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Associations between Maternal Support and Physical Activity Among 5th Grade Students

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Abstract

Background—A large body of research has established an association between parental support for children's physical activity (PA) and children's PA. However, there has been little attention to the relative influences of parent and child perceptions of that parental support.

Purpose—To examine agreement among parent and child perceptions of parent support for PA and whether these perceptions are associated with objectively-measured moderate-to-vigorous physical activity (MVPA) among those children.

Methods—Cross-sectional associations between PA of children measured via accelerometers and child-reported and mother-reported perceptions of parental support for children's PA were assessed via mixed-model regression analyses in a cohort of 693 5th graders.

Results—Children's perceptions of parental support for PA were consistent with those of their mothers. Nonetheless, in models that included both children's and mothers' perceptions of parental support for PA, mothers' perceptions, but not children's perceptions, were significantly associated with children's PA. Associations were consistent for Total MVPA, After School MVPA, and Evening MVPA, with stronger associations among males than among females.

Conclusion—Maternal support may influence children's PA. Studies which consider only children's accounts of parental support may overlook important mechanisms.

Keywords

child behavior; exercise; motor activity; parenting; social support

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INTRODUCTION

Physical inactivity in adolescents is associated with higher rates of overweight and unfavorable chronic disease risk factor profiles. Yet, many U.S. children and adolescents fail to meet current physical activity (PA) guidelines (Komro et al., 2001), leading many organizations to identify the promotion of PA in children and youth as a major priority for public health initiatives. The results of research aimed at identifying factors important for promoting PA among children have underscored the importance of addressing psychosocial and socioenvironmental factors in these efforts (Beets, Cardinal, & Alderman, 2010; Craggs, Corder, Van Sluijs, & Griffin, 2011; Franzini et al., 2009).

This study focused on one aspect of children's social environments that might influence PA – support from parents for engaging in PA. Family influences on child and adolescent behavior have been more commonly studied in the context of risk behaviors, albeit with mixed results (Beck, Shattuck, Haynie, Crump, & Simons-Morton, 1999; Chuang, Ennett, Bauman, & Foshee, 2009; Davison, Cutting, & Birch, 2003; DiClemente et al., 2001; Ennett, Bauman, Foshee, Pemberton, & Hicks, 2001; Gaylord, Kitzmann, & Coleman, 2003; Gregson & Colley, 1986; Jackson, Henriksen, & Dickinson, 1999; Kelli A. Komro, McCarty, Forster, Blaine, & Chen, 2003; Simons-Morton, 2002). Such studies have noted a tendency for parents to increase communication about specific behaviors after they become aware of their child's engagement in that behavior, rather than before the child has engaged in the behavior. Parental monitoring, commonly defined in terms of parents' awareness of their child's activities and establishment of structure and rules, has been a particular focus of studies of adolescent risk behaviors.

In research on the role of family factors in promoting PA, researchers have focused less on how parents may act to constrain youth behaviors and more on how parents can actively support children in being physically active, both when they are together and when they are apart. In general, this body of evidence provides support for the notion that children are more active when their parents are active (Anderssen & Wold, 1992; Davison et al., 2003; Davison, 2004; Fogelholm, Nuutinen, Pasanen, Myöhänen, & Säätelä, 1999; Freedson & Evenson, 1991; Gottlieb & Chen, 1985; Gregson & Colley, 1986; Moore et al., 1991; Sallis, Prochaska, & Taylor, 2000; Trost, Kerr, Ward, & Pate, 2001; Vilhjalmsson & Thorlindsson, 1998; Wold & Anderssen, 1992), encourage them to be active (Anderssen & Wold, 1992; Beets et al., 2010; Mcguire, Hannan, Neumark-Sztainer, Cossrow, & Story, 2002; Prochaska, Rodgers, & Sallis, 2002; Sallis et al., 1992; Trost et al., 2001), participate in sports or PA with them (Davison, 2004; Freedson & Evenson, 1991; Prochaska et al., 2002; Stucky-Ropp & DiLorenzo, 1993), and provide tangible supports such as taking them to places to be active and enrolling them in organized activities (Davison et al., 2003; Davison, 2004; Hoefer, McKenzie, Sallis, Marshall, & Conway, 2001; Prochaska et al., 2002; Sallis et al., 2000). Given these findings, efforts to increase parental participation in and support for youth PA may represent important intervention strategies.

Most of the previous research on parental support for PA has relied on children's accounts of parental support. Yet, parental support of children's PA is inherently an exchange between parent and child, and it is important to consider whether previous findings reflect

actual parental support or simply children's perceptions of parental behaviors. The limited prior research on agreement between adolescent and parent reports has found fair to moderate agreement between parent and child accounts of observable behaviors, such as the number of sports teams in which a child participates, but poorer agreement for less overt behaviors, such as parental support (Sessa, Avenevoli, Steinberg, & Morris, 2001). In addition, agreement may vary by the gender of the child (Carlston & Ogles, 2009). One small study found agreement between parent and child reports of support for PA, but child reports of parental support were more strongly associated with children's actual PA than were parents' self-reports (Barr-Anderson, Robinson-O'Brien, Haines, Hannan, & Neumark-Sztainer, 2010). Collectively, this evidence underscores the need to better understand the interplay between parent and child perceptions of parental behavior and how they influence children's PA. This paper examines agreement among mothers' and children's perceptions of parent support for PA and the extent to which those perceptions are associated with objectively-measured child PA levels across the day (Total MVPA, Afterschool MVPA, and Evening MVPA).

