Published in final edited form as:
Am J Prev Med. 2005 July ; 29(1): 10–18.

Self-Management Strategies Mediate Self-Efficacy and Physical Activity

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Abstract

Background—Self-efficacy theory proposes that girls who have confidence in their capability to be physically active will perceive fewer barriers to physical activity or be less influenced by them, be more likely to pursue perceived benefits of being physically active, and be more likely to enjoy physical activity. Self-efficacy is theorized also to influence physical activity through self-management strategies (e.g., thoughts, goals, plans, and acts) that support physical activity, but this idea has not been empirically tested.

Methods—Confirmatory factor analysis was used to test the factorial validity of a measure of self-management strategies for physical activity. Next, the construct validity of the measure was tested by examining whether self-management strategies mediated the relationship between self-efficacy and self-reported physical activity, independently of several social-cognitive variables (i.e., perceived barriers, outcome expectancy value, and enjoyment), among cross-sectional samples of 6th grade (n =309) and 8th grade (n =296) girls tested between February 14 and March 17, 2002. Data were analyzed in 2004.

Results—Consistent with theory, self-efficacy had direct effects on the social-cognitive variables. The primary novel finding is that self-management strategies mediated the association of self-efficacy with physical activity in both samples.

Conclusions—The measure of self-management strategies for physical activity yields valid scores among adolescent girls and warrants experimental study as a mediator of the influence of efficacy beliefs on physical activity.

Introduction

Physical inactivity contributes to the increasing health burden of obesity and type 2 diabetes among youths in the United States.[1,2] Recent estimates indicate that 26% of girls and 20% of

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No financial conflict of interest was reported by the authors of this paper.

boys aged 9 to 13 years do not participate in physical activity during their free time.[3] Moreover, physical activity declines during adolescence, especially among girls.[4–7] The public health significance of physical inactivity among adolescent girls underscores the importance of identifying mediators and moderators of physical activity that can be targeted by interventions to increase physical activity levels.[8]

Social-cognitive variables (i.e., beliefs that are formed by social learning and reinforcement history, such as self-efficacy, perceived barriers, outcome expectancy value, and affective experience) are putative influences on self-initiated change in health behavior.[9] They may be especially important during early adolescence as physical activity increasingly becomes a leisure choice. A large number of social-cognitive correlates of physical activity have been identified among adolescents,[10] but their independent utility for explaining physical activity has not been determined within the context of established theoretical models of behavior change.

Self-efficacy theory[11,12] proposes that confidence in personal ability to carry out a behavior (i.e., self-efficacy) influences the direction, intensity, and persistence of behavior. Accordingly, girls who have high self-efficacy about physical activity would perceive fewer barriers to their physical activity or be less influenced by them, be more likely to act (i.e., pursue goals) on their expectations of desirable outcomes of being physically active (i.e., outcome expectancy value), and be more likely to enjoy physical activity. The causal path between self-efficacy and goal striving has been further elaborated by a mediating role of intervening processes[12] or implementation strategies[13] (e.g., instrumental acts) that consist of planning, monitoring, and guidance control of goal pursuit. Thus, self-efficacy might influence physical activity by self-management strategies (e.g., thoughts, goals, plans, and acts) that support physical activity, but this idea has not been tested. Nigg[14] recently provided evidence of sequential, cross-sectional bivariate relationships across 3 years between exercise behavior and self-efficacy, outcome expectancy value, and a measure of processes of change among adolescents, but the independent and mediated relations of those variables with physical activity were not simultaneously evaluated in that report.

The main purpose of this study was to examine the validity of a measure of self-management strategies for physical activity by testing whether it mediated the relationship between self-efficacy and physical activity, independently of selected social-cognitive variables (i.e., perceived barriers, outcome expectancy value, and enjoyment), among two samples of adolescent girls differing in age. Such a mediating influence would provide evidence for the construct validity of self-management strategies by confirming the functional, theoretical network[15] among self-efficacy, self-management strategies, and physical activity.[11–13]

The validity of measures of the variables had not been reported among 6th grade girls, so confirmatory factor analytic procedures[16,17] were used first to establish the factorial validity and the multigroup and longitudinal (i.e., 2 weeks) invariance of the measures in separate samples of 6th and 8th grade girls. Factorial validity is the degree to which the structure of a measure conforms to the theoretical definition of its construct.[15,18–20] Factorial invariance is the degree to which a construct is measured similarly between groups of people or across points of time.[18,21] Without evidence for factorial invariance, differences between groups or across time in scores on a measure might reflect variability in the measurement properties of the self-report instrument used rather than true differences in the latent variable.

