# Five-Year Longitudinal Predictive Factors for Disordered Eating in a Population-Based Sample of Overweight Adolescents: Implications for Prevention and Treatment

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**ABSTRACT**

**Objective:** The objective of this study is to identify predictors of prevalence and incidence of disordered eating (binge eating and extreme weight control behaviors) among overweight adolescents.

**Method:** Five-year longitudinal associations were examined in 412 overweight adolescents who participated in Project EAT-I and II.

**Results:** Among both overweight males and females, risk factors for disordered eating included exposure to weight loss magazine articles, higher weight importance, and unhealthy weight control behaviors, while family connectedness, body satisfaction, and regular meals were protective factors, although there were some differences in predictors of prevalence (total cases) versus incidence (new cases) of disordered eating. Among males, poor eating patterns, including fast food and sweetened beverage intake, increased risk for disordered eating, and the use of healthy weight control behaviors was protective.

**Discussion:** Attention should be directed toward decreasing disordered eating among overweight adolescents. Findings suggest the importance of promoting positive family relationships, psychological health, and regular meals, and steering adolescents away from overemphasizing weight and using unhealthy weight control behaviors. 

**Keywords:** overweight; etiology; binge eating; disordered eating; risk factors

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## Introduction

Obesity among adolescents is of public health concern given its high prevalence and potential adverse medical consequences.[1,2] The use of disordered eating behaviors, such as binge eating and unhealthy weight control behaviors, is also a serious problem given that these behaviors are commonly used by adolescents and are associated with poor eating patterns and dietary quality,[3,4] eating disorders,[5] and depression,[6,7] and have been found to longitudinally increase risk for weight gain and obesity.[8–11] In previous analyses of the Project EAT study population, which is utilized in the current study, the co-occurrence of overweight status and use of disordered eating behaviors was found to be high, particularly among female adolescents.[12,13] Thus, while an important goal is to prevent obesity in adolescents, it may be even more important to prevent the co-occurrence of obesity and disordered eating in youth.

In the design of interventions aimed at the prevention and treatment of disordered eating, it is important to identify and address factors that are associated with increased risk for these behaviors. Furthermore, in the design of interventions for overweight adolescents, it is important to know whether there are different subgroups which may be at particularly high risk for disordered eating and need tailored interventions. Studies to date examining disordered eating in overweight adolescents have tended to focus on clinical samples.[14–23] However, clinical samples of overweight youth may differ from non–treatment-seeking overweight youth in terms of their level of preoccupation with their weight, prevalence of disordered eating,

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psychological well-being, and sociodemographic characteristics; therefore, generalizations from studies on clinical samples of adolescents need to be made cautiously. Furthermore, studies have mostly been cross-sectional in nature and thus do not allow for a determination of temporality in determining whether factors identified as risk factors preceded or followed the onset of disordered eating behaviors.[14–26] Additionally, in a review of the literature on disordered eating attitudes and behaviors in overweight youth, Goldschmidt et al. indicate there has been limited research in ethnically diverse populations, and few studies have had a large enough sample of boys to examine factors associated with disordered eating in overweight boys.[27] They concluded that although risk factors for eating disorder pathology have been identified in the general population, factors predicting the development of eating disorder pathology specifically in overweight youth remain largely unknown.[27]

We embarked upon the current study to identify risk and protective factors for disordered eating behaviors among overweight adolescents. This study builds upon the existing literature, by examining risk and protective factors for disordered eating among overweight adolescents using a longitudinal study design and a nonclinical study population of adolescent males and females from diverse ethnic/racial and socioeconomic backgrounds. The specific aim of the current study is to identify factors that predict the prevalence and incidence of disordered eating among overweight adolescents. Disordered eating behaviors that are examined include binge eating with loss of control and extreme weight control behaviors (i.e., self-induced vomiting and use of diet pills, laxatives, or diuretics). We hypothesized that predictors for disordered eating among overweight adolescents would be similar to those found in the general adolescent population and would include weight-specific variables from within the domains of socioenvironmental factors (e.g., weight-related pressures from families and friends), personal factors (e.g., high importance of weight), and behavioral factors (e.g., dieting and unhealthy weight control behaviors).[12] We also hypothesized that other more global variables from within these domains would be predictive of disordered eating, including lower family connectedness, poorer psychological well-being, and poorer eating patterns.[12] Five-year longitudinal associations are examined between an array of socioenvironmental, personal, and behavioral factors and disordered eating among overweight male and female adolescents who participated in a large, population-based study.

