
Extreme UWCB	1.14 (0.84, 1.54)	1.02 (0.76, 1.36)	**1.71 (1.31, 2.25)*****	0.85 (0.60, 1.22)	0.76 (0.54, 1.06)	**1.46 (1.02, 2.10)***
Binge Eating	1.23 (0.96, 1.58)	**0.76 (0.61, 0.96)***	1.23 (0.99, 1.52)	1.05 (0.77, 1.42)	0.82 (0.62, 1.07)	1.15 (0.87, 1.53)
	***Father Parenting Practices*[e]:**			***Father Parenting Practices*[e]:**		
	Connection	Knowledge	Psychological Control	Connection	Knowledge	Psychological Control
Dieting	0.99 (0.82, 1.19)	0.94 (0.79, 1.11)	1.01 (0.88, 1.16)	0.90 (0.74, 1.10)	0.99 (0.81, 1.22)	1.18 (1.00, 1.39)
UWCB[c]	0.89 (0.74, 1.06)	0.87 (0.74, 1.03)	0.99 (0.87, 1.14)	0.86 (0.71, 1.04)	0.99 (0.82, 1.19)	1.16 (0.99, 1.35)
Extreme UWCB	1.25 (0.90, 1.74)	0.75 (0.55, 1.03)	1.08 (0.86, 1.36)	0.88 (0.59, 1.34)	1.04 (0.67, 1.62)	1.11 (0.78, 1.56)
Binge Eating	0.94 (0.71, 1.24)	0.86 (0.66, 1.12)	1.19 (0.99, 1.45)	0.81 (0.58, 1.13)	1.17 (0.82, 1.65)	1.18 (0.90, 1.53)

[a] Odds Ratio = reduced odds of engaging in given behavior, given one standard deviation increase in family functioning and after controlling for socio-demographics, BMI, and all other family functioning and parenting practices. One logistic regression model is fit for each outcome simultaneously including family functioning and all parenting predictors.

[b] Adjusted for SES, race, age, BMI and mutually adjusted for each of the other mother and father parenting predictors

[c] UWCB = Unhealthy Weight Control Behaviors

[d] Adjusted for SES, race, age, BMI and mutually adjusted for father parenting predictors and family functioning

[e] Adjusted for SES, race, age, BMI and mutually adjusted for mother parenting predictors and family functioning

* Statistically significant at $p < 0.05$.

** Statistically significant at $p < 0.01$

*** Statistically significant at $p < 0.001$

Table 4a

Interaction effect estimates[a] between family functioning (FF) and mother and father parenting practices (connection, knowledge and psychological control) on **girls**' dieting and disordered eating behaviors

		Mother Parenting Practice:								
		Connection			**Knowledge**			**Psychological Control**		
		log-odds ratio	**s.e.**	**p-value**	**log-odds ratio**	**s.e.**	**p-value**	**log-odds ratio**	**s.e.**	**p-value**
Dieting	family functioning	−0.226	0.068		−0.284	0.063		−0.218	0.063	
	parenting practice	−0.064	0.074		0.029	0.072		0.158	0.063	
	FF*parenting practice	0.072	0.057	0.207	0.023	0.061	0.713	0.025	0.054	0.647
UWCB	family functioning	−0.339	0.066		−0.303	0.061		−0.280	0.062	
	parenting practice	−0.010	0.071		−0.096	0.069		0.265	0.061	
	FF*parenting practice	−0.042	0.055	0.442	−0.097	0.059	0.102	**0.175**	**0.053**	**0.001**
Extreme UWCB	family functioning	−0.463	0.118		−0.452	0.107		−0.310	0.127	
	parenting practice	−0.052	0.135		−0.160	0.131		0.577	0.121	
	FF*parenting practice	−0.002	0.089	0.981	−0.042	0.096	0.660	0.054	0.099	0.589
Binge Eating	family functioning	−0.327	0.101		−0.279	0.092		−0.323	0.099	
	parenting practice	−0.099	0.110		−0.292	0.101		0.327	0.097	
	FF*parenting practice	−0.075	0.080	0.350	−0.116	0.082	0.158	**0.211**	**0.084**	**0.012**
		Father Parenting Practice:								
		Connection			Knowledge			Psychological Control		
		log-odds ratio	s.e.	p-value	log-odds ratio	s.e.	p-value	log-odds ratio	s.e.	p-value
Dieting	family functioning	−0.268	0.067	.	−0.275	0.064	.	−0.276	0.065	.
	parenting practice	−0.070	0.071	.	−0.064	0.067	.	0.046	0.066	.
	FF*parenting practice	−0.038	0.061	0.534	−0.059	0.061	0.338	−0.011	0.057	0.849
UWCB	family functioning	−0.318	0.067	.	−0.311	0.063	.	−0.357	0.064	.
	parenting practice	−0.171	0.069	.	−0.205	0.065	.	0.089	0.065	.
	FF*parenting practice	−0.108	0.060	0.070	−0.087	0.061	0.152	0.055	0.056	0.327
Extreme UWCB	family functioning	−0.538	0.121	.	−0.517	0.115	.	−0.569	0.122	.

