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The Association of Self-Efficacy and Parent Social Support on Physical Activity in Male and Female Adolescents

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Abstract

Objective—Previous research has shown that cognitive factors may account for the relationship between interpersonal factors and health behaviors. Given these findings, the current study sought to further explore the direct and indirect relationship between parental social support and adolescent physical activity (PA).

Method—Data were collected from 1,421 sixth graders (73% African American, 54% females, 71% on free or reduced lunch) in South Carolina. Measures for emotional social support, instrumental social support, and adolescent self-efficacy (SE) were assessed and PA was assessed via accelerometry.

Results—Parent instrumental social support was directly related to girls' PA and parent emotional social support was inversely related to girls' PA. Parent instrumental social support was indirectly related to boys' PA through boys' SE. The covaried association of SE with PA was significant for boys and marginal for girls.

Conclusions—SE for overcoming barriers may be an important construct for understanding the relationship between parent instrumental social support and boys' PA in underserved populations. The mechanisms for engaging in PA may be different for adolescent girls and boys.

Keywords

Physical activity; Adolescents; Social Support; Parents; Self-Efficacy

The lack of sufficient physical activity among youth is a major health concern nationally (Miller & Silverstein, 2007). Only 8% of adolescents are meeting the national guidelines of engaging in 60 minutes a day of moderate-to-vigorous physical activity (PA; Troiano et al., 2008). Youth of low socioeconomic status (SES) and African-Americans in particular, engage in less physical activity than their non-minority counterparts (Wilson et al., 2011) and there is a scarce amount of studies that have tested mediation to understand PA in these populations (Wilson & Kitzman-Ulrich, 2008). Previous research also shows that girls engage in fewer minutes of PA daily than boys (Trost et al., 2002). Interventions to increase PA are therefore crucial, and continuing to research possible underlying mechanisms could advance the field.

Mediation models may help investigators specify mechanisms that are effective in the delivery of PA interventions (Wilson, 2009). Social Cognitive Theory (Bandura, 1989) suggests that strong social support networks increase an individual's self-efficacy (SE) to overcome barriers to being physically active. Parent influence especially constitutes a major source of social support throughout a child's lifespan. According to socialization theory, parent influence has an effect on a youth's competency to engage in a specific behavior such as increasing PA (Bois, Sarrazin, Brustad, Trouilloud, & Cury, 2005; Eccles & Harold, 1991). Empirical research (van Suijs, McMinn, & Griffin, 2007) also supports the important

role of parents and family on increasing PA in youth. In an intervention for mothers with young children that emphasized social support and overcoming barriers to PA, SE mediated PA behavior change (Miller, Trost, & Brown, 2002). An intervention emphasizing parent support also mediated the relationship on adolescent PA through SE (Haerens et al., 2008). Taken together, these studies support investigating further how parent socialization of adolescent PA may be mediated through SE.

Parents can provide emotional social support for engaging in PA through providing encouragement and they can provide instrumental social support through offering tangible support such as transportation to PA events (Barrera, 1986). Previous research has shown that parent emotional and instrumental social support are positively associated with PA in youth (Duncan, Duncan, & Strycker, 2005; Heitzler, Martin, Duke, & Huhman, 2006). In a recent review by Beets and colleagues (2010) parent social support was also shown to be consistently positively associated with adolescent PA. However, further research is needed to understand what mechanisms may explain how parent social support influences PA in youth specifically.

SE for overcoming barriers to PA has been shown to be a significant mediator between PA interventions and adolescent PA engagement (Haerens et al., 2008). Past cross-sectional (Mottl, Dishman, Saunders, Dowda, & Pate, 2007) and longitudinal studies (Shields et al., 2008) support the role of SE as a mediator between family social influences (including support) and adolescent PA, though some researchers have shown inconsistent effects (Wu & Pender, 2002). Given the inconsistent evidence further research is needed to expand understanding of mechanisms, especially among underserved youth who are at high risk for inactivity.