## Method

### *Study Population and Design*

Project EAT is a study of socioenvironmental, personal, and behavioral factors of potential relevance to dietary intake and weight-related outcomes in adolescents.[13,28] There were two measurement time points; the first (Project EAT-I: Time 1) occurring when participants were in middle school and high school and the second (Project EAT-II: Time 2) occurring 5 years later. Project EAT-I surveyed middle school and high school adolescents from 31 public schools in the Minneapolis/St Paul area during the 1998–1999 academic year. Participants completed in-class surveys and anthropometric measures. Five years later (2003–2004), Project EAT-II resurveyed participants by mail. Details on study design and response rates have been previously described.[8,29] All applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research, and the University of Minnesota's Institutional Review Board Human Subjects Committee approved all study protocols.

The total study population included 2,516 ethnically and socioeconomically diverse adolescents (1,386 females and 1,130 males) who completed surveys in both Project EAT-I and Project EAT-II. The current analysis includes only adolescents who were overweight (BMI $\geq$85th percentile for age and gender)[30,31] at both assessments: $N$ = 180 male adolescents and 232 female adolescents. After weighting the data to account for attrition over the 5-year study period (see Statistical Analyses section below), the ethnic/racial breakdown of this subsample of overweight participants was as follows: 45% Caucasian, 24% African-American, 16% Hispanic, 6% Asian, 5% Native American, and 4% mixed or other race. Forty-two percent of this sample was of low or low–middle socioeconomic status (SES). A third of the participants were in middle school in Project EAT-I (mean age: 12.7 $\pm$ 0.8 years at Time 1 and 17.3 $\pm$ 0.6 years at Time 2) and two-thirds of the participants were in high school in Project EAT-I (mean age: 15.9 $\pm$ 0.9 years at Time 1 and 20.0 $\pm$ 0.9 years at Time 2).

### *Survey Development and Measures*

The development of the Project EAT survey was guided by 21 focus groups with adolescents,[32] Social Cognitive Theory,[33,34] a review of existing instruments, reviews by adolescents and experts, and several pilot tests of the survey. The survey was designed to assess issues of relevance to a broad spectrum of weight-related problems in adolescents. Measures used in the current analysis are described in Table 1.

