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Family Relationships and Adolescents' Health Attitudes and Weight: The Understudied Role of Sibling Relationships

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Abstract

Family relationships are important predictors of adolescents' diet, physical activity, and health issues including obesity. Despite their prominence in the family, siblings have received little attention on how they may influence these health-related behaviors. Addressing this gap, the present study examined associations between sibling relationship qualities and adolescents' health attitudes, exercise behaviors, and weight controlling for other family relationship qualities. Participants included one parent and two adolescent siblings (ages 12 to 19) from 326 families. Multilevel models indicated that net of parent-adolescent relationship qualities and adolescents' personal characteristics, sibling intimacy was related to healthy attitudes and greater exercise behaviors, whereas sibling conflict was associated with increased risk of being overweight. Links between sibling conflict and weight status, however, were further qualified by gender composition of the sibling dyad. Results highlight the significance of sibling relationships in adolescents' everyday health attitudes and behaviors and implications for intervention efforts are discussed.

Keywords

adolescence; exercise; family relationships; health; obesity; sibling relationships

Adolescence is a critical period in the development and maintenance of healthy behaviors, including diet and exercise (Breinbauer & Maddaleno, 2005). Research reveals, however, that physical activity decreases throughout adolescence (Troiano et al., 2007), with older adolescents (16-19) being one of the most sedentary groups in the United States (Matthews et al., 2008). In fact, sedentary behaviors, along with unhealthy eating, and low exercise are associated with being overweight or obese during adolescence (Mellin, Neumark-Sztainer,

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Story, Ireland, & Resnick, 2002). Given the major health problems (e.g., cardiovascular diseases, diabetes, and depression) associated with adolescent overweight and obesity (for review see Daniels, 2006) as well as the high prevalence—one in three children and adolescents are overweight or obese (American Heart Association, 2012)—it is critical to explore the predictors of adolescents' weight and health behaviors.

Familial Relationships and Health

Research and theory on social support suggests that social relationships are strongly related to individual health and well-being (Cohen, Gottlieb, & Underwood, 2000). In fact, research reveals that family relationships are significant predictors of adolescents' health behaviors, including diet and exercise. For example, high family conflict as well as low connectedness predicts inadequate fruit and vegetable consumption (Neumark-Sztainer, Story, Resnick, & Blum, 1996) and obesity (Zeller et al., 2007) among adolescents. In contrast, authoritative parenting style, characterized by greater connectedness and as well as a degree of demandingness, is associated with healthy fruit intake and physical activity among adolescents (Kremers, Brug, de Vries, & Engels, 2003; Schmitz et al., 2002). Furthermore, parent-child closeness is positively associated with health promoting behaviors (Youngblade et al., 2007). In short, accumulating evidence strongly implicates the nature and quality of family relationships, specifically parent-child relationships, as salient predictors of adolescents' health behaviors and weight status.

Sibling relationships

The influence of siblings, who play a central role in the family environment, has been largely neglected by health researchers. Sibling relationship qualities (e.g., warmth, conflict) specifically, have received little attention in the context of adolescent physical activity, nutrition, and weight (for exceptions see de Leeuw, Snoek, van Leeuwe, van Strien, & Engels, 2007; Vincent & McCabe, 2000). This omission is particularly surprising given that research demonstrates that sibling relationship qualities are significant predictors of a variety of adolescent outcomes (e.g., delinquency, depression, peer competence) above and beyond parent-child relationship quality (Branje, van Lieshout, van Aken, & Haselager, 2004; Criss & Shaw, 2005; Kim, McHale, Crouter, & Osgood, 2007; Stocker, Burwell, & Briggs, 2002) and shared characteristics like parenting and genetics (Natsuaki, Ge, Reiss, & Neiderhiser, 2009).

Risk and protective functions of sibling relationships—Leading perspectives on social support suggest that relationships influence health through their effects on self-esteem and self-regulation and/or by providing resources necessary to handle stress (Cohen et al., 2000). With respect to the former, research focusing primarily on youths' adjustment has found that positive sibling relationship qualities like warmth and intimacy have been linked to increased social competence, self-esteem, and self-regulation in adolescence (Kim et al., 2007; Padilla-Walker, Harper, & Jensen, 2010; Yeh & Lempers, 2004). With respect to the latter, positive sibling relationship qualities have been shown to serve as protective factors and buffer the influence of stressors such as family conflict (Caya & Liem, 1998), low parent support (Milevsky & Levitt, 2005), poor peer relationships (East & Rook, 1992), and

other ecological risks (Milevsky & Levitt, 2005). Furthermore, positive sibling relationship qualities have also been associated with fewer externalizing (Branje et al., 2004) and internalizing behaviors (Kim et al., 2007; Yeh & Lempers, 2004). Despite these potential protective functions, research consistently reveals that negative sibling relationship qualities such as sibling conflict and hostility are positively associated with externalizing (Criss & Shaw, 2005; Natsuaki et al., 2009) and internalizing behaviors (Kim et al., 2007; Padilla-Walker et al., 2010; Stocker et al., 2002) during adolescence. As such, negative sibling relationships may serve as important risk factors for unhealthy coping behaviors, whereas positive sibling relationships may serve as protective factors and promote health.