METHODS

This paper is based on cross-sectional baseline data from the Transitions and Activity Changes in Kids ("TRACK") study, a multi-level, longitudinal study of influences on the changes in children's PA as they transition from elementary to middle school.

Participants

Children were recruited from 21 public elementary schools in two school districts in South Carolina. District approval was obtained through meetings with superintendents and administrators prior to soliciting school participation. One of the school districts was located in the north-central section of the state, in a county with a 2010 population of 226,073 persons, 75% of whom reported their race as white alone, and 19% of whom reported their race as Black or African American (U.S Census Bureau, 2015). The second school district was located in a county in the central part of the state with a 2010 population of 107,463 persons, 49% of whom reported their race as white alone, and 47% of whom reported their race as Black of African American (U.S. Census Bureau, 2015). Collectively, the populations of the two counties included in this study are highly representative of the state's population overall.

Fourteen of the 17 elementary schools in one district and all seven elementary schools in the other district agreed to participate. Recruitment assemblies were held in all schools, during which 5th graders were invited to participate in the study and received information regarding the data collection procedures. Informed consent packets were sent home with the children for their parents to read, complete and return. Children also gave their assent before beginning any study procedures. Children who enrolled in the study attended a measurement session held during the school day to complete anthropometry and computer-assisted self-administered instruments and to be fitted with their accelerometer. Parent surveys were sent home with enrolled children. Data for 5th graders were collected between January 2010 and

December 2010. The Institutional Review Board at the University of South Carolina approved all protocols.

There were 1,857 children enrolled in the 21 elementary schools, and 1,083 children (60.5%) agreed to participate in the study. For this analysis, the sample was limited to children with complete baseline data on PA, parental education, and parent and child accounts of parent support for PA. Further, since 91% of the parent surveys were completed by females, these analyses are restricted to children for whom the parent survey was completed by a female, resulting in a final sample of 693 5th grade students (311 boys and 382 girls). As shown in Table 1, the characteristics of the sample used in these analyses mirror those of the sample prior to omissions for missing data on independent variables.

Measures

Physical Activity—PA was measured by accelerometry (ActiGraph GT1M and GT3X models, Pensacola, FL). The ActiGraph has been validated for use with children and has high inter-unit reliability and strong correlations with energy expenditure. Children wore the monitors on their right hip for 7 consecutive days during most waking hours, except when sleeping or doing water-related activities (e.g., bathing or swimming). Monitors were initialized prior to data collection and were set to begin collecting data at 5:00a.m. on the day after they were distributed to participants at school. Data were collected and stored in 1-min intervals. Any period of 60 minutes or more with consecutive zeros recorded was considered non-wear time. For the present analyses, only activity counts from weekdays were used, due to lower levels of measurement protocol compliance on weekends. Children wore the accelerometers for an average of 12.5 hours per weekday (SD=0.9, range=9.7–14.3 hours).

At the 5^{th} grade measurement, 80% of the children had accelerometer data for at least 8 hours/day on at least 4 days. Missing values for children with at least two days of eight or more hours of wear each day were estimated by multiple imputation using PROC MIXED in SAS software (SAS Institute, 2011). Ninety-two percent of children had complete accelerometer data for three or more days during the hours after school. Missing after-school accelerometer data were imputed separately by gender for children with 2 or more days with at least 60% (≥2.2 hours) of after-school wear. Imputed days and/or hours of wear were based on the child's data record from the remaining days.

The threshold for moderate PA was 2200 counts/min, corresponding to 4.0 metabolic equivalents (METs; 1 MET=3.5 mL O_2 kg^{1} min^{1}), and the threshold for vigorous PA was 5100 counts/min, corresponding to 7 METs (Freedson, Pober, & Janz, 2005). The threshold to distinguish sedentary from light activity was set at 100 counts/min. Using these cut-points, accumulated minutes per hour of total PA (Total PA=light PA + MVPA), MVPA, and sedentary behavior were determined for each participant. A measure of MVPA weighted for activity intensity was calculated by summing METS for MVPA over the entire day. Similar calculations were made for each time period. After-School MVPA was calculated for those with at least 2.2 hours of data between 2:25p.m and 6:00p.m., and Evening MVPA was calculated for those with at least 2.4 hours of data between 6:00p.m. and 10:00p.m. These data requirements correspond to 60% of the time period in question. There were no

significant differences in the sociodemographic characteristics of the participants for whom Total MVPA, After-School MVPA, and Evening MVPA were calculated. Lastly, the proportion of children who met current PA guidelines (≥60 min of MVPA per day) was calculated.

Perceptions of Parental Support for Physical Activity—The measure of parental support for PA that was administered to parents (Sallis, Taylor, Dowda, Freedson, & Pate, 2002) asked parents to report how many days in a typical week they engaged in four types of support: (a) encourage your child to do physical activity or play outside; (b) play outside or do physical activity with your child; (c) provide transportation to a place where he or she can do physical activity or play; and (d) watch your child participate in physical activities or outdoor games. The items were rated on a 5-point scale with the following response categories: 0 days, 1–2 days, 3–4 days, 5–6 days, and 7 days. Consistent with previous research using this measure (Dowda, Dishman, Pfeiffer, & Pate, 2007; Prochaska et al., 2002; Sallis et al., 2002), the items were treated as a single factor and the scale composite score was the mean of the four items. The internal consistency reliability (Cronbach's alpha) of this scale was 0.76.

