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Associations between friends' disordered eating and muscle-enhancing behaviors

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Abstract

Dieting, unhealthy weight control and muscle-enhancing behaviors are common among adolescents: friends are a probable source of influence on these behaviors. The present study uses data provided by nominated friends to examine associations between friends' disordered eating and muscle-enhancing behaviors and participants' own behaviors in a diverse sample of American youth. Male and female adolescents (mean age = 14.4) completed surveys and identified their friends from a class roster; friends' survey data were then linked to each participant. Participants ($N = 2126$) who had at least one nominated friend were included in the analytic sample. Independent variables were created using the same weight control and muscle-enhancing behaviors reported by nominated friends, and were used in logistic regression models to test associations between participants' and their friends' behaviors, stratified by gender. Results indicated that dieting, disordered eating and muscle-enhancing behaviors were common in this sample, and selected friends' behaviors were associated with the same behaviors in participants. For example, girls whose friends reported extreme weight control behaviors had significantly greater odds of using these behaviors than girls whose friends did not report these same behaviors ($OR = 2.39$). This research suggests that friends' weight- and shape-related behaviors are a feature of social relationships, and is the first report demonstrating these associations for muscle-enhancing behaviors. Capitalizing on the social element may be important to the development of increasingly effective intervention and prevention programs.

Keywords

U.S.A.; Adolescents; Disordered eating; Muscle-enhancing; Friends; Social influence

Introduction

Disordered eating and muscle-enhancing behaviors

Dieting and unhealthy weight control behaviors are common among adolescents. According to the 2009 Youth Risk Behavior Surveillance System, a national survey of American high school students conducted by the Centers for Disease Control and Prevention, almost two-thirds (59.3%) of female adolescents and 30.5% of male adolescents report trying to lose weight (Eaton et al., 2010). Although healthy weight control strategies are common, many youth also report unhealthy weight control behaviors, such as fasting (14.5% of females, 6.9% of males), using diet pills/powders/liquids (6.3% of females, 3.8% of males), and vomiting or taking laxatives (5.4% of females, 2.6% of males) (Eaton et al., 2010). Dieting and unhealthy weight control behaviors predict weight gain and the onset of more severe disordered eating behaviors and clinical eating disorders, including anorexia nervosa, bulimia nervosa, and binge eating disorder (Keel, Fulkerson, & Leon, 1997; Neumark-Sztainer, Wall, Guo et al., 2006; Neumark-Sztainer, Wall, Larson, Eisenberg, & Loth, 2011; Ohring, Graber, & Brooks-Gunn, 2002; Patton, Selzer, Coffey, Carlin, & Wolfe, 1999). These behaviors have also been shown to predict depression and other medical and psychosocial morbidity (Crow, Eisenberg, Story, & Neumark-Sztainer, 2008; Katzman, 2005; Stice, Hayward, Cameron, Killen, & Taylor, 2000).

Body change behaviors are not restricted to those behaviors undertaken with a goal of weight loss. The pursuit of muscularity and unhealthy muscle building behaviors are analogous to the pursuit of thinness and disordered eating. Surveillance studies have begun to include selected measures of these behaviors, indicating that 8.0% of females and 10.2% of males use protein supplements (Field et al., 2005); 2.2% of females and 4.3% of males report steroid use (Eaton et al., 2010); and 1.0% of females and 11.0% of males report using creatine, a dietary supplement marketed to increase muscle size, strength and endurance (Johnston, O'Malley, Bachman, & Schulenberg, 2011). Such substances can cause sex-linked bodily changes such as hair loss, breast development and genital shrinking (in men). Use of steroids is further associated with rage, heart attacks, strokes and liver problems (U.S. Department of Health and Human Services, 2006). Other substances (e.g. creatine) have been linked with adverse health outcomes but have been studied minimally in adolescents (Fernandez & Hosey, 2009; Koshy, Griswold, & Scheenberger, 1999; Metzl, Small, Levine, & Gershel, 2001; Prichard & Kaltra, 1998). In addition to being health damaging in their own right, use of muscle-enhancing behaviors are considered symptomatic of Body Dysmorphic Disorder and severe Body Image Disturbance (American Psychiatric Association, 1994, 2000).