Multidimensionality of sibling relationship—To our knowledge, only one study has looked at the influence of both sibling and parental relationships on adolescents' eating behaviors. Vincent and McCabe (2000) found that discussion with siblings about weight loss was positively associated with cognitive dietary restraint in adolescent girls; however the quality of the sibling relationship itself did not predict body dissatisfaction or disordered eating in adolescent boys and girls, and nor did the quality of relationship with parents. One possible reason for this finding is that relationship quality was measured globally (parental care and sibling care) and did not differentiate the positive and negative dimensions of the relationships. As discussed earlier, a body of work on sibling (as well as parent-child) relationships highlights the contributions of both positive and negative relationship qualities for youths' development. To date, most work has examined the implications of positive and negative relationship qualities separately, with results demonstrating contrasting patterns of influence (i.e., positive qualities linked to better outcomes and negative qualities associated with poorer outcomes). In the daily lives of youth, however, positivity and negativity do not occur in isolation, and the effects of one may suppress the implications of the other on youth's adjustment. Therefore, to gain a more complete understanding of the implications of sibling and other family relationships for individual health and adjustment the contribution of both positive and negative dimensions of the relationship should be considered concurrently.

To date, the few studies that have investigated the relative contribution of sibling conflict versus sibling intimacy yield mixed results. For example, East and Shi (1997) found that in younger sisters of pregnant or parenting adolescents, negativity in the sibling relationship was a stronger predictor of younger siblings' delinquency and sexual behaviors than positivity in the relationship. Similarly, in a prospective study, Criss and Shaw (2005) found sibling conflict, but not sibling intimacy, at age 10 predicted antisocial behaviors at ages 11 and 12. In contrast, in a cross-sectional study, Pike, Coldwell, and Dunn (2005) found that sibling positivity was more consistently linked to older siblings' prosocial behaviors and total difficulties than negativity. Padilla-Walker and colleagues (2010) found sibling intimacy to consistently predict multiple adolescent outcomes (i.e., prosocial behaviors, externalizing behaviors) compared to sibling hostility, which predicted only internalizing behaviors. Although findings are mixed overall, the latter two studies suggest that in positive domains sibling positivity may serve as a buffer and protect youth from the negative outcomes associated with sibling negativity. To address this possibility and to demonstrate the need for a holistic approach to studying sibling relationships, the present study

simultaneously considered sibling conflict and intimacy as predictors of adolescent health outcomes.

Current Study

In this study, we specifically explored whether sibling intimacy and conflict were related to adolescents' health attitudes, exercise behaviors, and weight status above and beyond parent-child relationship qualities (intimacy and conflict) as well as individual (e.g., age, temperament) and family characteristics (i.e., SES). Given previous findings (e.g., Branje et al., 2004; Kim et al., 2007), we hypothesized that sibling intimacy would be positively associated with healthy attitudes and exercise behaviors and decrease the risk of being overweight. In contrast, we hypothesized that sibling conflict would be negatively associated with health attitudes and exercise behavior and would increase the probability of being overweight. We also expected that sibling intimacy would be more strongly associated with positive outcomes (i.e., health attitudes and exercise behaviors; Padilla-Walker et al., 2010; Pike et al., 2005) as compared to sibling conflict. Given that previous research reveals that sibling relationship qualities often vary as a function of the gender composition of the sibling dyad (e.g., Buhrmester, 1992), we also examined whether the associations between sibling relationship quality and health behaviors were moderated by sibling gender composition.