The measure of parental support for PA that was administered to children (Sallis et al., 2002) asked children to report the extent to which an adult in the household provided support during a typical week, using a 5-point scale with the following response categories: none, once, sometimes, almost daily, and daily. The measure included four items: (a) How often has she encouraged you to do physical activities or play sports? (b) How often has she done a physical activity or played sports with you? (c) How often has she provided transportation to a place where you can do physical activities or play sports? and (d) How often has she watched you participate in physical activities or sports? Consistent with previous research using this measure, the items were treated as a single factor and the scale composite score was the mean of the four items. The internal consistency reliability (Cronbach's alpha) of this scale was 0.78.

Although the measures of parental support used for parents and children were not identical, the question stems for the parent and the child measures were very similar, including the reference to a typical week as the frame of reference for the response, which supports direct comparison of the responses. The only substantive difference in question stems occurred in the encourage items, in which parents were asked about physical activity or playing outside, whereas children were asked about physical activity or sports. Such variations in wording are the result of previous validation work with samples of parent and children, respectively (Sallis et al., 2002). We chose to use wording consistent with this previous work rather than to modify the measures to obtain identical wording. Also, we should note that even identical wording does not necessarily ensure that the inferred meanings will be identical; nonetheless, the measures in question do focus on fairly concrete behavioral transactions between parents and their children which are likely to be cognitively accessible to both parents and children.

The response scales for both the parent and the child measures included 5 ordered response categories; thus, the level of detail requested can be considered comparable. Moreover, the

anchors for the response scales, while not worded exactly the same, *represented* the same value (no days per week and every day, respectively).

Typically, measures related to PA use either a "typical week" or the "past week" as the time frame of reference for self-reports (Bauman, Phongsavan, Schoeppe, & Owen, 2006). This study employed a "typical week" time frame for three reasons. First, as children were measured on a rolling basis, we viewed the week in which measurement occurred as a snapshot of the children's activities. Second, given that parent surveys were completed by parents across broader time intervals than the measures completed with children, direct alignment of the reference period for the parent survey with measurement of children's PA was not possible. Lastly, for activities which are regular or frequent, a "typical week" time frame has been demonstrated to have greater validity than "past week" time frames (Chang & Krosnick, 2003).

Control variables—Children completed a survey that asked their age, gender, and race/ethnicity. For race, they were asked to check as many categories as applied (white, African American/black, Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander and other). They were also asked to identify whether they consider themselves Hispanic or Latino (yes/no). The racial/ethnic background of the current sample was approximately 38% white, 34% black, 11% Hispanic, and 17% mixed or other race; since the mixed/other race category (n=137) include a wide range of different backgrounds with very small numbers of participants reporting each permutation, responses were collapsed and recoded as 'white' or 'minority' (i.e., black and Hispanic) for the present analysis. Child height and weight was measured by trained staff at baseline using Seca height boards and Seca model 770 scales, respectively. With this information, body mass index (BMI) was calculated using the standard equation (body weight [kg]/height $[m]^2$). Analyses used BMI z-scores based upon growth charts from the Centers for Disease Control and Prevention (Kuczmarski et al., 2000). A proxy for socio-economic status (SES) was estimated based on parental report of the highest level of parental education; the item was re-coded as 'high school or less' and 'more than high school.' The measurement of SES is extremely complex. In the interest of minimizing participant burden, we used this single-item measure which has been shown to be the best measure when researchers are restricted to using a single item (M. H. Bornstein & Bradley, 2014; M. H. Bornstein, Hahn, Suwalsky, & Haynes, 2003; Hoff, Laursen, & Bridges, 2012).

Statistical Analysis

Descriptive statistics were calculated for the total sample and separately for males and females. *T*-tests and Chi-square analyses were used to determine if there were differences in any of the support variables between males and females. We examined these differences at the item level rather than at the level of the composite scale to ensure that substantively important differences were not obscured by the scale construction process.

We used the criteria developed by Barr-Anderson et al. (2010) to examine the consistency of parent and child reports of parental support for physical activity. Responses were considered to be in agreement if they differed by no more than one increment on our 5-point response

scales. For example, if a parent report encouraging their child to do physical activities “5–6” days per typical week, and their child reported being encouraged “daily”, these responses were considered to be in agreement. We examined consistency rather than absolute agreement between children’s and mothers’ accounts of parental support for PA because of known differences in the response scales for these measures and the possibility that children and parents may not apply the response scales in the same way. This approach prioritizes consistency in ratings of *whether* support occurred over consistency in the specific rating of the *frequency* of that behavior.

We estimated a series of mixed-model regression models to examine the associations of composite scales for mothers’ and children’s perceptions of parental support with Total MVPA, After-School MVPA, and Evening MVPA with adjustment for school clustering, child’s age, race/ethnicity, BMI z-scores and parent education. For total day MVPA and MET-weighted MVPA, covariance parameter estimates for between-school variation represented approximately 8% of the variance in the models. For After-School MVPA and MET-weighted MVPA, covariance parameter estimates for between-school variance represented 0 to 3% of the variance in the models. For Evening MVPA and MET-weighted MVPA, covariance parameter estimates for between-school variance represented 8%–9% of the variance in the models.

Because some children had values of zero for the MVPA variables, all dependent variables were square root transformations of MVPA values. Separate models were run for MVPA and MET-weighted MVPA. Since our parent-reported data on parent support came from mothers, we tested separate models for boys and girls to explore the possibility of different associations between mothers’ support and boys’ and girls’ PA, respectively. An interaction term between mothers’ and children’s perceptions of parental support was also tested. If the interactions were not significant, the term was removed from the models.