Muscle-enhancing behaviors have been studied relatively little compared to disordered eating behaviors. Existing research focuses largely on athletes and body builders where prevalence of these behaviors is highest (Metzl et al., 2001; Smith & Dahm, 2000). The comparability of the drive for thinness and muscularity has led to greater interest in studying the latter in recent years; however, relevant measures are rarely included in large population-based studies. Additionally, existing research on these constructs has, for the most part, been gender-specific, focusing on females' disordered eating and males' muscle-enhancing behaviors. Although each type of behavior is more common in one sex than the other, both are reported by young males and females. Relatively little is known about disordered eating in males and muscle-enhancing in females.

Peer influences

Several hallmarks of adolescence make it a critical period for studying body image and behaviors aimed at changing weight or shape. The onset of puberty, identity formation tasks,

and emergence of important peer relationships converge in this life stage and affect young people's self perceptions, especially with regards to body image (Markey, 2010). Multiple health behavior theories posit that important "others" are influential (Azjen, 1980; Bandura, 1986; Flay & Petraitis, 1994), and peers and friends can be particularly important (Daddis, 2008; Gifford-Smith, Dodge, Dishion, & McCord, 2005; Peterson, 1988). This influence is complex and could operate through mechanisms such as modeling, peer pressure, weight-related teasing, social comparison, appearance culture, teaching behaviors and "fat talk," all of which convey values and norms of expected behavior (Cialdini & Trost, 1998; Festinger, 1954; Haines, Neumark-Sztainer, Eisenberg, & Hannan, 2006; Jones, 2001; Jones, Vigfusdottir, & Lee, 2004; Lieberman, Gauvin, Bukowski, & White, 2001; Nichter, 2000).

A growing body of research has demonstrated the important influence of friends. In both cross-sectional and longitudinal studies, weight-related attitudes and behaviors among friends have been associated with adolescents' body image, weight-loss intention, disordered eating and muscle-enhancing behaviors, even after controlling for various family, friend and individual factors (Eisenberg & Neumark-Sztainer, 2010; Eisenberg, Neumark-Sztainer, Story, & Perry, 2005; Gibbs, 1986; Huon, Lim, & Gunewardene, 2000; Hutchinson & Rapee, 2007; Leahey, LaRose, Fava, & Wing, 2011; McCabe & Ricciardelli, 2005; McCabe, Ricciardelli, & Holt, 2010; Paxton, Schutz, Wertheim, & Muir, 1999; Pike, 1995; Ricciardelli & McCabe, 2003; Ricciardelli, McCabe, & Banfield, 2000; Smolak, Murnen, & Thompson, 2005; Taylor et al., 1998; Woelders, Larsen, Scholte, Cillessen, & Engels, 2010). Although this work is powerfully suggestive, it is subject to an important shortcoming: most research on this topic relies on participants' self-reports of their friends' attitudes and behaviors (Eisenberg & Neumark-Sztainer, 2010; Eisenberg et al., 2005; Gibbs, 1986; Huon et al., 2000; McCabe & Ricciardelli, 2005; McCabe et al., 2010; Ricciardelli & McCabe, 2003; Ricciardelli et al., 2000; Smolak et al., 2005; Taylor et al., 1998; Woelders et al., 2010). For example, our previous cross-sectional study asked girls to report their own dieting behavior and indicate whether their friends dieted to lose weight (Eisenberg et al., 2005). Research on adolescent substance use and delinquent behavior suggests that reports of friends' behavior are likely to be colored by an individual's own behaviors and may not reflect the friends' actual views or behavior (Ionnotti & Bush, 1992; Kandel, 1996; Prinstein & Wang, 2005). That is, we might expect an adolescent who uses unhealthy weight control behaviors to inaccurately attribute the same behaviors to her friends (in the interest of increasing perceived agreement and lessening tensions with friends, or "psychological balance" (Heider, 1958)), which could substantially bias measures of associations.