Few studies have examined sex differences in understanding the role of SE and different types of social support in relation to PA. Wu and colleagues (2003) examined SE as a mediator between social influences (parent and peer emotional support, modeling, norms) and adolescent PA, and found the pathway between peer social influences and adolescent SE to be stronger for boys than girls, whereas the pathway between SE and PA was similar for boys and girls. Parent social influences were not related to PA directly or indirectly through SE. Other research shows that SE relates stronger to boys' PA than girls' PA (DiLorenzo, Stucky-Ropp, Vander Wal, & Gotham, 1998) and that girls report more barriers to being physically active than boys (Cardon et al., 2005). Given these sex difference in SE and PA, it is important to better understand how boys and girls may differ in the types of social support that may influence their daily regulation and self-efficacy for engaging in PA.

Boys and girls also may demonstrate different preferences for certain types of social support. For example, Belle (1987) reports that social relationships of females are more dyadic, exclusive, intimate and self-disclosing than those of males. This preference for verbal discussion and support may be indicative of emotional social support having a more important role for girls than boys, due to the differences in socialization of sex roles. Choquet and colleagues (2008) found that a lack of general parent emotional support was associated with a high risk for drug use among girls but not boys. Another study demonstrated that under stress, boys showed less physiological arousal with instrumental social support compared to emotional social support, but not for girls (Wilson, Kliever, Bayer et al, 1999). This suggests that boys tend to react more negatively to emotional social support than girls.

Findings from past studies have been mixed regarding which type of social support is more strongly related to adolescent PA in boys as compared to girls. One study showed that family emotional social support was positively associated with PA for boys, but not for girls

(McGuire et al., 2002). This contradicts a study among adolescent females, showing that family encouragement was significantly related to girls' PA (Springer et al., 2006). Clearly, more studies are needed that investigate how specific types of social support may influence PA differentially in boys versus girls. Results from another study demonstrated that mothers' logistical support (e.g. transportation) and fathers' explicit modeling were positively associated with girls' PA (Davison, Cutting, & Birch, 2003). Other investigators found that parent transportation to sports activities was significantly related to girls' and boys' PA, but this relationship was stronger in girls (Hoefler, McKenzie, Sallis, Marshall, & Conway, 2001). Taken together these studies suggest that there may be sex differences in the relation between parent social support and adolescent PA, though there are inconsistencies. Examining the role of indirect effects may help clarify these discrepancies.

The present study expands on past research by investigating the unique contribution of instrumental and emotional social support on adolescent PA. In particular, this study examined boys and girls separately to clarify potential differences in direct and indirect relationships between social support, SE and adolescent PA. A recent review (Gustafson & Rhodes, 2006) noted that few previous studies have used objective measures of PA, therefore the present study's use of accelerometry is a major strength. Furthermore, little is known about minority populations and PA (Van der Host, Paw, Twisk, & Van Mechelen, 2007). De Bourdeaudhuij and Sallis (2002) suggested that more studies are necessary to gain a consensus on the role that different types of social support have on promoting PA among minority groups.

Based on previous research, it was hypothesized that adolescent SE for overcoming barriers would account for the relationship between parent social support (emotional and instrumental) and adolescent PA across boys and girls. In addition, given that boys and girls are socialized to seek out and respond differentially to emotional and instrumental support, it was hypothesized that emotional social support would have stronger direct and indirect effects on PA for girls than boys and that instrumental social support would have stronger direct and indirect effects on PA for boys than girls. Furthermore, given previous empirical findings it was hypothesized that the relationship between SE and PA would be stronger in boys than girls.