RESULTS

Descriptive characteristics (proportions or means and standard deviations) of the children are presented in Table 1. The mean age was 10.6 years (SD=0.5). The mean BMI was 21.1 kg/m^2 (SD=5.0); based on national growth charts (Kuczmarski et al., 2000), 47% of the children had a BMI at or above the 85^{th} percentile (“overweight”), and 29% had a BMI at or above the 95^{th} percentile (“obese”). Overall, children averaged 2.9 minutes per hour of MVPA (SD=1.8) and 16.0 minutes per hour of MET-weighted MVPA. Only 11% of children met the daily physical activity guideline of 60 minutes per day of moderate or vigorous physical activity (U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2008).

Table 2 presents means and standard deviations for mothers’ and children’s accounts of parental support for PA for individual items and for the composite scores. Overall, both mothers and children reported moderate levels of parental support, with means ranging from 2.8–3.8 among children, which corresponds to response values from “sometimes” to “almost daily” on the children’s response scale, and means ranging from 2.5–3.5 among mothers, which corresponds to values from “1–2 days” to “3–4 days” on the parents’ response scale.

The mean composite score for child-reported support for children's physical activity was 3.4 (SD=1.0), and the mean composite score for mother-reported parental support was 2.9 (SD=0.8). There were no significant differences in child-reported or mother-reported means between boys and girls.

Table 3 displays the proportions of children and mothers reporting almost daily or daily parental support for PA, as well as the consistency between children's and mothers' accounts of parental support for PA. Accounts of nearly daily or daily parental support varied considerably across both children (30%–63%) and mothers (17%–48%); nonetheless, accounts within mother-child dyads were moderately consistent (57%–66%). There were significant gender differences for both children's and mothers' reports of one type of parental support for PA watching the child engage in PA, with greater support reported for male children than for female children.

Table 4 presents the results of regression models estimating the separate associations of mothers' and children's perceptions of parental support with MVPA, separately for Total MVPA, After-School MVPA, and Evening MVPA, controlling for age, BMI, race, and parent education along with corresponding models for MET-weighted MVPA. Models were run separately for males and females. With mothers' perceptions of parental support also in the models, children's perceptions of parental support were not significantly associated with MVPA in any of the models. In contrast, among both males and females, mothers' perceptions of support had modest positive associations with Total MVPA (β=0.14 for males; β=0.07 for females) and Total MET-weighted MVPA (β=0.31 for males; β=0.16 for females). Mothers' perceptions of support were positively associated with After-School MVPA (β=0.19 for males; β=0.08 for females) and After School MET-weighted MVPA (β=0.42 for males; β=0.22 for females). Likewise, among males and females, mothers' perceptions of support were positively associated with Evening MVPA (β=0.19 for males; β=0.10 for females) and Evening MET-weighted MVPA (β=0.56 for males; β=0.31 for females). No interaction effects between mothers' and children's perceptions of parental support were detected. Although mothers' support for PA was significantly associated with PA for both genders across the three time periods, it is noteworthy that the associations between mothers' perceptions of support and the dependent variable were consistently about twice as strong for males as for females. Also interesting is a comparison of the results for MVPA and MET-weighted MVPA. In every case, parameter estimates were stronger for MET-weighted MVPA

DISCUSSION

This study examined levels of agreement between children's and mothers' perceptions of parental support for children's physical activity and the associations of these perceptions with objectively-measured children's physical activity among 5th grade students and their mothers. We found consistency between children's and mothers' perceptions of parental support to be moderate, with over half of mother-child dyads providing consistent accounts of support for children's PA. Yet, associations of mothers' and children's perceptions of parental support with children's physical activity levels revealed that mothers' perceptions

of parental support, not children's perceptions of that support nor the interaction between mothers' and children's perceptions, were associated with children's physical activity levels.

Mothers' accounts of their support for their children's physical activity were associated with Total MVPA, After-School MVPA and Evening MVPA among both boys and girls, with stronger associations for boys than for girls and stronger associations for MET-weighted MVPA than for MVPA without intensity-weighting. Given the design limitations of this analysis, it is not clear whether these gender patterns reflect stronger influences of parents for boys, or stronger influences of mothers in particular for boys. Moreover, there may be competing influences on girls' PA that are not fully reflected in this analysis. Future studies might examine whether the gender differences in the influence of parental support for PA on children's PA are artifacts of gender differences in patterns of children's PA activities or differences in the influence of support from same sex versus opposite sex parents.

Our findings of stronger associations for MET-weighted MVPA than for non-MET-weighted MVPA should be considered in light of their implications for children's health status. The non-MET-weighted MVPA measure provides a parsimonious measure of activity, whereas MET-weighted MVPA offers a more fine-grained measure that differentiates between moderate and vigorous PA. Given previous evidence that vigorous PA is important for reducing cardiometabolic risk factors in youth (Hay et al., 2012), stronger associations between parent support and MET-weighted MVPA underscore the potential role of parent support for PA in children's cardiometabolic risk trajectories.

This study appears to be the first to examine the relationships of mothers' and children's perceptions of parental support for physical activity with objectively-measured physical activity. Our results diverge from those of the one previous study that found child perceptions of parental support to be more strongly associated with children's self-reported physical activity than parent perceptions of that same support (Barr-Anderson et al., 2010). Two possible explanations for this contrasting pattern of results relate directly to strengths of this study. First, this study utilized accelerometers to obtain objective measures of physical activity rather than relying on self-reported measures of behavior. Thus, our key constructs – mothers' accounts of parental support, children's perceptions of parental support, and children's physical activity – relied upon measures from distinct observers (i.e., mothers' report, children's report, and accelerometry), thereby reducing the likelihood of spurious associations that might result from common measurement methods.