A handful of studies have addressed peer influences on health behaviors using different methods. In some research, peers are linked by virtue of attending the same school or assigned dormitories (Eisenberg et al., 2005; Meyer & Waller, 2001; Mueller, Pearson, Muller, Frank, & Turner, 2010). For example, Meyer and Waller (2001) examined change in body image and disordered eating among young women after 14 weeks of living together in college dorms. All participants reported on their own attitudes and behaviors, and results indicated significant convergence among dorm-mates over time. Eisenberg et al. (2005) and Mueller et al. (2010) demonstrated that the proportion of peers in the same school who are attempting to lose weight was associated with girls' own weight-loss efforts. In order to address the relationships of friends' behaviors more specifically, other studies have asked participants to identify (or "nominate") their close friends. Those nominated friends were then asked to provide their own data regarding weight-related behaviors. This research has further demonstrated the associations between friends' or cliques' body image and disordered eating behaviors, and those of the individual (Crandall, 1988; Hutchinson & Rapee, 2007; Paxton et al., 1999; Pike, 1995; Woelders et al., 2010). For example, Crandall (1988) prospectively examined friendship cliques in two sororities over the course of an academic

year. By the end of the year, participants' binge eating scores could be predicted from the self-reported binge eating behaviors of others in the same clique. More recently, Hutchinson and Rapee (2007) found that an individual girls' dieting and extreme weight control behavior could be predicted from her friends' similar behaviors.

This second group of studies provides strong evidence for friends' shared disordered eating attitudes and behaviors. However, two important gaps remain. First, studies using data provided by an individual's friends have been conducted in exclusively female and primarily white samples. Research in a racially and ethnically diverse sample of both males and females is needed to fully understand the role of friends in the general population of adolescents. Second, we are not aware of research on muscle-enhancing behaviors that employs data collected directly from peers. Understanding the role of friends in these high risk behaviors is a critical step toward developing effective prevention measures that capitalize on their social component. For example, peer education or social norms campaigns could be implemented, which have been successfully utilized to intervene on other negative health behaviors, such as high risk sexual behavior or alcohol use (Maticka-Tyndale & Barnett, 2010; Park, Smith, Klein, & Martell, 2011; Perkins & Craig, 2006).

The present research addresses these gaps by using data provided by nominated friends and linked to each individual participant to examine associations between participants' reports of disordered eating and, importantly, muscle-enhancing behaviors, and those same behaviors among their friends. We hypothesize that adolescents whose friends engage in disordered eating and muscle-enhancing behaviors will be more likely to engage in the same behaviors than individuals whose friends do not report these behaviors. This study uses a large and diverse population-based sample of males and female adolescents, which will extend the generalizability and application of findings.

Methods

Study design and population

Data come from EAT 2010 (Eating Among Teens), a study of weight status, dietary intake, physical activity, weight control behaviors and related factors among American adolescents. Surveys and anthropometric measures were completed during the 2009–2010 academic year. Trained research staff administered surveys and measured adolescents' height and weight during selected health, physical education, and science classes, and visited each school on up to three occasions to collect data. Following survey completion, participants were given a \$10 gift card. All study procedures were approved by the University of Minnesota's Institutional Review Board Human Subjects Committee and by the research boards of the participating school districts. A total of 3122 students were invited to participate (i.e., received parental consent letters in advance of the survey); among them, 2883 received parental consent and 2793 completed surveys (89.5% of those invited; 96.9% of those with parental consent).

The sample includes adolescents from 20 public middle schools and high schools in the Minneapolis/St. Paul metropolitan area of Minnesota, which serve socioeconomically and racially/ethnically diverse communities. The mean age of the study population was 14.4 years ($SD = 2.0$); 46.1% were in middle school (6th–8th grades) and 53.9% were in high school (9th–12th grades). The sample was approximately equally divided by gender (46.8% male, 53.2% female). 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. The mean BMI was 23.7 ($SD = 5.7$).

Survey and measures

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 initially guided by a review of previous Project EAT surveys to identify the most salient items (Neumark-Sztainer, Croll et al., 2002; Neumark-Sztainer, Story, Hannan, & Croll, 2002; Neumark-Sztainer, Wall, Eisenberg, Story, & Hannan, 2006). When a draft of the EAT 2010 survey was complete, the measures were pretested by 56 adolescents with diverse backgrounds to examine their understandability and relevance. This draft survey was additionally reviewed by a team of experts in the domains of nutrition, physical activity, adolescent development, body image, family relations, 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 two-week period. The results were used to further refine the wording of measures and to inform decisions about reducing the overall length of the survey. Test-retest reliability measures (Pearson's or Spearman's r for continuous or ordinal variables and percent agreement for categorical items) are presented below when applicable.

