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Parent-Adolescent Conversations about Eating, Physical Activity and Weight: Prevalence across Sociodemographic Characteristics and Associations with Adolescent Weight and Weight-Related Behaviors

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Abstract

This paper aims to describe the prevalence of parent-adolescent conversations about eating, physical activity and weight across sociodemographic characteristics and to examine associations with adolescent BMI, dietary intake, physical activity and sedentary behaviors. Data from two linked epidemiological studies were used for cross-sectional analysis. Parents (n=3,424; 62% females) and adolescents (n=2,182; 53.2% girls) were socioeconomically and racially/ethnically diverse. Fathers reported more parent-adolescent conversations about healthful eating and physical activity with their sons and mothers reported more weight-focused conversations with their daughters. Parents of Hispanic/Latino and Asian/Hmong youth and parents from lower SES categories engaged in more conversations about weight and size. Adolescents whose mothers or fathers had weight-focused conversations with them had higher BMI percentiles. Adolescents who had two parents engaging in weight-related conversations had higher BMI percentiles. Healthcare providers may want to talk about the types of weight-related conversations parents are having with their adolescents and emphasize avoiding conversations about weight specifically.

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Disclosures

Jerica M. Berge, Richard F. MacLehose, Katie A. Loth, Marla E. Eisenberg, Jayne A. Fulkerson and Dianne Neumark-Sztainer declare that they have no conflict of interest.

Informed Consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

Keywords

Weight Conversations; Parents; Adolescents; Obesity; Dietary Intake; Physical Activity

INTRODUCTION

Given the high prevalence and adverse consequences associated with obesity in adolescents (Daniels, 2009; Ogden, et al., 2012), it is important for parents to understand how to approach parent-adolescent conversations related to healthful eating, physical activity, and weight in a helpful and healthy way. Although it may seem intuitive for a parent who is concerned about his/her child's weight or health to engage in parent-adolescent conversations about eating more healthfully or exercising to lose weight, it is unclear if these conversations have the desired outcome the parent intends (e.g., the child is motivated and eats more healthfully vs. the child does not change dietary intake or their behaviors become less healthful). Additionally, it is also unknown how often parent-adolescent conversations about weight or size, healthful eating or physical activity occur between parents and adolescents and whether these conversations differ across sociodemographics.

Furthermore, many parents look to their health care provider for advice about how to address weight issues with their children, however research suggests that health care providers have questions about how best to advise parents with regard to parent-adolescent conversations about healthful eating, physical activity, and weight with their adolescents (Foster et al., 2003; Pollack et al., 2009). Thus, knowing about overall frequency and potential demographic differences would be helpful for health care providers who work directly with racially/ethnically and socioeconomically diverse families and for intervention development targeting obesity prevention across diverse families.

Limited previous research has examined parent-adolescent weight and weight-related conversations (Berge et al., 2013). Three studies found that when parent-adolescent conversations were focused on weight, or labeling of the adolescent as "obese", rather than on healthful eating patterns, adolescents exhibited more disordered eating behaviors (e.g., dieting, bingeing, skipping meals/fasting, purging, taking laxatives) (Berge, et al., 2013), psychological distress (e.g., depressive symptoms, anxiety) (Mustillo, et al., 2013), or higher BMI (Hunger & Tomiyama, 2014) as compared with adolescents whose parents did not engage in parent-adolescent weight-related conversations. Other prior studies have not focused on parent-adolescent conversations about healthful eating, physical activity or weight per se, but have examined parental support for adolescent physical activity and healthful food choices, and encouragement for dieting. For example, parental support of adolescents to make healthful food choices has been associated with higher intake of fruits and vegetables (Granner et al., 2004; Larson et al., 2008; Neumark-Sztainer et al., 2003; Pearson, et al., 2009) and parental support for physical activity has been associated with increased hours of physical activity among adolescents (Bauer, et al., 2008; Kuo, et al., 2007; Trost et al., 2003). In contrast, parental encouragement to diet, control or lose weight has been associated with several negative outcomes including excessive worry about weight, chronic dieting, binge eating, and use of unhealthy weight control behaviors and higher BMI

among adolescents (Dixon, et al., 1996; Fulkerson et al., 2002; Kluck, 2010; Meesters, et al., 2007; Neumark-Sztainer et al., 2010). Overall, findings to date are mixed and suggest that different types of parental behaviors (i.e., encouragement, support) yield different weight and weight-related behaviors for children, with some being helpful (e.g., more physical activity) and others being harmful (i.e., more unhealthy weight control behaviors).

Thus, with regard to parent-adolescent healthful eating, physical activity, and weight conversations, there are many remaining questions. For example, how common are different types of parent-adolescent conversations about healthful eating, physical activity, and weight? Do such parent-adolescent conversations differ across sociodemographic characteristics, such as sex, race/ethnicity and socioeconomic status (SES)? Additionally, there is a need for research that can identify the specific types of messages that are being delivered by parents (e.g. messages about healthful eating and physical activity vs. messages about child's weight or size) in order to understand whether certain messages are associated with positive (e.g., healthful eating patterns) or negative youth health behaviors (e.g., higher sedentary behaviors). This type of research has the potential to inform recommendations for health care providers. For example, if specific types of parent-adolescent conversations (e.g., conversations about healthful eating and physical activity, but not about weight per se) are associated with lower BMI, more healthful eating and increased physical activity behaviors, health care providers may want to consider focusing on educating parents how to engage in such conversations. In contrast, if such conversations are associated with higher BMI and poorer dietary intake and physical activity patterns, provider messages may need to be aimed at educating parents about avoiding these types of conversations altogether.

The current paper addresses gaps in the extant research by examining the frequency of different types of parent-adolescent conversations regarding healthful eating, physical activity and weight by demographic characteristics to address how common these parent-adolescent conversations are and whether they are higher among certain population subgroups. Furthermore, the relationship between these parent-adolescent conversations and adolescent BMI and health behaviors in a racial/ethnically and sociodemographically diverse sample will be examined. Additionally, both parents are included in analyses to identify whether parent-adolescent conversations by both parents are more strongly associated with youth health behaviors as compared to parent-adolescent conversations from only one parent, which has not been done in prior research (Berge et al., 2013). Such results will help public health researchers and healthcare providers know which individuals and/or dyads to target to increase effectiveness of prevention efforts.