Another key difference between our study and previous studies relates to the size and generalizability of our sample. Not only was our sample considerably larger than the most salient previous study (Barr-Anderson et al., 2010), but also our sample was recruited from 21 schools specifically for participation in a observational study, whereas the previous study was based on a sample recruited for participation in an intervention program, which may have introduced additional layers of selection bias.

Despite the strengths of our study, our conclusions are limited by the cross-sectional nature of the study. While our measurements technically represent only a snapshot of mothers' and children's perceptions and one week of children's physical activity, our study design did

employ strategies to ensure that the data collected were representative of a typical week for each mother-child dyad. Also, the fact that most parent surveys were completed by mothers precludes our ability to examine the dynamics of parental support for physical activity in same sex vs. opposite sex parent-child dyads. Future research should consider these factors and whether gender differences exist in the types of support that parents provide.

This study provides strong evidence of a positive association between maternal support and children's PA. These findings highlight the need to understand how such influences operate as children navigate the transition to adolescence. Our finding that mothers' support is most strongly associated with children's physical activity among boys after school and during the evening is not surprising, given substantially lower levels of After-School and Evening PA among girls as compared to boys, as well as less variability among girls. These findings are consistent with previous investigations of gender differences in levels of PA among children and adolescents (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008); at the same time, they do raise questions for future research related to gender differences in patterns of physical activity and methods of parental support during these times of day.

The findings of this study have important implications for health care providers concerned with preventing child and/or adolescent obesity. As noted in a recent *Cochrane for Clinicians* review (Saguil & Stephens, 2012), participation in physical activity programs by children up to 12 years of age has been significantly associated with lower BMI. The review concluded that parents should be encouraged to make use of structured recommendations such as those in the Physical Activity Guidelines for Americans Midcourse Report (U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2008). That parental support was associated with objectively-measured PA among children highlights the potential value of informing parents about the role that their support can play in promoting PA. While parents are likely to be aware that they can influence their children's PA through instrumental supports, such as modeling of healthy behaviors or providing transportation, they may be less well aware that less active forms of support, such as encouragement and even watching their children engage in PA, can influence their children's PA. Health care providers have valuable opportunities to discuss these issues with parents in the context of their broader dialog about health issues, and they can serve as highly respected channels of communication for such information.

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Abbreviations

BMI	body mass index
MET	metabolic equivalent
MVPA	moderate-to-vigorous physical activity
PA	physical activity

References

Anderssen N, Wold B. Parental and peer influences in leisure-time physical activity in young adolescents. Research Quarterly for Exercise and Sport. 1992; 63(4):341–348. http://doi.org/10.1080/02701367.1992.10608754. [PubMed: 1439157]

Barr-Anderson DJ, Robinson-O'Brien R, Haines J, Hannan P, Neumark-Sztainer D. Parental report versus child perception of familial support: which is more associated with child physical activity and television use? Journal of Physical Activity & Health. 2010; 7(3):364–368. [PubMed: 20551493]

Bauman A, Phongsavan P, Schoeppe S, Owen N. Physical activity measurement- a primer for health promotion. Health Promotion & Education. 2006; 13(2):92–103. http://doi.org/10.1177/10253823060130020103. [PubMed: 17017286]

Beck KH, Shattuck T, Haynie D, Crump AD, Simons-Morton B. Associations between parent awareness, monitoring, enforcement and adolescent involvement with alcohol. Health Education Research. 1999; 14(6):765–775. http://doi.org/10.1093/her/14.6.765. [PubMed: 10585384]

Beets MW, Cardinal BJ, Alderman BL. Parental social support and the physical activity-related behaviors of youth: a review. Health Education & Behavior : The Official Publication of theSociety for Public Health Education. 2010; 37(5):621–644. http://doi.org/10.1177/1090198110363884.

Bornstein, MH.; Bradley, RH. Socioeconomic Status, Parenting, and Child Development. New York: Routledge; 2014.

Bornstein, MH.; Hahn, C-S.; Suwalsky, JTD.; Haynes, OM. Socioeconomic status, parenting and child development: The Hollingshead four-factor index of social status and the economic index of occupations. In: Bornstein, MH.; Bradley, R., editors. Socioeconomic status, parenting and child development. Lawrence Erlbaum Associates; 2003. p. 29-82.

Carlston DL, Ogles BM. Age, gender, and ethnicity effects on parent-child discrepancy using identical item measures. Journal of Child and Family Studies. 2009; 18(2):125–135. http://doi.org/10.1007/s10826-008-9213-2.

Chang L, Krosnick JA. Measuring the frequency of regular behaviors: Comparing the "typical week" to the "past week. Sociological Methodology. 2003; 33:55–80.

Chuang YC, Ennett ST, Bauman KE, Foshee VA. Relationships of adolescents' perceptions of parental and peer behaviors with cigarette and alcohol use in different neighborhood contexts. Journal of Youth and Adolescence. 2009; 38(10):1388–1398. http://doi.org/10.1007/s10964-009-9424-x. [PubMed: 19779814]

Craggs C, Corder K, Van Sluijs EMF, Griffin SJ. Determinants of change in physical activity in children and adolescents: A systematic review. American Journal of Preventive Medicine. 2011; 40(6):645–658. http://doi.org/10.1016/j.amepre.2011.02.025. [PubMed: 21565658]

Davison KK. Activity-Related Support From Parents, Peers, and Siblings and Adolescents ' Physical Activity: Are There Gender Differences ? Journal of Physical Activity and Health. 2004; 1(4):363–376.

