Perceptions of Physical and Social Environment Variables and Self-Efficacy as Correlates of Self-Reported Physical Activity Among Adolescent Girls

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Objective This cross-sectional study examined the direct and indirect effects of perceived equipment accessibility, neighborhood safety, and social support on self-reported physical activity among older adolescent girls.

Methods Adolescent girls (n = 1,655) who were in the 12th grade completed a battery of questionnaires that included self-report measures of the perceived physical environment, social support, barriers self-efficacy, and physical activity.

Results Perceived neighborhood safety did not exhibit direct or indirect effects on self-reported physical activity. Perceived equipment accessibility exhibited an indirect effect on self-reported physical activity that was accounted for by barriers self-efficacy. Perceived social support exhibited direct and indirect effects on self-reported physical activity; the indirect effect was accounted for by barriers self-efficacy. The relationships were independent of parental education and body mass index (BMI).

Conclusions Perceived physical environmental factors indirectly influenced self-reported physical activity, and perceived social environmental factors both directly and indirectly influenced self-reported physical activity in this sample of older adolescent girls.

Key words adolescents; body mass index; determinants; physical activity; race.

Introduction

Physical inactivity is increasing among adolescent girls in the United States (Grunbaum et al., 2002), and this underscores the public health focus on developing successful physical activity interventions. Developing such interventions requires the identification of variables that correlate with physical activity (Baranowski, Anderson, & Carmack, 1998), and this might be aided by social cognitive theory (SCT) (Bandura, 1997). SCT describes the triadic reciprocal determinism among the environment (e.g., well-maintained sidewalks and social support), individual (e.g., self-efficacy), and behavior (e.g., physical activity). Consistent with SCT, perceptions of equipment accessibility, neighborhood safety, social support, and self-efficacy have been identified as correlates of self-reported physical activity in adolescent girls (Dunton, Janner, & Cooper, 2003; Motl et al., 2002; Saunders, Motl, Dowda, Dishman, & Pate, 2004).

We previously examined whether the relation between the perceived physical environment and self-reported physical activity might be accounted for by perceptions of self-efficacy in adolescent girls (Motl et al., 2005). That study included 8th- and 9th-grade adolescent girls and indicated that (a) perceived neighborhood safety did not have cross-sectional or longitudinal effects on self-reported physical activity;
(b) perceived equipment accessibility had a cross-sectional, but not a longitudinal, effect on self-reported physical activity; and (c) self-efficacy for overcoming barriers accounted for the cross-sectional effect of perceived equipment accessibility on self-reported physical activity. To our knowledge, no studies have examined the possibility that the relation between the perceived social environment and self-reported physical activity might be accounted for by perceptions of self-efficacy in adolescent girls.

This study involved a replication and an extension of previous research on 8th- and 9th-grade girls (Motl et al., 2005) by examining the cross-sectional relationships of perceived neighborhood safety, equipment accessibility, social support, and self-efficacy with self-reported physical activity in 12th-grade girls, while controlling for body mass index (BMI) and parental education (Gordon-Larsen, Adair, & Popkin, 2002). The replication involved examining perceived self-efficacy as a factor accounting for effects of perceived neighborhood safety and perceived equipment accessibility on self-reported physical activity. The extension involved examining perceived self-efficacy as a factor accounting for the effect of perceived social support on self-reported physical activity. We focused on 12th-grade girls because the rate of physical inactivity is increased in 12th compared with 9th-grade adolescent girls (Grunbaum et al., 2002), and this might be explained by a similar or a different set of correlates than previously observed with younger adolescent girls. That is, the relations of physical activity with perceptions of social and physical environments might be different in the 9th and 12th grades, and those relations might be differentially influenced by self-efficacy late in high school when physical activity increasingly becomes a personal leisure choice and physical activity levels precipitously decline.