Because EAT 2010 was based on a social ecological framework (Sallis, Owen, & Fisher, 2008), assessments of multiple aspects of the social environment were part of the study design. In particular, participants were asked to nominate up to six of their fellow students as their friends, as has been done in previous studies (Hutchinson & Rapee, 2007; Jaccard, Blanton, & Dodge, 2005; Paxton et al., 1999; Trogon, Nonnemaker, & Pais, 2008). Lists of all students in each grade were obtained in advance of data collection from each school. Alphabetized rosters organized by grade level were compiled for each school, and study staff created a unique four-digit network identification (ID) number for each enrolled student in the school. At the time of data collection, participants were provided with the rosters containing the names and IDs of all other students in the school. Participants recorded the IDs of their three closest female friends and three closest male friends (in order of closeness). Generic codes were used to indicate having no friends or having friends who did not attend their school. Data provided by each nominated friend on his or her own survey was linked by ID number to each individual student (the "target" adolescent), allowing for the creation of friends' predictors unique to each participant. Participants nominated an average of 5.2 ± 1.3 friends and an average of 2.1 ± 1.7 of those friends participated in EAT 2010 themselves and provided their own survey data. Data from at least one nominated friend were available for 2126 study participants (76.9% of females, 75.2% of males), and data from all available friends contributed to each friend variable (separately by gender). Each of these participants was therefore a target adolescent in analysis, and, if nominated by another student, provided friend data for that other student. Data collection occurred in required classes which presumably included a random selection of students in any given class. Participants with available friend data were compared to the remaining sample whose nominated friends were not included in the study, using chi-square tests of association. We found no statistically significant differences in any of the eight disordered eating and muscle enhancing behaviors (described below) between those in the analytic sample and those who were not. This subset is therefore expected to represent the full EAT 2010 sample.

Dependent variables of interest included eight weight control and muscle-enhancing behaviors. Dieting was assessed with the question "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... 1) never; 2) 1–4 times; 3) 5–10 times; 4) more than 10 times; or 5) I am always dieting" (test-retest $r = 0.76$). Respondents reporting that they had gone on a diet 1 or more times were considered to have any dieting, and those reporting dieting five or more times were

categorized as chronic dieters. Unhealthy weight control behaviors over the past year were assessed with the question: “Have you done any of the following things in order to lose weight or keep from gaining weight during the past year?” (yes/no for each method). Responses classified as unhealthy weight control behaviors included doing one or more of the following: 1) fasted; 2) ate very little food; 3) used food substitute (powder/special drink); 4) skipped meals; and 5) smoked more cigarettes (test–retest agreement = 85%). Respondents classified as using extreme weight control behaviors responded “yes” to any one or more of the following: 1) took diet pills; 2) made myself vomit; 3) used laxatives; and 4) used diuretics (test–retest agreement = 96%). Binge eating was assessed with the question “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 = 89%). Muscle-enhancing behaviors in the past year were assessed with the question, adapted from previous studies (Field et al., 2005; Smolak et al., 2005): “How often have you done each of the following things in order to increase your muscle size or tone during the past year?” (never, rarely, sometimes, often for each method) and included “Used protein powder or shakes” (test–retest $r = 0.52$), “used steroids” and “used another muscle-building substance (such as creatine, amino acids, hydroxyl methylbutyrate [HMB], DHEA, or growth hormone).” For each muscle-enhancing behavior (separately), those who reported any use were compared to those who responded “never.”

Independent variables were created using the same weight control and muscle-enhancing behaviors reported by nominated friends, separately by sex. Gender-specific appearance expectations (e.g. “fat talk” among girls, interest in large biceps or “six-pack abs” among boys, toned arms among girls), and the focus on same-sex others as objects of social comparison in issues related to weight and body image (Jackson, 1992; Jones, 2001; Renna, Grafova, & Thakur, 2008; Vartanian, Giant, & Passino, 2001) suggest that exploring gender-matched friends might be important. The potential role of opposite-sex friends is a relatively unexplored area. Nominated friends were used regardless of reciprocity (i.e., friend did not also need to nominate the target adolescent) for both theoretical and practical reasons: 1) adolescents look to those they consider friends as models of normative behaviors and attitudes, and this supposed influence is not dependent on whether the friend similarly looks to the target participant; and 2) only 33% of male and 38% of female friendship nominations were reciprocal, which, when combined with low prevalence of several behaviors, led to convergence problems for some models.¹ Targets with at least one same-sex or opposite-sex friend reporting the behavior of interest were compared to targets with none of these friends reporting that behavior.

