

## MEASURING SOCIAL PROVISIONS FOR PHYSICAL ACTIVITY AMONG ADOLESCENT BLACK AND WHITE GIRLS

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The authors evaluate the validity of the Social Provisions Scale for physical activity among adolescent Black ( $n = 896$ ) and White ( $n = 823$ ) girls. The girls completed the scale and measures of subjective norms and physical activity in the eighth and ninth grades. Within the sample of White girls, the Social Provisions Scale contained 24 items that were represented by six first-order substantive factors and a single second-order factor, plus an orthogonal method factor for the negatively worded items. Within the sample of Black girls, the Social Provisions Scale contained 22 items that were represented by four substantive factors and a single second-order factor, plus an orthogonal method factor for the negatively worded items. Those models exhibited longitudinal invariance. Social provisions influenced physical activity and correlated with subjective norms. The Social Provisions Scale for physical activity exhibited evidence of factorial and construct validity among Black and White girls.

**Keywords:** *confirmatory factor analysis; structural equation modeling; social support; subjective norm*

Physical inactivity increases in prevalence from early to late adolescence among girls in the United States, particularly among Black girls (Kimm et al., 2002). The potential public health burden of inactivity among adolescent

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girls (Sallis & Patrick, 1994) underscores the importance of developing interventions that can increase physical activity (Sallis et al., 1992; Sallis, Prochaska, & Taylor, 2000). Successful interventions depend, in part, on the identification of correlates of physical activity that can be targeted as potential mediators of intervention effects (Baranowski, Anderson, & Carmack, 1998).

Literature reviews have identified five primary categories of physical activity correlates among adolescents (Sallis et al., 1992, 2000). Those categories broadly include demographic, psychological, behavioral, social, and environmental variables. Psychological variables have received the most research attention, but there has been an increased recognition that social variables are potentially important determinants of physical activity among adolescents (Sallis et al., 1992, 2000; Smith, 2003).

Most adolescents are physically active in groups rather than alone, and peers, siblings, and parents are putative influences of physical activity among adolescents (e.g., Prochaska, Rodgers, & Sallis, 2002; Smith, 1999). Hence, subjective norms (i.e., perceived expectations of important referent individuals and the individual's motivation to comply with the perceived expectations) have been hypothesized to influence physical activity through the mediating effect of intention (Ajzen, 1991; Ajzen & Driver, 1992). However, subjective norms consistently have exhibited weak relationships with intention to be physically active among adolescents and adults (Hagger, Chatzisarantis, Biddle, & Orbell, 2001; Hausenblas, Carron, & Mack, 1997).

Recent research has indicated that social support, rather than subjective norms, might be a more theoretically relevant social influence of both intention and physical activity (Courneya & McAuley, 1995; Courneya, Plotnikoff, Hotz, & Birkett, 2000; Rhodes, Jones, & Courneya, 2002). Social support has been defined as "the contact, assistance, and/or information one receives through formal and informal contacts with individuals or groups" (Wallston, Alagna, DeVellis, & DeVellis, 1983, p. 369). Social support involves "aid and assistance exchanged through social relationships and interpersonal transactions" (Heaney & Israel, 1997, p. 181). As discussed by R. S. Weiss (1974), social support theoretically consists of six different social functions or provisions that may be obtained from relationships with others. Those social provisions include guidance (advice or information), reliable alliance (assurance that others can be counted on for tangible assistance), reassurance of worth (recognition of one's competence, skills, and value by others), opportunity for nurturance (sense that others rely on one for their well-being), attachment (emotional closeness from which one derives a sense of security), and social integration (sense of belonging to a group that shares similar interests, concerns, and recreational activities). The six components of R. S. Weiss's model incorporate the major dimensions within most conceptualizations of social support (e.g., Cobb, 1976).

Based on R. S. Weiss's (1974) theoretical model, Cutrona and Russell (1987) developed and validated the Social Provisions Scale. The Social Provisions Scale initially consisted of 12 statements: 1 positively worded statement and 1 negatively worded statement that tapped each of the 6 provisions identified by Weiss. After initial evidence supported the validity of the Social Provisions Scale, Cutrona and Russell added 12 items to the Social Provisions Scale to improve its reliability and content validity. The factorial validity of the 24-item, 6-subscale Social Provisions Scale then was supported using confirmatory factor analysis. The confirmatory factor analysis further indicated that the covariances among the 6 subscales were reasonably represented by a single second-order factor, namely, social provisions. Hence, the Social Provisions Scale tapped both specific components of social support as well as the overall level of support available to an individual (Cutrona & Russell, 1987).

The Social Provisions Scale subsequently was modified to be specific to physical activity participation among adults. T. E. Duncan and McAuley (1993) tested the factorial validity of the modified Social Provisions Scale in a small sample ( $n = 85$ ) of healthy, asymptomatic, sedentary men and women who were in an aerobic exercise program. Confirmatory factor analysis supported a six-factor model that corresponded with the six social provisions identified by R. S. Weiss (1974) and Cutrona and Russell (1987). Oman (as cited in T. E. Duncan, Oman, & Duncan, 1994) tested the factorial validity of the modified Social Provisions Scale in a small sample ( $n = 154$ ) of primarily middle-aged female volunteers from aerobic exercise programs in a medium-sized metropolitan area. The model fit adequately, although the Nurturance subscale exhibited a weak relationship with the social provisions latent variable. Those studies provided preliminary evidence for the factorial validity of the modified Social Provisions Scale among adults.

Subsequent studies examined the relationships between the Social Provisions Scale and measures of self-efficacy, subjective norms, and/or participation in an exercise program among samples of adults (Courneya & McAuley, 1995; T. E. Duncan, Duncan, & McAuley, 1993; T. E. Duncan et al., 1994; T. E. Duncan & McAuley, 1993; Rhodes et al., 2002). Those studies provided evidence of (a) discriminant validity for the modified Social Provisions Scale (Courneya & McAuley, 1995; Rhodes et al., 2002), (b) a relationship between social provisions and exercise behavior (T. E. Duncan et al., 1993), and (c) a mediated relationship between social provisions and exercise through self-efficacy (T. E. Duncan et al., 1994; T. E. Duncan & McAuley, 1993). Hence, the valid measurement and usefulness of social provisions for physical activity have been supported by a series of studies on adults in the context of an exercise program.