The specific research questions addressed in the current study include: (1) What is the prevalence of parent-adolescent conversations about healthful eating, physical activity, and weight across adolescent and parent gender, race/ethnicity, socioeconomic characteristics and weight status?; (2) How are different types of such conversations associated with adolescent BMI, dietary patterns, physical activity and sedentary behaviors?; and (3) Do adolescents who experience such conversations from two parents as compared to only one parent, have different outcomes related to BMI, dietary patterns, physical activity, and sedentary behaviors? The hypotheses for each research question are as follows: (1) Parent-adolescent conversations about healthful eating, physical activity and weight will be more

prevalent in minority populations and among mothers and daughters; (2) Parent-adolescent conversations focused on healthful eating and physical activity will be associated with lower adolescent BMI percentile, whereas parent-adolescent conversations focused on weight will be associated with higher adolescent BMI percentile; (3) Adolescents who experience weight-based conversations from both parents will have higher BMI percentile's compared to adolescents who only experience weight-based conversations from one parent.

These research questions and hypotheses are guided by Family Systems Theory (Bertalanffy, 1952; Minuchin, 1974; Whitchurch & Constantine, 1993), which purports that parent-child interaction/communication is bi-directional, in that each family member is shaping and being shaped by the other family member's words and actions all the time and these interactions influence the ultimate behaviors that each family member engages in. For example, a mother who talks with her daughter about her weight will influence the daughter's response to the conversation (either positively or negatively), which will in turn shape the weight-related behaviors (e.g., dietary intake, physical activity) the daughter engages in.

METHODS

Study Design and Population

Data were drawn from two linked, population-based studies. EAT 2010 (Eating and Activity in Teens) was designed to examine dietary intake, physical activity, weight control behaviors, weight status and factors associated with these outcomes in adolescents (Neumark-sztainer, et al., 2003; Berge et al., 2013; Berge, et al., 2012). Project F-EAT (Families and Eating and Activity Among Teens) was designed to examine factors within the family and home environment of potential relevance to adolescents' weight and weight-related behaviors (Berge et al., 2012). All study procedures were approved by the University of Minnesota's Institutional Review Board Human Subjects Committee and the participating school districts and all participants were enrolled using informed consent procedures.

For the EAT 2010 study, 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 mean age of the study population was 14.4 years (SD=2.0) and adolescents were well-balance 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/primarily Hmong, 16.9% Hispanic/Latino, 3.7% Native American, and 11.6% mixed or other. The socioeconomic status (SES) of participants included: 29.4% low SES, 24.3% low-middle SES, 33.3% Middle SES, 6.4% Upper-Middle SES, and 2.8% High SES.

For the Project F-EAT study, data were collected by surveying up to two parents/caregivers (n=3,709) of the adolescents in EAT 2010 by mail or phone interviews. In total, 2,382 EAT 2010 (85.3%) adolescent participants had at least one parent respond and there were two parent respondents for 1,327 adolescents. Parent participants had a mean age of 42.3 years (SD=8.6). The majority of parent respondents were mothers or other female guardians

(62.0%). Participating families of adolescents were ethnically and socioeconomically diverse similar to the adolescent sample (Berge et al., 2012).

The analytic sample used in the current study includes EAT 2010 participants who had at least one parent that they lived with at least 50% of the time respond to the Project F-EAT questionnaire. Our final sample size consisted of 3,528 parents and 2,348 adolescents. Approximately half (45%) of the analytic sample had data from two parents (Berge et al., 2013).

Survey Development

Both the EAT 2010 student survey (Neumark-Sztainer et al., 2000) and the F-EAT parent survey (Berge, et al., 2013) are self-report instruments that assess a range of factors that are potentially related to weight status and weight-related behaviors among adolescents and parents. Survey development was initially guided by a review of pre-existing standardized instruments and surveys in the field of adolescent development/health, nutrition and family social science/psychology (Neumark-Sztainer et al., 2002; Neumark-Sztainer, et al., 1999). In addition, a theoretical framework, which integrates Family Systems Theory (Bertalanffy, 1952; Whitchurch & Constantine, 1993), Social Cognitive Theory (Reynolds, et al., 1999), and Socio-Ecological Theory (Sallis, et al., 2008) was used to guide the incorporation of survey items. Drafts of the surveys were pre-tested by 56 adolescents and 35 parents from diverse backgrounds for clarity, readability and relevance. The surveys were also reviewed by an interdisciplinary team of experts. After revisions, the surveys were additionally pilot tested with a different sample of 129 middle school and high school students and 102 parents to examine the test-retest reliability of measures. Reliability results guided final changes made to the survey.

Measures

All exposure variables (i.e., parent-adolescent conversations about healthful eating, physical activity and weight), outcome variables (i.e., adolescent BMI percentile, fruit and vegetable intake, sugar-sweetened beverages consumption, breakfast intake, fast food consumption, physical activity, sedentary activity) and control variables (i.e., race/ethnicity, parental education attainment, age) are described in Table 1. The outcome variables were chosen based on empirical literature showing strong associations between these outcome variables and risk and protective factors for adolescent obesity (Larson & Story, 2011; Pesa & Turner, 2001).

Statistical Analysis

The adjusted prevalences of parent-adolescent conversations about healthful eating, physical activity and weight were estimated by adolescent sociodemographics and weight status. The proportion of parents engaging in each type of conversation was adjusted for gender, race, parental education and weight status using logistic regression models that were estimated separately for mothers and fathers.

We used linear regression models to estimate the association between parent-adolescent healthful eating, physical activity and weight conversations (independent variables) and

adolescent BMI, fruit and vegetable intake, breakfast consumption, physical activity or sedentary behavior (dependent variables). Separate models were fit for each type of parent-adolescent conversation, which were modeled as a 4-level categorical variable, using indicator variables (e.g., no conversations; conversations about healthful eating only; weight conversations only; conversations about healthful eating and weight). All models were fit separately for male and female parents, due to previous research showing differences in child weight-related behaviors by parent gender (Berge, 2010; Berge, et al., 2010). In addition, all models were adjusted for gender of the child, parent education, race of the child, child's BMI (except in the model with BMI as the outcome), and parent BMI. Interactions between our predictors of interest and child gender and parent BMI were examined in all models. No evidence of interaction by child gender or parent BMI in relation to parent-adolescent eating, physical activity or weight conversations were found. This suggests that parent-adolescent conversations are not a function (i.e., moderation) of whether the child is male or female, or whether the parent is overweight or not, thus final models do not include any interaction terms.