**Methods**

**Participants**

The study was approved by an institutional review board, and participants and the parent or legal guardian provided written informed consent. Participants (n = 1,655) were 12th-grade girls from 22 public high schools in South Carolina who completed the measures in groups of 6–10 girls. The mean age and BMI of the sample was 17.7 years (SD = 0.6) and 25.2 kg m⁻² (SD = 6.4), respectively. The sample had racial proportions of 39.5% African American, 53.7% White, and 3.9% other; 2.9% of the girls did not report race.

**Measures**

The measure of perceived physical environment (Motl et al., 2005) included four items that were rated on a 5-point scale with anchors of 1 (disagree a lot) and 5 (agree a lot) and that corresponded with two factors of equipment accessibility and neighborhood safety. Internal consistency for the entire scale was .62, and internal consistency for the equipment accessibility and neighborhood safety subscales was .46 and .69, respectively.

The measure of perceived social support included 24 items that were rated on a 5-point Likert-type scale that ranged between 1 (disagree a lot) and 5 (agree a lot) and corresponded with six 4-item subscales: Reliable Alliance, Attachment, Guidance, Nurturance, Social Integration, and Reassurance of Worth (Motl, Dishman, Saunders, Dowda, & Pate, 2004). We used the Guidance, Nurturance, and Reassurance of Worth subscales as measures of perceived social support based on previous analyses in samples of adolescent girls (Motl et al., 2004) and examinations of perceived social support as a predictor of adolescent physical activity (Saunders et al., 2004). Internal consistency for the entire scale was .81, and internal consistency for the Guidance, Nurturance, and Reassurance of Worth subscales was .76, .72, and .64, respectively.

The measure of perceived self-efficacy for overcoming barriers contained eight items rated on a 5-point scale ranging from 1 (disagree a lot) to 5 (agree a lot) (Motl et al., 2000) and conformed to a unidimensional model that was invariant across 1 year (Motl et al., 2000) and between Black and White girls (Dishman et al., 2002). Internal consistency for this scale was .80.

Self-reported physical activity was assessed by the 3-Day Physical Activity Recall (3DPAR) (Pate, Ross, Dowda, Trost, & Sirard, 2003). The 3DPAR required participants to recall physical activity behavior from three previous days of the week. The 3 days were segmented into thirty-four 30-min blocks, beginning at 7:00 a.m. and continuing through to 12.00 a.m. The thirty-four 30-min blocks were grouped into broader time periods (e.g., before school, during school, and lunchtime). The 3DPAR included a list of 55 commonly performed activities grouped into broad categories (e.g., eating, work, afterschool/spare time/hobbies, transportation, physical activities, and sports). For each of the thirty-four 30-min time blocks, students reported the main activity performed and rated the relative intensity of the activity based on illustrations depicting activities of the various intensities. On the basis of specific activity and level of intensity, each 30-min block was assigned a MET value (i.e., physical activity level expressed as multiples of basal metabolic rate). The MET values were
summed over each of the 3 days, and the 3DPAR provides a global measure of all types of physical activities. The validity of the 3DPAR as a measure of usual activity has been established on the basis of correlations with an objective measure of physical activity derived from accelerometry (i.e., total counts; Pate et al., 2003). The stability of the 3 days of monitoring, based on an intraclass correlation, was .72 in this study.

Data Analysis
Data were analyzed using structural equation modeling (SEM) and full-information maximum likelihood (FIML) estimation in AMOS 5.0 (SmallWaters Corporation, Chicago, Illinois). FIML was used because there were between 4% of missing data for perceived self-efficacy and 9% of missing data for self-reported physical activity. Missing data are common in school-based studies of physical activity that involve large samples and are often the result of item nonresponse and being absent on the day of data collection. Compared with other missing data techniques (e.g., pairwise and listwise deletion), FIML has yielded more accurate parameter estimates and fit indices with up to 25% of simulated missing data (Enders & Bandalos, 2001).