**TABLE 1. Description of measures**

| Variables | Description of Survey Item(s) |
|---|---|
| Weight status and disordered eating | |
| Overweight status | Height and weight were self-reported and body mass index (BMI; kg/m$^2$) was calculated. Adolescents with BMI values above the 85th percentile for gender and age were classified as overweight.[30,31] |
| Binge eating with loss of control | "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)?" 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?" Respondents who answered affirmatively to both of these questions were classified as engaging in binge eating with loss of control.[35] |
| Extreme weight control behaviors | "Have you done any of the following things in order to lose weight or keep from gaining weight in the past year?" (a) used laxatives; (b) took diet pills; (c) made myself vomit; and (d) used diuretics. Respondents were categorized as having used extreme weight control behaviors if they reported any of these behaviors.[36] |
| Socioenvironmental variables | |
| Weight-related norms | |
| Maternal/paternal weight concerns/behaviors | "My mother (father) diets to lose weight or keep from gaining weight." "My mother (father) encourages me to diet to control my weight." Four responses ranging from "not at all" to "very much." Responses for mother and father were summed (range = 4–16) such that higher scores indicated greater parental concern about weight. Cronbach's $\alpha = 0.77$. |
| Peer dieting behaviors | "Many of my friends diet to lose weight or keep from gaining weight." Four responses ranging from "not at all" to "very much." |
| Weight teasing by family members | "Have you ever been teased or made fun of by family members because of your weight?" (yes/no) Respondents who indicated they had been teased and also bothered by family members teasing them about their weight in a separate question were categorized as having been teased.[37] |
| Weight teasing by peers | Same questions as above about teasing by other kids. |
| Media exposure | |
| Magazines on weight loss | "How often do you read magazine articles in which dieting or weight loss are discussed?" Four response categories ranged from "never" to "often." |
| Television viewing | "In your free time on an average weekday (Monday–Friday), how many hours do you spend watching TV and videos?" A similar question was asked about weekend use.[38,39] Responses for weekday and weekend use were combined (5 × weekday hours + 2 × weekend hours) to compute total viewing hours per week (range = 0–35). |
| Family meals | |
| Family meal frequency | "During the past seven days, how many times did all, or most, of your family living in your house eat a meal together?" |
| Family meal atmosphere | "How strongly do you agree with the following statements? (a) I enjoy eating meals with my family; (b) In my family, eating brings people together in an enjoyable way; (c) In my family, mealtime is a time for talking with other family members; and (d) In my family, dinner time is about more than just getting food, we all talk with each other." Items were rated on a four-point scale and responses were summed (range = 4–16) such that higher scores indicated a more positive atmosphere. Cronbach's $\alpha = 0.73$. |
| Relationships | |
| Family connectedness | "How much do you feel you can talk to your mother (father) about your problems?" "How much do you feel your mother (father) cares about you?" Five response categories. Responses for mother and father were summed (range = 4–20) such that higher scores indicated more communication and greater caring. Cronbach's $\alpha = 0.69$. |
| Friend connectedness | "Do you have one or more close friends who you can talk to about your problems?" Response categories were "yes, always," "yes, sometimes," and "no." |
| Personal variables | |
| Body image and weight concerns | |
| Body satisfaction | Body satisfaction scale assessing satisfaction with different body parts (height, weight, body shape, waist, hips, thighs, stomach, face, body build, shoulders). Five response categories. Responses to the ten items were summed (range = 10–50) such that higher scores indicated greater body satisfaction. Cronbach's $\alpha = 0.92$.[40] |
| Weight concern | "How strongly do you agree with the following statements? (a) I think a lot about being thinner; and (b) I am worried about gaining weight." Items were rated on a four-point scale and responses were summed such that a higher score indicated greater concern about weight (range = 2–8). Cronbach's $\alpha = 0.87$. |
| Weight importance | "During the past six months, how important has your weight or shape been in how you feel about yourself?" Four responses ranging from "weight and shape were not very important" to "weight and shape were the most important things that affected how I felt about myself".[35] |
| Psychological well-being | |
| Depressive symptoms | Kandel and Davies' (1982) six-item scale assessing depressive mood. Items were rated on a three-point scale and responses were summed (range = 6–18) such that a higher score indicated a more depressed mood. Cronbach's $\alpha = 0.82$.[41] |
| Self-esteem | Shortened six-item version of Rosenberg's Self-Esteem Scale. Items were rated on a four-point scale and responses were summed such that a higher score indicated greater self-esteem (range = 6–24). Cronbach's $\alpha = 0.79$.[42] |

(Continued)

