

# Peer Influence on Children's Physical Activity: An Experience Sampling Study

Sarah-Jeanne Salvy, PhD,<sup>1</sup> Julie Wojslawowicz Bowker, PhD,<sup>2</sup> James N. Roemmich, PhD,<sup>1</sup> Natalie Romero, RD,<sup>1</sup> Elizabeth Kieffer, MA,<sup>1</sup> Rocco Paluch, MS,<sup>1</sup> and Leonard H. Epstein, PhD,<sup>1</sup>

<sup>1</sup>*Department of Pediatrics, Division of Behavioral Medicine, University at Buffalo, The State University of New York, Farber Hall, Room G56, 3435 Main Street, Building #26, Buffalo NY, 14214-3000 and*

<sup>2</sup>*Department of Psychology, University at Buffalo, The State University of New York 224 Park Hall, Buffalo, NY 14260-4110*

**Objective** The primary objective was to examine the associations between social context (the presence of peers, friends, and family members) and physical activity intensity for overweight and lean girls and boys. **Methods** Participants for this study included 10 boys ( $M = 13.4$  years;  $SD = .8$ ) and 10 girls ( $M = 13.8$  years;  $SD = .8$ ). Twelve participants were between the 15<sup>th</sup> and the 85<sup>th</sup> BMI percentile (eight girls, four boys) and eight youth were at or above the 85<sup>th</sup> BMI percentile (six boys, two girls). Participants reported on their activity intensity and whether the activity was solitary or with others for seven consecutive days.

**Results** Children were more likely to report more intense physical activity when in the company of peers or close friends. Overweight children reported greater physical activity when in the presence of peers than did lean children; however, overweight children also reported more time spent alone.

**Conclusions** Taken together, findings highlight the importance of considering peer relationships in studies of physical activity and childhood "obesity."

**Key words** overweight in children; physical activity; social context.

## Introduction

Healthy peer relationships are important for youths' development and to avoid the insidious and damaging influence of friendlessness and peer rejection (Kupersmidt & DeRosier, 2004; Rubin, Bukowski, & Parker, 2006). Peer relationships provide a unique context within which children learn social skills and develop social-cognitive abilities including the development of perspective-taking and moral reasoning skills (McGuire & Weisz, 1982). Peer relationships also promote psychological well-being, self-esteem, and feelings of general self-worth (Bagwell, Newcomb, & Bukowski, 1998). By contrast, peer rejection or victimization, place children at risk for psychosocial maladjustment (Deater-Deckard, 2001). Children without friends report greater psychological distress than those with friends (Parker & Asher, 1993), and peer rejection predicts the development of internalizing and externalizing problems (Kraatz-Keiley, Bates, Dodge, & Pettit, 2000).

Rejected and victimized children often respond to negative peer treatment by disengaging from the social environment to avoid additional abuse (Hart, Ladd, & Burleson, 1990; Kochenderfer & Ladd, 1996; Ladd, 1999), and the combination of isolation and negative feedback from the normative peer group result in further isolation (Buhs & Ladd, 2001). The experience of being rejected and victimized may further lead children to narrow their circle of friends to other children who experience similar peer problems and who share similar social limitations, as children tend to make friends with similar others (Cairns, Leung, Buchanan, & Cairns, 1995; Hodges, Malone, & Perry, 1997).

Whereas the majority of attention has been devoted to the study of the ways in which peer relationships impact cognitive, psychological, and emotional development (Rubin et al., 2006), peer relationships are also relevant for understanding youths' involvement in active

*All correspondence concerning this article should be addressed to S.-J. Salvy. E-mail: ssalvy@buffalo.edu.*

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leisure and recreational activities. With their peers, youths engage in team sports and other physical and leisure activities that provide the context for the development of physical abilities and socio-emotional competencies. Friendships offer important opportunities for companionship and physically active alternatives to eating and sedentary behavior (Bukowski, Hoza, & Boivin, 1994). By contrast, social isolation and peer victimization may impose constraints on access to these healthy alternatives. Overweight children avoid taking part in activities, such as physical education classes or sports to avoid peer victimization (Faith, Leone, Ayers, Moonseong, & Pietrobelli, 2002) and this relationship between overweight status and physical activity is mediated by peer rejection (Storch et al., 2007). Furthermore, depressive symptoms and loneliness mediate the relationship between peer victimization and physical activity (Storch et al., 2007). Attempts to substitute physical activity for sedentary behavior and eating may not be effective if problematic peer relationships persist, in part because sedentary activities and snack foods are easily accessible and less threatening for socially isolated youths. These constraints may also account for the impediments met when trying to substitute physical activity for snacking and sedentary behavior in overweight youths.