Method

Participants

Participants included one parent (87% female; $M_{age} = 44.95$ years, $SD = 5.54$) and two consecutively-born adolescent-age siblings ($M_{age} = 17.17$, $SD = .94$ years for earlier-born siblings and $M_{age} = 14.52$, $SD = 1.27$ years for later-born siblings, respectively) from 326 families. Families ranged from working to upper class on the basis of family income ($Med = \$70,000$, $M = 77,964$, $SD = 72,806$, range \$0 – 980,000) and parents' education ($M = 14.50$ years, $SD = 2.37$). Seventy-one percent of the participating families were Caucasian, 23% were African American, and 6% were of other ethnic groups. Seventy-seven percent of the parents were married. Sibling dyads were distributed almost equally among the four possible gender compositions (29% older sister-younger sister; 22% older brother-younger brother, 27% older brother-younger sister; and 22% older sister-younger brother). Siblings were $M = 2.65$ years ($SD = 1.08$) apart in age and 97% of the siblings were full biological siblings. The number of children in the household ranged from 2 to 8 ($M = 2.8$, $SD = 1.13$) and all target siblings resided together.

Procedure

To generate the sample, we targeted families with at least two adolescent children from seven different counties within one Midwestern US state. To increase the ethnic diversity of the sample, African American families were oversampled (23% of the current sample was African American as compared to a state average of 9%; U.S. Census Bureau, 2010). Names, addresses, and phone numbers of families that included at least two adolescent children from the seven target counties were identified from purchased marketing lists. Families were sent prenotification letters that described the study and included a telephone

number, e-mail address, and a postage paid postcard to return if the family fit the study criteria and was interested in participating. Study criteria required that the older adolescent was in the 11th or 12th grade and the younger sibling was in the 7th grade or above. Forty-two percent of eligible and contacted families participated in the study (for more information on sampling and recruitment see Whiteman, Jensen, & Maggs, 2013).

Participating families were mailed informed consent/assent forms along with postage paid envelopes to return the forms. After signed consent/assent was received, telephone interviews were scheduled with the family. Research assistants trained in standardized interviewing procedures conducted separate interviews with the parent and the two siblings. Participants' sense of privacy to answer questions comfortably was checked on before their interview. If lack of privacy was a concern for the participant or the interviewer, then interviews were rescheduled for a later date. Each interview lasted between 30-45 minutes. Parents reported on demographics and adolescent temperament. Siblings reported on their health, health behaviors, sibling relationship, and parent-child relationship qualities. Each participant was compensated \$35 for their participation (a total of \$105 per family).

Measures

Sibling Relationship Qualities—*Sibling intimacy* was measured using an adaptation of Blyth, Hill, and Thiel's (1982) eight-item scale. Specifically, siblings reported on the level of support, understanding, and acceptance they experienced in the sibling relationship (e.g., "How much do you share your inner feelings or secrets with your brother/sister?"). Items were responded to on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*very much*). Total scores were averaged across the items, with higher scores denoting greater intimacy ($M = 3.22$, $SD = .68$, $\alpha = .83$ for earlier-born siblings; $M = 3.27$, $SD = .68$, $\alpha = .81$ for later-born siblings).

Siblings also reported on the level of *conflict* in their relationship using five items from Furman and Buhrmester's (1985) Network Relationship Inventory. An example item is "How much do you and your brother/sister disagree or quarrel with each other?" Items were rated on a 5-point scale from 1 (*not at all*) to 5 (*very much*). Total scores were averaged across items, with higher scores indicating greater conflict in the relationship ($M = 3.17$, $SD = .82$, $\alpha = .90$ for earlier-born siblings; $M = 3.13$, $SD = .89$, $\alpha = .91$ for later-born siblings).

Parent-Child Relationship Qualities—Both siblings reported on their relationship with their mothers and fathers. *Parent-child intimacy* was measured using the same eight-item scale used to measure sibling intimacy (Blyth et al., 1982). Total scores were averaged across the eight items, with higher scores denoting greater intimacy ($M_{mother} = 3.58$, $SD = .72$; $M_{father} = 3.24$, $SD = .85$ for earlier-born siblings; $M_{mother} = 3.60$, $SD = .66$; $M_{father} = 3.33$, $SD = .77$ years for later-born siblings). Cronbach's α s ranged from .83 to .89.

Parent-adolescent conflict was assessed using a scale adapted from Smetana (1988) that measured the frequency of conflict in 12 domains (e.g., chores, appearance, homework and schoolwork, social life, behavior and personality, relationship with siblings). Items were rated on a 6-point scale from 1 (*not at all*) to 6 (*several times a day*). Total scores were averaged across the items with higher scores indicating greater conflict in the relationship

($M_{mother} = 2.22, SD = .70; M_{father} = 2.05, SD = .76$ for earlier-born siblings; $M_{mother} = 2.27, SD = .73; M_{father} = 2.05, SD = .72$ years for later-born siblings). Cronbach's α s ranged from .84 to .89.