As far as we know, no studies have evaluated the factorial and construct validity of the modified Social Provisions Scale among adolescents,

although S. C. Duncan (1993) reported on the factorial validity of four items from the Social Provisions Scale that assessed reassurance of worth among male and female seventh- and eighth-grade students. An evaluation of the factorial and construct validity of the entire modified Social Provisions Scale among adolescents is important for four reasons. First, parents and same-sex friends are the most frequent providers of support among adolescents (Berndt, 1988; Furman & Buhrmester, 1992). Parents provide attachment, reliable alliance, enhancement of worth, and guidance, whereas peers provide social integration and attachment (Berndt, 1988; Furman, 1988; Furman & Buhrmester, 1985). This is important as social support has been identified as an influence on psychological, social, and behavioral outcomes in adolescents (e.g., Berndt, 1988; Harter, 1990). Hence, parents and peers play an important role in fulfilling the requisite social provisions of adolescents.

Second, social support has been identified as an important factor influencing behavior within physical activity environments. For example, frequently cited reasons for children's participation and enjoyment of sport are affiliation, being part of a team, and being with friends (e.g., Wankel & Kreisel, 1985; M. R. Weiss & Petlichkoff, 1989). Moreover, friendship provisions (companionship and reassurance of worth; S. C. Duncan, 1993), peer acceptance and close friendship (Smith, 1999), parental and peer support for physical activity (Anderssen & Wold, 1992), and parental values and expectancies of physical activity (Dempsey, Kimiecik, & Horn, 1993) have been examined for understanding physical activity intention and behavior among children and adolescents. Thus, social variables play an important role in influencing adolescent physical activity behavior.

Third, social provisions are amenable to change. If they indeed are independently related to physical activity levels, they offer attractive targets for intervention among adolescent girls who typically are less active than recommended for health (Kimm et al., 2002). Fourth, emerging evidence indicates that physical activity levels track, albeit weakly, from adolescence into adulthood (Campbell et al., 2001), where they continue to decline with age (Schoenborn & Barnes, 2002). Hence, the study of social support for physical activity during the transition from adolescence to adulthood presents a rich area for understanding human development that is also important for public health.

Accordingly, the present study evaluated the factorial and construct validity of the Social Provisions Scale for physical activity among samples of Black and White adolescent girls. This enabled a possible comparison of the measurement equivalence of the Social Provisions Scale across race. The study provides an important step in the continued study of the relationship between social support and physical activity among adolescent girls by evaluating a theoretically based and psychometrically valid measure, consistent

with previous recommendations by experts on adolescent physical activity (Sallis et al., 1992, 2000; Smith, 2003).

## Method

### *Participants*

Participants were eighth- and ninth-grade girls recruited from 24 high schools and their associated 31 middle schools in South Carolina. The high schools were randomly selected from 54 of the 214 schools within the 91 school districts of South Carolina that were eligible and willing to participate in a school-based intervention to increase physical activity and fitness. The eligibility of the schools was based on two criteria: (a) number of eighth-grade girls per school and (b) a nearly equal mix of Black and White girls in the school. The eligibility criteria were used for match pairing of schools and then randomly assigning them to conditions. There were 4,044 girls enrolled in the 24 schools, and 44.4% of the girls ( $n = 1,797$ ) participated in the baseline measurement component of the study; the majority of the girls ( $n = 1,658$ ) completed the follow-up measurement assessments 1 year later in the ninth grade. The sample initially had a mean age of 13.6 years ( $SD = 0.6$ ) and a mean body mass index of  $23.1 \text{ kg/m}^2$  ( $SD = 5.5$ ). The racial proportions were 50.2% Black, 46.1% White, and 3.6% other; 0.7% of the girls did not report race. Only data from the Black ( $n = 896$ ) and White ( $n = 823$ ) girls were used in this study.

### *Measures*

As originally developed (Cutrona & Russell, 1987), the Social Provisions Scale included 24 statements rated on a 4-point Likert-type scale that ranged from 1 = *strongly disagree* to 4 = *strongly agree*. The 24 statements corresponded to six, four-item subscales: Reliable Alliance, Attachment, Guidance, Nurturance, Social Integration, and Reassurance of Worth. Several modifications to the original Social Provisions Scale were made in the present study. The wording was changed to be specific to physical activity by a panel of experts. Based on an evaluation of the instrument by focus groups of eighth-grade girls using standard methodology (Krueger, 1988), some of the 24 items were rewritten to improve comprehension by eighth-grade girls. The items were rated on an easy-to-understand, 5-point Likert-type scale with anchors of 1 = *disagree a lot* and 5 = *agree a lot*; this differs from the original 4-point rating scale. Items 2, 3, 9, 10, 14, 15, 18, 19, 21, 22, and 24 were negatively worded and thus reverse-scored. The 24 items are listed in the appendix.

The measure of subjective norms included eight items that consisted of normative beliefs about the expectations of others toward being physically active and the corresponding motivation to comply with the expectations (Dishman et al., 2002; Motl et al., 2000). The items were rated on a 5-point scale anchored by 1 = *disagree a lot* and 5 = *agree a lot*. The subjective norm item scores were formed as a product of the normative belief and motive to comply item scores, which is in accordance with theory (Ajzen, 1991) and previous research (Motl et al., 2000). The factor structure underlying the subjective norms questionnaire consisted of a single factor with correlated uniquenesses among four pairs of similarly worded items (Motl et al., 2000). The factor structure has been invariant across a 1-year period and between Black and White girls (Dishman et al., 2002; Motl et al., 2000).

Physical activity was measured using the 3-Day Physical Activity Recall (3DPAR). The 3DPAR is a modification of the Previous Day Physical Activity Recall (Weston, Petosa, & Pate, 1997). The 3DPAR required participants to recall physical activity behavior from 3 previous days of the week; 2 weekdays and 1 weekend day. Data were reduced to the number of 30-minute blocks per day in which the main activity was three or more multiples of basal metabolic rate (i.e., moderate-to-vigorous physical activity [MVPA]). The validity of the 3DPAR has been established based on correlations with a self-report measure of sport involvement (Motl et al., 2001) and an objective measure of physical activity (Pate, Ross, Dowda, Trost, & Sirard, 2003). The factor structure of the 3DPAR has been partially invariant across a 1-year period and between Black and White girls (Motl, Dishman, Dowda, & Pate, in press).

### *Procedure*

The procedure was approved by the University of South Carolina Institutional Review Board, and all participants and the parent or legal guardian provided written informed consent. The measures were administered to participants in groups of 6 to 10 girls by trained data collectors in the spring semesters of 1999 (i.e., baseline data) and 2000 (i.e., follow-up data) when students were in the eighth and ninth grade.