**TABLE 1. (*Continued*)**

| Variables | Description of Survey Item(s) |
|---|---|
| Behavioral variables | |
| Weight control practices | |
| Dieting | "How often have you gone on a diet in the past year? By 'diet' we mean changing the way you eat so you can lose weight." Responses were categorized dichotomously. |
| Healthy weight control behaviors | "Have you done any of the following things in order to lose weight or keep from gaining weight during the past year? (a) exercise; (b) ate more fruits and vegetables; (c) ate less high-fat foods; (d) ate less sweets" Respondents were categorized as having used only healthy weight control behaviors if they used any of these behaviors but did not use any unhealthy weight control behaviors. |
| Unhealthy weight control behaviors | "Have you done any of the following things in order to lose weight or keep from gaining weight during the past year? (a) fasted; (b) ate very little food; (c) used food substitute (e.g., slimfast); (d) skipped meals." Respondents were categorized as having used unhealthy weight control behaviors if they used any of these behaviors. |
| Eating/physical activity patterns | |
| Breakfast frequency | "During the past week, how many days did you eat breakfast?" |
| Lunch frequency | "During the past week, how many days did you eat lunch?" |
| Dinner frequency | "During the past week, how many days did you eat dinner?" |
| Fast food | "In the past week, how often did you eat something from a fast food restaurant (like McDonald's, Burger King, Hardee's, etc.)?" |
| Dietary intake | Intake of fruits and vegetables, sugar-sweetened beverages, and diet soda were assessed with the 149-item, semiquantitative Youth and Adolescent Food Frequency Questionnaire.[43,44] |
| Moderate-to-vigorous physical activity | Modified version of the Leisure time Exercise Questionnaire.[45–47] Responses on two questions assessing hours spent in strenuous activity and moderate physical activity in a usual week were summed (range = 0–16 h). |
| Demographic variables | |
| Sex | Are you. . .1) male 2) female. |
| Ethnicity/race | "Do you think of yourself as. . .White, Black or African American, Hispanic or Latino, Asian American, Hawaiian or Pacific Islander, or American Indian or Native American." Subjects could choose more than one category; those responses indicating multiple categories were coded as "mixed/other". |
| Age | What is your age? |
| Socioeconomic status | Composite variable based primarily on parental level of education, defined by the higher level of either parent. In cases of missing data on educational level for both parents, other variables used included eligibility for public assistance, eligibility for free or reduced-cost school meals, and parental employment status.[28] |

Body mass index (BMI) and overweight status are based on self-reported heights and weights. Although at Time 2, only self-reported height and weight was assessed, at Time 1 both measured and self-reported height and weight were assessed and BMI values were highly correlated (females: $r = 0.85$; males: $r = 0.89$).[48]

Disordered eating behaviors in the past year included binge eating with loss of control and extreme weight control behaviors (self-induced vomiting and use of diet pills, laxatives, and diuretics). This variable was coded dichotomously; adolescents using at least one of the disordered eating behaviors in the past year were considered to have engaged in disordered eating behaviors.

Table 1 also includes sociodemographic variables and an array of socioenvironmental, personal, and behavioral variables of potential relevance to disordered eating.

### *Statistical Analyses*

All analyses were performed on the subset of adolescents who were overweight at both Time 1 and Time 2 and who had complete information on disordered eating at both times. Analyses were conducted separately for female and male adolescents because of previously identified differences in the prevalence and predictors of disordered eating across gender.[12,13] We first examined and calculated the prevalence, incidence, and persistence of disordered eating behaviors (i.e. binge eating or engaging in extreme weight control behaviors). Logistic regression was used to identify socioenvironmental, personal, and behavioral predictors of prevalence and incidence of Time 2 disordered eating adjusted for sociodemographic characteristics (age cohort, race/ethnicity, SES). Separate regressions were run for each predictor. Predictors of Time 2 *prevalence* (i.e., total cases) of disordered eating were identified using logistic regression on all of the adolescents identified as overweight at Time 1 and Time 2, while analyses for predictors of Time 2 *incidence* (i.e., new cases) of disordered eating included only those overweight adolescence who were not engaging in disordered eating at Time 1. All analyses were stratified by gender and conducted using SAS software (version 9.1, 2003, SAS, Cary, NC).

To account for differential response rates across sociodemographic groups in the longitudinal sample, data were weighted using the response propensity method,[49] where the inverse of the estimated probability that an individual responded at Time 2 is used as the weight. After adjusting for sociodemographics and weighting, there were no significant differences found for Time 1 overweight status,

binge eating, or extreme weight control behaviors between Time 2 responders and nonresponders.