Health Behaviors—Siblings reported on their own health habits using nine items developed for this study. Seven of these items measured *general attitudes towards health and eating* (e.g., “I think about being a healthy person a lot”; “I make sure I eat nutritiously”) and the remaining two items measured level of *exercise* (e.g., “I engage in physical activity regularly”; “I am sure to get regular exercise”). Items were rated on a 5-point scale ranging from 1 (*really not true*) to 5 (*really true*). Total scores were averaged across the items for each of the two subscales, with higher scores denoting healthier attitudes and greater exercise ($M_{health} = 3.51, SD = .70; M_{exer} = 3.78, SD = 1.08$ for older siblings; $M_{health} = 3.59, SD = .69; M_{exer} = 3.84, SD = .96$ for younger siblings). Cronbach's α s for the general health and eating subscale were .87 and .86, and α s for the exercise subscale were .87 and .73, for older and younger siblings, respectively.

Weight Status—Siblings reported on their height and weight, which was used to calculate their body mass index (BMI) using the formula $\text{weight}(\text{kg})/\text{height}^2(\text{m})$. Body mass index percentile curves adjusted for age and gender (Centers for Disease Control and Prevention, 2000) were used to categorize adolescents as normal, underweight, overweight, and obese. Of the older siblings approximately 10% were obese, 12% overweight, 75% were of normal weight, and 4% were underweight. Among younger siblings, 16% were obese, 14% overweight, 68% normal weight, and 2% were underweight. The obese and overweight groups were combined to create an overweight group and the underweight adolescents were omitted from the weight analyses.

Covariates—Given previous findings highlighting age (Matthews et al., 2008), gender (Rolls, Federoff, & Guthrie, 1991), and temperament (de Brujin, Kremers, Schaalma, van Mechelen, & Brug, 2005) are associated with adolescent's eating and exercise behaviors and weight regulation, these factors were controlled in our analyses. Parents reported on dimensions of temperament quality for both siblings using items adapted from the Revised Dimensions of Temperament Survey (DOTS-R; Windle, 1992; Windle & Lerner, 1986). For this study, three items indexing perseverance (e.g., “Stays with an activity for a long time”) were included. Items were rated on a 4-point scale from 1 (*usually false*) to 5 (*usually true*). Total score were averaged across items, with higher scores indicating greater perseverance ($M = 3.03, SD = .75, \alpha = .79$ for earlier-born siblings; $M = 3.15, SD = .68, \alpha = .84$ for later-born siblings). Adolescent gender (0 = girls, 1 = boys) and sibling gender composition (girl-girl dyad as reference group) were dummy coded. Additionally, we controlled for socioeconomic status, birth order and age spacing of the sibling dyad. Information on family income and parents' education was collected from parents. Standardized scores of family income and parents' education were averaged together to index socioeconomic status (SES). Birth order was dummy coded (0 = older sibling; 1 = younger sibling).

Analytic Strategy

We employed a series of multi-level models (MLM) to examine whether sibling relationship qualities predicted adolescent health attitudes, exercise behavior, and weight status net of parent-child qualities and individual characteristics like age and perseverance. Multi-level modeling is advantageous because it extends multiple regression techniques to account for the nested nature of the data. In this study, siblings (Level 1) were nested in families (Level 2). Analyses were run in SAS 9.2; the MIXED procedure was used to predict health attitudes and exercise behaviors and the NLMIXED procedure was used to predict weight status. Following McMahon, Pouget and Tortu's (2006) guidelines for modeling dyadic data with binary outcome using the NLMIXED procedure, the starting parameters for intercept and slopes were obtained using the GENMOD procedure and the initial value for the variance due to dyads was obtained using the MIXED procedure. For all outcomes, predictors were entered hierarchically, with main effects prior to interaction terms. All the continuous variables were grand mean centered.

Results

Table 1 displays the correlations between study variables separately for older and younger siblings.

General Attitudes Towards Health

Results of the multi-level models predicting adolescents' general health attitudes are presented in Table 2. In general, our models revealed significant effects for several of the control variables. First, age was negatively related to adolescents' general health attitudes. Additionally, adolescents' perseverance was positively associated with general health attitudes. With respect to family relationship qualities, conflict with mothers was negatively linked to general health attitudes, whereas intimacy with fathers was positively associated. Consistent with expectations, sibling intimacy was positively associated with adolescents' general health attitudes, net of parent-adolescent relationship qualities and other controls. Contrary to our hypothesis, sibling conflict was not associated with youths' health attitudes. Gender composition of the sibling dyad did not moderate these effects (not shown in Table 2).