### *Data Analysis*

The analyses were conducted for the samples of White and Black girls separately. The factor structure for the Social Provisions Scale initially was evaluated using confirmatory factor analysis (CFA) with the baseline data. The final factor structure then was cross-validated using an analysis of longitudinal factorial invariance with the baseline and follow-up data. Assuming that a similar model with the same pattern of fixed and freed factor loadings

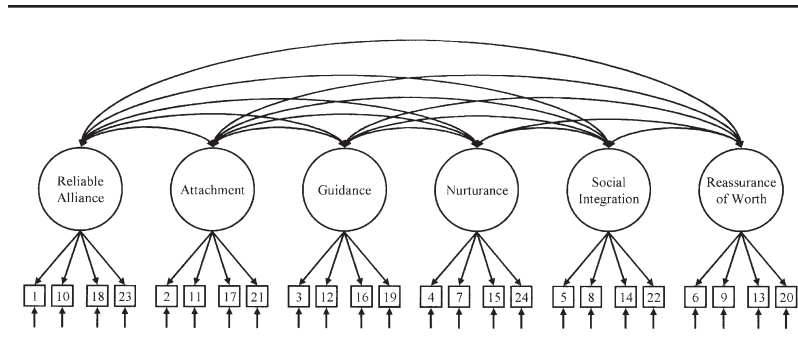


Figure 1. Six-factor, correlated measurement model for the modified Social Provisions Scale tested using confirmatory factor analysis.

Note. Numbers correspond with scale items in the appendix.

was generated for both White and Black girls (i.e., conceptual equivalence of the underlying theoretical variable), the Social Provisions Scale would be subjected to an analysis of multigroup factorial invariance. The construct validity of the Social Provisions Scale was evaluated based on hypothesized longitudinal relationships among the measures of social provisions, subjective norms, and physical activity that were tested using latent variable structural equation modeling.

#### CFA

The CFA was performed using full-information maximum likelihood (FIML) estimation in AMOS 4.0 (Arbuckle & Wothke, 1999). FIML was selected because there were missing responses to items on the measures. FIML is an optimal method for the treatment of missing data in CFA (Arbuckle, 1996; Enders & Bandalos, 2001). The size of the sample was adequate to estimate the models (Jackson, 2001).

*Model specification.* The initial measurement model for the Social Provisions Scale consisted of six latent variables, as illustrated in Figure 1. Each of the six latent variables contained four items; the item numbers are listed in Figure 1. No items cross-loaded (i.e., simple structure), and uniquenesses were estimated for each item. The variances and covariances were freely estimated for the six latent variables.

*Model fit.* Model fit was assessed using multiple indices. We relied on the chi-square statistic (Bollen, 1989; Jöreskog, 1993), the root mean square error of approximation (RMSEA; Browne & Cudeck, 1993), comparative fit

index (CFI; Bentler, 1990), and nonnormed fit index (NNFI; Bentler & Bonnet, 1980) to evaluate model-data fit. RMSEA values approximating .06 and zero demonstrated close and exact fit of the model, respectively (Browne & Cudeck, 1993; Hu & Bentler, 1999). CFI and NNFI values of .90 (Bentler, 1990; Bentler & Bonnet, 1980) and .95 (Hu & Bentler, 1999) indicated minimally acceptable and good fit of the model, respectively. The factor loadings, uniquenesses, standard errors,  $z$  statistics (i.e., parameter estimate divided by its standard error), and squared multiple correlations (SMCs) were inspected for appropriate sign and magnitude.

*Method effects.* The factor structure of the Social Provisions Scale may be influenced by the presence of positively and negatively worded items (cf., Marsh, 1996). We tested this possibility using the correlated trait, correlated method (CTCM) framework within CFA (Motl & DiStefano, 2002; Tomás & Oliver, 1999). Based on the CTCM framework, we tested the fit of three nested models. Model 1 was a baseline measurement model with no method effects. Models 2 and 3 included the baseline measurement model, plus an additional orthogonal method factor representing either positively (Model 2) or negatively (Model 3) worded items.

*Second-order model.* The covariances among the latent variables on the Social Provisions Scale may be best described by a single second-order factor, namely, social provisions as described by Cutrona and Russell (1987). We tested for a single second-order factor using standard procedures (Bollen, 1989; Jöreskog & Sörbom, 1996). The baseline measurement model with covariances among the first-order factors served as a comparison for the second-order model.

*Cross-validation.* The final model was cross-validated by testing its longitudinal factorial invariance. This test provided information about the stability of the model and its parameters across time (Bollen, 1989; Motl & DiStefano, 2002). The invariance routine involved testing and comparing six models that imposed successive restrictions on model parameters. Model 1 tested the equality of the overall structure. Model 2 included the restrictions from Model 1 plus the additional constraint of equal first order-factor loadings. Model 3 included the restrictions from Model 2 plus the additional constraint of equal second-order factor loadings. Model 4 included the restrictions from Model 3 plus the additional constraint of equal first-order factor variances. Model 5 included the restrictions from Model 4 plus the additional constraint of equal second-order factor variances and covariances. Model 6 included the restrictions from Model 5 plus the additional constraint of equal item uniquenesses. This routine is similar for establishing multigroup invariance.



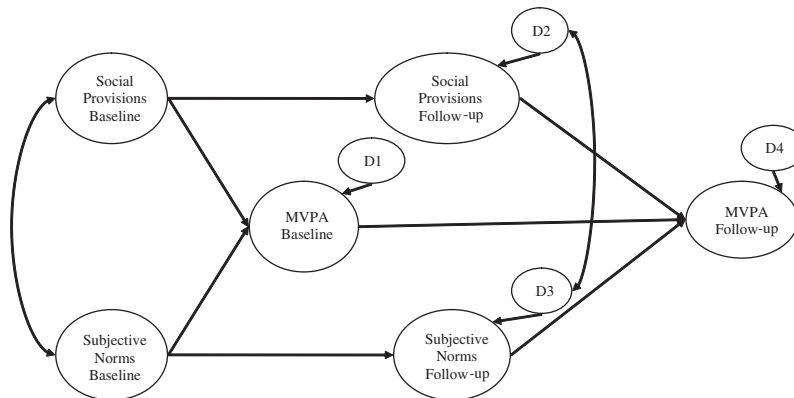


Figure 2. Model depicting the hypothesized longitudinal relationships among social provisions, subjective norms, and physical activity.

Note. MVPA = moderate-to-vigorous physical activity; D1-D4 = disturbance terms. The indicators are not provided for simplifying the depiction of the hypothesized longitudinal relationships.

#### Latent Variable Structural Equation Modeling (LVSEM)

LVSEM was performed using FIML estimation in AMOS 4.0 (Arbuckle & Wothke, 1999). The entire sample of adolescent girls was adequate to estimate the structural model with latent variables (Jackson, 2001).