To examine the simultaneous impact of both parents' eating, physical activity and weight conversations with their adolescents, new variables were created to indicate whether 0, 1 or 2 parents engaged in each type of parent-adolescent conversation (i.e., conversations about healthful eating; conversations about physical activity; weight-focused conversations). Table 1 contains more information about the formation of these variables. We estimated a final set of regression models that were limited to only those adolescents who had two parents respond to the survey (n=1,180). We fit two sets of regression models: the first included the number of parents who engaged in parent-adolescent healthful eating (continuous variable) and number of parents who engaged in parent-adolescent eating-related weight conversations (continuous variable) as the independent variables; the second included number of parents who had parent-adolescent conversations about physical activity (continuous variable) and the number of parents who engaged in parent-adolescent physical activity-related weight conversations (continuous variable) as the independent variables. Separate models were fit for each of the dependent variables described above. These models allowed us to estimate the average change in the dependent variable associated with an increase in the number of parents engaging in each type of conversation. All analyses were conducted using Stata (version 12.1, 2012, College Station, TX).

RESULTS

Frequency of Parent-Adolescent Conversations about Eating, Physical Activity, and Weight

Parent-adolescent conversations by parent gender—Approximately two-thirds of mothers and fathers reported having parent-adolescent conversations about healthful eating and physical activity habits and approximately one-third of mothers and fathers had parent-adolescent conversations about weight or size or the need to lose weight through eating differently or exercising (Table 2). Fathers had significantly more frequent parent-adolescent conversations about healthful eating and physical activity with their sons compared with their daughters ($p < 0.05$); mothers' had significantly more parent-adolescent conversations

about weighing too much and needing to lose weight with their daughters compared with their sons ($p < 0.05$).

Parent-adolescent conversations by race/ethnicity—Over two-thirds of mothers and fathers of Hispanic/Latino and Asian/Hmong adolescents reported having parent-adolescent conversations about healthful eating and physical activity habits, which was significantly higher than mothers or fathers of adolescents from other race/ethnicities (Table 2). Mothers and fathers of Asian/Hmong adolescents reported having significantly more parent-adolescent conversations about weight or size, weighing too much or the need to lose weight through eating differently, or exercising as compared to mothers and fathers of adolescents from other race/ethnicities (almost 10 times higher for the “weigh too much” conversation compared to white parents) ($p < 0.05$ for all comparisons).

Parent-adolescent conversations by parent education—Mothers and fathers with higher educational attainment reported more parent-adolescent conversations about healthful eating and physical activity as compared to parents with lower educational attainment. In contrast, compared with mothers with higher educational attainment, mothers with lower educational attainment reported significantly more parent-adolescent conversations about adolescent weight or size, and mentioning more often to their adolescent children that they weighed too much or that they needed to exercise more to lose weight/keep from gaining weight ($p < 0.05$ for all weight conversations) (Table 2).

Parent-adolescent conversations by adolescent weight status—Mothers and fathers with adolescents who were overweight/obese ($> 85^{\text{th}}$ percentile) reported significantly more parent-adolescent conversations about healthful eating, physical activity, weight or size, the need to eat differently to lose weight/keep from gaining weight, and the need to exercise more to lose weight/keep from gaining weight as compared to mothers and fathers whose children were not obese ($p < 0.05$ for all types of parent-adolescent conversations) (Table 2).

Associations between Parent-Adolescent Conversations about Eating, Physical Activity, and Weight and Adolescent Weight and Weight-related Outcomes

Associations with adolescent BMI percentile—Mothers who reported having both weight-focused and healthful eating parent-adolescent conversations had adolescents with significantly higher BMI percentiles than adolescents whose mothers did not report engaging in these conversations, after controlling for the gender of the child, parent education, race of the child, and parent’s BMI (Table 3). A similar association was observed among fathers who had parent-adolescent weight conversations alone or who had both weight and healthful eating conversations, relative to fathers who had no parent-adolescent conversations or conversations about healthful eating only ($p < 0.05$ for all outcomes) (Tables 3a–b). For example, adolescents’ BMI percentile was 0.12 percentile units higher if their fathers reported having conversations with them about weight or size, as compared to adolescents whose fathers did not report having any parent-adolescent conversations on these topics (Table 3a). There were no statistically significant associations between parent-

adolescent conversations related to healthful eating only or physical activity only (relative to no conversations) and BMI percentile (Tables 3a–b).

Associations with adolescent healthful eating and physical activity/sedentary patterns—Mothers and fathers who reported having both healthful eating and weight-focused parent-adolescent conversations, had adolescents who ate more servings of fruit and vegetables per day as compared to adolescents whose mothers and fathers did not engage in parent-adolescent weight conversations, after controlling for the gender of the child, parent education, race of the child, and child and parent BMI (Table 3a). For example, adolescents' daily fruit and vegetable intake was 0.46 servings higher if their fathers reported talking with them about both healthful eating and weight or size as compared to adolescents whose fathers did not report having such conversations with them (Table 3a). Additionally, fathers who reported weight-focused parent-adolescent conversations had adolescents who reported significantly more screen time than fathers who reported no conversations on these topics (Table 3b). There were no significant associations between any type of parent-adolescent conversations and adolescent breakfast consumption, sugar-sweetened beverage consumption, fast food intake, or physical activity (Tables 3a–b).

Parent-Adolescent Eating, Physical Activity and Weight Conversations Occurring with Both Parents

The number of parents reporting parent-adolescent weight conversations in the home was significantly associated with higher adolescent BMI percentile, after controlling for the gender of the child, parent education, race of the child, and parent's BMI (Table 4). For example, for each additional parent who engaged in parent-adolescent weight conversations (e.g., 2 parents vs 1 parent; 1 parent vs 0 parents), there was an 8 percentage point increase in adolescent BMI percentile (Table 4). Additionally, the number of parents who engaged in parent-adolescent healthful eating conversations was significantly associated with higher adolescent daily intake of fruits and vegetables.