Method

Participants

Sixth grade students (ages 10–14 years) in South Carolina participated in baseline assessments as part of the Active by Choice Today (ACT) randomized controlled trial testing the efficacy of a motivational and behavioral skills intervention on increasing PA (Wilson, et al., 2008; Wilson et al., 2011). Adolescents were excluded if they 1) had a medical condition that interfered with PA, 2) were developmentally delayed such that the intervention materials were not cognitively appropriate or, 3) were currently in treatment for a psychiatric disorder. Students volunteered to participate in the afterschool program. The current study used baseline data that were obtained prior to randomization from students who participated in ACT (N=24 schools; schools were the unit of randomization). The target population was all sixth grade students at the 24 schools (n=2,500–3,000 students), of which 1,563 were deemed eligible and 1,422 participated (16 did not meet inclusion criteria, 55 refused to participate, 9 moved, 60 alternates, 1 other reason). Not all eligible students participated in ACT, given other afterschool activities. Therefore, 91% of the students from those eligible to participate were recruited. Our final sample was representative of the target population in terms of race and income distribution. The sixth graders in the study were 73% African American (compared to 69% African-American of all the sixth graders at the 24 participating schools), 54% females (compared to 52%), 71% on free or reduced lunch

(compared to 67%). The study was approved by the University of South Carolina Institutional Review Board. All parents/guardians completed an informed consent form, and all adolescents completed an assent form prior to participating.

Procedure

Measures were collected by trained staff and included demographic and psychosocial surveys, height, weight, waist circumference, and 7-day accelerometer estimates of PA. Participants received a \$5 incentive for completing the assessment.

Psychosocial Measures

Psychometrics—A measurement model was performed to evaluate the psychometrics of the survey instruments. All measures were run within one model specifying different factors for emotional social support, instrumental social support, and SE. Analyses were conducted in Mplus version 6 using the WLSMV estimator (Flora & Curran, 2004). Boys and girls were constrained to be equal on all measures, assuming measurement invariance, and the model fit for all measures included simultaneously was good ($\chi^2(464) = 691.6$; $p < .001$; CFI = .97; TLI = .97; RMSEA = .03), based on guidelines by Hu and Bentler (1999; CFI = .95, TLI = .95 and RMSEA = .06). To examine specific hypothesized sex differences, another model was run which allowed three parameters to vary by sex (the *a* paths for emotional social support and instrumental social support and the *b* path for SE). This model also demonstrated good fit ($\chi^2(461) = 697.3$; $p < .001$; CFI = .97; TLI = .97; RMSEA = .03). Distributions for all independent variables were approximately normal, providing support for underlying model assumptions and evidence of even spread across variables for the scales. The social support variables accounted for 21.5% of the variance (measured by R^2 values) in boys' SE and 20.1% of the variance in girls' SE. Both social support types and SE accounted for 8.5% of the variance in boys' PA and 6.6% of the variance in girls' PA.

Emotional social support—Parent emotional social support for PA was measured using a 12-item modified version of the Support for Exercise Scales (Sallis et al., 1987). An example item was “In the past month, how often has your parent or another adult you live with talked about being active with you?” Adolescents' responded to a three-point scale from 1 (*None*) to 3 (*Many times*). In the original measure, six items were positively worded and six items were negatively worded. For this study, negatively-worded items were dropped. Previous studies demonstrate that negative items, when reverse-coded, may introduce a method bias (Lawman, Wilson, Van Horn, Resnicow, & Kitzman-Ulrich, 2011). Standardized factor loadings ranged from .61–.81, and examination of the item residuals revealed only one standardized residual over .20. Cronbach's alpha values indicated adequate reliability of this modified scale overall ($\alpha = .80$), and across boys ($\alpha = .81$) and girls ($\alpha = .79$). Emotional social support was significantly correlated with SE ($r = .29$, $p < .01$), and instrumental social support ($r = .52$, $p < .01$).

Instrumental social support—A four-item measure developed by Williams (2004) was used to assess perceived instrumental social support from family. An example item was “How often in the past month did people in your family buy you games, balls, etc. for physical activity?” Responses ranged from 1 (*Not at all*) to 3 (*About every day*). Standardized factor loadings ranged from .60–.77, and no problems were found from examination of the item residuals. Cronbach's alpha values reliabilities were $\alpha = .67$ for boys and $\alpha = .75$ for girls. Instrumental support was significantly correlated with SE ($r = .33$, $p < .01$), emotional social support ($r = .52$, $p < .01$), and PA ($r = .12$, $p < .01$).