The troubling relationship between peer difficulties and physical activity is an important concern because increased time allocated to sedentary behavior may be largely responsible for the reduction in physical activity and for the increased adiposity of youth (Robinson, 1999). Physical activity and active play during childhood and adolescence also increase self-esteem (Calfas & Taylor, 1994) and promote increases in bone mineral density (Janz et al., 2006), muscle strength and muscular and aerobic endurance that persist into adulthood (Byers & Walker, 1995). Being physically active during childhood and adolescence is particularly important because it is associated with activity in adulthood (Telama et al., 2005).

Child-by-environment models of risk and adaptation wherein peer difficulties, such as friendlessness, are considered a product of both the child and the environment might be usefully applied to the study of children's physical activity level (Magnusson & Stattin, 2006). One might expect, for example, that the individual child characteristics of gender may play a role in the effects of the presence of others on youths' activity level. Beginning with interactions with their parents, boys and girls are socialized into different worlds that tend to reinforce these gender differences (Maccoby, 1986; Meaney, Stewart, & Beatty, 1985). Fathers engage in

physical activities and vigorous play with their sons (MacDonald, 1993), and the play of boys and their friends often involves more physically active and vigorous games than does girls' play (Pellegrini, Blatchford, Kato, & Baines, 2004). Young girls, on the other hand, have been found to be more closely supervised by parents and teachers (Fagot, 1994), which may inhibit their choice of leisure and recreational activities (Maccoby, 1986) and their overall level of activity. Therefore, the presence of others might not have the same effects on boys and girls, as family members may operate in such a way as to act as a brake and limit girls' activity, while encouraging boys' involvement in vigorous activities.

Another individual child characteristic, weight status, may be a factor influencing the relationship between the social context and youth's physical activity. Obese children find sedentary activities more reinforcing than physically active alternatives (Epstein, Smith, Vara, & Rodefer, 1991), and free access to preferred sedentary behaviors may make it difficult to increase involvement in alternative activities (Epstein, Roemmich, Saad, & Handley, 2004). Children are also less inclined to seek the company of overweight peers and do not enjoy interacting with them as much as they do with lean children, which further inhibits the involvement of overweight youths in leisure activity (Bell & Morgan, 2000; Sigelman, Miller, & Whitworth, 1986; Young & Avdzej, 1979). Consequently, the relationship between social contexts and youths' activities may not be the same for overweight and lean youth as overweight youth may avoid taking part in social activities to avoid peer victimization (Faith et al., 2002; Storch et al., 2007) and choose leisure activities that are solitary in nature. Researchers have not yet thoroughly examined peer experiences in relation to individual child physical characteristics, except in studies of physical attractiveness and peer rejection (e.g., Newcomb, Bukowski, & Pattee, 1993). Yet, the consideration of youth's weight status may allow an understanding of the ways in which child physical characteristics and peer relationships interact to determine mental and physiological well-being during childhood.

### **Assessment Considerations**

Experience-sampling procedures have been used to study a range of phenomena in psychology and behavioral medicine. These procedures facilitate ecologically valid research by allowing for the collection of a representative sample of participants' behavior and the relationships with their unique environment. To our knowledge this is the first study of children's activity intensity using

experience-sampling methodology with two-way pagers. The pagers allow sending and receiving wireless messages and e-mails discreetly, immediately, reliably, and cost-effectively. Pagers have several advantages over palm pilot and micro-computers. One advantage of pagers is the ability to receive real time data, with no need to wait until the participants bring back the devices to download the data. This allows prompting participants without delay and ensuring integrity of the data. This methodology also does not require retrieval or reconstruction of data from memory, but rather involves reporting the information available contingent on the signal (i.e., experimenters' pages). The two-way pagers do not entail software programming and they require no particular setup. A copy of each e-mail (page) sent with the devices can be sent to the experimenter simultaneously. This feature eliminates the problem of participants using the device for other purposes or to e-mail their friends. Finally, a less quantifiable advantage of the pagers is the enthusiasm of participants to use this technology. We found that youths' eagerness to use these devices lasted throughout the study and eliminated sample attrition.