Exercise Behaviors

Similarly to general health attitudes, several of control variables were significantly related to adolescents' exercise behaviors (see Table 2). A main effect of gender revealed that boys reported higher exercise behavior than girls. A main effect of gender composition also revealed that siblings in older brother-younger sister dyads reported higher exercise behaviors than youth in older sister-younger sister dyads. Adolescents' perseverance was positively associated with exercise as well. Conflict and intimacy with fathers were both positively linked with exercise behaviors. Conflict with mothers was negatively associated with exercise behaviors. With respect to sibling relationship qualities, consistent with hypotheses, sibling intimacy was positively associated with exercise behaviors; sibling conflict, however, was unrelated. Again, no interaction effects were found between sibling relationship qualities and sibling gender composition (not shown in Table 2).

Weight Group

The NLMIXED procedure provided the logarithmic odds of being overweight for each predictor. For ease of interpretation the log-odds were converted to adjusted odds ratio by taking their exponents. Consistent with the results of health attitudes and exercise behaviors, several control variables were significant in predicting the probability of being overweight (see Table 3). The odds of being overweight decreased with age and perseverance. Inconsistent with previous work, conflict with mothers was associated with decreased risk of being overweight. Inconsistent with expectations, sibling intimacy was not associated with youths' weight status. Sibling conflict, however, was a significant predictor of being overweight. Specifically, in the main effects model, a one unit increase in sibling conflict increased the odds of being overweight approximately two times. This effect, however, was qualified by an interaction with sibling gender composition (see Table 3). As can be seen in Figure 1, sibling conflict was more strongly linked to elevated probabilities of being overweight for sibling dyads with brothers.

Discussion

Despite their centrality in the family, there has been limited research exploring how sibling relationships are related to adolescents' everyday health attitudes and behaviors. Taking a systemic view on the family and holistic perspective of the sibling relationship, we found that sibling intimacy was a significant predictor of adolescents' health attitudes and exercise behaviors after controlling for parent-child relationship qualities and individual characteristics such as temperament. Even though bivariate correlations revealed that sibling conflict was significantly associated with health attitudes and exercise behaviors, these associations were not present when considered simultaneously with sibling intimacy. Although work examining the concurrent influence of intimacy and conflict is limited, these findings are consistent with research showing that sibling intimacy, as compared to conflict, is more strongly related to positive outcomes (Padilla-Walker et al., 2010; Pike et al., 2005). Other research has also shown that sibling intimacy is related to greater self-regulation and self-esteem (Kim et al., 2007; Yeh & Lempers, 2004) and also buffers the effects of stress (Caya & Liem, 1998; Milevsky & Levitt, 2005). Given that self-esteem and self-regulation are associated with physical activity and healthy eating in youth (Kalavana, Maes, & Gucht, 2010; Reynolds et al., 1990), it could be that sibling intimacy indirectly promotes positive health attitudes and exercise behaviors by improving healthy coping and overall mental health.

Although unrelated to adolescents' general health attitudes and exercise behaviors, sibling conflict, and not sibling intimacy, was associated with an increased risk of being overweight. There are several possible mechanisms through which sibling conflict may influence weight. For example, research suggests that the experience of stress is positively associated with behaviors such as fatty food intake and frequent snacking in adolescents (Cartwright et al., 2003). Perhaps sibling conflict produces or exacerbates stress and contributes to the development of overweight and obesity through compromised coping skills. Additionally, sibling conflict may influence obesity through hormonal changes. For example, presence of excessive glucocorticoid hormone secreted in response to experience

of stress is associated with the development of visceral obesity (Adam & Epel, 2007). Our analyses, however, revealed that sibling gender composition moderated the effects of sibling conflict on the risk of being overweight. Links between conflict and the risk for being overweight were strongest for dyads with older brothers (i.e., brother-brother and brother-sister dyads) and lowest for sister-sister dyads. Perhaps conflict in the sister-sister dyads is not as consequential as it is in other dyads as sisters generally provide more warmth and support than brothers (Buhrmester, 1992). In fact, sister-sister dyads may be unique as other studies have shown these dyads to differ from other gender constellations on other markers of health (Vogt Yuan, 2009). Ultimately, in order to fully understand how sibling relationships influence adolescents' health and well-being, future research will need to investigate the potential pathways (e.g., stress, self-regulation, coping) that may differentially mediate the links between sibling relationships and youths' outcomes for the different gender compositions.