Davison KK, Cutting TM, Birch LL. Parents' activity-related parenting practices predict girls' physical activity. Medicine and Science in Sports and Exercise. 2003; 35(9):1589–1595. http://doi.org/10.1249/01.MSS.0000084524.19408.0C. [PubMed: 12972881]

DiClemente RJ, Wingood GM, Crosby R, Sionean C, Cobb BK, Harrington K, Oh MK. Parental monitoring: association with adolescents' risk behaviors. Pediatrics. 2001; 107(6):1363–8. [PubMed: 11389258]

Dowda M, Dishman RK, Pfeiffer KA, Pate RR. Family support for physical activity in girls from 8th to 12th grade in South Carolina. Preventive Medicine. 2007; 44(2):153–9. http://doi.org/10.1016/j.ypmed.2006.10.001. [PubMed: 17157371]

Ennett ST, Bauman KE, Foshee VA, Pemberton M, Hicks KA. Parent-child communication about adolescent tobacco and alcohol use: What do parents say and does it affect youth behavior? Journal of Marriage and Family. 2001; 63(1):48–62. http://doi.org/10.1111/j.1741-3737.2001.00048.x.

Fogelholm M, Nuutinen O, Pasanen M, Myöhänen E, Säätelä T. Parent-child relationship of physical activity patterns and obesity. International Journal of Obesity and Related Metabolic Disorders :

Journal of the International Association for the Study of Obesity. 1999; 23(12):1262–1268. http://doi.org/10.1038/sj.ijo.0801061.

Franzini L, Elliott MN, Cuccaro P, Schuster M, Gilliland MJ, Grunbaum JA, Tortolero SR. Influences of physical and social neighborhood environments on children's physical activity and obesity. American Journal of Public Health. 2009; 99(2):271–278. http://doi.org/10.2105/AJPH.2007.128702. [PubMed: 19059864]

Freedson PS, Evenson S. Familial aggregation in physical activity. Research Quarterly for Exercise and Sport. 1991; 62(4):384–389. http://doi.org/10.1080/02701367.1991.10607538. [PubMed: 1780560]

Freedson PS, Pober D, Janz KF. Calibration of accelerometer output for children. Medicine and Science in Sports and Exercise. 2005; 37 http://doi.org/10.1249/01.mss.0000185658.28284.ba.

Gaylord, NK.; Kitzmann, KM.; Coleman, JK. Parents' and Children's Perceptions of Parental Behavior: Associations with Children's Psychosocial Adjustment in the Classroom. Parenting. 2003. http://doi.org/10.1207/S15327922PAR0301_02

Gottlieb NH, Chen MS. Sociocultural correlates of childhood sporting activities: Their implications for heart health. Social Science and Medicine. 1985; 21(5):533–539. http://doi.org/10.1016/0277-9536(85)90037-1. [PubMed: 4049022]

Gregson JF, Colley A. Concomitants of sport participation in male and female adolescents. International Journal of Sport Psychology. 1986; 17(1):10–22.

Hay J, Maximova K, Durksen A, Carson V, Rinaldi RL, Torrance B, McGavock J. Physical activity intensity and cardiometabolic risk in youth. Archives of Pediatrics & Adolescent Medicine. 2012; 166(11):1022–9. http://doi.org/10.1001/archpediatrics.2012.1028. [PubMed: 22965682]

Hoefer WR, McKenzie TL, Sallis JF, Marshall SJ, Conway TL. Parental provision of transportation for adolescent physical activity. American Journal of Preventive Medicine. 2001; 21(1):48–51. http://doi.org/10.1016/S0749-3797(01)00314-2. [PubMed: 11418257]

Hoff E, Laursen B, Bridges K. Measurement and Model Building in Studying the Influence of Socioeconomic Status on Child Development. The Cambridge Handbook of Environment in Human Development. 2012:590–606.

Jackson C, Henriksen L, Dickinson D. Alcohol-specific socialization, parenting behaviors and alcohol use by children. Journal of Studies on Alcohol. 1999; 60(3):362–367. [PubMed: 10371264]

Komro, KA.; McCarty, MC.; Forster, JL.; Blaine, TM.; Chen, V. Parental, family, and home characteristics associated with cigarette smoking among adolescents. American Journal of Health Promotion. 2003. http://doi.org/10.4278/0890-1171-17.5.291

Komro KA, Perry CL, Williams CL, Stigler MH, Farbakhsh K, Veblen-Mortenson S. How did Project Northland reduce alcohol use among young adolescents? Analysis of mediating variables. Health education research. 2001; 16

Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, Flegal KM, Guo SS, Wei R, Johnson CL. CDC growth charts: United States. Advance Data. 2000; (314):1–27. [PubMed: 11183293]

Mcguire MT, Hannan PJ, Neumark-Sztainer D, Cossrow NHF, Story M. Parental correlates of physical activity in a racially/ethnically diverse adolescent sample. Journal of Adolescent Health. 2002; 30(4):253–261. http://doi.org/10.1016/S1054-139X(01)00392-5. [PubMed: 11927237]

Moore LL, Lombardi DA, White MJ, Campbell JL, Oliveria SA, Ellison RC. Influence of parents' physical activity levels on activity levels of young children. The Journal of Pediatrics. 1991; 118(2):215–219. http://doi.org/10.1016/S0022-3476(05)80485-8. [PubMed: 1993947]