*Model specification.* The measurement model for the Social Provisions Scale was specified based on the CFA results for the samples of White and Black girls. The measurement model for the subjective norms measure was specified to be unidimensional with correlated uniquenesses among four pairs of items, as described by Motl et al. (2000). The measurement model for the measure of MVPA was specified to be unidimensional, as described by Motl et al. (2001).

As seen in Figure 2, the structural model included (a) paths between latent variables measured across time and (b) paths from social provisions and subjective norms to MVPA for both baseline and follow-up. There were correlations between the social provisions and subjective norms exogenous latent variables at baseline and correlations between disturbance terms for the social provisions and subjective norms endogenous latent variables at follow-up. The correlation between disturbance terms was added because there was no basis for specifying a directional path between social provisions and subjective norms, and the correlation thus accounted for the nondirectional covariance between the social constructs. There were autocorrelations among the uniquenesses of identical items across time.

*Model fit.* Model fit was assessed using the chi-square statistic and the aforementioned guidelines for the RMSEA and 90% confidence interval (CI), CFI, and NNFI values. The parameter estimates, standard errors,  $z$  statistics, and SMCs were inspected for appropriate sign and magnitude.

## Results

### CFA

*Sample of White girls.* We initially tested the fit of the six-factor, correlated measurement model in the sample of White girls using baseline data. The fit of the model was not acceptable,  $\chi^2 = 1055.76$ ,  $df = 237$ , RMSEA = .065 (90% CI = .061-.069), CFI = .85, NNFI = .83. The factor loadings, uniquenesses, standard errors,  $z$  statistics, and SMCs generally were of the appropriate sign and magnitude, although Items 9 and 10 had relatively weak standardized factor loadings of .23 and .21 and SMCs of .05 and .04, respectively. The mean of the standardized factor loadings and SMCs were .57 (range = .21-.76) and .35 (range = .04-.58), respectively. The standardized factor covariances were significant and ranged between .42 and .96 ( $M = .71$ , median = .76).

The poor fit of the six-factor measurement model may be related to the presence of positively and negatively worded items on the Social Provisions Scale. We tested this possibility using three models based on the CTCM framework (Motl & DiStefano, 2002; Tomás & Oliver, 1999). Model 1 was a baseline measurement model with no method effects. Models 2 and 3 included the baseline measurement model plus an additional orthogonal method factor representing either positively (Model 2) or negatively (Model 3) worded items. Model 1,  $\chi^2 = 1055.76$ ,  $df = 237$ , RMSEA = .065 (90% CI = .061-.069), CFI = .85, NNFI = .83, fit worse than both Model 2,  $\chi^2 = 684.74$ ,  $df = 224$ , RMSEA = .050 (90% CI = .046-.054), CFI = .92, NNFI = .90, and Model 3,  $\chi^2 = 642.07$ ,  $df = 226$ , RMSEA = .047 (90% CI = .043-.052), CFI = .92, NNFI = .91. Model 3 fit better than Model 2. Hence, the Social Provisions Scale was best represented by six substantive factors and a single orthogonal method factor associated with the negatively worded items (Motl & DiStefano, 2002; Tomás & Oliver, 1999).

We then tested the fit of a second-order model for describing the covariances among the six substantive first-order factors on the Social Provisions Scale; this model included an orthogonal method factor for the negatively worded items. The second-order model provided an acceptable fit,  $\chi^2 = 725.67$ ,  $df = 235$ , RMSEA = .050 (90% CI = .046-.055), CFI = .91, NNFI = .90. The fit of the second-order model was significantly worse than the fit of the baseline measurement model without a second-order structure,  $\chi^2 =$

642.07,  $df = 226$ , RMSEA = .047 (90% CI = .043-.052), CFI = .92, NNFI = .91, based on a chi-square difference test,  $\chi^2_{diff} = 83.60$ ,  $df = 9$ ,  $p < .0001$ , although Jöreskog (1971, p. 421) has cautioned against the overreliance on the conservative nature of statistical criteria in comparing nested models, particularly with large samples. The RMSEA point estimates and 90% CIs were overlapping between models, thereby providing some support for the second-order model. The factor loadings, uniquenesses, standard errors,  $z$  statistics, and SMCs were of the appropriate sign and magnitude. The mean of the standardized second-order factor loadings and SMCs were .83 (range = .58-.94) and .70 (range = .33-.89), respectively. The weakest second-order factor loading ( $\gamma_{51} = .58$ ) and associated SMC ( $R^2 = .33$ ) were for the Nurture factor, and this was consistent with the observations of Cutrona and Russell (1987). Hence, the covariances among the six first-order factors underlying the Social Provisions Scale could be reasonably described by a single, second-order factor representing social provisions. This final model is consistent with the original Social Provisions Scale and its ability to account for both specific components of social support as well as the overall level of support available to an individual (Cutrona & Russell, 1987).

The fit of the final model containing one second-order factor describing the covariances among the six first-order substantive factors plus an orthogonal method effect factor was tested with the follow-up data from the sample of White girls. The fit of the model satisfied minimal criteria,  $\chi^2 = 720.05$ ,  $df = 235$ , RMSEA = .050 (90% CI = .046-.054), CFI = .91, NNFI = .89, but was significantly worse than the baseline measurement model without a second-order factor structure,  $\chi^2 = 589.20$ ,  $df = 226$ , RMSEA = .044 (90% CI = .040-.049), CFI = .93, NNFI = .92, based on a chi-square difference test,  $\chi^2_{diff} = 130.85$ ,  $df = 9$ ,  $p < .0001$ . The RMSEA point estimates and 90% CIs were not overlapping between models. The factor loadings, uniquenesses, standard errors,  $z$  statistics, and SMCs were of the appropriate sign and magnitude. The mean of the first-order factor loadings and SMCs were .58 (range = .22-.82) and .44 (range = .19-.67), respectively. The mean of the standardized second-order factor loadings and SMCs were .84 (range = .58-.95) and .72 (range = .34-.90), respectively. The weakest second-order factor loading ( $\gamma_{51} = .58$ ) and associated SMC ( $R^2 = .34$ ) were for the Nurture factor. Those results provided some additional evidence that the covariances among the six first-order factors underlying the Social Provisions Scale can be reasonably described by a single, second-order factor representing social provisions.