### Summary and Research Questions

The overarching goal of the present study was to extend prior work on physical activity with an examination of the relationships between social context and youths' activity intensity, using an experience-sampling methodology with two-way pagers. This study is the first to explore *both* individual child characteristics (gender, weight status) and environmental or relationship factors (peer and familial relationships) in relation to physical activity (Magnusson et al., 2006). We hypothesized that the presence of peers and friends would be associated with greater physical activity intensity and that time spent alone would predict involvement in sedentary activities ( $\leq 1.5$  metabolic equivalents). We also predicted that overweight youth would choose leisure activities that were solitary in nature and would report being alone on more occasions than normal-weight youth. Finally, we expected that parents would operate in such a way as to act as a brake and limit the intensity of girls' activity, while encouraging boys' involvement in vigorous activities.

### Method Participants

Participants for this study included 10 boys and 10 girls between 12–14 years of age (Table I). Twelve participants were between the 15th and the 85th BMI percentile

**Table I.** Body Mass Index Percentile and Age (SD) of Participants Across Conditions

	Male		Female	
	Age	BMI%	Age	BMI%
Overweight ( $n = 8$ )	13.4 (0.7)	92.9 (3.5)	13.2 (1.3)	94.8 (2.2)
Normal Weight ( $n = 12$ )	13.6 (0.8)	56.9 (15.6)	13.9 (0.7)	59.4 (10.3)

(eight girls, four boys) and eight youth were at or above the 85th BMI percentile (six boys, two girls). Weight and height were assessed by a trained staff member. Weight measurements were taken using a digital scale, which was assessed daily, and height was assessed using a SECA stadiometer. On the basis of the height and weight data, the BMI was calculated according to the following formula:  $BMI = kg/m^2$ . The BMI-for-age percentile was used to interpret BMI data and classify youth because BMI follows a gender-specific growth curve, naturally increasing with age until early adulthood. Youth were considered overweight or at risk for becoming overweight, if they were above the 85th BMI percentile and were considered normal weight if below the 85th BMI percentile for their age and gender (Kuczmarski et al., 2000). These are the current guidelines for weight status in children and adolescents set forth by the Centers for Disease Control (Kuczmarski et al., 2000).

A relative measure of BMI (LMS  $z$ -BMI) was further used for statistical purposes to control for age and sex. The formula for calculating LMS  $z$ -BMI score based on age and sex is LMS method  $z$ -BMI =  $[(BMI/M^L) - 1]/(L \times S)$ , where BMI = an individual BMI,  $M$  = the median BMI for age and gender,  $L$  = power in the Box-Cox transformation for age and gender, and  $S$  = standard deviation for age and gender (Kuczmarski, 2002).

A small sample was used in the current study to use pager technology to insure good control over the data and to avoid data overload when receiving the participants' answers. Families were recruited from newspaper ads and from our database of families who had inquired about previous studies. Parents were screened by phone for their child's height, weight, a brief medical history, and ethnic background. Children were excluded if they were below the 10th BMI percentile; had a cold or upper respiratory distress; had current psychopathology or developmental disability; and/or if they were on medications or had conditions that could influence their mobility or their activity level (e.g., methylphenidate). In this study, 18% of the sample was minority, with 7% African-American and 11% Hispanic or Latino. All procedures used in this study were approved by the

Children & Youth Institutional Review Board of the University at Buffalo.

## Measures

### Experience-Sampling Equipment

The pagers used were the P900 Dragon two-way pagers (Unication U.S.A. Inc., Arlington, TX). Questions regarding the children's activities and social context were written in a general e-mail, which was sent recurrently and simultaneously to each child according to the study schedule. Youth quickly learned to operate the device and reported spending  $\leq 2$  min answering each page. Batteries were provided in case they needed to be replaced. Participants were asked to contact the experimenters immediately if they had any problem with the pager.