Self-efficacy for overcoming barriers—SE was measured using the Efficacy for Exercise Behavior Scale by Sallis et al. (1988), adapted for use with a sixth grade sample. A

10-item scale was used with response categories ranging from 1 (*A little sure*) to 3 (*Very sure*). An example item was “How sure are you that you can stick to your exercising when you’re feeling lazy?” One item was dropped as previous research showed it was not invariant across sex (Lawman, Wilson, Van Horn, & Resnicow, 2011). Standardized factor loadings ranged from .61–.81, and no problems were found from examination of the item residuals. This scale has been shown to have adequate internal consistency ranging from 0.85 to 0.93 (Sallis et al., 1988). Also, predictive validity for this scale has previously been demonstrated in African-American adolescents (Wilson et al., 2002). SE for overcoming barriers has good construct validity, as it has been correlated with another SE measure ($r=.71$; Saunders et al., 1997). Cronbach’s alpha values in the present study indicated adequate reliability of this scale in boys ($\alpha=.85$), and in girls ($\alpha=.86$).

Moderate-to-vigorous PA—Based on national recommendations (DHHS, 2009), adolescents should engage in 60 minutes of moderate-to-vigorous (MV) PA per day, thus the primary outcome for this study was MVPA. PA was assessed with omnidirectional Actical accelerometers (Mini-Mitter, Bend, OR). Actical has been shown to have moderate to high correlations between activity counts and energy expenditure of individuals measured concurrently by other empirically tested accelerometers (e.g., MTI Actigraph, Caltrac, Tritrac; Puyau, Adolph, Vohra, Zakeri, & Butte, 2004). The Actical was worn by participants, attached to a waistband, for seven consecutive days. Students data were considered missing for a given time period if they wore the accelerometer less than 80% of the time that 70% of the students wore their accelerometers (Catellier et al., 2005). Data were recorded in 1-minute epochs (Welk, Schaben, & Morrow, 2004) and raw activity data were converted into time spent in moderate PA (3–5.9 METS), vigorous PA (6–8.9 METS), and MVPA (3–8.9 METS) based on Actical-specific activity count thresholds for children identified by Puyau and colleagues (2004) where MVPA = 1,500 to < 6,500 and vigorous PA = > 6,500. Estimates of PA were combined for all seven days to provide one daily measure of PA for the data analyses.

Analysis Plan

Basic descriptive statistics were examined and then a mediation model was conducted, evaluating the direct effect of the two social support variables on PA and the indirect effect on PA via SE. While various methods have been proposed for estimating mediation, the commonly used causal steps method (Baron & Kenny, 1986) has been shown to have insufficient power to detect mediated effects (Fritz & MacKinnon, 2007). The product of coefficients approach has been recommended as the most suitable for complex models, while retaining sufficient power, if implemented with asymmetric confidence intervals (MacKinnon, Fairchild, & Fritz, 2007). Total, direct and indirect effects were estimated using structural equation modeling. Bias-corrected bootstrapped standard errors of the mediated effects were used to obtain asymmetric confidence limits for mediated effects. To test for differences in mediated effects across boys and girls, nested models were compared. As differences were expected between boys and girls in the effects of social support on SE and in the effects of SE on PA, each of these paths was tested individually (Fairchild & MacKinnon, 2009). In total, five models were run 1) fully constrained, 2) releasing only the emotional support *a* path, 3) releasing only the instrumental social support *a* path, 4) releasing only the *b* path, and 5) releasing all three paths. Test of sex differences were accomplished using chi-square difference tests in which each of these models was compared to the unconstrained model.