## Results

### *Disordered Eating Prevalence, Incidence, and Tracking among Overweight Adolescents*

Among the 232 overweight female adolescents, 30.8% ($n$ = 71) engaged in disordered eating at Time 1 and that number increased to 40.1% ($n$ = 93) at Time 2. Among the 161 overweight females who were not engaging in disordered eating at Time 1, about one-third of them (34.1%, $n$ = 55) started to engage in disordered eating behaviors by Time 2. Among the 71 females who were already engaging in disordered eating at Time 1, roughly half (53.6%, $n$ = 38) were still engaging in those behaviors at Time 2. Among the 93 overweight adolescent females reporting disordered eating behaviors at Time 2, almost all (89.2%, $n$ = 83) reported the use of at least one extreme weight control behavior and one-third (32.2%, $n$ = 30) reported binge eating with loss of control.

Among the 180 overweight male adolescents, 13.4% ($n$ = 24) engaged in disordered eating at Time 1 and that number increased to 20.2% ($n$ = 36) at Time 2. Among the 24 overweight males engaging in disordered eating behaviors at Time 1, 37.6% ($n$ = 9) continued to engage in these behaviors at Time 2, while 17.5% ($n$ = 27) of the overweight males previously not engaged in disordered eating at Time 1 had begun by Time 2. Of the 36 overweight males engaging in disordered eating at Time 2, the majority (77.8%, $n$ = 28) reported the use of at least one extreme weight control behavior and almost one-third (30.6%, $n$ = 11) reported binge eating with loss of control. Similar to the females, overweight males were more likely to use extreme weight control behaviors than to engage in binge eating.

At Time 2, females engaging in disordered eating behaviors had higher BMI levels ($M$ = 32.3; SD = 5.6) than females not engaging in disordered eating ($M$ = 30.9; SD = 4.6) ($p < .041$). Similarly, among male adolescents, those with disordered eating behaviors had higher BMI levels ($M$ = 34.5; SD = 6.9) than those not engaging in disordered eating ($M$ = 31.8; SD = 4.1) ($p = 0.003$).

### *Predictors of Disordered Eating*

In overweight adolescent females, a number of socioenvironmental, personal, and behavioral Time 1 variables were identified that predicted the prevalence and/or incidence of disordered eating at Time 2 (**Table 2**). For variables within the socioenvironmental domain, exposure to magazine articles about weight loss was associated with increased prevalence and incidence of disordered eating, while a positive atmosphere at family meals and greater family connectedness was associated with a lower prevalence of disordered eating. For personal factors, higher levels of weight concerns were associated with increased prevalence and incidence of disordered eating, higher levels of weight importance were associated with higher prevalence of disordered eating, and higher levels of body satisfaction and self-esteem were associated with a lower prevalence of disordered eating. Behaviors associated with increases in prevalence and incidence of disordered eating included dieting, unhealthy weight control behaviors (skipping meals, eating very little, smoking, fasting, and using food substitutes), and increased hours of moderate-to-vigorous physical activity. Eating lunch and dinner on a regular basis were protective against disordered eating in overweight female adolescents.

Among overweight male adolescents, within the domain of socioenvironmental factors, peer dieting predicted a higher prevalence of disordered eating, exposure to magazine articles about weight loss was associated with higher prevalence and incidence of disordered eating, and family connectedness was a protective factor for both prevalence and incidence of disordered eating (**Table 2**). Personal factors that predicted higher prevalence and incidence of disordered eating included greater weight importance and depressive symptoms, while body satisfaction was protective for prevalence of disordered eating. Behavioral risk factors predicting higher levels of disordered eating included unhealthy weight control behaviors, eating fast food, and drinking sweetened beverages. The use of healthy weight control behaviors and eating meals on a regular basis predicted lower prevalence of disordered eating in overweight male adolescents.