		Mother Parenting Practice:								
		Connection			**Knowledge**			**Psychological Control**		
		log-odds ratio	**s.e.**	**p-value**	**log-odds ratio**	**s.e.**	**p-value**	**log-odds ratio**	**s.e.**	**p-value**
	parenting practice	−0.087	0.138	.	−0.214	0.134	.	0.295	0.127	.
	FF*parenting practice	−0.081	0.101	0.422	−0.077	0.108	0.475	**0.201**	**0.098**	**0.040**
Binge Eating	family functioning	−0.263	0.104	.	−0.257	0.098	.	−0.259	0.099	.
	parenting practice	−0.176	0.109	.	−0.227	0.106	.	0.217	0.101	.
	FF*parenting practice	−0.042	0.086	0.627	−0.020	0.092	0.828	−0.005	0.078	0.949

[a]Family functioning and all parenting practice variables are standardized and treated as continuous variables in logistic regressions controlling for SES, race, age, BMI. Log-odds ratio estimates for main effects are included along with estimated interaction effect to facilitate interpretation of direction (synergy/antagonistic) of interaction where negative log-odds ratios indicate decreased risk and positive values indicate increased risk. Statistically significant interaction effects (p<.05) are bolded. Note, p-values are not presented for main effects to avoid incorrect interpretation of tests for main effects in the presence of an interaction.

Table 4b

Interaction effect estimates[a] between family functioning (FF) and mother and father parenting practices (connection, knowledge and psychological control) on **boys**' dieting and disordered eating behaviors

		Mother Connection			**Mother Knowledge**			**Mother Psych Control**		
		log-odds ratio	**s.e.**	**p-value**	**log-odds ratio**	**s.e.**	**p-value**	**log-odds ratio**	**s.e.**	**p-value**
Dieting	family functioning	−0.260	0.086		−0.241	0.079		−0.198	0.079	
	parenting practice	0.049	0.084	.	0.056	0.072	.	0.172	0.077	.
	FF*parenting practice	0.009	0.074	0.902	0.070	0.069	0.310	0.052	0.081	0.522
UWCB	family functioning	−0.262	0.079		−0.316	0.073		−0.296	0.073	
	parenting practice	−0.159	0.075		−0.074	0.065		0.224	0.070	
	FF*parenting practice	0.034	0.069	0.628	0.035	0.065	0.590	0.047	0.075	0.535
Extreme UWCB	family functioning	−0.348	0.207		−0.456	0.193		−0.666	0.205	
	parenting practice	−0.397	0.165		−0.268	0.153		0.446	0.187	
	FF*parenting practice	−0.046	0.146	0.754	0.013	0.142	0.928	0.321	0.194	0.098
Binge Eating	family functioning	−0.382	0.154		−0.399	0.146		−0.502	0.143	
	parenting practice	−0.106	0.146		−0.107	0.129		0.201	0.140	
	FF*parenting practice	0.091	0.115	0.430	0.103	0.107	0.336	0.152	0.139	0.272
		Father Connection			Father Knowledge			Father Control		
		log-odds ratio	s.e.	p-value	log-odds ratio	s.e.	p-value	log-odds ratio	s.e.	p-value
Dieting	family functioning	−0.217	0.086		−0.242	0.083		−0.204	0.083	
	parenting practice	−0.054	0.078		0.001	0.077		0.203	0.076	
	FF*parenting practice	−0.050	0.074	0.496	0.001	0.080	0.986	−0.020	0.080	0.800
UWCB	family functioning	−0.311	0.079		−0.321	0.076		−0.324	0.076	
	parenting practice	−0.117	0.071		−0.056	0.070		0.179	0.070	
	FF*parenting practice	−0.018	0.069	0.798	−0.081	0.074	0.273	−0.042	0.075	0.579
Extreme UWCB	family functioning	−0.634	0.196		−0.729	0.199		−0.689	0.188	
	parenting practice	−0.167	0.167		−0.265	0.176		0.251	0.166	
	FF*parenting practice	−0.129	0.160	0.419	**−0.544**	**0.187**	**0.0036**	0.288	0.166	0.082

		Mother Connection			Mother Knowledge			Mother Psych Control		
		log-odds ratio	**s.e.**	**p-value**	**log-odds ratio**	**s.e.**	**p-value**	**log-odds ratio**	**s.e.**	**p-value**
Binge Eating	family functioning	−0.430	0.149		−0.475	0.142		−0.478	0.143	
	parenting practice	−0.104	0.133		0.049	0.137		0.209	0.131	
	FF*parenting practice	−0.020	0.119	0.864	0.045	0.135	0.741	0.073	0.125	0.561