Several demographic and personal characteristics of the target adolescent were included in statistical analysis. Age was assessed with the open-ended question “What is your birthdate” and calculated from survey completion date. Race/ethnicity were 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) Hawaiian or Pacific Islander, or 6) American Indian or Native American” and respondents were asked to check all that apply. Those with multiple responses were coded as “mixed/other” for analyses. Just twelve Hawaiian or Pacific Islander participants were sampled; these students were also coded as “mixed/other”. Socioeconomic status (SES) was based primarily on parental education level, defined as the higher level of educational attainment of either parent. An algorithm was developed that also took into account family eligibility for public assistance, eligibility for free or reduced-cost school meals, and employment status of the mother or father (Breiman, Friedman, Olshen, &

¹In models that converged when restricted to reciprocal friends, the resulting odds ratios were similar in effect size to the models described here, which use data from any available friend without regards to mutuality, but were only significant in the case of extreme weight control behaviors among females with same-sex friends.

Stone, 1984; Neumark-Sztainer, Story et al., 2002). Body mass index (BMI) was calculated using anthropometric data assessed by EAT 2010 staff. Height was measured without shoes (to the nearest 0.1 cm) and weight was measured without heavy outerwear or shoes (to the nearest 0.5 pound). Involvement in organized sports teams was assessed with a single item, "During the past 12 months, on how many sports teams did you play" and participants were dichotomized into those reporting 0 vs. 1 or more teams.

Data analysis

The analytic sample included 1143 females and 983 males with at least one friend in the dataset. Descriptive proportions of each dichotomous outcome were calculated separately for females and males. Logistic regression models were used to test associations between friends' use and targets' use of the same behavior. These models which include summaries of friends' outcomes (i.e., disordered eating and muscle enhancing behaviors) as explanatory variables are called "autologistic models" (Besag, 1972) and have a long history of use in spatial data analysis where outcomes in neighboring regions are hypothesized to be related to one another (analogous to peers being related). While the full likelihood function is complicated by endogeneity, it has been shown that maximum pseudo-likelihood estimation obtained from traditional logistic regression provides consistent estimates of model parameters (Besag, 1975). To account for clustering of students within schools, generalized estimating equations (GEE) with an independent working correlation matrix were used to obtain standard errors. Models were run for each dependent variable (separately) for respondents with same-sex and opposite-sex friends, and were further adjusted for the target's age, race, SES, sports team participation, an indicator of whether any nominated friends participated on a sports team, and number of nominated friends with usable data. It was important to control for the number of nominated friends with usable data so that inherent differences in the probability of having any one of those friends doing the behavior would be accounted. Models were also run with adjustment for target's BMI; results were very similar to those without this adjustment (described here). Confidence intervals and p-values using GEE were derived from model-based variance estimators and subsequently checked with robust empirical-based variance estimators because the number of schools, 20, is at the cutpoint between sample size recommendations for preferring one method over the other (Horton & Lipsitz, 1999). All analyses were stratified by gender and used an alpha of 0.05 to determine statistical significance. SAS version 9.1 was used for all analysis.

Results

Dieting, disordered eating and muscle-enhancing behaviors

Dieting, disordered eating and muscle-enhancing behaviors were common. A high percentage of participants reported engaging in unhealthy behaviors such as dieting (46.8% of females, 32.1% of males) and using protein powders or shakes (21.2% of females, 35.5% of males). Use of any of the more extreme weight control behaviors (e.g. use of diet pills, self-induced vomiting) was reported by 6.2% of females and 4.1% of males, and steroid use was reported by 4.2% of females and 5.6% of males. Prevalences of additional behaviors are shown in Table 1.