DISCUSSION

Overall, there were four key findings from this population-based, cross-sectional study including, (1) parent-adolescent conversations about healthful eating, physical activity and weight were common, particularly among same-sex parent/child dyads, parents of overweight adolescents, parents of Hispanic/Latino and Asian/Hmong adolescents, and across educational categories; (2) parent-adolescent healthful eating and physical activity conversations were not consistently associated with adolescent healthful behaviors, however parent-adolescent weight-focused conversations were consistently associated with higher adolescent BMI percentile; (3) parent-adolescent conversations that included both healthful eating and weight-focused messages were associated with both positive and negative weight and weight-related behaviors in adolescents; and (4) as the number of parents involved in parent-adolescent eating, physical activity and weight conversations in the home increased, there was a stronger association with adolescents' health behavior or BMI percentile, although this finding was not consistent.

First, the finding that parent-adolescent conversations about healthful eating, physical activity and weight were common among minority sub-groups, educational categories, and same-sex parent/child dyads both corroborates and expands results from previous studies regarding weight talk and weight teasing (Hunger & Tomiyama, 2014, Jackson, et al., 2000; Libbey, 2008; Neumark-Sztainer et al., 2010; Neumark-Sztainer, et al., 2002; van den Berg, 2008). Specifically, prior studies have shown that parents/family members are more likely to tease youth who are heavier compared to youth who are not overweight/obese and that teasing is more prevalent among Hispanic/Latino and Asian/Hmong minorities compared to other race/ethnicities (Dubowitz et al., 2011; Jackson et al., 2000; Libbey, 2008; Neumark-Sztainer et al., 2010; Neumark-Sztainer, et al., 2002; Singh, et al., 2008; van den Berg, 2008). The current study indicates that while parents from all different races/ethnicities engaged in parent-adolescent weight and size conversations, these types of conversations were more common among Asian/Hmong and Hispanic/Latino populations. While it remains unknown exactly why this may be the case, one explanation is that parents from these cultures may have a heightened awareness regarding the influence acculturation has played on weight gain in their cultural group, which may promote more parent-adolescent weight and weight-related conversations on an individual-level in the home. However, it may also be the case that parents from different cultures are less aware of the negative consequences associated with weight conversations or they may use weight talk in an affectionate manner. Furthermore, another explanation may be that adolescents from minority families are already more overweight/obese than other groups and thus, their parents engage in more weight-based conversations with them because they are overweight/obese.

Current results indicating that fathers more often engaged in parent-adolescent conversations about healthful eating and physical activity with their sons vs. daughters and mothers engaged in more weight-focused conversations with their daughters vs. their sons is another new finding. It may be that fathers and sons talk more about shape and size in relation to muscle build/tone which may constitute “physical activity-focused” conversations. Additionally, mothers may be more likely to focus on weight-based conversations with their daughters compared to their sons because of cultural messages that reinforce women being aware of their weight and body size. Taken together, these results suggest that it may be important to tailor messages to parents from differing race/ethnicities and socioeconomic status and to highlight same-sex parent/child dyad findings for prevention efforts. However, further research is needed that includes both parents and adolescents of both genders to explore reasons behind observed gender differences.

Second, parent-adolescent healthful eating and physical activity conversations were not consistently associated with adolescent healthful behaviors, such as eating more fruits and vegetables, being more physically active, or engaging in less screen time. These findings support previous research and recommendations by experts who suggest that parental modeling of healthful behaviors may be more important than parents talking about healthful behaviors (Berge, et al., 2009; Neumark-Sztainer, 2005). However, parent-adolescent weight conversations were consistently associated with higher BMI percentile in adolescents. Given the cross-sectional nature of this study, it is unclear whether parent-adolescent weight conversations preceded higher adolescent BMI or whether parent-adolescent conversations

about weight was a result of the adolescent's higher BMI. However, it is likely that parent-adolescent weight conversations and higher BMI in adolescents may go hand-in-hand, or are bi-directional (i.e., parent-adolescent weight conversations increase the likelihood of adolescent overweight, which in turn promotes more parent-adolescent weight conversations) thus, it is important for parents to be cautious about engaging in parent-adolescent weight conversations with their children who are overweight or obese (Eisenberg, et al., 2003; Neumark-Sztainer, 2008). In addition, previous research has shown that weight conversations lead to weight gain and increased likelihood of engaging in disordered eating behaviors, thus regardless of why parents are engaging in weight conversations it is important to provide education that it is not a helpful response (Berge et al., 2013). Furthermore, future research is needed that can examine parent-child conversations from earlier stages in life and follow them forward in order to help establish temporality of associations.

Third, when parents engaged in both parent-adolescent healthful eating and weight conversations there was a significant association with both positive (i.e., higher intake of fruit and vegetable) and negative (i.e., higher BMI) weight and weight-related behaviors in adolescents. These findings were unexpected. One explanation for this finding may be that parents who were having more of both types of parent-adolescent conversations exposed their adolescent to more messages overall, which may have led to more healthful eating behaviors because of the frequency of the messages. Likewise, it may also be that parents who engaged in both parent-adolescent conversation types may have actually emphasized the healthful eating conversations more than the weight conversations, thus promoting more healthful behaviors in their adolescents. However, our previous work has shown that parent-adolescent weight conversations are associated with a higher prevalence of disordered eating behaviors (Berge et al., 2013). Thus, weight conversations may be more harmful in the long run and parents may want to avoid parent-adolescent weight conversations in order to reduce the risk of adolescent disordered eating behaviors.

Finally, the findings in the current study suggesting associations between the number of parents involved in parent-adolescent healthful eating conversations or weight conversations in the home and adolescent fruit and vegetable intake and BMI percentile are a new contribution to the literature, although results were not consistent and need to be confirmed in other studies. This finding may be important for public health researchers and healthcare providers to be aware of in order to emphasize to parents that parent-adolescent weight conversations by more than one parent may be experienced negatively (for example, as "ganging up" on the adolescent), whereas parent-adolescent healthful eating conversations from more than one parent may be experienced positively.