## Discussion

The aim of the current study was to identify risk and protective factors for disordered eating among a population-based sample of overweight adolescents. Although similar proportions of adolescent females and males were overweight, disordered eating was about twice as common among

**TABLE 2. Five-year longitudinal predictors of prevalence (total cases) and incidence (new cases) of disordered eating at Time 2 among overweight adolescents (at Time 1 and Time 2)[a,b]**

| | Females | | | | Males | | | |
|---|---|---|---|---|---|---|---|---|
| | OR | CI | *p*-value (prevalence) | *p*-value[c] (incidence) | OR | CI | *p*-value (prevalence) | *p*-value[c] (incidence) |
| Socioenvironmental factors | | | | | | | | |
| Weight-related norms | | | | | | | | |
| Maternal weight concerns/behaviors | 1.23 | 0.93, 1.63 | .151 | .117 | 1.18 | 0.78, 1.77 | .430 | .904 |
| Paternal weight concerns/behaviors | 1.06 | 0.78, 1.45 | .711 | .366 | 1.05 | 0.69, 1.60 | .830 | .504 |
| Peer dieting behaviors | 1.16 | 0.94, 1.43 | .165 | .374 | 1.51 | 1.09, 2.10 | .014 | .575 |
| Weight-teasing by family | 1.36 | 0.76, 2.43 | .302 | .217 | 0.64 | 0.23, 1.76 | .383 | .088 |
| Weight-teasing by peers | 1.58 | 0.89, 2.82 | .122 | .878 | 0.68 | 0.30, 1.53 | .350 | .061 |
| Media exposure | | | | | | | | |
| Magazines on weight loss | 1.55 | 1.12, 2.15 | .009 | .004 | 1.80 | 1.18, 2.73 | .006 | .020 |
| Television viewing | 0.99 | 0.96, 1.02 | .691 | .903 | 0.99 | 0.95, 1.03 | .484 | .218 |
| Family meals | | | | | | | | |
| Family meal frequency | 0.94 | 0.84, 1.05 | .253 | .944 | 0.93 | 0.79, 1.10 | .413 | .742 |
| Family meal atmosphere | 0.61 | 0.44, 0.86 | .005 | .146 | 0.75 | 0.44, 1.28 | .294 | .455 |
| Relationships | | | | | | | | |
| Family connectedness | 0.90 | 0.83, 0.98 | .010 | .322 | 0.86 | 0.77, 0.96 | .009 | .024 |
| Friend connectedness | 0.85 | 0.55, 1.29 | .438 | .934 | 1.17 | 0.64, 2.14 | .605 | .195 |
| Personal factors | | | | | | | | |
| Body image and weight concerns | | | | | | | | |
| Body satisfaction | 0.94 | 0.91, 0.98 | <.001 | .086 | 0.96 | 0.91, 1.00 | .049 | .178 |
| Weight concern | 1.90 | 1.27, 2.83 | .002 | .021 | 1.29 | 0.82, 2.02 | .280 | .577 |
| Weight importance | 1.44 | 1.08, 1.93 | .014 | .710 | 1.88 | 1.20, 2.95 | .006 | .042 |
| Psychological well-being | | | | | | | | |
| Self-esteem | 0.91 | 0.84, 0.99 | .022 | .214 | 0.92 | 0.81, 1.04 | .184 | .577 |
| Depressive symptoms | 1.08 | 0.99, 1.18 | .088 | .158 | 1.15 | 1.03, 1.28 | .014 | .037 |
| Behavioral factors | | | | | | | | |
| Weight-control practices/binge eating | | | | | | | | |
| Dieting (yes/no) | 4.30 | 1.89, 9.78 | <.001 | .034 | 2.13 | 0.93, 4.84 | .072 | .222 |
| Only healthy weight control (yes/no) | 0.57 | 0.29, 1.11 | .097 | .196 | 0.33 | 0.13, 0.85 | .022 | .089 |
| Unhealthy weight control (yes/no) | 2.30 | 1.20, 4.40 | .012 | .007 | 3.52 | 1.40, 8.85 | .007 | .037 |
| Eating/physical activity patterns | | | | | | | | |
| Breakfast (times/week) | 0.89 | 0.79, 1.00 | .058 | .129 | 0.86 | 0.74, 1.00 | .052 | .047 |
| Lunch (times/week) | 0.84 | 0.75, 0.95 | .004 | .010 | 0.75 | 0.62, 0.91 | .004 | .078 |
| Dinner (times/week) | 0.89 | 0.76, 1.05 | .171 | .007 | 0.78 | 0.62, 0.99 | .040 | .131 |
| Fruit/vegetable intake (times/week) | 1.05 | 0.95, 1.15 | .355 | .108 | 0.87 | 0.73, 1.04 | .114 | .122 |
| Fast food (times/week) | 1.04 | 0.84, 1.29 | .711 | .279 | 1.32 | 1.03, 1.69 | .030 | .052 |
| Sugared beverages (servings/day) | 1.32 | 0.85, 2.03 | .215 | .316 | 2.46 | 1.35, 4.46 | .003 | .003 |
| Diet soda pop (servings/day) | 1.23 | 0.70, 2.17 | .476 | .290 | 1.00 | 0.38, 2.62 | .994 | .801 |
| MVPA (h/week) | 1.14 | 1.03, 1.29 | .032 | .004 | 0.90 | 0.78, 1.04 | .144 | .269 |