Associations between adolescents' and friends' behaviors

Results from logistic regression models suggest that friends' behaviors are associated with the same behaviors in the targets (Table 2). Among females, those with at least one same-sex friend reporting chronic dieting had significantly greater odds of being chronic dieters than those whose friends did not chronically diet (OR = 1.82, CI: 1.13, 2.92). Associations were even more pronounced for extreme weight control behaviors (OR = 2.39, CI: 1.20, 4.76) and steroid use (OR = 3.74, CI: 1.58, 8.88), where same-sex friends' behavior was

associated with almost four times the odds of the targets reporting that behavior. Behaviors of opposite-sex friends were similarly associated with females' extreme weight control (OR = 3.37, CI: 1.21–9.41).

Same-sex friends' and targets' behaviors were also related among males, for whom associations were statistically significant for four of the eight dependent variables (Table 2). Among males, those with at least one same-sex friend reporting binge eating had significantly greater odds of binge eating than those whose same-sex friends did not binge (OR = 1.95, CI: 1.15, 3.30). The association between same-sex friends' and targets' behaviors was statistically significant for all three muscle-enhancing behaviors. In particular, males whose friends used steroids had over seven times the odds of reporting this behavior compared to those whose friends did not use steroids (OR=7.47, CI: 3.06,18.23). Odds were similarly elevated among those whose same-sex friends used other muscle-enhancing substances (OR = 4.43, CI: 2.48, 7.92). Behaviors of opposite-sex friends were associated with males' steroid use (OR = 7.12, CI: 2.46, 20.65) and muscle-enhancing behaviors (OR = 3.28, CI: 1.36, 7.89).

Control variables including age, race, SES and sports team participation were also associated with select disordered eating and muscle-enhancing behaviors in these models. Findings are available in Appendix A.

Discussion

Adolescent participants in this study had high rates of involvement in dieting, disordered eating and muscle-enhancing behaviors. Results further indicate adolescents' use of these behaviors is associated with their friends' use of the same behaviors. The use of a large and diverse population-based sample suggests that friends' behaviors are relevant to adolescents' own behaviors across a broad spectrum of youth. Significant associations were apparent for both males and females, and for both disordered eating and muscle-enhancing behaviors, but were most consistent for males' muscle-enhancing behaviors. In particular, males' steroid use and use of other muscle-enhancing substances were strongly related to their friends' use, suggesting this may be a potent avenue of influence. These findings are similar to previous studies that have used data provided by friends (Crandall, 1988; Hutchinson & Rapee, 2007; Paxton et al., 1999; Pike, 1995; Woelders et al., 2010). However, two characteristics of this work extends prior findings in important ways: a) it examines the role of friends in disordered eating behaviors among males, and b) it includes muscle-enhancing behaviors among both sexes, which have only been examined previously with regards to the individuals' perception of friends' attitudes and behaviors (McCabe & Ricciardelli, 2005; McCabe et al., 2010; Ricciardelli & McCabe, 2003; Ricciardelli et al., 2000; Smolak et al., 2005). Collectively, this body of research suggests that friends' weight- and shape-related behaviors are a feature of social relationships, and capitalizing on this element may be important to the development of increasingly effective intervention and prevention programs.

Although this study and previous work indicate an association between individual and friends' behaviors, the direction of this relationship is not entirely clear. Two competing explanations exist: selection or influence. In the first case, the theory of homophily suggests that “like chooses like,” or that individuals become friends with others who are similar to them in attitudes and behaviors (McPherson, Smith-Lovin, & Cook, 2001). The comfort of associating with similar others is an important feature of human interactions and likely accounts for a portion of the observed relationships. However, some research has specifically tested the prospective development of disordered eating behaviors among selected social relationships and found evidence supporting the theory that friends influence

each other to become more similar over time – i.e., the friendship contributes to the behavior (Crandall, 1988; Meyer & Waller, 2001; Zalta & Keel, 2006). For example, Zalta and Keel (2006) examined bulimic symptoms and several personality characteristics among college students. The authors found that although individuals selected as friends those who had similar traits such as perfectionism and impulsivity, their bulimic symptoms were responsive to exposure to friends over time. Although studies of this nature are smaller and more limited in terms of sample diversity and disordered eating behaviors than the present work, they do suggest that the associations observed here may be the results of friends influencing each other in this domain. We are not aware of existing research attempting to disentangle influence from selection in the domain of muscle-enhancing behaviors. However, we expect friends' influence to be a powerful component, with friends providing information and access to steroids and other muscle-enhancing substances and creating norms of accepted or expected behaviors within cliques. Importantly, findings of an association between friends' disordered eating and muscle enhancing behaviors are useful regardless of the direction of influence. Prevention and intervention programs could be strengthened by focusing on friendship groups with messages aimed at reducing the spread or limiting the escalation of shared behaviors.