Study strengths and limitations should be taken into account when interpreting the study findings. The current study had several strengths. This study included a large, diverse, population-based sample with a high response rate, allowing for generalization of findings to similar populations. In addition, data were collected from both parents and children, including fathers and sons, which is not commonly done. Furthermore, several different types of weight-related parent-adolescent conversations were measured and adjustments were made for possible third variable confounding of results (age, parent education, race/

ethnicity, child and parent BMI). One limitation of this study is the cross-sectional design. Because we were unable to examine longitudinal associations, we cannot determine temporality of associations. For example, it is also equally likely that having an overweight/obese child could lead to increased parent-adolescent weight conversations, rather than parent-adolescent weight conversations leading to increased adolescent weight. Thus, longitudinal analyses are needed to identify temporal associations. Additionally, our sample necessarily is restricted to those adolescents who had parents responding to the surveys and this may have resulted in some selection bias. For example, adolescents with at least one parent responding to the survey were similar to those with no parents responding with regards to adolescent BMI, gender and age, however higher SES adolescents were significantly more likely to have parents respond to the survey. Additionally, differences were observed between adolescents with two parents responding versus no parents responding. Adolescents who had two parents respond were younger, had lower BMI and had higher SES.

Furthermore, while several associations in the analyses were statistically significant, the magnitude of these differences was not large. For example, mothers were approximately 3% more likely to mention to their daughters than their sons that they weighed too much (Table 2a). However, to the extent that weight talk is associated with child outcomes, minor differences may play an important role at a population level. Additionally, while the purpose of the statistical techniques we employed was to estimate parameters, we also conducted a large number of statistical tests and cannot exclude the possibility that some of the positive results we observed were due to chance alone. Future research using longitudinal designs to identify temporal associations between parent-adolescent conversations and adolescent weight status is warranted. In addition, it would be beneficial to use qualitative designs to understand more about parents' and adolescents' perceptions of, and intentions of, their healthful eating, physical activity and weight conversations.

CONCLUSIONS

Study findings may help to guide professionals who work with adolescents and their parents. Physicians and other health care providers may want to take time to explore with parents the types of parent-adolescent conversations regarding healthful eating, physical activity, and weight that are occurring in the home. Helping parents identify the ways in which they talk with their adolescents will allow for a discussion about which types of conversations to avoid (e.g., making comments about weight). In addition, results from this study, in conjunction with previous research on parent-adolescent conversations (Berge et al., 2013), may be helpful for public health interventions in tailoring prevention efforts regarding parent-adolescent weight conversations. For example, findings suggest that it is important to teach parents that parent-adolescent conversations that focus specifically on weight are unlikely to be helpful and may have adverse consequences including increased risk for disordered eating (Berge et al., 2013) and weight gain over time (Dixon, et al., 1996; Fulkerson, et al., 2002; Meesters, et al., 2007).

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Table 1

Exposure, Outcome and Control Variables used in the Analyses

Measure	Description
Exposure Variables:	
Parent weight-related conversations	<p>Weight-related conversations were assessed using six items that were modeled after items in the Parental Energy Index (Lytle, Birnbaum, Boutelle, & Murray, 1999) Mothers and fathers were asked, "How often in the past year... [Never or Rarely, A few times a year, A few times a month, A few times a week, Almost every day] (1) Have you had a conversation with your child about healthy eating habits? (Test-retest $r=0.48$); (2) Have you had a conversation with your child about being physically active? (Test-retest $r=0.64$); (3) Have you had a conversation with your child about his/her weight or size? (Test-retest $r=0.59$); (4) Have you mentioned to your child that he/she weighs too much? (Test-retest $r=0.73$); (5) Have you mentioned to your child that he/she should eat differently in order to lose weight or keep from gaining weight? (Test-retest $r=0.56$); (6) Have you mentioned to your child that he/she should exercise in order to lose weight or to keep from gaining weight?" (Test-retest $r=0.71$). Each question was dichotomized with "never/rarely" and "a few times a year" collapsed into one category and "a few times a year" "a few times a month" and "almost every day" collapsed into another category.</p> <p>A categorical variable was created for each parent to describe their level of healthful eating (1, above) and weight conversations (3,4,5 above): "0" was used to indicate parents who engaged in no conversations about healthful eating or weight; "1" was used to indicate parents who engaged in healthful eating conversations and no weight conversations; "2" was used to indicate parents who engaged in weight conversations only. "3" was used to indicate parents who engaged in both weight conversations and healthful eating conversations. Another categorical variable was created in the same way to describe each parent's level of physical activity (2, above) or weight conversations (3,4,6 above). These categorical variables were included using indicator (dummy) variables in the analysis.</p> <p>When examining the joint effect of both parents, using the subset of the adolescents for whom both parents responded to the survey, we created additional family level variables. Four family level variables were created: healthful eating variable, weight/eating conversations, healthful physical activity, and weight/physical activity conversations. The healthful eating variable was the total number of parents who engaged in item (1) above. The healthful physical activity variable was the total number of parents who engaged in (2) above. The weight/eating conversations variable was the sum of parents who engaged in any of (3) (4) or (5) above. The weight/physical activity variable was the number of parents who engaged in any of (3) (4) or (6) above. Each of these four variables take values of 0, 1, or 2, depending on how many parents endorse that conversation.</p>
Outcome Variables:	
Adolescent Body Mass Index (BMI) percentile	Height and weight measurements were conducted at school by trained research staff in a private area with standardized equipment and procedures. Adolescents were asked to remove shoes and outerwear (e.g., heavy sweaters). BMI values were calculated according to the following formula: weight (kg)/height (meters) ² and converted to percentiles, standardized for gender and age (Himes & Dietz, 1994; Kuczmarski et al., 2002).
Adolescent fruit/vegetable intake and sugar-sweetened beverage consumption	Dietary intake was assessed with the 149-item Youth and Adolescent Food Frequency Questionnaire (YAQ) (Rockett et al., 1997). For fruit and vegetable intake, daily servings were defined as the equivalent of one-half cup. A serving of sugar-sweetened beverages (e.g. soda pop, sports drinks) was defined as the equivalent of one glass, bottle, or can. Validity and reliability of the YAQ have been previously tested with youth and found to be within acceptable ranges for dietary assessment tools (Rockett, Wolf, & Colditz, 1995; Rockett et al., 1997). Responses to questions on the frequency of intake of fruits (n=14; excluding fruit juice) and vegetables (n=20; excluding french fries), were summed to assess average total daily intake.
Adolescent breakfast frequency	Adolescents were asked: "During the past week, how many days did you eat breakfast?" Response options ranged from never to every day. Responses were coded numerically as: 0, 1.5, 3.5, 5.5, and 7 days/week. (Test-retest breakfast $r=0.76$).
Adolescent frequency of eating at a fast-food restaurant	Adolescents were asked: "In the past week, how often did you eat something from the following types of restaurants (like McDonald's Burger King, Hardee's, etc.)?" Response options were never, 1-2 times 3-4 times, 5-6 times, 7 times and more than 7 times. Responses were scored as: 0, 1.5, 3.5, 5.5, 7 and 9 times/week (Test-retest $r=0.38$).
Adolescent physical activity	Physical activity questions were adapted from the Godin-Shepherd Leisure-Time Exercise Questionnaire. (Van Cleave, Gortmaker, & Perrin, 2010) EAT 2010 adolescents were asked: "In a usual week, how many hours do you spend doing the following activities: (1) strenuous exercise (e.g. biking fast, aerobics, jogging, basketball, swimming laps, soccer, rollerblading) (2) moderate exercise (e.g. walking quickly, easy bicycling, volleyball, skiing, dancing, skateboarding, snowboarding)." Response options ranged from "none" to "6+ hours a week". (Test-retest $r=0.73$). Items were summed together to assess average hours of moderate and vigorous physical activity per week.