[a] Odds ratios (OR) and 95% confidence intervals (CI) are shown for longitudinal predictors of prevalence of disordered eating at Time 2 among adolescents who were overweight at both Time 1 and Time 2.

[b] All associations are adjusted for sociodemographic characteristics (age cohort, race/ethnicity and SES).

[c] *p*-values are provided for associations with incidence of disordered eating, but corresponding odds ratios and 95% confidence intervals are not shown in the table.

overweight females than overweight males at Time 2. A number of socioenvironmental, personal, and behavioral variables were identified that longitudinally predicted disordered eating in this population. While there were some differences across prevalence and incidence analyses, and between males and females, a number of fairly consistent patterns emerged. Within the realm of socioenvironmental factors, reading magazines that had articles on dieting and weight loss was a risk factor for disordered eating, while family connectedness was a protective factor. Personal factors that predicted disordered eating in both females and males included weight importance, while body satisfaction was protective. Higher self-esteem was protective in female adolescents, and the existence of depressive symptoms was a risk factor in male adolescents. Unhealthy weight control behaviors (including skipping meals, eating very little, fasting, using food substitutes, and smoking) increased risk for disordered eating, while eating meals on a regular basis was protective in both male and female adolescents. Given the high prevalence of overweight adolescents engaging in disordered eating behaviors and the potentially harmful consequences associated with these behaviors,[3–11] it is crucial to develop interventions to prevent and reduce disordered eating in this population. Findings from the current study can help guide the implementation of such interventions.

Many of the risk and protective factors for disordered eating in overweight adolescents are similar to those found among a general population of adolescents, although there were a few noteworthy differences. In a previous analysis of the entire Project EAT population, we found that risk and protective factors for binge eating or extreme weight control behaviors included weight-related family and peer norms, reading magazine articles on weight loss, family meal frequency and atmosphere, body image and weight concerns, psychological well being, weight control practices, and frequency of regular meals.[12] Many of these variables were also identified in the current analysis as predictive of disordered eating in the subgroup of overweight adolescents. One surprising finding in the current analysis was that family and peer weight-related norms (e.g., weight teasing) did not predict increased risk for disordered eating among the overweight adolescents. In part, this difference may be explained by lower power in the current study, which examined associations in a subgroup of the larger population. In general, combined findings from the full Project EAT population the subgroup of overweight adolescents suggest that interventions designed to prevent disordered eating among the general adolescent population by decreasing the importance of weight, promoting a positive psychological well-being, decreasing unhealthy avoiding unhealthy weight control practices, and eating meals on a regular basis, may also have relevance for high-risk overweight adolescents. However, more work is needed to fully understand familial weight-specific interactions within the homes of overweight adolescents.

Findings from the current study clearly suggest the importance of strong family relationships for overweight adolescents. Interestingly, research findings regarding associations between family connectedness and obesity in children and adolescents have not been consistent; some studies have found no associations,[50,51] while one study found that adolescent girls from cohesive and expressive families were at decreased risk for obesity.[52] In contrast, as in the current study, research more clearly suggests that high levels of family connectedness may help overweight adolescents to adopt more healthful behaviors and have better psychosocial well-being.[53,54] Thus, although family connectedness may not protect adolescents from being overweight, it may protect overweight adolescents from engaging in binge eating or extreme weight control behaviors. Families may be able to protect their adolescents from engaging in harmful disordered eating behaviors through enhanced communication, caring relationships, and, for females, via more enjoyable family meals.