Although conflict has commanded attention as the sibling relationship construct with high potential to influence adolescent adjustment (Kramer, 2010), our results reveal differential links when considered independently versus in context of other relationship dimensions. Sibling relationships are characterized not only by conflicts, teasing, and rivalry, but also by affection, pride, and shared laughter (Furman & Buhrmester, 1985). For two out of three outcomes, we found that sibling intimacy has the potential to protect youth from the negative effects of conflict. Moving forward, it is imperative that future work continue to examine multiple affective dimensions of the sibling relationship simultaneously to better understand the complete contribution of sibling relationships for adolescents' health and well-being. In fact, person centered techniques such as cluster analysis or latent class analysis may be particularly effective in capturing the synergistic associations among multiple relationship dimensions prevalent in family and other close relationships (Whiteman & Loken, 2006).

While not the main focus of this study, some parent-child relationship qualities were related to adolescent outcomes in unexpected directions. For example, conflict with fathers was associated with higher exercise behaviors and conflict with mothers was associated with decreased odds of being overweight. Although counterintuitive, these findings are consistent with a recent study, which found better relationships with mothers during adolescence were associated with increased risk for obesity in adulthood (Gillette, Lohman, & Flittner, 2013). These findings also suggest that siblings and parents may influence adolescent health and related behaviors through different mechanisms. For instance, although parents are similar to siblings in being potential sources of support or stress, parents also play a gatekeeping role. Parents make decisions about food availability, hours of television watching, and sports classes or physical activities they can afford for their child (Beets, Cardinal, & Alderman, 2010; Campbell et al., 2007). Additionally, parental feeding practices such as controlling portion sizes or using food for reinforcement have been linked to adolescent eating behaviors and obesity (Birch, Savage, & Ventura, 2007; Campbell et al., 2007). Ultimately, research examining the entire family system is required to understand the mediating (and potentially moderating) processes that link family relationships to adolescent health.

Limitations and Implications

The results of this study should be considered in the context of several limitations related to the study design and methodology. First, the cross-sectional nature of this study prevented the formal testing of directional effects. Consistent with extant cross-sectional and longitudinal studies, we posited that sibling relationship qualities predict health outcomes (e.g., conflict predicts adolescents' overweight). It is possible, however, that adolescents' health could influence their relationship quality (e.g., overweight adolescents have poorer sibling relationships). Ultimately, longitudinal data are required to understand the bidirectional relationships between these variables. Second, our measures relied on adolescents' self-reports. It is possible that associations between relationship qualities and siblings' health-related attitudes and behaviors were inflated because of method variance problems (e.g., Lorenz, Conger, Simon, Whitbeck, & Elder, 1991). Relatedly, reports of height and weight were provided by adolescents. Although this has been found to be a reliable method of obtaining BMI and is used widely, it is possible that adolescents misreported their height and weight, which may lead to this study misestimating potential associations. Finally, our sample was more affluent and included more married couples as compared to state averages (U.S. Census Bureau, 2010). As such, the results may not generalize to lower income groups or single-parent families. Therefore, it is essential that this work be replicated in more diverse populations.

Despite these limitations, the current study had several strengths and important implications for practice. First, it adds to the scarce literature on the effects of sibling relationship qualities on adolescent health. Second, the use of multilevel models allowed us to study multiple siblings from the same families. Third, majority of studies tend to focus on conflict and negativity in the relationships to an extent of exclusion of positive aspects. By testing sibling conflict and intimacy concurrently we showed the relative importance of each on different health outcomes.

Overall, our findings support a risk/protective framework of sibling relationships and have implications for prevention and intervention efforts. Family based treatment programs directed towards weight loss and improving diet and physical activity in youth seldom include siblings (for review see Kitzman-Ulrich et al., 2010). Our results indicate that siblings play an important role in adolescent health, and intervention efforts should capitalize on such findings. In fact, accumulating evidence reveals that sibling relationships during childhood and adolescence are malleable, making them important targets for intervention. For example, intervention efforts focused on teaching emotion regulation and a variety of other skills including communication, problem-solving, and negotiation can teach siblings to handle the emotionally charged nature of the sibling relationship and decrease conflict (Kramer, 2010). Furthermore, a recent sibling-focused intervention enhanced positivity and reduced negativity in the sibling relationship, which in turn, were associated with better child and adolescent outcomes (Feinberg, Solmeyer, & McHale, 2012). Additionally, promoting positive engagement, respect, and shared experiences can create a sense of alliance and protection, helping siblings to draw upon one another as social support (Feinberg, Solmeyer, Hostetler et al., 2012; Kramer, 2010). In short, prevention and intervention efforts would benefit from focusing on the sibling relationships as way to

enhance adjustment and psychosocial competence in youth, ultimately leading to overall healthy development.