The mechanisms underlying this type of influence are also not determined by the present study, but previous research is again instructive. Influence may take subtle forms or be more overt. For example, “fat talk” is common among young women (Nichter, 2000) and creates a climate with undue emphasis on weight issues. Simply being a part of this weight-focused discourse, and the social comparison that accompanies it, might contribute to disordered eating behaviors intended to help one “measure up” to perceived standards in a peer group (Festinger, 1954). This socialization around fat talk might explain why we found extreme weight control behaviors were related among female friends but not among males, for whom talk of dieting and weight loss is non-normative. Peer interactions may also include encouragement to diet or use unhealthy behaviors – perhaps intended to be helpful or supportive (McCabe et al., 2010; Ricciardelli & McCabe, 2003) – as well as outright teasing and harassment about weight. These interactions are common and have been repeatedly demonstrated to be associated with disordered eating behaviors among males and females across the adolescent and young adult age groups (Eisenberg, Berge, Fulkerson, & Neumark-Sztainer, 2011; Eisenberg, Berge, & Neumark-Sztainer, in press; Eisenberg & Neumark-Sztainer, 2008; Haines et al., 2006; Lieberman et al., 2001; Neumark-Sztainer, Falkner et al., 2002; Neumark-Sztainer, Story, & Faibisch, 1998). Finally, peers may model behaviors for one another, teach each other, or provide the means of engaging in disordered eating or muscle-enhancing behaviors (e.g. sharing diet pills, steroids). Effective interventions will rely on a fuller understanding of the pathways by which friends might influence one another's behaviors, which necessitates further research with additional relevant variables not available in the present study. For example, including information regarding shared weight-related talk, shared eating experiences or common sports teams would provide important information. Specifically, given the results in the current study, it is of interest to explore whether girls engaging in extreme weight control behaviors are more likely than boys to discuss these behaviors with their friends. Similarly, it would be interesting to explore the contexts within which adolescents, particularly boys, discuss their use of muscle-enhancing behaviors.

Limitations and strengths

In addition to the cross-sectional design, which limits our ability to understand the direction of the associations found here between friends' and individuals' behaviors, the present study is limited in that we were not able to collect data from each participant's complete group of friends. Although we assume that sampled friends represent all nominated friends due to

random assignment to participating classes, the 20-school design prohibited us from surveying every student in every school, and their representativeness cannot be explicitly tested. In addition, the possibility remains that the associations identified here result from shared external factors (such as neighborhood resources, economic status, or community norms). Future research should examine the role of friends' behaviors in the context of these broader social characteristics. The single item measures of behaviors of interest are an additional limitation; assessment of other body change behaviors might have captured unhealthy peer context not reflected by the present measures. Finally, the way in which friend groups were categorized as using disordered eating and muscle-enhancing behaviors (i.e., any friends using vs. none) errs on the side of underestimating friends' use of relevant behaviors. That is, multiple friends using the same behavior would be expected to exert a stronger influence than a single friend; testing this additive effect was not feasible due to the relatively small and varied number of friends sampled for each target adolescent in this study. True associations may therefore be stronger than those found here.

Strengths of this research include the large and diverse sample of male and female adolescents, assessment of a wide variety of disordered eating and muscle-enhancing behaviors, and the use of data provided by nominated friends. To our knowledge, this is the first study that has used data directly from friends to test the associations between friends' and participants' muscle-enhancing behaviors, and to test the associations between friends' and male adolescents' disordered eating behaviors.