Model Specification
We tested the relationships presented in Fig. 1. The measurement model included five latent variables of perceived neighborhood safety (two indicators), perceived equipment accessibility (two indicators), perceived social support (three indicators), perceived barriers self-efficacy (eight indicators), and self-reported physical activity (three indicators). There were correlations among the perceived neighborhood safety, perceived equipment accessibility, and perceived social support latent variables. The structural model included (a) paths from perceived neighborhood safety, perceived equipment accessibility, and perceived social support to perceived barriers self-efficacy and self-reported physical activity and (b) a path from perceived barriers self-efficacy to self-reported physical activity.

Model Fit
Model fit was assessed using the $\chi^2$, root mean square error of approximation (RMSEA), and comparative fit index (CFI). The $\chi^2$ assessed the absolute fit of the model (Bollen, 1989). The RMSEA tests the closeness of fit, and values approximating 0.06 indicate good model fit (Hu & Bentler, 1999). The CFI tests the proportionate improvement in fit of the target model with the null model. CFI values approximating 0.90 indicated acceptable fit (Bentler, 1990); CFI values approximating 0.95 indicated good fit (Hu & Bentler, 1999).

Results

Confirmatory Factor Analysis
Correlations among variables are provided in Table 1 based on an initial confirmatory factor analysis of a 5-factor, correlated measurement model ($\chi^2 = 550.35$, df = 125, $p < .01$, RMSEA = 0.05, and CFI = 0.93). All correlations were statistically significant, except for the correlation between perceived neighborhood safety and self-reported physical activity.

Structural Equation Modeling
The model in Fig. 1 provided an acceptable fit ($\chi^2 = 550.35$, df = 125, $p < .01$, RMSEA = 0.05, and CFI = 0.93). There were statistically significant effects of perceived equipment accessibility ($\gamma_{1,2} = .34$) and perceived social support ($\gamma_{1,3} = .34$) on perceived self-efficacy; the effect from perceived neighborhood safety ($\gamma_{1,2} = -.03$) to perceived self-efficacy was not statistically significant. There were statistically significant effects of perceived self-efficacy ($\beta_{1,2} = .15$) and perceived social support ($\gamma_{2,3} = .28$) on self-reported physical activity; the effects from perceived equipment accessibility ($\gamma_{2,1} = -.07$) and perceived neighborhood safety ($\gamma_{2,2} = .03$) to self-reported physical activity were not statistically significant. There were statistically significant correlations between perceived equipment accessibility and perceived neighborhood safety ($\phi_{1,2} = .57$), perceived equipment accessibility and perceived social support ($\phi_{1,3} = .45$), and perceived neighborhood safety and perceived social support ($\phi_{2,3} = .09$). The model accounted for 33% of the variation in perceived self-efficacy and 12% of the variance in self-reported physical activity.

Cross-Validation Analysis
We undertook a cross-validation analysis by randomly splitting the sample in half and then conducting an invariance analysis that tested the equivalence of the factor structure, factor loadings, and path coefficients

Table I. Correlations Among Scores from the Measures of Perceived Physical Environment, Perceived Social Environment, Barriers Self-Efficacy, and Self-Reported Physical Activity

<table>
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<tbody>
<tr>
<td>1. Perceived equipment accessibility</td>
<td>1.00</td>
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<tr>
<td>2. Perceived neighborhood safety</td>
<td>0.57</td>
<td>1.00</td>
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<tr>
<td>3. Perceived social support</td>
<td>0.45</td>
<td>0.09</td>
<td>1.00</td>
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<td>4. Perceived barriers self-efficacy</td>
<td>0.48</td>
<td>0.20</td>
<td>0.49</td>
<td>1.00</td>
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<tr>
<td>5. Self-reported physical activity</td>
<td>0.14</td>
<td>0.04</td>
<td>0.33</td>
<td>0.26</td>
<td>1.00</td>
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Note: The correlations were computed from a confirmatory factor analysis performed with full-information maximum likelihood (FIML) estimation in AMOS 5.0.
between the two samples using a standard invariance routine (Motl et al., 2002). The model provided in Fig. 1 fit acceptably in the calibration sample ($\chi^2 = 354.68, \text{df} = 125, p < .01, \text{RMSEA} = 0.05, \text{and CFI} = 0.93$) and the cross-validation sample ($\chi^2 = 321.59, \text{df} = 125, p < .01, \text{RMSEA} = 0.04, \text{and CFI} = 0.94$). We then tested the invariance of model parameters between the two samples, and the nested analyses supported the invariance of the overall structure ($\chi^2 = 676.27, \text{df} = 250, p < .01, \text{RMSEA} = 0.03, \text{and CFI} = 0.93$), factor loadings ($\chi^2 = 708.95, \text{df} = 263, p < .01, \text{RMSEA} = 0.03, \text{and CFI} = 0.93$), and path coefficients ($\chi^2 = 715.35, \text{df} = 270, p < .01, \text{RMSEA} = 0.03, \text{and CFI} = 0.93$) based on overlapping fit indices. The pattern and magnitude of the relationships among variables did not differ between calibration and cross-validation samples, and this equivalence replicates and validates the relationships reported in this article.