The results of the analysis of longitudinal invariance are presented in Table 1. All six of the models within the invariance routine represented an adequate model-data fit. There was evidence for the invariance of the overall structure (Model 1), first-order factor loadings (Model 2), second-order factor loadings (Model 3), first-order factor variances (Model 4), second-order

Table 1  
*Confirmatory Factor Analysis Testing the Longitudinal Invariance of the Second-Order Model for the Modified Social Provisions Scale Among the Sample of White Girls*

Model	<i>df</i>	$\chi^2$	RMSEA	90% CI	CFI	NNFI
1	1014	2128.87	.037	.034-.039	.90	.89
2	1032	2178.28	.037	.035-.039	.90	.89
3	1037	2181.82	.037	.034-.039	.90	.89
4	1043	2186.03	.037	.034-.039	.90	.89
5	1044	2187.53	.037	.034-.039	.90	.89
6	1068	2254.49	.037	.035-.039	.90	.89

Model Comparisons	<i>df</i>	$\chi^2_{diff}$	<i>p</i>
Model 1 vs. 2	18	49.41	.0001
Model 2 vs. 3	5	3.54	.62
Model 3 vs. 4	6	4.21	.65
Model 4 vs. 5	1	1.50	.22
Model 5 vs. 6	24	66.96	.0001

*Note.* RMSEA = root mean square error of approximation; CI = confidence interval; CFI = comparative fit index; NNFI = nonnormed fit index;  $\chi^2_{diff}$  = chi-square difference test.

factor variances (Model 5), and item uniquenesses (Model 6). Only two of the five chi-square difference tests reported in Table 1 were statistically significant; those were for the tests of invariant first-order factor loadings and item uniquenesses. The subjective fit indices were identical across all six nested models and provided evidence for the invariance of the model and all its parameters. The RMSEA point estimates and 90% CIs were overlapping across the six models. Moreover, the values of the CFI, and, for that matter, the NNFI, did not change ( $\Delta CFI = CFI_{constrained\ model} - CFI_{unconstrained\ model}$ ) across the six models; a criterion of  $-0.01$  has been reported to be robust for testing the multigroup invariance of CFA models (Cheung & Rensvold, 2002) and has been used in a test of the longitudinal invariance of a measure of self-esteem (Motl & DiStefano, 2002). Hence, the subjective fit indices provided evidence that the second-order structure and all of the model parameters exhibited longitudinal invariance during a 1-year period. The standardized factor covariance between the second-order social provision factors across time was .65 in Model 6, indicating acceptable stability.

*Sample of Black girls.* We first tested the fit of the six-factor, correlated measurement model in the sample of Black girls using baseline data. This model was not an admissible solution because the covariance matrix among factors was not positive definite. Inspection of the output indicated that the standardized covariances between the Attachment and Social Integration, Attachment and Reliable Alliance, and Reliable Alliance and Social Inte-

gration factors all exceeded 1.00. Because the content of the items on the three factors was overlapping, the Attachment, Social Integration, and Reliable Alliance factors were collapsed into a single factor (i.e., Presence of Affectional Ties; Cutrona & Russell, 1987), which yielded a four-factor, correlated measurement model. The fit of this model was not acceptable,  $\chi^2 = 1678.71$ ,  $df = 246$ , RMSEA = .081 (90% CI = .077-.084), CFI = .70, NNFI = .67. The factor loadings, uniquenesses, standard errors,  $z$  statistics, and SMCs generally were of the appropriate sign and magnitude, with the exception of Items 9 and 10, whose standardized factor loadings were .10 and .14 and SMCs were .01 and .02, respectively. Items 9 and 10 were removed, and the fit of the four-factor, correlated measurement still was not acceptable,  $\chi^2 = 1393.01$ ,  $df = 203$ , RMSEA = .081 (90% CI = .077-.085), CFI = .74, NNFI = .70. The factor loadings, uniquenesses, standard errors,  $z$  statistics, and SMCs were of the appropriate sign and magnitude. The mean of the standardized factor loadings and SMCs were .51 (range = .31-.74) and .28 (range = .10-.55), respectively. The standardized factor covariances were significant and ranged between .49 and .85 ( $M = .69$ , median = .69).

The inadequate fit of the four-factor measurement model may be related to the presence of positively and negatively worded items on the Social Provisions Scale. We tested this possibility using the CTCM framework (Motl & DiStefano, 2002; Tomás & Oliver, 1999). Model 1 was a baseline measurement model with no method effects. Models 2 and 3 included the baseline measurement model, plus an additional orthogonal method factor representing either positively (Model 2) or negatively (Model 3) worded items. Model 1,  $\chi^2 = 1393.01$ ,  $df = 203$ , RMSEA = .081 (90% CI = .077-.085), CFI = .74, NNFI = .70) fit worse than did both Model 2,  $\chi^2 = 566.63$ ,  $df = 190$ , RMSEA = .047 (90% CI = .043-.052), CFI = .92, NNFI = .90, and Model 3,  $\chi^2 = 483.97$ ,  $df = 194$ , RMSEA = .041 (90% CI = .036-.045), CFI = .94, NNFI = .92. Model 3 fit better than Model 2 did. Hence, the Social Provisions Scale was best represented by four substantive factors and a single orthogonal method factor associated with the negatively worded items (Motl & DiStefano, 2002; Tomás & Oliver, 1999).

We then tested the fit of a second-order model for describing the correlations among the four substantive first-order factors on the Social Provisions Scale; this model included an orthogonal method factor for the negatively worded items. The second-order model provided an acceptable fit,  $\chi^2 = 531.78$ ,  $df = 196$ , RMSEA = .044 (90% CI = .039-.048), CFI = .93, NNFI = .91. The fit of the second-order model was significantly worse than the fit of the baseline measurement model without a second-order structure,  $\chi^2 = 483.97$ ,  $df = 194$ , RMSEA = .041 (90% CI = .036-.045), CFI = .94, NNFI = .92 based on a chi-square difference test,  $\chi^2_{\text{diff}} = 47.81$ ,  $df = 2$ ,  $p < .0001$ . The RMSEA point estimates and 90% CIs were overlapping between models, thereby providing some support for the second-order model. The factor load-

ings, uniquenesses, standard errors,  $z$  statistics, and SMCs were of the appropriate sign and magnitude, although the error variance for the Presence of Affectional Ties factor was not statistically significant and indicated that it is a nearly perfect measure of social provisions (Bollen, 1989). The mean of the standardized second-order factor loadings and SMCs were .81 (range = .65-.98) and .68 (range = .42-.95), respectively. The weakest second-order factor loading ( $\gamma_{31} = .65$ ) and associated SMC ( $R^2 = .42$ ) were for the Nurture factor. Hence, the covariances among the four first-order factors underlying the Social Provisions Scale could be reasonably described by a single, second-order factor representing social provisions.