### Participants' Activity Intensity

When receiving a page, youth were asked to stop what they were doing and describe in detail the activity in which they were engaged and the social context (i.e., which videogame were they playing; were they sitting or standing up; were they eating while watching TV). They were also asked to rate on a 10-point Likert scale how physically tiring the activity was (Table II). Youth activities were converted into MET values according to the compendium of physical activities (Ainsworth et al., 2000). The compendium lists activities by major headings (e.g., house chores, occupation, transportation, etc.) and specific activities under each major heading are assigned a MET value, defined as the ratio of the metabolic rate of the activity to the resting metabolic rate. The assigned MET value for an activity is a generalized estimate based on the literature and expert opinion (Ainsworth, Irwin, Addy, Whitt, & Stolarczyk, 1999; Harrell et al., 2005). The compendium of physical activities was developed to enhance the comparability of results across studies that use self-reports (Harrell et al., 2005). The amount of detail provided by the youth in describing their activities and its intensity largely removed the experimenter's need to infer or interpret the nature, type, and intensity of the activities described. This information was further clarified with the participants during the follow-up phone calls (i.e., every two days), and again during the post-study interview (described subsequently).

## Procedure

Interested parents and adolescents were scheduled to come to the laboratory for an information session. The study took place during the summer so as to not interfere with school and school-related activities. All participants came to the laboratory for an orientation session where

the youth heard an "assent" script and were asked if they were willing to take part in the study; parents were asked to read and provide written consent. Participants were then trained to use their two-way pagers and were provided with a detailed demonstration of the text messaging procedure which was modeled by the experimenters. Parents and participants were given a list of the questions the experimenters would send daily (Table II).

For seven consecutive days, the participants received identical pages every day from 10 a.m. to 10 p.m. at two hour variable intervals. Pagers were kept on the vibration mode at all times to avoid disruption. Participants were asked to stop their current activity when they were paged and to reply to the questions. They were told to ignore any signal occurring during an incompatible activity such as soccer game, bike riding, and church to avoid injuries and/or disruption, but to respond as soon as possible. When the paged questions were left unanswered,

**Table II.** Questions Used for the Experience Sampling

Questions	Response Choices
What are you doing?	Be as specific as possible!
How long have you been doing this?	(a) 1–5 (few minutes) (b) 10 min (c) 15 min (d) 20 min (e) 30 min (f) 1 h (g) more than 1 h (Specify)
How physically tiring is this activity?	Not tiring at all      Tiring      Very, very tiring 0-----5-----10
What were you doing before?	Be as specific as possible!
Where are you?	(a) Home      (f) Relatives' house (b) School      (g) Library (c) Playground      (h) Church (d) Park      (i) Other ... (Specify) (e) Friend's house
Who are you with?	(a) Friend      (f) Grandma/grandpa (b) Sister/brother      (g) Neighbor (c) Mom/dad      (h) Stranger (d) Cousin      (i) Alone (e) Uncle/aunt      (j) Other ... (Specify)
How many people are with you?	List the number of people
What are you going to do next?	Be as specific as possible!

a reminder symbol was left on the screen of the pager (i.e., an envelope signaling a message). Participants and their parents were also informed that the experimenter would call every two days to answer their questions, address problems they might have, and to ensure the integrity of the data collection.

When the 7 days of experience-sampling were completed, participants were scheduled for a post-study interview. The objective of this session was to review and clarify the information collected to ensure the accuracy of the data (e.g., Who is Joe? Is he a friend/your cousin?). Also at that time, participants' height and weight measurements were taken by a trained staff member. Finally, the participants and their parents were debriefed by the experimenters and they received a 100-dollar gift card for a shopping mall of their choice for their participation.