Multigroup Invariance
We tested the invariance of the factor structure, factor loadings, and path coefficients between Black ($n = 648$) and White ($n = 882$) girls using a standard procedure (Motl et al., 2002). The nested analyses supported the invariance of the overall structure ($\chi^2 = 665.10, \text{df} = 252, p < .01, \text{RMSEA} = 0.03, \text{and CFI} = 0.93$), factor loadings ($\chi^2 = 727.50, \text{df} = 265, p < .01, \text{RMSEA} = 0.03, \text{and CFI} = 0.92$), and path coefficients ($\chi^2 = 741.74, \text{df} = 272, p < .01, \text{RMSEA} = 0.03, \text{and CFI} = 0.92$) based on overlapping fit indices. The pattern and magnitude of the relationships among variables did not differ between Black and White girls.

Influences of Parental Education and BMI
We conducted an additional analysis that included parental education and BMI as influences of the relationships among perceived neighborhood safety, perceived equipment accessibility, perceived social support, and perceived self-efficacy with self-reported physical activity. The model represented an acceptable fit ($\chi^2 = 656.90, \text{df} = 169, p < .01, \text{RMSEA} = 0.04, \text{and CFI} = 0.93$). The path coefficients in our earlier analyses were unchanged because there were still statistically significant effects of
perceived equipment accessibility ($\gamma_{1,1} = .34$) and perceived social support ($\gamma_{1,3} = .33$) on perceived self-efficacy and statistically significant effects of perceived self-efficacy ($\beta_{2,1} = .15$) and perceived social support ($\gamma_{2,3} = .27$) on self-reported physical activity. There were statistically significant relationships between parental education with perceived neighborhood safety ($\gamma_{1,4} = .16$), perceived equipment accessibility ($\varphi_{2,4} = .29$), and perceived social support ($\varphi_{3,4} = .20$), and between the participant's BMI and perceived neighborhood safety ($\varphi_{3,5} = -.06$), perceived equipment accessibility ($\varphi_{2,3} = -.16$), and perceived social support ($\varphi_{3,3} = -.12$).

**Discussion**

This study replicated and extended previous research (Motl et al., 2005) by examining the cross-sectional relationships of perceived neighborhood safety, perceived equipment accessibility, perceived social support, and perceived self-efficacy with self-reported physical activity in 12th-grade adolescent girls. Our results indicated that perceived equipment accessibility and perceived social support were linked with perceived self-efficacy, and perceived self-efficacy and perceived social support were linked with self-reported physical activity among the 12th-grade adolescent girls; the relationships were not affected by parental education or BMI.

Our findings provide additional evidence for the potential utility of targeting perceived equipment accessibility as a means of increasing perceived self-efficacy for overcoming barriers and perhaps physical activity in adolescent girls. The perception of equipment that is accessible in the home (e.g., bicycles and balls) or in the community (e.g., playgrounds and parks) might promote physical activity participation among adolescent girls by increasing perceived self-efficacy for overcoming barriers. Increasing the awareness of accessible equipment in the environment might be accomplished by media-based informational campaigns. For example, print, audiovisual, or broadcast media programs could be developed that increase awareness of accessible equipment within the local community. There is a need for research that manipulates perceptions of the physical environment and examines the influence on physical activity in adolescent girls.