Measure	Description
Adolescent sedentary behavior	Adolescents were asked, "In your free time on an average weekday (Monday-Friday), how many hours do you spend doing the following activities?...[0 hr, ½ hr, 1 hr, 2 hr, 3 hr, 4 hr, 5+ hr]." (Godin, 1997) Activities assessed included: Watching TV/DVDs/videos, Using a computer (not for homework), and Xbox/Play-Station/other electronic games that you play when sitting (Test-retest $r = 0.84$). This same question was asked for weekends (Test-retest $r = 0.77$). For each sedentary behavior an "hours per week" variable was created by multiplying the weekday hours per day by 5 and adding it to the weekend hours per day multiplied by 2. Students who reported 5+ hours of use were coded as having 6 hours. Total sedentary behavior per week was calculated as the sum of the three individual behaviors per week.
Control Variables:	
Socio-demographic characteristics.	Adolescents' and parents' race/ethnicity, age and parents' educational attainment were assessed by self-report in adolescents and parents respectively. <u>Race/ethnicity</u> was assessed with the 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. Participants who checked "white" and another option were included in the "other" category. Those who checked two non-white options were categorized as "mixed/other race". Additionally, those checking "Hawaiian/Pacific Islander" or "American Indian/Native American" were also categorized as "mixed/other race" due to their small numbers in this dataset. Highest level of <u>parent educational attainment</u> was used as a proxy for socio-economic status and was assessed using the following question, "What is the highest level of education that you have completed?". Response options for education included: less than high school; finished high school or GED; some college; finished college; advanced degree. Those who finished college or completed advanced degrees were combined in analyses for a total of 4 categories.(Horacek et al., 2002) Parent and adolescent <u>age</u> was calculated using self-reported birth date and survey completion date.

Table 2

Adjusted Percentage of mothers and fathers engaging in conversations about healthful eating, physical activity, and weight by adolescent gender, race, and weight status*

Maternal Weight Talk:	N	Conversation about Healthy Eating Habits %	Conversation about being Physically Active %	Conversation about Weight or Size %	Mentioned Weigh too much %	Mentioned should eat differently to lose weight/keep from gaining %	Mentioned should exercise to lose weight/keep from gaining %
Total**	2242	65.0	64.9	36.7	17.3	32.2	34.9
Adolescent Gender							
Male	1015	66.4	64.5	36.6	15.6	29.6	32.1
Female	1227	63.9	65.3	36.5	18.5	34.3	37.0
p-value		0.224	0.715	0.972	0.045	0.008	0.008
Adolescent Ethnicity/Race							
White	451	63.1 ^{ab}	58.8 ^a	21.7 ^c	5.3 ^b	19.8 ^c	22.9 ^c
Black	626	58.5 ^a	60.0 ^{ab}	32.2 ^a	12.4 ^a	26.7 ^a	29.1 ^a
Hispanic/Latino	385	73.9 ^c	77.1 ^d	47.8 ^b	21.1 ^c	38.7 ^b	42.9 ^b
Asian American	451	68.1 ^{bc}	66.8 ^c	50.4 ^b	31.0 ^d	46.7 ^d	49.6 ^d
Other/mixed	321	65.1 ^b	66.1 ^{bc}	31.4 ^a	13.0 ^a	30.5 ^a	30.4 ^a
p-value		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Parent Educational Attainment							
< High School	530	60.3 ^a	62.4 ^a	38.2 ^a	21.1 ^c	34.1 ^{ab}	36.8 ^{ab}
High School or GED	457	62.6 ^a	61.7 ^a	38.9 ^a	17.6 ^{bc}	34.8 ^b	39.4 ^b
Some College	633	64.6 ^a	65.3 ^{ab}	35.7 ^a	15.6 ^{ab}	29.1 ^a	31.7 ^a
Finished College/Advanced Degree	602	71.1 ^b	68.9 ^b	33.8 ^a	13.1 ^a	31.6 ^{ab}	32.3 ^a
p-value		0.003	0.082	0.305	0.002	0.110	0.016
Adolescent Weight status							
Underweight (<5th)	41	56.3 ^a	55.0 ^{ab}	25.8 ^{ab}	2.7 ^a	8.2 ^a	13.8 ^a
Normal weight (>5th-<85th)	1310	60.7 ^a	58.6 ^a	27.3 ^a	7.7 ^a	19.3 ^b	21.4 ^a
Overweight (>= 85th < 95th)	397	65.1 ^a	67.8 ^b	38.0 ^b	16.0 ^b	36.7 ^c	41.5 ^b
Obese (>=95th)	494	77.2 ^b	80.5 ^c	60.5 ^c	42.3 ^c	64.3 ^d	66.0 ^c