### Overview of Data Analysis

The assumption of independence required for analysis of variance and standard regression models is violated when there are nested observations within individuals. Mixed effect models (also called multilevel, hierarchical linear, or random regression) provide a useful approach to account for interdependence in multiple observations within individuals (Gibbons & Hedeker, 1994; Hedeker & Gibbons, 1994). Mixed models assume that the data within clusters are dependent among the observations. This is determined by the covariances among the regression coefficients and can be characterized by a covariance function (Hedeker & Gibbons, 1996). The outcomes at the individual level are modeled taking into consideration the dependence of observations within dyads (Hedeker, 2003). These models allow simultaneously estimating the parameters of the regression model and the variance components accounting for the data clustering (Gibbons & Hedeker, 1994).

Two separate random coefficient models with random intercept and fixed effects were used to assess the relationship between the social context and children's physical activity as measured in METs. One model assessed the impact of the presence of others versus being alone as a time variant variable and participants' gender and participants' LMS  $z$ -BMI as time invariant factors as well as interactions between these terms on youth activity. The second model examined the effects of the presence of different individuals (i.e., peer/friends vs. family members) as time variant predictors and participants' gender and  $z$ -BMI as time invariant variables and interactions between these terms on children's

activity intensity. For both models, all predictors were first entered into the model and nonsignificant variables were removed to identify the best fitting model. Finally, a chi-square was performed to test the hypothesis that overweight participants were more frequently alone than normal-weight participants. Data were analyzed using SYSTAT (Systat, 2004) and SAS (SAS, 2002) software.

### Results

The first question of interest was whether youth were engaged in less intense activity when alone than when in the company of others. Table III illustrates the average MET intensity for overweight/at risk of overweight and normal-weight participants across social contexts. When the relationship between the social context (presence of others vs. being alone), participants'  $z$ -BMI, gender, and interactions between these terms were examined, the presence of other individuals (vs. being alone) was the only significant predictor of participants' activity MET intensity,  $F(1,946) = 51.4$ ,  $p < .001$ . When  $z$ -BMI and its interactions were removed from the model, both the presence of others,  $F(1,946) = 50.91$ ,  $p < .001$  and participants' gender,  $F(1,946) = 4.59$ ,  $p < .05$ , predicted participants' activity intensity. Consistent with our prediction, differences of least square means revealed that youth engaged in less intense activity when alone,  $M = 1.2$ ,  $SE = .14$ , than when in the company of other individuals,  $M = 2.15$ ,  $SE = .09$ ;  $t(946) = 7.14$ ,  $p < .001$  ( $d = .47$ ; 95% CI: .34 to .6), and that overall, boys,  $M = 1.89$ ,  $SE = .14$ , performed more intense activity than girls,  $M = 1.48$ ,  $SE = .14$ ;  $t(946) = -2.14$ ,  $p < .05$  ( $d = .17$ ; 95% CI: .04–.3).

A chi-square was performed to test the second hypothesis that overweight participants were alone more often than normal-weight participants. As expected, results indicated that overweight youth reported being alone in 28% of their total responses, while lean participants reported being alone in 17% of their responses  $\chi^2(1) = 17.14$ ,  $p < .001$ .

The second model assessed the impact of the presence of different individuals on youth physical

**Table III.** Intensity of Activity in MET (SD) as a Function of the Social Context

	Alone	Peers/Friends	Family
Overweight ( $n = 8$ )	1.4 (0.9)	3.9 (3.3)	1.9 (1.5)
Normal Weight ( $n = 12$ )	1.2 (0.5)	2.5 (2.0)	1.8 (1.4)

activity intensity (Table III). The presence of peers and friends, the presence of family members, participants' gender and  $z$ -BMI, and interactions between these terms were entered into the model. The presence of peers/friends,  $F(1,732)=11.75$ ,  $p < .001$ , the participants' gender,  $F(1,732)=16.82$ ,  $p = .001$ ,  $z$ -BMI,  $F(1,732)=7.49$ ,  $p < .01$ , and the interaction of  $z$ -BMI by presence of peers and friends  $F(1,732)=12.29$ ,  $p < .001$ , were significant predictors of children's activity intensity. The presence of family members was not a significant predictor of activity intensity ( $p = .41$ ), but the interaction of family by participants' gender was found to predict children's activity intensity,  $F(1,732)=28.92$ ,  $p < .0001$ .