Missing data were dealt with using single imputation to provide unbiased parameter estimates and standard errors as proposed in a previous national trial (Catellier et al., 2005). Although not as rigorous as multiple imputation, single imputation is preferred to listwise

deletion and mean substitution (Cohen et al., 2003). A relatively small amount of data were missing; that is, 3% of all accelerometry data, 3% of demographic information, and 1% of psychosocial data. Since the rate of missing information was small (less than 5%; Schafer, 1999), single-imputation inferences were considered to be accurate.

The current analyses included BMI and race as covariates due to their relations with PA (Grieser et al., 2008). One participant with an extreme value of PA (over 8 hours daily) was removed as it is highly unlikely for a student to obtain this level of average daily PA across a week. As the current data contained a nested design, the sandwich estimators of standard errors were obtained, which account for clustering within schools.

Results

Descriptive Data

Demographic and baseline characteristics for the total sample and by sex are depicted in Table 1. Analyses of mean differences indicated that boys had higher levels of PA and SE, were older, and had lower BMI as compared to girls ($p < .01$ for all). Girls reported that they received higher levels of parent emotional social support compared to boys ($p < .05$).

Mediation Results

Total Effects—Given there were some significant differences across boys and girls, results are presented from the model where the two *a* pathways and the single *b* pathway were freely estimated by sex. The model showed good fit to the data ($\chi^2(461) = 697.3$; $p < .001$; CFI = .97; TLI = .97; RMSEA = .03). Results (see Table 2) for boys showed that emotional social support was not significantly associated with PA and instrumental social support was marginally significant with PA in the expected direction. Results for girls showed that emotional social support was significantly negatively associated with PA and instrumental social support was significantly positively associated with PA.

Indirect Effects—Results (see Figure 1 and Table 2) for boys showed that while there was no mediated effect of emotional social support on PA through SE, there was a significant mediated effect of instrumental social support on boys' PA through boys' SE. Results for girls showed that emotional social support did not significantly mediate the effect on PA through SE, but it was marginally significant in the expected direction. There was no significant mediated effect of instrumental social support on PA through SE for girls.

Direct Effects—Results (see Figure 1 and Table 2) for boys showed that after accounting for indirect effects, there were no direct effects of either emotional social support or instrumental social support on PA. For girls, there was a significant negative direct effect of emotional social support on PA and a significant positive effect of instrumental social support on PA that remained after accounting for SE.

Differences in Mediated Pathways across Boys and Girls—There were no significant differences in the *ab* pathways across sex ($\chi^2(3) = 5.54$, $p = .14$). There were significant differences between boys and girls in the effects of both emotional ($\chi^2(1) = 6.89$, $p < .01$) and instrumental ($\chi^2(1) = 5.13$, $p < .05$) social support on SE (the *a* paths). There was no significant difference in the effect of SE on PA ($\chi^2(1) = 0.43$, $p > .05$); the *b* path). Overall, this supports the hypothesis that the mediated effect is moderated by sex (Fairchild & MacKinnon, 2009). Table 3 displays the fit statistics across the five models that were tested.

Discussion

It was hypothesized in the current study that parent social support would have direct and indirect effects on adolescent PA. Adolescent SE for overcoming barriers was predicted to account for the relationship between parent social support (emotional and instrumental) and adolescent PA across boys and girls. The results of this study demonstrated that parent instrumental social support had a significant direct effect on adolescent PA only for girls, and not boys. SE for overcoming barriers to PA was shown to account for the relationship between parent instrumental social support and boys' PA. In addition, although it was hypothesized that the relationship between SE and PA would be stronger for boys than girls, as others have demonstrated (DiLorenzo et al., 1998) our findings showed similar relationships for underserved boys and girls. No effects for emotional support were found for boys, though a marginal mediated effect was demonstrated in girls through SE on girls' PA.