The findings provide initial support for the utility of targeting perceived social support as a means of indirectly and directly increasing self-reported physical activity behavior among adolescent girls. The perception of receiving assistance in performing physical activity from significant others (e.g., family and friends) might, in part, be associated with self-reported physical activity by increasing barriers self-efficacy. Perceptions of social support, however, had a stronger direct than indirect effect on self-reported physical activity. Therefore, increasing perceptions of social support might be important for encouraging participation in physical activity among adolescent girls because the enactment of physical activity often requires the support of others. Possible antecedents for increasing perceived social support include social networks (i.e., interactive field of persons who provide “give and take” of helpfulness and protection), social embeddedness (i.e., connectedness people have to significant others within a social network), and social climate (i.e., quality of social relationships; Langford, Bowsher, Maloney, & Lillis, 1997). Importantly, we only measured perceived social support and self-reported physical activity, and future research should examine both perceived and actual social support in association with self-reported and actual physical activity.

The measure of perceived social support used in this study targeted three social functions, namely guidance (i.e., advice or information provided by others), nurturance (i.e., sense that others rely upon one for advice or information), and reassurance of worth (i.e., recognition of one’s competence, skills, and value by others). Those three social provisions, if targeted properly, might serve as strategies for increasing physical activity. Guidance and nurturance might be targeted by forming exercise support groups (Duncan & McAuley, 1993). Reassurance of worth might be targeted by social reinforcement, in the form of praise and favorable gestures (Carron, Hausenblas, & Mack, 1996). Such possibilities serve as directions for future research.

Our measure of the perceived physical environment did not allow for an examination of specific features of the environment that are the most important correlates of perceived self-efficacy or self-reported physical activity. Future researchers might examine the perceived presence or absence of traffic, sidewalks, and gangs as separate and independent correlates of physical activity. Identifying the key-specific elements of the perceived physical environment that correlate with physical activity might allow for more targeted and effective interventions.

This study focused on perceptions of physical and social environments that might be associated with self-reported physical activity. The cultural environment (i.e., sociocultural milieus that differ in shared values, customs, and social practices) is another possible influence of physical activity based on SCT (Bandura, 1997). The cultural environment might have a stronger...
relationship with physical activity than the physical and social environment, particularly among the Black adolescent girls. Future researchers might examine and compare the influence of the cultural environment vs. the physical and social environment on physical activity in a racially or ethnically diverse sample of adolescent girls.

One limitation of this study is the lack of objective measures of the environment that might clarify or corroborate the meaning of the self-report measures of the environment. Future research should adopt a measurement approach that uses both self-report and objective measures in predicting self-efficacy and physical activity. Another limitation is the weak reliability of the measures of the perceived environment. However, our data analytic technique included measurement models for all latent variables that account for common and error score variance in all indicators (Bollen, 1989). Therefore, the weak reliability does not impact the magnitude of the relations that we report in this study. Another limitation is the possibility of a response bias in self-reported physical activity. Previous research has documented the presence of a response bias in self-reported physical activity in 8- to 10-year-old African-American girls (Klesges et al., 2004). However, the 3DPAR was validated on the basis of its relationship with accelerometer counts, and this is consistent with recommendations for validating self-report measures of physical activity in adolescents (Sirard & Pate, 2001). Nonetheless, future research in this area should include objective measures of physical activity concurrently with self-report measures of physical activity. We recognize the limited generalizability of our findings, particularly aspects of neighborhood safety, in light of the high level of perceived environmental safety reported by the participants in this study. Finally, our results are limited to cross-sectional relations. Nonetheless, we believe that the present results are sufficiently positive to encourage additional studies that clarify the causal meaning of relationships between the perceived physical and social environment, self-efficacy, and physical activity.

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