Differences of least square means revealed that youth engaged in more intense activity in the presence of peers and friends,  $M=3.14$ ,  $SE = .14$ , than when they were not in company of peers and friends,  $M=1.78$ ,  $SE = .15$ ;  $t(732) = -6.09$ ,  $p < .001$  ( $d = .69$ ; 95% CI: .54–83). Once again, boys,  $M=2.88$ ,  $SE = .15$ , were found, overall, to engage in more intense activity than girls,  $M=2.04$ ,  $SE = .13$ ;  $t(732) = -4.10$ ,  $p < .001$  ( $d = .25$ ; 95% CI: .10–4). Furthermore, analysis of the interaction indicated that when youths were *not* in company of family members, boys,  $M=3.37$ ,  $SE = .24$ , engaged in more intense activity than girls,  $M=1.75$ ,  $SE = .2$ ;  $t(732) = -5.67$ ,  $p < .001$  ( $d = .91$ ; 95% CI: .64–1.2), but when youth were in the presence of family members, boys' activity intensity,  $M=2.40$ ,  $SE = .17$ , was not different than the girls' activity intensity,  $M=2.32$ ,  $SE = .17$ ;  $p = .73$  (effect size = .07,  $IC = -.1$  –.24). Furthermore, contrary to expectation, girls engaged in more intense activity when they were with family than when they were not,  $t(732) = -2.21$ ,  $p < .05$  ( $d = .27$ ; 95% CI: .07–47), whereas boys performed more intense activity when they were not with family members than when they were with family members,  $t(732) = 3.31$ ,  $p < .001$  ( $d = 1.12$ ; 95% CI: .89–1.342).

To simplify the interpretation of the interaction of  $z$ -BMI by the presence of peers and friends, we transformed the continuous  $z$ -BMI variable into a categorical weight status variable (<85th BMI percentile vs.  $\geq$  the 85th BMI percentile). The result of the mixed effects analysis were in the same direction  $F(1,732)=4.86$ ,  $p < .05$ . Difference of least square means revealed that when youths were in the presence of peers and friends, overweight participants,  $M=3.58$ ,  $SE = .24$ , engaged in more intense activity than normal-weight participants,  $M=2.85$ ,  $SE = .19$ ;  $t(732) = 2.39$ ,  $p < .05$  ( $d = .60$ ; 95% CI: .35–84). However, when youth were not in the

presence of peers and friends, there was no difference in activity intensity between the overweight,  $M=1.80$ ,  $SE = .21$ , and lean youth,  $M=1.72$ ,  $SE = .18$ ,  $p = .72$  ( $d = .08$ ; 95% CI:  $-.1$ –.26). These analyses were rerun removing all formal team practices because some youths in the sample (three boys, two girls) were involved in teams and formal practices may have influenced the findings. Results from this model were equivalent to those described above.

## Discussion

This study examined the associations between children's activity and the social context using an experience-sampling methodology. Notably, the findings support the first hypothesis that the presence of peers and friends is associated with higher activity intensity, and that time spent alone is related to youths' lower activity intensity. Put another way, youth engaged in less intense activity when alone than when in the presence of others and more intense activity in the presence of peers and friends than when in company of family members. Although many investigators have examined peers as a moderator of social and emotional development (Rubin et al., 2006), the present study contributes to the literature by demonstrating that peer relationships also play an important role in children's activity intensity.

In our analyses, important gender differences were revealed. Consistent with others' findings, we found that boys engaged in more intense activity than girls (e.g., Pellegrini et al., 2004). However, contrary to our third hypothesis that parents would inhibit girls' activity intensity (Fagot, 1994), we found that girls were, in fact, more intensely active when they were in the company of family members than when they were with peers and friends. In contrast, boys engaged in less intense activity in the presence of family members than when they were only with other youths. Conceivably, the vigorous physically active games of adolescent boys may be seen as disruptive for the family environment and family members may attempt to hinder or redirect vigorous games to other environments. Another possible explanation for these findings resides in differences between boys and girls in terms of leisure activities from childhood to adolescence. Across societies, active play disappears as a category of activity in adolescence (Larson & Verma, 1999), but in Western societies, and mostly in girls, it is replaced by equal amounts of time spent talking (Richards, Crowe, Larson, & Swarr, 1998).