The results of this study showed a significant total effect of parent instrumental social on adolescent PA for underserved girls, but this effect was weaker and only marginally significant for boys. This result is somewhat consistent with Hoefer and colleagues (2001), who found that parent transportation to sports was more strongly associated with girls' PA than boys' PA. Other investigators have also found direct support for PA from parents and peers to be associated with girls' PA but not boys' PA (Frenn et al., 2005). The current study also suggests that when underserved adolescent girls receive parent instrumental social support, this may be associated with PA through other cognitive mediators that were not explored in the current study. Future research is needed to better understand why the relationships differ for boys as compared to girls.

For boys, it is possible that the indirect effect of instrumental social support on boys' PA had somewhat more power than the total effect. The relationship between instrumental social support and adolescent PA may differ across sex because of PA preferences. Some have found that boys report engagement in competitive sports whereas girls report a wide variety of PA activities such as dance and jumping rope (Wright, Wilson, Griffin, & Evans, 2010). Perhaps boys rely more on transportation to competitive sport activities, which in turn relates to an increase in boys' SE. In fact, the present study also demonstrated a stronger relationship between instrumental social support and adolescent SE in boys than girls. Maybe allowing the opportunity for activities in the house (e.g. dance music or jump ropes) may not relate as strongly to an increase in girls' SE, but still provides a direct outlet for girls' PA. Future researchers need to further examine PA preferences.

Parent instrumental social support was associated with a greater confidence to overcome PA barriers for boys and in turn was associated with increased PA. Results are consistent with research demonstrating that SE acts as an important mediator between social influences and adolescent PA (Motl et al., 2007; Trost et al., 2003; Wu et al., 2003). The current study expands on past research by demonstrating the importance of instrumental social support in the relation to adolescent PA among low-income and minority adolescents. The present study did not find a significant positive effect of emotional social support on adolescent PA in either boys or girls, which is inconsistent with some past findings (e.g. Frenn et al., 2005). However, the current study's findings are consistent with other studies (Prochaska, Rodgers, & Sallis, 2002; Wu & Pender, 2002) that did not find a significant relationship between parental emotional social support and adolescent PA. It is worth noting that these previous studies used self-reported PA to examine the relationship between emotional social support and adolescent PA, which has been shown to result in stronger effects in comparison to accelerometer estimates (Prochaska et al., 2002) as used in the current study. Also the current study was composed of low-income and primarily African-American adolescents

who are at increased risk for inactivity and whom have been understudied. Considering these findings within the context of this unique sample is important.

Parent emotional social support was associated with lower PA engagement in girls. Interestingly, once SE was taken into account, this relationship was slightly more negative and remained significant. This finding suggests a suppression effect (MacKinnon, Krull, & Lockwood, 2000) which indicates that perhaps emotional social support functions differently in underserved adolescent girls. Parent encouragement to be active may be perceived as forced or overbearing as has been reported in a previous study (Wright et al., 2010). The current study showed that for girls, being African-American or overweight was associated with lower SE for overcoming PA barriers. As this relationship was not demonstrated in boys, understanding PA in girls may require consideration of different mechanisms in underserved populations (Kitzman-Ulrich, Wilson, Van Horn, & Lawman, 2010). For instance, studies have demonstrated that in the African-American culture, girls have preferences for a heavy body type (Fitzgibbon, Blackman, & Avellone, 2000), which may influence their desire to be physically active. Future researchers need to consider other cognitive mediators associated with BMI, perceptions of weight status and risk of chronic disease, when examining the relation of parent emotional social support to girls' PA.

Taken together, this study highlights the importance of parent social support on engaging adolescents in PA. Overall, investigators have found social and cognitive variables to account for 10–25% of the variance in adolescent PA (Frenn et al., 2005; Robbins, Wu, Sikorskii, & Morley, 2008; Shields et al., 2008), and similarly, the current study found parent SS and SE to account for approximately 8% of the variance in adolescent PA. This suggests the importance of continuing to examine other variables to capture more of the variance accounting for adolescent PA. Although overall these effects are somewhat low in magnitude, they do begin to shed light on potential meditation relationships between support, SE and PA in underserved youth.