Maternal Weight Talk:	N	Conversation about Healthy Eating Habits %	Conversation about being Physically Active %	Conversation about Weight or Size %	Mentioned Weigh too much %	Mentioned should lose weight/keep from gaining %	Mentioned should exercise to lose weight/keep from gaining %
p-value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Paternal Weight Talk:	N	Conversation about Healthy Eating Habits %	Conversation about being Physically Active %	Conversation about Weight or Size %	Mentioned Weigh too much %	Mentioned should lose weight/keep from gaining %	Mentioned should exercise to lose weight/keep from gaining %
Total**	1286	58.0	62.1	34.8	16.6	29.4	33.7
Adolescent Gender							
Male	619	61.3	66.7	37.1	15.8	28.5	34.0
Female	667	55.1	57.8	32.5	17.5	30.1	33.4
p-value		0.0242	0.001	0.066	0.357	0.478	0.808
Adolescent Ethnicity/Race							
White	332	46.0 ^a	47.3 ^c	14.5 ^d	4.9 ^b	16.7 ^a	18.1 ^c
Black	223	55.1 ^b	62.5 ^a	35.3 ^{ab}	13.1 ^a	23.3 ^a	31.6 ^{ab}
Hispanic/Latino	253	69.7 ^c	73.1 ^b	42.5 ^{bc}	16.6 ^a	34.8 ^b	38.6 ^b
Asian American	322	65.7 ^c	66.7 ^{ab}	49.8 ^c	29.9 ^c	43.3 ^c	49.2 ^d
Other/mixed	152	52.7 ^{ab}	65.7 ^{ab}	29.4 ^a	12.2 ^a	24.2 ^a	27.3 ^a
p-value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Parent Educational Attainment							
< High School	270	49.3 ^a	52.6 ^b	39.3 ^a	20.5 ^b	32.0 ^a	31.6 ^a
High School or GED	238	58.1 ^b	61.6 ^b	32.9 ^a	16.8 ^{ab}	30.0 ^a	37.8 ^a
Some College	335	57.1 ^{ab}	64.6 ^a	34.8 ^a	14.0 ^a	27.5 ^a	34.0 ^a
Finished College/Advanced Degree	437	63.7 ^b	65.9 ^a	31.9 ^a	14.9 ^{ab}	28.4 ^a	32.2 ^a
p-value		0.008	0.015	0.239	0.119	0.631	0.327
Adolescent Weight status							
Underweight (<5th)	28	59.9 ^{ab}	51.6 ^{ab}	36.6 ^{bb}	3.6 ^a	11.4 ^a	23.5 ^{ab}
Normal weight (>5th<85th)	789	54.9 ^a	59.9 ^a	28.0 ^a	8.9 ^a	19.7 ^a	22.1 ^a
Overweight (>= 85th < 95th)	204	59.5 ^{ab}	61.5 ^a	33.7 ^a	17.8 ^b	29.9 ^b	35.5 ^b
Obese (>=95th)	265	66.3 ^b	70.8 ^b	53.8 ^b	37.9 ^c	58.5 ^c	66.4 ^c

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Paternal Weight Talk:	N	Conversation about Healthy Eating Habits %	Conversation about being Physically Active %	Conversation about Weight or Size %	Mentioned Weigh too much %	Mentioned should eat differently to lose weight/keep from gaining %	Mentioned should exercise to lose weight/keep from gaining %
p-value		0.012	0.008	<0.001	<0.001	<0.001	<0.001

* For categories within each demographic variable, percents with differing superscripts are statistically different from one another (p-value <0.05).

** The total proportion given is unadjusted

Table 3

a: Relationship between mothers' and fathers' healthful eating or weight conversations and adolescents' fruit and vegetable intake, breakfast intake and BMI*											
Fathers (N=1286)						Mothers (N=2242)					
Conversation Type											
	No Eating or Weight Conversations ^a (N=459)	Conversations about Healthy Eating Only ^b (N=280)	Weight Conversations ^c (N=76)	Conversations about Healthy Eating and Weight ^d (N=457)	No Eating or Weight Conversations ^a (N=666)	Conversations about Healthy Eating Only ^b (N=558)	Weight Conversations ^c (N=109)	Conversations about Healthy Eating and Weight ^d (N=875)			
Daily Fruit & Vegetable Intake											
Mean	2.61 (0.10) ^a	2.83 (0.13) ^{ab}	2.57 (0.25) ^{ab}	3.07 (0.11)^b	2.65 (0.09) ^a	2.85 (0.10) ^{ab}	2.62 (0.23) ^{ab}	3.01 (0.08)^b			
Difference (95% CI)	Ref	0.22 (-0.11, 0.55)	-0.04 (-0.58, 0.49)	0.46 (0.15, 0.76)	Ref	0.21 (-0.06, 0.47)	-0.02 (-0.51, 0.46)	0.37 (0.12, 0.61)			
Daily Breakfast Consumption											
Mean	4.39 (0.12) ^a	4.55 (0.15) ^a	4.04 (0.29) ^a	4.59 (0.12) ^a	4.17 (0.10) ^a	4.34 (0.11) ^a	3.97 (0.26) ^a	4.20 (0.09) ^a			
Difference (95% CI)	Ref	0.17 (-0.21, 0.54)	-0.35 (-0.98, 0.28)	0.20 (-0.14, 0.55)	Ref	0.17 (-0.12, 0.47)	-0.20 (-0.75, 0.34)	0.03 (-0.25, 0.30)			
Daily Sugar-sweetened Beverage Intake											
Mean	0.76 (0.04) ^a	0.68 (0.05) ^a	0.90(0.10) ^a	0.72 (0.04) ^a	0.83 (0.04) ^a	0.81 (0.04) ^a	0.78 (0.09) ^a	0.76 (-0.03) ^a			
Difference (95% CI)	Ref	-0.08 (-0.21, 0.05)	0.14 (-0.08, 0.35)	-0.04 (-0.16, 0.08)	Ref	-0.02 (-0.13, 0.08)	-0.06 (-0.25, 0.14)	-0.07 (-0.17, 0.03)			
Weekly Fast Food Consumption											
Mean	1.35 (0.07) ^a	1.39 (0.09) ^a	1.31 (0.17) ^a	1.44 (0.07) ^a	1.57 (0.06) ^a	1.46 (0.07) ^a	1.79 (0.16) ^a	1.58 (0.06) ^a			
Difference (95% CI)	Ref	0.04 (-0.18, 0.26)	-0.04 (-0.40, 0.32)	0.10 (-0.10, 0.30)	Ref	-0.11 (-0.30, 0.07)	0.22 (-0.12, 0.55)	0.01 (-0.16, 0.18)			
BMI percentile											
Mean	0.64 (0.01) ^a	0.62 (0.02) ^a	0.75 (0.03)^b	0.74 (0.01)^b	0.65 (0.01) ^{ab}	0.62 (0.01) ^a	0.69 (0.03) ^b	0.76 (0.01)^c			
Difference (95% CI)	Ref	-0.02 (-0.06, 0.02)	0.12 (0.05, 0.18)	0.11 (0.07, 0.14)	Ref	-0.03 (-0.06, 0.00)	0.04 (-0.01, 0.10)	0.11 (0.08, 0.14)			