The fit of the final model containing one second-order factor describing the covariances among the four substantive first-order factors plus an orthogonal method factor was tested with the follow-up data from the Black girls. The second-order model was not an admissible solution because the error variance for the Presence of Affectional Ties factor was negative and not statistically significant. We fixed the error variance to zero and then retested the second-order model. The second-order model provided an acceptable fit,  $\chi^2 = 540.90$ ,  $df = 197$ , RMSEA = .044 (90% CI = .040-.049), CFI = .91, NNFI = .89. The fit of the second-order model was significantly worse than the fit of the baseline measurement model without a second-order structure,  $\chi^2 = 498.25$ ,  $df = 194$ , RMSEA = .042 (90% CI = .037-.046), CFI = .92, NNFI = .90, based on a chi-square difference test,  $\chi^2_{diff} = 42.65$ ,  $df = 3$ ,  $p < .0001$ . The RMSEA point estimates and 90% CIs were overlapping between models, thereby providing some support for the second-order model. The factor loadings, uniquenesses, standard errors,  $z$  statistics, and SMCs were of the appropriate sign and magnitude. The mean of the first-order factor loadings and SMCs were .51 (range = .30-.75) and .38 (range = .12-.56), respectively. The mean of the standardized second-order factor loadings and SMCs were .80 (range = .55-.00) and .67 (range = .30-.00), respectively. The weakest second-order factor loading ( $\gamma_{51} = .55$ ) and associated SMC ( $R^2 = .30$ ) were for the Nurture factor. Those results provided evidence that the covariances among the four first-order factors underlying the Social Provisions Scale could be reasonably described by a single, second-order factor representing social provisions.

The results of the analysis of longitudinal invariance are presented in Table 2. Note that the error variance for the Presence of Affectional Ties factor was fixed to be zero in both the baseline and follow-up portions of the model. All six of the models within the invariance routine represented an adequate model-data fit. There was evidence for the invariance of the overall structure (Model 1), first-order factor loadings (Model 2), second-order factor loadings (Model 3), first-order factor variances (Model 4), and second-order factor variances (Model 5), but not the item uniquenesses (Model 6). Only one of the five chi-square difference tests reported in Table 2 was statis-

Table 2  
*Confirmatory Factor Analysis Testing the Longitudinal Invariance of the Second-Order Model for the Modified Social Provisions Scale Among the Sample of Black Girls*

Model	<i>df</i>	$\chi^2$	RMSEA	90% CI	CFI	NNFI
1	851	1578.50	.031	.029-.033	.92	.91
2	869	1599.09	.031	.028-.033	.92	.91
3	872	1604.55	.031	.028-.033	.92	.91
4	875	1611.99	.031	.028-.033	.92	.91
5	876	1615.13	.031	.028-.033	.92	.91
6	898	1678.19	.031	.029-.033	.91	.91

Model Comparisons	<i>df</i>	$\chi^2_{diff}$	<i>p</i>
Model 1 vs. 2	18	20.59	.30
Model 2 vs. 3	3	5.46	.14
Model 3 vs. 4	3	7.44	.06
Model 4 vs. 5	1	3.14	.08
Model 5 vs. 6	22	63.06	.0001

Note. RMSEA = root mean square error of approximation; CI = confidence interval; CFI = comparative fit index; NNFI = nonnormed fit index;  $\chi^2_{diff}$  = chi-square difference test.

tically significant; that was for the test of invariant item uniquenesses. The subjective fit indices were similar across five of the six nested models. The RMSEA point estimates and 90% CIs were overlapping across the models. Moreover, the values of the CFI did not change ( $\Delta CFI = CFI_{constrained\ model} - CFI_{unconstrained\ model}$ ) across five of the six models; a criterion of  $-0.01$  has been reported to be robust for testing the multigroup invariance of CFA models (Cheung & Rensvold, 2002) and has been used in a test of the longitudinal invariance of a measure of self-esteem (Motl & DiStefano, 2002). Hence, the subjective fit indices provided evidence that the second-order structure and all of the model parameters, except for the item uniquenesses, exhibited longitudinal invariance over a 1-year period. The standardized factor covariance between the second-order social provision factors across time was .61 in Model 5, indicating acceptable stability.

*Multigroup racial invariance.* Because the final model did not have the same pattern of fixed and freed factor loadings for both White and Black girls (i.e., conceptual equivalence of the underlying theoretical variable), we were unable to undertake the analysis of multigroup factorial invariance for the Social Provisions Scale. Without an equal number of factors and similar factor pattern matrices for White and Black girls (Raju, Laffitte, & Byrne, 2002), there is no basis for an examination of the measurement invariance of the Social Provisions Scale between race.

### *Latent Variable Structural Equation Model*

*Sample of White girls.* We tested the hypothesized relationships depicted in Figure 2 among the White girls using LVSEM. The model yielded an acceptable fit,  $\chi^2 = 4020.36$ ,  $df = 2252$ , RMSEA = .031 (90% CI = .029-.032), CFI = .90, NNFI = .89. The factor loadings, uniquenesses, standard errors,  $z$  statistics, and SMCs were of the appropriate sign and magnitude. There were significant direct effects between social provisions and MVPA for baseline ( $\gamma_{11} = .28$ ) and follow-up ( $\beta_{42} = .14$ ). The covariances between social provisions and subjective norms were significant for baseline ( $\phi_{12} = .38$ ) and follow-up ( $\psi_{23} = .42$ ). There were nonsignificant paths between subjective norm and MVPA for baseline ( $\gamma_{12} = .05$ ) and follow-up ( $\beta_{43} = .02$ ). The stability coefficients for social provisions, subjective norms, and MVPA across baseline and follow-up were .64 ( $\gamma_{21}$ ), .53 ( $\gamma_{32}$ ), and .42 ( $\beta_{41}$ ), respectively.

*Sample of Black girls.* Using LVSEM, we then tested the hypothesized relationships among social provisions, subjective norm, and MVPA as depicted in Figure 2 among the Black girls; the measurement model for the Social Provisions Scale was specified based on the results of the CFA. The model yielded an acceptable fit,  $\chi^2 = 3085.93$ ,  $df = 2001$ , RMSEA = .025 (90% CI = .023-.026), CFI = .92, NNFI = .92. The factor loadings, uniquenesses, standard errors,  $z$  statistics, and SMCs were of the appropriate sign and magnitude. There were significant direct effects between social provisions and MVPA for baseline ( $\gamma_{11} = .20$ ) and follow-up ( $\beta_{42} = .16$ ). The covariances between social provisions and subjective norms were significant for baseline ( $\phi_{12} = .41$ ) and follow-up ( $\psi_{23} = .36$ ). There were nonsignificant paths between subjective norms and MVPA for baseline ( $\gamma_{12} = .00$ ) and follow-up ( $\beta_{43} = -.09$ ). The stability coefficients for social provisions, subjective norms, and MVPA across baseline and follow-up were .60 ( $\gamma_{21}$ ), .50 ( $\gamma_{32}$ ), and .42 ( $\beta_{41}$ ), respectively.