There were several limitations to the current study. Due to the cross-sectional nature of this study, results do not provide strong support for the causal mechanisms of PA. There are strong reasons to believe that the effects of parent support on SE and PA operate primarily in the hypothesized direction. Socialization theory specifies that external agents, such as parental influence, have an effect on an individual's competency to engage in a specific behavior, and that in turn influences PA (Bois et al., 2005; Eccles & Harold, 1991). Also, intervention studies have shown that changes in parental support lead to changes in PA (e.g., Haerens et al., 2008). However, there are also good reasons to believe that the relationship between social support and SE is bi-directional as proposed by Social Cognitive Theory (e.g., Davison, Downs, & Birch, 2006). There has been further evidence suggesting that SE moderates the relation between social support and adolescent PA (Dishman, Saunders, Motl, Dowda, & Pate, 2009). Results of the present study support the role of social support and SE in determining PA behavior in underserved boys and girls and indicate that these variables should be examined longitudinally and in interventions. The strong theoretical basis of this study allowed for clarification in the relationships between well-defined constructs. While the causal nature of the mechanisms for PA examined in this study are subject to further evaluation, the finding of sex differences in these mechanisms strongly suggests the need for additional work to evaluate differences between boys and girls in the causes of PA and the need for different intervention approaches.

Overall this study demonstrated that parent instrumental social support related to adolescent PA in both underserved boys and girls; and indirectly in boys through boys' SE to overcome PA barriers. Findings imply that parents should increase their instrumental social support to foster PA engagement. Further research is needed to develop intervention components that

address instrumental social support specifically related to increasing boys' SE. Specific strategies to capitalize on the relationship between instrumental social support and boys' SE might include shared decision making between parents and youth around which PA activities and resources are appealing to the adolescents. More longitudinal research still is needed to understand the mechanism that explains the relationship between parent instrumental social support and girls' PA. This will provide guidance on the content of parent interventions that aim to increase parent instrumental social support in parents of adolescent girls. Clarifying the role between social support, SE, adolescent PA will be useful in developing effective programs for increasing PA and reducing obesity in underserved adolescents.

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Figure 1.

Structural equation model of the direct and indirect effects of instrumental social support and emotional social support on moderate-to-vigorous physical activity

Note: Standardized parameters are given for with the value for boys on the left of the slash mark and the value for girls on the right of the slash from the unconstrained model ($\chi^2(461) = 697.3$; $p < .001$; CFI = .97; TLI = .97; RMSEA = .03). The total effect for boys' instrumental social support was $\beta = .13$, $p < .10$ and boys' emotional social support was $\beta = .09$, $p > .05$. The total effect for girls' instrumental social support was $\beta = .25$, $p < .01$. The total effect for girls' emotional support was $\beta = -.13$, $p < .01$. Significance values: * $p < .05$; ** $p < .01$; $^{\dagger} p < .10$. The measurement portion of the model and the residuals were excluded from the figure for clarity.

Table 1

Demographic, Baseline, and Psychosocial Characteristics by Sex

Variable	Total	Girls	Boys
Sample	1421	769	652
Waist	71.03 (12.42)	71.26 (12.38)	70.76 (12.47)
Age (yrs) **	11.34 (.59)	11.27 (.53)	11.43 (.64)
% Free/Reduced Lunch	71.4 (1015)	69.6% (454)	73.0% (561)
% African-American	73.3 (1042)	73.0% (476)	73.5% (566)
BMI (kg/m ²) **	22.82 (6.02)	23.30 (6.09)	22.32 (5.89)
% Overweight (kg/m ²)	51.58 (733)	52.02 (400)	51.19 (333)
MVPA [†] (min/day) **	43.05 (27.00)	35.61 (21.55)	51.83 (29.39)
Emotional social support *	1.90 (.52)	1.93 (.51)	1.87 (.52)
Instrumental social support	1.84 (.96)	1.80 (.93)	1.88 (.93)
SE for Barriers **	2.07 (.52)	2.02 (.53)	2.14 (.52)

Note. Values are expressed as means (standard deviations). Significance indicators display differences between girls and boys.