b: Relationship between mothers' and fathers' physical activity or weight conversations and adolescents' physical activity, screen time and BMI*									
Fathers (N=1286)					Mothers (N=2242)				
Conversation Type									
	No Physical Activity or Weight Conversations ^a (N=416)	Conversations about Physical Activity Only ^b (N=292)	Weight Conversations ^c (N=89)	Conversations about Physical Activity and Weight ^d (N=473)	No Physical Activity or Weight Conversations ^a (N=659)	Conversations about Physical Activity Only ^b (N=519)	Weight Conversations ^c (N=129)	Conversations about Physical Activity and Weight ^d (N=893)	
Weekly Hours of Moderate/Vigorous Physical Activity									
Mean	6.14 (0.23) ^a	5.89 (0.27) ^a	6.22 (0.58) ^a	5.62 (0.22) ^a	5.99 (0.18) ^a	5.88 (0.21) ^a	6.13 (0.46) ^a	5.73 (0.17) ^a	
Difference (95% CI)	Ref	-0.25 (-0.95, 0.45)	0.07 (-1.15, 1.30)	-0.53 (-1.17, 0.11)	Ref	-0.10 (-0.65, 0.45)	0.15 (-0.82, 1.12)	-0.25 (-0.75, 0.26)	
Weekly Hours of Screen Time									
Mean	36.99 (1.28) ^a	36.69 (1.52) ^a	43.92 (3.18) ^b	39.81 (1.21) ^{a,b}	41.69 (1.07) ^a	39.09 (1.22) ^a	40.13 (2.59) ^a	40.96 (0.95) ^a	
Difference (95% CI)	Ref	-0.30 (-4.15, 3.55)	6.93 (0.17, 13.69)	2.82 (-0.74, 6.37)	Ref	-2.60 (-5.74, 0.55)	-1.56 (-7.08, 3.96)	-0.72 (-3.61, 2.16)	
BMI percentile									
Mean	0.62 (0.01) ^a	0.63 (0.02) ^{a,b}	0.70 (0.03)^{b,c}	0.75 (0.01)^c	0.62 (0.01) ^a	0.63 (0.01) ^a	0.65 (0.03) ^a	0.76 (0.01)^b	
Difference (95% CI)	Ref	0.01 (-0.03, 0.05)	0.07 (0.00, 0.14)	0.12 (0.09, 0.16)	Ref	0.01 (-0.03, 0.04)	0.03 (-0.03, 0.08)	0.14 (0.11, 0.16)	

* All models adjusted for adolescent gender and race, parental education, child BMI (except for BMI outcomes) and parent BMI. Sample is limited to kids with parent who lives with the kid >=50% of the time.

^aThese conversations included no comments about healthful eating or weight.

^bThe conversations included only comments about the importance of healthful eating behaviors.

^cThese conversations included comments about adolescent weight/size, mentioning that the adolescent weighted too much or that they should eat differently to lose weight or keep from gaining weight, but no comments about healthful eating.

^dThese conversations included comments about healthful eating and weight

Percentages with **different** letter superscripts^{a,b,c} are statistically significantly different.

Table 4

Relationship between parents' (mothers and fathers combined) healthful eating, physical activity or weight conversations and adolescents' dietary patterns, level of physical activity and BMI* (n =1,180)

	Conversations about Healthful Eating^a	Weight Conversations^b
Daily Fruit & Vegetable Intake		
Difference (95% CI)	0.24 (0.05, 0.43)	0.10 (-0.10, 0.29)
Daily Breakfast Consumption		
Difference (95% CI)	0.21 (-0.01, 0.43)	-0.13 (-0.35, 0.09)
Daily Sugar-sweetened Beverage Intake		
Difference (95% CI)	-0.07 (-0.15, 0.00)	0.06 (-0.02, 0.14)
Weekly Fast Food Consumption		
Difference (95% CI)	-0.02 (-0.15, 0.11)	0.06 (-0.06, 0.19)
BMI percentile		
Difference (95% CI)	-0.02 (-0.04, 0.01)	0.08 (0.06, 0.11)
	Conversations about Physical Activity Only^c	Weight Conversations^d
Weekly Hours of Moderate/Vigorous Physical Activity		
Difference (95% CI)	-0.08 (-0.49, 0.34)	-0.15 (-0.56, 0.26)
Weekly Hours of Screen Time		
Difference (95% CI)	-0.38 (-2.70, 1.93)	2.10 (-0.21, 4.41)
BMI percentile		
Difference (95% CI)	0.01 (-0.02, 0.03)	0.07 (0.05, 0.10)

* All models adjusted for adolescent gender and race, parental education, parent BMI and child BMI (except for analyses with BMI as the outcome). Sample is limited to kids with parent who lives with the kid $\geq 50\%$ of the time.

^aThese conversations included only comments about the importance of healthful eating behaviors.

^bThe conversations included only comments about adolescent weight/size, mentioning that the adolescent weighted too much or that they should eat differently to lose weight or keep from gaining weight, but no comments about the importance of healthful eating.

^cThese conversations included only comments about the importance of engaging in physical activity.

^dThese conversations included comments about adolescent weight/size, mentioning that the adolescent weighted too much or that they should exercise more to lose weight or keep from gaining weight, but no comments about the importance of physical activity.

Percentages with **different** letter superscripts^{a,b,c} are statistically significantly different.