Nader PR, Bradley RH, Houts RM, McRitchie SL, O'Brien M. Moderate-to-vigorous physical activity from ages 9 to 15 years. JAMA : The Journal of the American Medical Association. 2008; 300(3):295–305. http://doi.org/10.1016/S0162-0908(08)79321-8. [PubMed: 18632544]

Prochaska JJ, Rodgers MW, Sallis JF. Association of parent and peer support with adolescent physical activity. Research Quarterly for Exercise and Sport. 2002; 73(2):206–210. http://doi.org/10.1080/02701367.2002.10609010. [PubMed: 12092896]

Saguil A, Stephens M. Interventions to prevent childhood obesity. American Family Physician. 2012; 86(1):30–32. [PubMed: 22962910]

Sallis JF, Alcaraz JE, McKenzie TL, Hovell MF, Kolody B, Nader PR. Parental behavior in relation to physical activity and fitness in 9-year-old children. American Journal of Diseases of Children (1960). 1992; 146(11):1383–8. [PubMed: 1415081]

Sallis JF, Prochaska J, Taylor W. A review of correlates of physical activity of children and adolescents. Medicine and Science in Sports and Exercise. 2000; 32(5):963–975. http://doi.org/10.1097/00005768-200005000-00014. [PubMed: 10795788]

Sallis JF, Taylor WC, Dowda M, Freedson PS, Pate RR. Correlates of vigorous physical activity for children in grades 1 through 12: Comparing parent-reported and objectively measured physical activity. Pediatric Exercise Science. 2002; 14:30–44.

SAS Institute. SAS, Version 9.3. Cary, NC: 2011.

Sessa FM, Avenevoli S, Steinberg L, Morris AS. Correspondence among informants on parenting: preschool children, mothers, and observers. Journal of Family Psychology : JFP :Journal of the Division of Family Psychology of the American Psychological Association (Division 43). 2001; 15(1):53–68. http://doi.org/10.1037/0893-3200.15.1.53.

Simons-Morton BG. Prospective analysis of peer and parent influences on smoking initiation among early adolescents. Prevention Science. 2002; 3(4):275–283. http://doi.org/10.1023/A:1020876625045. [PubMed: 12465590]

Stucky-Ropp RC, DiLorenzo TM. Determinants of exercise in children. Preventive Medicine. 1993; 22(6):880–889. http://doi.org/10.1006/pmed.1993.1079. [PubMed: 8115345]

Trost SG, Kerr LM, Ward DS, Pate RR. Physical activity and determinants of physical activity in obese and non-obese children. International Journal of Obesity and Related Metabolic Disorders : Journal of the International Association for the Study of Obesity. 2001; 25(6):822–829. http://doi.org/10.1038/sj.ijo.0801621.

U.S Census Bureau. State and County Quick Facts: York County. 2015. Retrieved July 20, 2015, from http://quickfacts.census.gov/qfd/states/45/45091.html

U.S. Census Bureau. State and County Quick Facts: Sumter County. 2015. Retrieved July 20, 2015, from http://quickfacts.census.gov/qfd/states/45/45085.html

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, N. C. for C. D. P. and H. P. Physical Activity Guidelines for Americans. 2008. Retrieved June 22, 2015, from http://www.health.gov/paguidelines/guidelines/#toc

Vilhjalmsson R, Thorlindsson T. Factors related to physical activity: a study of adolescents. Social Science & Medicine (1982). 1998; 47(5):665–75. [PubMed: 9690849]

Wold B, Anderssen N. Health promotion aspects of family and peer influences on sport participation. International Journal of Sport Psychology. 1992; 23(4):343–359.

Table 1

Characteristics of 5th Grade Boys and Girls by Period of Day[a] Physical Activity

	Total Sample (n=994)[b]	Analysis Sample (N=693)	Male (N=311)	Female (N=382)
Age (years)	10.6 (0.5)	10.6 (0.5)	10.6 (0.5)	10.6 (0.5)
BMI (kg/m^2)	21.2 (4.9)	21.1 (5.0)	20.8 (4.9)	21.4 (5.0)
BMI z-score	0.89 (1.1)	0.89 (1.1)	0.87 (1.1)	0.91 (1.0)
Parental Education (> High school)	67.6%	68.0%	70.7%	65.7%
Race/Ethnicity				
Black	35.2%	34.0%	37.6%	31.1%
Hispanic	11.3%	10.6%	10.9%	10.3%
Other	17.1%	16.5%	15.8%	17.1%
White	36.4%	38.9%	35.7%	41.6%
Total MVPA (min/hr)	2.9 (1.7)	2.9 (1.8)	3.8 (2.1)	2.2 (1.1)*
After school MVPA (min/hr)	3.5 (2.8)	3.4 (2.9)	4.6 (3.4) [c]	2.5 (1.9)*[d]
Evening MVPA (min/hr)	3.3 (3.1)	3.3 (3.1)	4.4 (3.7)[e]	2.5 (2.0)*[f]
MET-weighted MVPA (min/hr)	15.9 (10.9)	16.0 (11.5)	20.9 (13.9)	12.1 (7.0)*
MET-weighted After school MVPA (min/hr)	20.2 (20.1)	20.1 (20.7)	27.2 (25.7)[c]	14.4 (13.2)*[d]
MET-weighted Evening MVPA (min/hr)	20.6 (23.0)	20.9 (23.5)	27.6 (28.9)[e]	15.5 (16.3)*[f]

Statistics are means (SD) unless denoted as a percentage.