* $p < .05$.

** $p < 0.01$.

[†] Moderate to vigorous physical activity

Table 2

Results from the structural equation model of the direct and indirect effects of instrumental social support and emotional social support on moderate-to-vigorous physical activity.

Variable	B	SE	β	t	Lower CI	Upper CI
Boys						
Emotional social support (Total)	0.09	0.08	0.09	1.19	-0.06	0.24
Instrumental social support (Total)	0.25 [†]	0.15	0.13	1.68	-0.04	0.53
Emotional social support (Indirect)	0.00	0.01	0.00	-0.01	-0.01	0.01
Instrumental social support (Indirect)	0.06 [*]	0.03	0.03	2.13	0.01	0.12
Emotional social support (Direct)	0.09	0.07	0.09	1.23	-0.05	0.24
Instrumental social support (Direct)	0.18	0.16	0.10	1.17	-0.12	0.49
Emotional-self-efficacy	-0.001	0.06	0.24	-0.01	-0.13	0.13
Instrumental-self-efficacy	0.65 ^{**}	0.13	0.24	5.15	0.41	0.90
Self-Efficacy-MVPA	0.10 [*]	0.04	0.07	2.30	0.01	0.18
Girls						
Emotional social support (Total)	-0.08 ^{**}	0.03	-0.13	-2.65	-0.14	-0.03
Instrumental social support (Total)	0.24 ^{**}	0.05	0.25	4.45	0.13	0.33
Emotional social support (Indirect)	0.01 [†]	0.01	0.02	1.69	-0.01	0.03
Instrumental social support (Indirect)	0.02	0.01	0.02	1.51	-0.01	0.04
Emotional social support (Direct)	-0.09 ^{**}	0.03	-0.15	-2.97	-0.15	-0.04
Instrumental social support (Direct)	0.22 ^{**}	0.06	0.23	4.01	0.11	0.31
Emotional-self-efficacy	0.21 ^{**}	0.06	-0.01	3.41	0.09	0.34
Instrumental-self-efficacy	0.32 ^{**}	0.10	0.47	3.38	0.14	0.51
Self-Efficacy-MVPA	0.06 [†]	0.04	0.09	1.77	-0.01	0.13

Note:

^{*}
p < .05;

^{**}
p < .01;

[†] $p < .10$. The only paths allowed to vary by sex were the a paths and b path. Fit statistics for the fully constrained model were $\chi^2(464) = 691.6$; $p < .001$; CFI = .97; TLI = .97; RMSEA = .03. Fit statistics for the freely estimated a and b path model were $\chi^2(461) = 697.3$; $p < .001$; CFI = .97; TLI = .97; RMSEA = .03.

Table 3

Fit statistics for invariance testing of the motivation and self-efficacy for PA measures

Model	Chi-Square	DF	p value	CFI	TLI	RMSEA	Difference Test
Fully constrained	697.3	461	0.00	.97	.97	.03	--
Instrumental <i>a</i> path freed	700.9	462	0.00	.97	.97	.03	$\chi^2=5.13$ (1), $p=.02$
Emotional <i>a</i> path freed	703.2	462	0.00	.97	.97	.03	$\chi^2=6.89$ (1), $p=.01$
Self-Efficacy <i>b</i> path freed	696.9	462	0.00	.97	.97	.03	$\chi^2=0.43$ (1), $p=.51$
Both <i>a</i> paths and <i>b</i> path freed	691.6	464	0.00	.97	.97	.03	$\chi^2=5.54$ (3), $p=.14$

Note: All difference tests presented are from the fully constrained model. Individual parameters in Table 2 are shown from the last model.