Conclusions and implications

The present study suggests several avenues for additional research. First, the current findings require replication with data from more complete social networks. Second, because weight-related behaviors, social norms and mechanisms of influence might differ across racial and ethnic groups, additional research which takes into account the race of the target adolescent, friends, and the mix of races in friendship groups would lead to a deeper understanding of the dynamics of friends' disordered eating and muscle-enhancing behaviors in diverse populations. Additionally, longitudinal research using data from friends is scarce, and typically limited to smaller and homogenous samples. Friendships evolve rapidly during adolescence, and more research is needed to understand the ways in which the attitudes and behaviors of old friends and new friends are linked to adolescent health behaviors and changes in such behaviors. Finally, this body of research using friends' data requires integration with other contextual influences such as interactions with specific friends, neighborhood resources and media exposure. In this way, future research will be able to identify the unique role friends play in each other's disordered eating and muscle-enhancing behaviors.

However, existing findings coupled with previous literature suggest that harnessing the power of friends may be a critical component in the development of effective intervention programs, such as peer education or social norms campaigns, which build on the naturally occurring influence within social groups. If high risk disordered eating and muscle-enhancing behaviors are spread by social pathways, this source of influence cannot be ignored in future prevention efforts. A fuller understanding of the mechanisms driving this association is needed to elucidate the most potent means by which these behaviors may be socially transmitted.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Past year dieting, disordered eating and muscle-enhancing behaviors in adolescents, *n* (%).

	Females (<i>n</i> = 1143) ^a		Males (<i>n</i> = 983) ^b	
	%	<i>n</i>	%	<i>n</i>
Any dieting	46.8	535	32.1	315
Chronic dieting	10.8	123	9.2	90
Unhealthy weight control	49.3	560	37.8	369
Extreme weight control	6.2	71	4.1	40
Binge eating	16.6	189	11.6	113
Protein powder/shakes	21.2	242	35.5	345
Steroids	4.2	48	5.6	54
Other muscle-enhancing substances	5.2	59	10.3	99

^a *n* = 1143 females have at least one female or male nominated friend with available data. (*n* = 1015 have female friend(s) and *n* = 730 have male friend(s)).

^b *n* = 983 males have at least one female or male nominated friend with available data. (*n* = 844 have male friend(s) and *n* = 673 have female friend(s)).

Table 2Associations between friends' and targets' disordered eating and muscle-enhancing behaviors.^a

	Same sex friends		Opposite sex friends	
	Female target with female friends (<i>n</i> = 1015)	Male target with male friends (<i>n</i> = 844)	Female target with male friends (<i>n</i> = 730)	Male target with female friends (<i>n</i> = 673)
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Any dieting	0.93 (0.70, 1.24)	1.38 (0.98, 1.94)	0.93 (0.66, 1.30)	0.99 (0.67, 1.47)
Chronic dieting	1.82 (1.13, 2.92)	1.15 (0.61, 2.16)	1.00 ^b (0.46, 2.15)	1.65 (0.83, 3.29)
Unhealthy weight control	1.14 (0.85, 1.53)	1.19 (0.86, 1.64)	1.27 (0.91, 1.78)	1.00 (0.69, 1.45)
Extreme weight control	2.39 (1.20, 4.76)	1.33 ^b (0.36, 4.93)	3.37 (1.21, 9.41)	1.23 (0.25, 5.95)
Binge-eating	1.33 (0.90, 1.95)	1.95^c (1.15, 3.30)	1.32 (0.76, 2.29)	0.84 (0.43, 1.65)
Protein powder or shake	1.07 (0.77, 1.49)	1.64 (1.19, 2.26)	1.23 (0.83, 1.83)	1.26 (0.84, 1.89)
Steroids	3.74 (1.58, 8.88)	7.47 (3.06, 18.23)	2.12 (0.66, 6.84)	7.12^b (2.46, 20.65)
Muscle enhancing substances	1.68 (0.67, 4.17)	4.43 (2.48, 7.92)	0.84 (0.30, 2.34)	3.28^b (1.36, 7.89)

Significant ORs shown in **bold**.

^a Logistic regression models adjusted for target's age, race, SES, an indicator of whether the target played a team sport, and an indicator of whether any of the target's nominated friends played a team sport and number of friends with usable data.

^b Race was collapsed from six to two categories (white/non-white) to facilitate model convergence.

^c In models using robust standard errors, association was marginally significant (i.e., $0.05 < p\text{-value} < 0.10$): OR(binge) = 1.95 (CI = 0.91, 4.19).