### Discussion

This study evaluated the factorial and construct validity of the Social Provisions Scale modified for physical activity among samples of adolescent Black and White girls. The primary findings were (a) the modified Social Provisions Scale contained 24 items that were adequately described by six first-order factors subordinate to a single second-order factor among adolescent White girls; (b) the modified Social Provisions Scale contained 22 items that were adequately described by four first-order factors subordinate to a single second-order factor among adolescent Black girls; (c) the second-order models demonstrated strong evidence of cross-validity based on analyses of longitudinal factorial invariance in both samples separately; (d) the



modified Social Provisions Scale was represented by different numbers of items and factors, as well as different factor pattern matrices, among the Black and White girls, precluding a test for multigroup invariance; and (e) scores from the modified Social Provisions Scale were correlated with a measure of subjective norms about physical activity and predicted self-reported MVPA across time for both samples. Thus, we have provided evidence for the factorial and construct validity of different versions of the modified Social Provisions Scale among adolescent Black and White girls.

#### *Factorial Validity*

*White girls.* The final model for the 24-item modified Social Provisions Scale among the White girls consisted of six substantive first-order factors subordinate to a single second-order factor plus an orthogonal method factor representing a wording effect for the negatively phrased items. This final model demonstrated cross-validity based on an analysis of longitudinal factorial invariance using baseline and follow-up data. There was evidence for the invariance of the overall structure of the model and all of its parameters over the 1-year period. Moreover, the second-order model was consistent with the factorial validity findings with the original Social Provisions Scale (Cutrona & Russell, 1987). Thus, the modified Social Provisions Scale exhibited evidence of factorial and cross-validity and can be employed for studies of specific components of social support as well as the overall level of support among adolescent White girls. This is consistent with Cutrona and Russell's (1987, pp. 49-50) original purpose for the Social Provisions Scale.

*Black girls.* The final model for the modified Social Provisions Scale among the Black girls consisted of 22 items that were described by four substantive first-order factors subordinate to a single second-order factor plus an orthogonal method factor for the negatively phrased items. This final model demonstrated cross-validity based on an analysis of longitudinal factorial invariance using baseline and follow-up data. There was evidence for the invariance of the overall structure of the model and all of its parameters, except the item uniquenesses, over the 1-year period. The presence of a second-order model was consistent with the factorial validity findings with the original Social Provisions Scale (Cutrona & Russell, 1987), but the number and pattern of the first-order factors was not; there were six first-order factors in the study by Cutrona and Russell (1987) but only four in the present study. Thus, the modified Social Provisions Scale exhibited evidence of factorial and cross-validity and can be employed for studies of specific components of social support as well as the overall level of support among adolescent Black girls.

There was an inadmissible solution in the initial test of the six-factor model for the modified Social Provisions Scale among the Black girls. The inadmissible solution was caused by out-of-bounds parameter estimates for the covariances between the Attachment and Social Integration, Attachment and Reliable Alliance, and Reliable Alliance and Social Integration factors; the standardized covariances all exceeded 1.00. Because the content of the items on the three factors was overlapping, the Attachment, Social Integration, and Reliable Alliance factors were collapsed into a single factor named Presence of Affectional Ties (Cutrona & Russell, 1987), which yielded a four-factor measurement model. The four-factor measurement model yielded an admissible solution, and the covariance matrix among factors was positive definite. This indicates that the items for Attachment, Social Integration, and Reliable Alliance were not measuring different constructs among adolescent Black girls. Future researchers should test this possibility among Black adults; moreover, this observation underscores the importance of testing the factorial invariance of the Social Provisions Scale across samples of Black adolescents and adults. Importantly, the final model was based on a series of modifications and should be cross-validated in another sample of adolescent Black girls.

*Method effect.* There is increasing evidence that the inclusion of negatively worded items on a questionnaire can be problematic in studies of an instrument's latent structure (Marsh, 1996; Motl et al., 2003; Motl & DiStefano, 2002; Tomás & Oliver, 1999) by introducing a method effect (i.e., systematic variance attributable to item wording that interferes with the measurement of a substantive construct). We observed such a method effect with the modified Social Provisions Scale in the present study. The negatively worded items initially resulted in a poor fit of the model for the Social Provisions Scale. This was illustrated by the CTCM model that included six substantive factors plus a single orthogonal method factor underlying the negatively worded items on the modified Social Provisions Scale for the White girls; there was a similar method effect for the Black girls. Whether the method effect represents a response style (Motl & DiStefano, 2002) or has another behavioral meaning remains to be determined. Regardless of the meaning of the method effect, researchers should be aware that the negatively worded items on the Social Provisions Scale contain common variance that is attributable to both the latent construct of interest plus item wording. Unless this additional source of common variance is accounted for by using covariance modeling, the magnitude of relationships with measures of external criteria could be biased.

*Previous factorial validity evidence.* Although few details were provided about the unpublished dissertation by Oman (as cited in T. E. Duncan et al.,

1994), a six-factor model appeared to adequately fit a modified version of the Social Provisions Scale among a small sample of primarily middle-aged female volunteers from aerobic exercise programs; similar results were reported by T. E. Duncan and McAuley (1993). Yet the Nurturance subscale exhibited a weak relationship with the social provisions latent variable in the study by Oman and in the original study by Cutrona and Russell (1987). In the present study, the Nurturance subscale exhibited a statistically significant, although weaker, relationship with the social provisions latent variable than did the other subscales. This consistent finding of a weak relationship is understandable as Nurturance is the only subscale on the Social Provisions Scale that reflects opportunities to extend support; the other subscales reflect support received. This likely results in the smaller covariances between Nurturance and the other subscales on the Social Provisions Scale and thereby yields a corresponding weaker relationship with the social provisions latent variable. Importantly, the Nurturance factor is consistent with both the reciprocal nature of social support (Cobb, 1976; Cutrona & Russell, 1987; R. S. Weiss, 1974) and the definition of social support as “aid and assistance *exchanged* through social relationships and interpersonal transactions” (Heaney & Israel, 1997, p. 181). Thus, we believe that the Nurturance subscale should be retained within the modified Social Provisions Scale rather than excluded as in other studies of physical activity with adults (T. E. Duncan et al., 1994).