Talking with peers increases 2-fold, from 1.3 to 2.5 h per day, for European American pre- and early adolescents (Raffaelli & Duckett, 1989). This age and gender pattern has been replicated for urban African American youth (Larson, Richards, Sims, & Dworkin, 2001). Thus, it is possible that the girls spent more time talking (or chatting on the computer vis-à-vis e-mail or instant messenger) when in company of peers and friends than with family.

Noteworthy findings concerning the individual child characteristic of weight status also emerged. Overweight youth engaged in more intense activity than lean participants when in the presence of other youths (i.e., friends and peers). This suggests that the "power" of friendship to influence activity intensity may be greater for overweight than lean children, an explanation consistent with the argument that friendships may be particularly helpful for at-risk children (e.g., Hodges, Boivin, Vitaro, & Bukowski, 1999). This finding is particularly important with its intervention implication; overweight children may benefit the most from intervention programs involving close friends. However, it may also be the case that some youth were not as active as they were reporting and that these findings reflect a reporting bias. However, we believe that reporting inaccuracies were consistent across reporters, and thus, this should not have affected differences between groups. Future researchers would benefit from including friends as additional informants and observations of mutual friends or accelerometers to validate the pager-reports.

Despite the strong relationship between activity intensity and peer involvement for overweight children, they also reported being alone on more occasions than lean youths. Although the actual amount of time spent alone was not assessed in this study, the percentages of responses obtained (17% for lean and 28% for overweight participants) are surprisingly similar to others' findings (Larson & Richards, 1991).

There is evidence that overweight children avoid taking part in intense physical activity, such as physical education classes or sports, to avoid peer victimization (Faith et al., 2002), and that the relationship between overweight status and physical activity is mediated by peer rejection (Storch et al., 2007). Furthermore, depressive symptoms and loneliness mediated the relation between peer victimization and physical activity (Storch et al., 2007). Although the present study was correlational and measures of peer rejection and victimization were not included, the aforementioned findings together with the present data strongly suggest that even though

the presence of others promotes physical activity in overweight youths, social isolation resulting from weight stigmatization may interfere with overweight youths' overall involvement in leisure activity. Decreased time allocation in alternative activities (Faith et al., 2002), in turn, may set the occasion for increased time allocation to sedentary activities that are socially nonthreatening for overweight kids. If overweight children avoid physical activity and unstructured active leisure activities because of peer difficulties, they reduce their chance of weight loss in relying solely on dietary recommendations (Storch et al., 2007).

Furthermore, the experience of being victimized may lead children to narrow their circle of friends to other children who are also rejected and who share similar limitations, as children tend to make friends with similar others (e.g., Cairns et al., 1995; Hodges et al., 1997). Researchers typically utilize *interpersonal attraction theory* (Byrne, 1971) to account for greater similarity between friends than nonfriends (Hamm, 2000; Haselager, Hartup, van Lieshout, & Riksen-Walraven, 1998), and research overwhelmingly demonstrates that friends are more behaviorally similar than nonfriends (Fisher & Bauman, 1988; Hamm, 2000; Haselager et al., 1998; Kupersmidt, DeRosier, & Patterson, 1995; Poulin & Boivin, 2000; Poulin et al., 1997). As behavioral similarity increases between children, the likelihood of a shared best friendship also increases (Kupersmidt, Burchinal, & Patterson, 1995; Kupersmidt, DeRosier et al., 1995). Children tend to be liked by peers who are behaviorally similar and disliked by peers who are behaviorally dissimilar (Nangle, Erdley, & Gold, 1996; Rubin, Lynch, Coplan, Rose-Krasnor, & Booth, 1994). Friendship functions protectively when children are similar to their friends in terms of prosocial tendencies and as a risk factor when there are behavioral concordances in negative traits (Dishion, Andrews, & Crosby, 1995). Behavioral similarity among overweight youths can ultimately maintain and reinforce overweight status, as research indicates that overweight children and pre-adolescents eat substantially more when in the presence of overweight peers than in the presence of leaner eating companions (Salvy, Romero, Paluch, & Epstein, in press).