*Gender differences were significant with $p<0.05$.

[a]Total day MVPA was based on all accelerometer data; after school MVPA was based on data for the time period from the end of the school day (2:25p.m.) until 6:00p.m. on weekdays; evening MVPA was based on data for the time period from 6:00pm until 10:00p.m.

[b]994 children in the original sample of 1083 study participants (92%) provided PA data; of those 693 (70%) provided adequate data on independent variables to be included in this analysis.

[c]The mean for afterschool MVPA among males was based upon the 302 males who met criteria for accelerometer wear time during the after school time period.

[d]The mean for afterschool MVPA among females was based upon the 378 females who met criteria for accelerometer wear time during the after school time period.

[e]The mean for evening MVPA among males was based upon the 273 males who met criteria for accelerometer wear time during the evening time period.

[f]The mean for evening MVPA among females was based upon the 338 females who met criteria for accelerometer wear time during the evening time period.

Table 2

Means (SD) for Mother-Reported and 5th Grade Child-Reported Parental Support Items and Composite Scales

	Children's Report [a] (n=693)			Mothers' Report[b] (n=693)		
	Total	**Boys (n=311)**	**Girls (n=382)**	**Total**	**Mothers of Boys (N=311)**	**Mothers of Girls (N=382)**
Individual Items						
Encourage PA	3.8 (1.2)	3.8 (1.2)	3.8 (1.1)	3.5 (1.1)	3.6 (1.1)	3.4 (1.1)*
Play outside/do PA	2.8 (1.3)	2.7 1.3)	2.9 (1.3)	2.6 (1.0)	2.6 (1.0)	2.5 (1.0)
Provide Transportation	3.4 1.3)	3.4 (1.4)	3.4 (1.4)	2.5 (1.1)	2.6 (1.1)	2.5 (1.1)
Watch child be physically active	3.4 (1.3)	3.5 (1.3)	3.3 (1.2)	2.8 (1.1)	3.0 (1.1)	2.7 (1.1)*
Composite Score	3.4 (1.0)	3.4 (1.0)	3.3 (0.9)	2.9 (0.8)	2.9 (0.8)	2.8 (0.8)*

*There were significant differences ($p < .05$) between means for males and females.

[a]The response scale for child-reported parental support was a five-point scale representing how often during a normal week, the adult engaged in the particular form of support. Response options ranged from "None" (0) to "Daily" (4).

[b]The response scale for parent-reported parental support was a five-point scale representing the number of days during a typical week during which the adult engaged in the particular form of support. Anchors for the response scale were "0 days" and "7 days".

Table 3

Consistency[a] Between Child-Reported and Mother-Reported Parental Support Within Mother-Child Dyads for Total Sample and by Child's Gender

	Total Sample (N=693)			Males (N=311)			Females (N=432)		
Perceived Parental Support	**Child**	**Mother**	**Consistency[a]**	**Child**	**Mother**	**Consistency**	**Child**	**Mother**	**Consistency[a]**
Encourage PA	62.5%	47.5%	65.4%	64.0%	51.5%	65.6%	61.3%	44.2%	65.2%
Play outside/do PA	30.0%	17.2%	66.4%	29.6%	19.0%	63.3%	30.4%	15.7%	68.9%
Provide Transportation	48.2%	17.8%	56.7%	50.8%	20.3%	55.3%	46.1%	15.7%	57.9%
Watch child be physically active	48.8%	25.0%	62.2%	55.0%	29.3%	57.2%	43.7%*	21.5%*	66.2%

*There were significant differences ($p < .05$) between proportions for males and females.

[a]Responses were considered to be consistent if they differed by no more than one increment on our 5-point response scales.

Table 4

Regression Analyses[a] (coefficients and 95% Confidence Intervals) for Associations of Mother-Reported & Child-Reported Parental Support for PA with Square Root Transformed MVPA Variables, By Period of Day and Child's Gender

	Total Day			
	MVPA		**MET-weighted MVPA**	
	Males	**Females**	**Males**	**Females**
Parent Perceptions of Parental Support	**0.14 (0.08–0.20)**	**0.07 (0.03–0.11)**	**0.31 (0.13–0.49)**	**0.16 (0.04–0.28)**
Child Perceptions of Parental Support	0.003 (−0.06–0.06)	0.001 (−0.03–0.04)	0.01 (−0.12–0.15)	−0.04 (−0.14–0.06)
	After School			
	MVPA		**MET-weighted MVPA**	
	Males	**Females**	**Males**	**Females**
Parent Perceptions of Parental Support	**0.19 (0.09–0.29)**	**0.08 (0.00–0.16)**	**0.42 (0.15–0.69)**	**0.22 (0.02–0.42)**
Child Perceptions of Parental Support	0.03 (−0.05–0.11)	−0.01 (−0.07–0.05)	0.18 (−0.06–0.42)	−0.05 (−0.21–0.11)
	Evening			
	MVPA		**MET-weighted MVPA**	
	Males	**Females**	**Males**	**Females**
Parent Perceptions of Parental Support	**0.19 (0.07–0.31)**	**0.10 (0.02–0.18)**	**0.56 (0.23–0.89)**	**0.31 (0.07–0.55)**
Child Perceptions of Parental Support	0.04 (−0.06–0.14)	0.04 (−0.04–0.12)	0.19 (−0.08–0.46)	0.07 (−0.13–0.27)

Statistically significant parameter estimates are bolded.

[a] All models control for age, BMI z-scores, race/ethnicity, and parent education.