#### *Longitudinal Factorial Invariance*

We tested the longitudinal invariance of the second-order model for the modified Social Provisions Scale to establish the final model’s cross-validity in the samples of White and Black girls. The second-order model exhibited longitudinal invariance of the overall structure and the first- and second-order factor loadings, first- and second-order factor variances, and item uniquenesses in the sample of White girls. The second-order model exhibited longitudinal invariance of the overall structure and the first- and second-order factor loadings and first- and second-order factor variances but not item uniquenesses in the sample of Black girls. These results demonstrate that the latent structure underlying the modified Social Provisions Scale exhibits cross-validity, stationarity, and stability. Stationarity demonstrates that the same construct is being measured across time and is based on the longitudinal invariance of the factor structure and factor loadings (Motl & DiStefano, 2002). Stability demonstrates that the relative rank order of participants on the construct remains constant across time and is based on the longitudinal invariance of the factor covariances (Motl & DiStefano, 2002). Hence, our results allow for meaningful comparisons of composite scores from the mod-

ified Social Provisions Scale across time in samples of adolescent Black and White girls (Vandenberg & Lance, 2000).

### *Multigroup Invariance*

Although a single second-order factor was tenable in both samples of White and Black girls, the number of items and factors and the pattern of factor loadings for the first-order factors differed between samples. With the sample of White girls, there were 24 items on the Social Provisions Scale, and the covariances of the items were described by six substantive first-order factors plus an orthogonal method factor. With the sample of Black girls, there were 22 items on the Social Provisions Scale, and the covariances of the items were described by four substantive first-order factors plus an orthogonal method factor. Hence, we were unable to undertake an analysis of multigroup factorial invariance for the Social Provisions Scale; the final model did not have the same number of items and pattern of fixed and freed factor loadings for both White and Black girls (i.e., conceptual equivalence of the underlying theoretical variable).

### *Construct Validity*

The structural equation modeling supported the hypothesized relationships between social provisions and MVPA, as illustrated in Figure 2. There were statistically significant direct effects between social provisions and MVPA for baseline and follow-up. With the sample of White girls, the direct effects indicated that a one standard deviation change in social provisions resulted in .28 and .14 standard deviation unit changes in MVPA at baseline and follow-up, respectively. With the sample of Black girls, the direct effects indicated that a one standard deviation change in social provisions resulted in .20 and .16 standard deviation unit changes in MVPA at baseline and follow-up, respectively. Those relationships are small in magnitude when judged against guideposts for sample statistics (Cohen, 1988), but the magnitude approximates previously observed effects for social-cognitive variables on physical activity among adolescents (Motl et al., 2001, 2003; Sallis et al., 2000).

Subjective norms were significantly correlated with social provisions for both baseline and follow-up data as expected. But there were zero-order correlations between subjective norms and MVPA. The observed pattern of relationships provides convergent and discriminant evidence for the construct validity of the modified Social Provisions Scale. Social provisions were moderately related with subjective norms; this indicated that both measures were tapping social constructs (i.e., convergent evidence). Social provisions,

but not subjective norms, predicted MVPA (i.e., discriminant evidence). Thus, the modified Social Provisions Scale apparently assesses a social construct that is related to subjective norm but is independently predictive of physical activity among adolescent girls.

Most studies of determinants of physical activity have used cross-sectional designs (Dishman, 1994; Sallis et al., 1992, 2000). The present study provided longitudinal evidence of a synchronous cross-sectional association between social provisions and physical activity. This provides strong evidence of a persistent association between social provisions and physical activity, supporting the idea that social provisions might be a mediator of change in MVPA among adolescent Black and White girls.

Because the purpose of this study involved the validation of inferences from an overall score on the modified Social Provisions Scale, we did not test the relationships between the individual subscales and MVPA separately. Moreover, our focus on the overall score from the modified Social Provisions Scale is consistent with most previous uses of this scale with samples of adults (T. E. Duncan et al., 1993, 1994; T. E. Duncan & McAuley, 1993; Rhodes et al., 2002). For example, T. E. Duncan and McAuley (1993) modeled social support as a single latent variable using the Attachment, Social Integration, and Guidance subscales of the Social Provisions Scale in a study of the hypothesized relationships among social support, self-efficacy, and exercise behavior. Similarly, social support was modeled as a single latent variable using the Reassurance of Worth, Social Integration, Guidance, Attachment, and Reliable Alliance subscales of the Social Provisions Scale in a study of the hypothesized relationships among social support, hardiness, self-efficacy, and exercise behavior (T. E. Duncan et al., 1994).

#### *Summary and Future Research*

These results support the factorial and construct validity of the modified Social Provisions Scale for physical activity among samples of Black and White adolescent girls. Researchers now have a technology for the pursuit of several important questions. The scale will facilitate the replication and extension of recent studies that identified social support, rather than subjective norms, as an important influence of physical activity within the theory of planned behavior (Courneya et al., 2000; Rhodes et al., 2002). The modified Social Provisions Scale also will enable tests of the mediating effect of self-efficacy on the relationship between social support and physical activity (e.g., T. E. Duncan & McAuley, 1993) among adolescents. Finally, interventions that focus on the mediating effects of social support on participation in physical activity among girls can be developed and evaluated.

Appendix  
Social Provisions Scale

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1. There are people I can count on to be physically active with me.
  2. I do not have any friends or relatives who are physically active.
  3. There is no one I can turn to for advice about physical activity.
  4. There are people who depend on me to help them be physically active.
  5. I know people who enjoy the same physical activities that I do.
  6. Other people think of me as being physically active.
  7. I feel personally responsible for helping another person be physically active.
  8. I am part of a group of people who have the same attitudes about physical activity.
  9. Other people do not respect my physical skills and abilities.
  10. There is no one to take over chores for me so I have time to be physically active.
  11. I am good friends with at least one person who values physical activity.
  12. There is someone I can talk to about physical activity.
  13. There are people who recognize my skills and abilities at physical activity.
  14. There is no one who shares my interests about physical activity.
  15. No one relies on me for help with their physical activity.
  16. There is a person I can turn to for advice if I have problems with physical activity.
  17. I have close relationships with people who make me feel good about myself.
  18. There is no one who rewards me for being physically active.
  19. There is no one who I feel comfortable talking about physical activity.
  20. There are people who admire my talents and abilities regarding physical activity.
  21. I am not close to anyone who values physical activity.
  22. There is no one who likes the same physical activities I do.
  23. There are people who will change their schedule to be physically active with me.
  24. No one counts on me to be physically active with them.
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