Method

Participants

Adolescent girls in the 6th (n =309) and 8th (n =296) grades were recruited from one to four middle schools in each of six regions of the United States (Baltimore MD, Columbia SC, Minneapolis MN, New Orleans LA, San Diego CA, and Tucson AZ) for the pilot testing of social-cognitive measures to be employed as potential moderators, mediators, or secondary outcomes in the Trial of Activity for Adolescent Girls, a physical activity intervention study sponsored by the National Heart, Lung, and Blood Institute. The 6th-grade girls had a mean age of 11.5 (standard deviation [SD] =0.6) years and racial percentages of 45.6% white, 19.7% black, 14.2% Hispanic/Latino, 3.2% Asian/Pacific Islander, 1.9% American Indian, and 3.9% other; 11.3% of the 6th-grade girls did not report race/ethnicity. The 8th-grade girls had a mean age of 13.5 (SD=0.6) years and racial percentages of 51.0% white, 17.6% black, 13.9% Hispanic/Latino, 3.0% Asian/Pacific Islander, 1.0% American Indian, and 3.0% other; 10.5% of the 8th-grade girls did not report race/ethnicity. The race percentages did not differ (χ^2=2.5 [df = 5, n =539], p =0.78) between 6th- and 8th-grade girls.

Measures

Self-management strategies were measured using a modified version of a scale derived from self-management theory, and previously developed for use with college students.[22] The scale included eight items that represented cognitive and behavioral strategies. There were four items for cognitive strategies and four for behavioral strategies. Examples of cognitive and behavioral items were, respectively, “I say positive things to myself about physical activity,” and “I do things to make physical activity more enjoyable.” The items were rated on a five-point scale ranging from 1 (never) to 5 (very often). Table 1 contains a list of the scale items.

Self-efficacy about physical activity was measured using an eight-item questionnaire developed for use with 8th- and 9th-grade girls and reported elsewhere.[16,17] The stability coefficient for the single factor across 1 year was 0.61. Example items on the self-efficacy measure follow: “I can be physically active during my free time on most days no matter how busy my day is,” and “I can ask my parent or other adult to do physically active things with me.” The items were rated on a five-point scale ranging from 1 (disagree a lot) to 5 (agree a lot).

Perceived barriers to physical activity were assessed by an abridged adaptation of a previously developed measure.[23] Among 60 boys and girls in grades 6 to 8 (60% nonwhite), the internal consistency of that scale (Cronbach α) was 0.88, and test–retest reliability (intraclass correlation coefficient [ICC]) across 2 weeks was 0.90. Items were selected from the scale based on content analysis and formative assessment with the girls in this pilot study. The content or language of some items was simplified to facilitate readability (e.g., original items, “my friends tease me during exercise or sports” and “self-conscious about my looks when I do activities” were condensed as, “it would make me embarrassed.” “Lack of a convenient place to do physical activity” was modified as, “I don’t have a place to do physical activity”). A new item was added (i.e., “I might get hurt or sore”). The scale items were rated on a five-point scale ranging from 1 (never) to 5 (very often) (Table 1).

Outcome expectancy value about physical activity was measured using nine items that consisted of belief and corresponding value statements adapted from previously developed scales.[16,17,23] Scores on these nine items obtained from separate pilot samples of 50 to 100 girls yielded acceptable internal consistency reliability (Cronbach α 0.72), and an ICC stability coefficient of 0.72 across 1 week. Belief statements were rated on a five-point scale ranging from 1 (disagree a lot) to 5 (agree a lot) (Table 1). Value statements were rated on a five-point scale with responses ranging from 1 (very unimportant) to 5 (very important). The outcome expectancy values were formed as a product of the belief and corresponding value item scores.[24]

Enjoyment of physical activity was measured using the seven negatively worded items from the modified 16-item version of the Physical Activity Enjoyment Scale reported elsewhere.[25] Positively worded items were excluded to reduce participant burden, and to remove their methodologic effect, as described elsewhere.[25] Example items were “When I am active I dislike it” and “When I am active it’s no fun at all.” The seven items were rated on a five-point scale ranging from 1 (disagree a lot) to 5 (agree a lot) and reverse scored.