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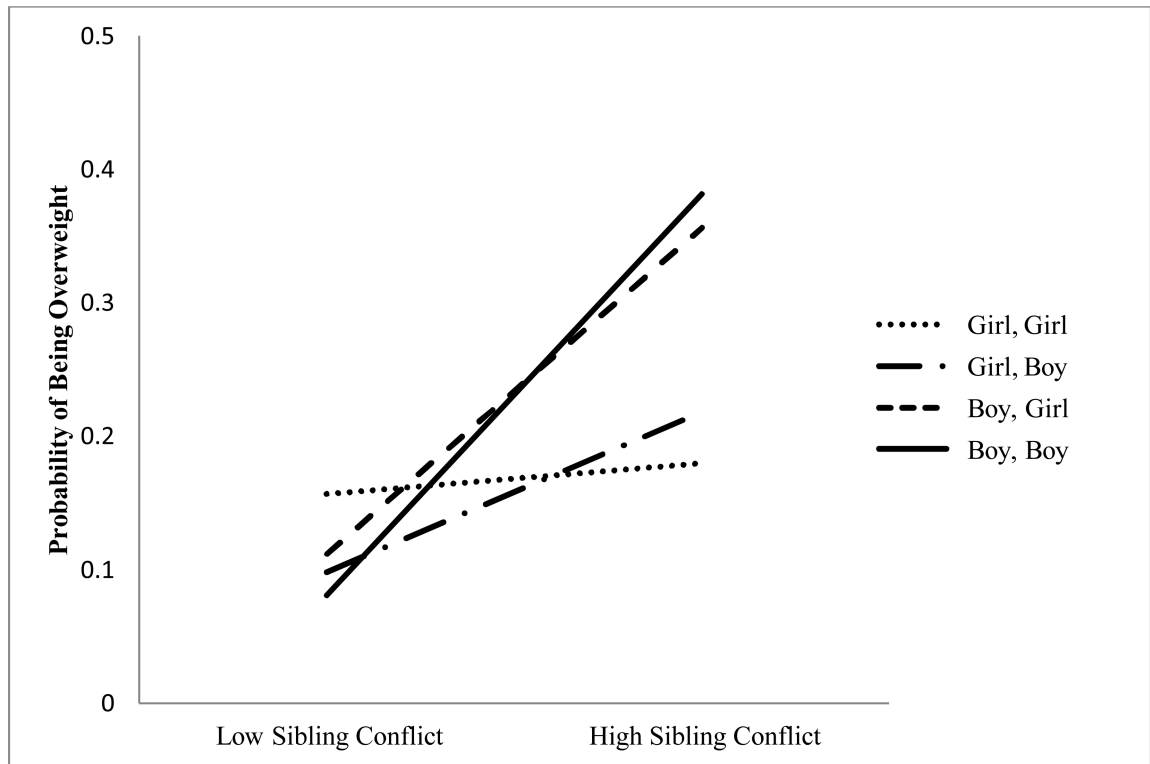


Figure 1.
Probability of Being Overweight based on Sibling Conflict and Gender Composition

Table 1
Correlations between Key Variables for Older (values below the diagonal) and Younger (values above the diagonal) Siblings