This study is not without limitations. First, MET intensity data were estimated from the physical activity compendium (Ainsworth et al., 2000; Harrell et al., 2005). Although the compendium is commonly used to estimate individuals' activity intensity (Ainsworth et al., 2000; Harrell et al., 2005) and the methodology did not require

retrieval or reconstruction of data from memory, it still involved having participants self-reporting their activities and the experimenters converting these activities in MET values. The use of more objective measures of participants' activity (e.g., accelerometer) would have been valuable to validate the experience-sampling methodology. Indeed, some participants may have underestimated the activity of some solitary activities, such as those involving new interactive video systems (e.g., the Wii and other interactive games). Second, the data suggest that the presence of peers and friends is associated with greater activity intensity and that time spent alone is related to youths' lower activity intensity. Overweight youth also reported being alone more frequently than their leaner peers. However, we did not assess whether time spent alone resulted from peer rejection or from a deliberate choice. The cause of solitary activities likely mediates the relationship between the social context and youths' activity, and factors other than weight status, such as social skill deficits or disruptive behavior may account for time spent alone. Future studies should include more thorough assessments of peer victimization and sound sociometric instruments to assess these questions. Similarly, future researchers may do well to consider the qualities of children's friendships, which could reveal important variations in the influence of friendship involvement on activity level. One might expect, for example, stronger relations between the presence of friends and activity level for those children who rate their friendships as high on indices of companionship and recreation than other children (Bukowski et al., 1994). Third, although we had a heterogeneous sample in terms of ethnicity, the sample was small, from a relatively small geographic area and only involved youths aged 12–14. Therefore, these findings may not generalize to adolescents from other geographic regions. Also, teens aged 12–14 may not be representative of "youth" of other ages. The small sample limited statistical power and may account for some of the statistically nonsignificant findings and especially the interaction variables. Furthermore, it is important to note that our sample did not include an even distribution of male and female overweight and normal-weight participants, which may also qualify the results. Finally, this study was completed during the summer period to avoid interference with school. However, one might expect that youths are more active during the summer than during the winter months and this seasonal effect undoubtedly influenced the data. The limited scope of this investigation prevents generalizing beyond this group of youth who participated in the study, and replication with independent samples is necessary.

In sum, our findings highlight the importance of the social context on youths' time allocation to active or passive leisure and recreational activities. A long tradition of research has demonstrated the importance of healthy peer relationships in youths' development (Kupersmidt & DeRosier, 2004). The present data suggest that peer relationships are also relevant for understanding youths' active lifestyle, findings which highlight the importance of the child by environment model of risk and adaptation to studies of physical activity (Magnusson & Stattin, 2006). These results may aid in the understanding of barriers to weight loss in overweight youths and past nonadherence to health recommendations. Presumably, the presence of peers and friends sets the occasion and serves as a pull-in factor for recreational and physical activities. By contrast, limited social interactions make it difficult and effortful to initiate these activities which are, for the most part, socially mediated. Increased time spent in solitary activities, in turn, may increase youths' involvement in sedentary activities.

Further research on the impact of peer influences on physical and sedentary activities may help in developing interventions, testing whether increased social involvement can be used as a tool for lifestyle changes in youths. Drawing from these initial findings and the work of others, (Faith et al., 2002; Storch et al., 2007) we contend that decreasing sedentary behavior and increasing active leisure activities may require the social structure of meaningful relationships with peers and friends. Attempts to substitute physical activity for sedentary behavior may not be effective if problematic peer relationships persist, in part because sedentary activities are more reinforcing, easily accessible, easily performed alone, and less threatening for socially isolated youths. The next step is to determine if social-skills training intervention (e.g., S.S.GRIN; DeRosier, 2002, 2004; DeRosier & Marcus, 2005) can impact socially isolated overweight and at risk of becoming overweight youths' choices of activities. Strategies that have been found to improve children's peer relationships, social behavior, and coping strategies may increase youths' social involvement, and as a result, increase their time allocation to active leisure and recreational activities. The long-term goal of this research is to better understand barriers to weight loss in overweight youths and nonadherence to health recommendations.

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