Findings from the current study show some similarities with those reported by Eddy et al.,[23] who examined cross-sectional correlates of eating disorder pathology in a clinical sample of 122 adolescents. Eddy et al. found negative affect, including depressive and anxious symptoms, to be correlated with eating disorder pathology.[23] In the current study, low self-esteem predicted greater prevalence of disordered eating in female adolescents and depressive symptoms predicted greater prevalence and incidence of disordered eating in male adolescents. Eddy et al. found internalization of a thin ideal to be a risk factor for eating disorder pathology. The current study also found that weight importance predicted greater prevalence of disordered eating in females and greater prevalence and incidence of disordered eating in males. However, as noted above, in the current study, weight-teasing was not found to predict disordered eating among the Project EAT sample of overweight adolescents, whereas Eddy et al.[23] did find that teasing experience was correlated with eating disorder pathology. While further work is needed utilizing more comparable measures and study designs, these findings suggest some important similarities in correlates for disordered eating in clinical and nonclinical samples of overweight adolescents.

In the current study, there were a number of noteworthy gender differences in behavioral predictors of disordered eating. Interestingly, among females, moderate-to-vigorous physical activity predicted higher risk for disordered eating. Thus, while physical activity is a critical component for overall health and weight loss and maintenance, health care providers should not assume that a physically active overweight adolescent is immune to engaging in disordered eating or disordered exercise patterns (e.g., excessive or compulsive exercise) and should screen for these behaviors. Among males, poor eating patterns, including fast food and sweetened beverage intake, increased risk for disordered eating, and the use of healthy weight control behaviors was protective. These findings suggest the importance of working with overweight boys to develop healthier eating patterns. These gender differences suggest different clusters of behaviors, and possibly different motivators, for female and male adolescents. Among female adolescents, disordered eating may be part of a cluster of behaviors aimed at weight control, while among males, there may be a broader cluster of unhealthy

eating patterns. Certainly, the findings suggest a need for further exploration of gender differences in the use of disordered eating behaviors and, more generally, for gender differences in the experience of being overweight in a thin-oriented society.

Strengths and limitations of the current study need to be taken into account in interpreting the findings. Strengths of the current study include the large and diverse nature of the study population, the 5-year follow-up period that crossed key transition periods of adolescence, and the assessment of an array of socioenvironmental, personal, and behavioral variables of potential relevance to disordered eating. However, it is important to note that many of the measures assessing predictor and outcome variables were brief and were based on self-report given the nature of Project EAT, which is a large and comprehensive population-based study.

In conclusion, while an important public health priority is to prevent obesity, it is also important to prevent the use of disordered eating behaviors among overweight adolescents. Findings from the current study indicate the importance of working with overweight adolescents to prevent an unhealthy preoccupation with weight, promote a positive psychological well-being, avoid unhealthy weight control behaviors, and engage in regular eating patterns, such as not skipping meals. Our findings further suggest a need for working with families of overweight adolescents to enhance family connectedness. Given the high prevalence of disordered eating in overweight adolescents, especially girls, we recommend that attention always be directed toward the prevention or reduction of disordered eating within obesity prevention and treatment interventions. However, findings from the current study suggest that special attention be directed toward the prevention of these behaviors in overweight adolescents displaying the risk factors identified here. For example, all overweight adolescents should learn about healthy ways of eating and about the dangers of unhealthy weight control behaviors. However, for adolescents placing a high level of importance on weight, extra time should be devoted toward discussing their feelings about their weight. For overweight adolescents from unsupportive families, family work may be necessary to enhance relationships, and different avenues of support might also be incorporated into treatment plans. Finally, health care providers and others working to prevent or treat obesity need to be educated about the dual risk of obesity and eating disorder pathology to avoid the implementation of interventions that do not take into account risk factors for disordered eating behaviors.



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