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.SES		-.09	.05	.15 ^b	-.12 ^a	-.08	.02	.17 ^b	.04	-.11 ^a	-.02	.10	.15 ^b	-.14 ^b
2.Age	-.07		.13 ^a	.09	-.12 ^a	-.08	-.06	-.13 ^a	-.69 ^c	-.11	-.06	-.07	-.01	-.14 ^a
3.Gender	-.03	.15 ^b		-.09	-.07	-.09	-.09	.13 ^a	-.07	-.11 ^a	-.16 ^b	.04	.18 ^c	.08
4.Perseverance	.09	-.01	-.10		-.22 ^c	-.15 ^b	.11 ^a	.16 ^b	-.12 ^a	-.09	.01	.21 ^c	.17 ^b	-.10
5.Mother Conf	-.00	-.15 ^b	-.09	-.19 ^c		.72 ^c	-.30 ^c	.27 ^c	.07	.38 ^c	-.12 ^a	-.30 ^c	-.12 ^a	.00
6.Father Conf	.11	-.14 ^b	-.10	-.15 ^b	.69 ^c		-.16 ^b	-.19 ^b	.00	.30 ^c	-.07 ^b	-.18	.03	.00
7.Mother Int	.03	-.02	-.05	.16 ^b	-.32 ^c	-.15 ^b		.50 ^c	.01	-.17 ^b	.33 ^c	.24 ^c	.12 ^a	.05
8.Father Int	.18 ^b	-.02	.13 ^a	.04	-.18 ^b	-.22 ^c	.34 ^c		.10	-.17 ^b	.20 ^c	.28 ^c	.22 ^c	-.00
9.Age Diff	.04	.21 ^c	-.02	.01	.03	-.01	.04	.02		.01	.10	.06	.04	.07
10.Sib Conf	-.11 ^a	-.12 ^a	-.18 ^b	-.04	.11 ^a	.11	-.00	-.10	.09		-.35 ^c	-.20 ^c	-.19 ^c	.09
11.Sib Int	-.03	-.06	-.13 ^a	.02	-.02	-.01	.24 ^c	.22 ^c	-.05	-.33 ^c		.17 ^b	.14 ^b	-.04
12.Health	.11 ^a	-.10	.04	.18 ^c	-.15 ^b	-.10	.16 ^b	.22 ^c	-.08	-.09	.09		.58 ^c	-.13 ^a
13.Exercise	.10	-.08	.24 ^c	.11	-.12 ^a	-.05	.11 ^a	.28 ^c	-.08	-.12 ^a	.14 ^b	.59 ^c		-.12 ^a
14.WtGrp	-.15 ^b	-.09	-.02	-.10	-.05	.00	.11	-.01	.02	.23 ^c	.02	-.08	-.11	

Note:

^a $p < .05$.

^b $p < .01$.

^c $p < .001$.

Table 2

Multi-level Model Predicting Adolescents' General Health Attitudes and Exercise Behaviors

Variables	Health Attitude (N = 599)		Exercise Behaviors (N = 599)	
	γ	SE	γ	SE
SES	.05	.04	.07	.06
Age	-.06*	.03	-.05	.04
Gender	.02	.07	.27**	.11
Perseverance	.16***	.04	.20***	.06
Adol-Mother Conf	-.13*	.05	-.17*	.08
Adol-Father Conf	.02	.05	.21**	.07
Adol-Mother Int	.05	.05	-.08	.07
Adol-Father Int	.12***	.04	.25***	.06
Birth Order	-.10	.08	-.11	.12
Sibling Age Difference	-.02	.03	-.04	.04
D1	.02	.09	.05	.13
D2	.11	.09	.28*	.12
D3	.11	.11	.27	.16
Sib Conflict	-.03	.04	-.04	.05
Sib Intimacy	.11*	.05	.19**	.07

Note:

D1 = older sister-younger brother dyad, D2 = older brother-younger sister dyad, D3 = older brother-younger brother dyad. Reference group is older sister-younger sister dyad.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3

Coefficients and Adjusted Odds Ratio (AOR) of Coefficients Associated with Overweight.

Variables	Main Effects Model (N = 568)			Interaction Model (N = 568)		
	γ	SE	AOR	γ	SE	AOR
SES	-.26	.18	0.77	-.28	.18	0.76
Age	-.26*	.13	0.77	-.28*	.12	0.76
Gender	.39	.35	1.48	.37	.35	1.45
Perseverance	-.37*	.18	0.69	-.38*	.17	0.68
Adol-Mother Conf	-.60*	.28	0.55	-.60*	.28	0.55
Adol-Father Conf	.19	.24	1.21	.23	.23	1.26
Adol-Mother Int	.37	.22	1.45	.38	.22	1.46
Adol-Father Int	-.18	.18	0.84	-.21	.17	0.81
Birth Order	.08	.41	1.08	-.03	.40	0.97
Age Difference	.09	.13	1.09	.09	.13	1.09
D1	.07	.45	1.07	-.15	.44	0.86
D2	.52	.39	1.68	.27	.39	1.31
D3	.37	.51	1.45	.14	.50	1.15
Sib Conflict	.69***	.18	1.99	.10	.30	1.11
Sib Intimacy	.21	.22	1.23	-.23	.38	0.79
Sib Conf \times D1				.46	.49	1.58
Sib Conf \times D2				.77	.42	2.16
Sib Conf \times D3				1.05*	.46	2.86
Sib Int \times D1				.45	.59	1.57
Sib Int \times D2				.76	.55	2.13
Sib Int \times D3				.40	.57	1.49

Note:.

** $p < .01$.

D1 = older sister-younger brother dyad, D2 = older brother-younger sister dyad, D3 = older brother-younger brother dyad. Reference group is older sister-younger sister dyad.

*
 $p < .05$.***
 $p < .001$.