Physical activity was measured using an abridged version of the Physical Activity Questionnaire for Older Children reported elsewhere.[26,27] This measure was chosen because it has been validated for use with children of ages similar to the present sample. Also, its length and format minimized participant burden, which was a concern in this pilot study, because all questions had to be answered by the students within a single class period. Each item is scored on a five-point scale, and the sum of the item scores is used as the indicator of physical activity. Internal consistency coefficients (Cronbach α) ranged from 0.79 to 0.89, and the test–retest stability coefficients across 2 weeks were 0.75 for boys and 0.82 for girls.[26] Physical activity was defined as “sports, games, or dance that make you breathe hard, make your legs feel tired, or make you sweat.” Five original items were used that specifically assess activity in physical education classes, during the lunch period, right after school, in the evenings, and on the weekend (Table 1). An item pertaining to recess was removed, which was not relevant to the sample,[26,28] as were three other items that lacked specificity and judged as too time consuming.

Procedure

The questionnaire administration was approved by the Institutional Review Board at each of the six universities participating in the project. All parents or guardians provided written informed consent, and all participants provided written consent. The scales were administered to participants in small groups of girls during class time by trained data collectors who used standardized protocols and scripts when obtaining responses. Nearly 80% of the 6th- (n =250) and 8th-(n =226) grade girls completed the measures again 2 weeks later, permitting an examination of the stability of the measurement instruments by longitudinal invariance analysis. Testing occurred between February 14 and April 17, 2002.

Data Analysis

Confirmatory factor analysis and path analysis were performed using full-information maximum likelihood (FIML) estimation in AMOS, version 4.0 (SmallWaters Corp., Chicago IL, 1999).[29] FIML was selected because there were missing responses to items on the questionnaires, ranging from 1% for the measure of physical activity to 12.5% for the measure of physical activity enjoyment. FIML is an optimal method for the treatment of missing data[29,30] that yields accurate fit indices and parameter estimates with up to 25% simulated missing data.[31,32]

The parameter estimates, standard errors, z-statistics, and squared multiple correlations were inspected for sign and/or magnitude. Parameters with nonsignificant z-statistics and/or a sign opposite of expected direction have no substantively meaningful interpretation.[33,34] Large standard errors provide an indication that the parameter estimate is not reliable.[35] Model fit was assessed using multiple indices. The χ^2 statistic is too sensitive to sample size and assumes the correct model,[20,33,35] so other fit indices are commonly used for judging model fit. Values of the root mean square error of approximation (RM-SEA) of 0.06 and zero (and the 90%

confidence interval) represent close and exact fit, respectively.[36] The comparative fit index (CFI) and non-normed fit index (NNFI) test the proportionate improvement in fit by comparing the target model with the independence model[37]; values approximating 0.90 and 0.95 indicate acceptable and good fit, respectively.[36,37]

The tests of multigroup and longitudinal invariance of the measures involved comparing models that imposed successive restrictions on model parameters for the equality of the overall structure, factor loadings, factor variances, and item uniquenesses.[20,35] The comparison of nested models was based on χ^2 difference tests and changes in the values of the RMSEA, CFI, and NNFI. The criterion of −0.01 for a change in the CFI ($CFI_{constrained\ model} - CFI_{unconstrained\ model}$) is robust for testing multigroup and longitudinal invariance.[38]

Results

Descriptive Statistics

Descriptive statistics for the variables are presented in Table 2. The correlations among the variables are provided in Table 3.

Factorial Validity of Measures

Results of the confirmatory factor analyses of responses to the questionnaires supported the factorial validity of the measures. The multigroup and longitudinal invariance analyses indicated that the factor structure and factor loadings were invariant between the samples of 6th and 8th grade girls, and across time in the combined sample, for the self-management strategies and the social-cognitive variables. The factor structure, factor loadings, and factor variances were invariant between groups and across time for the physical activity measure. The measures each conformed to a single factor structure. The fit indices, internal consistency, and stability coefficients for each scale are provided in Table 4.

The scale items for outcome expectancy value were best represented by a single substantive factor plus three pairs of correlated uniquenesses between similarly worded items. The self-management strategies items were best represented by two correlated factors (i.e., a cognitive strategies factor and a behavioral strategies factor) in each sample. The size of the correlations (0.89 and 0.80, in 6th- and 8th-grade girls, respectively) supported the existence of a single, second-order factor underlying the two, first-order factors. In the combined sample, internal consistency (Cronbach α) was 0.74 and 0.75 for the cognitive and behavioral first-order factors, respectively. The stability coefficients across 2 weeks were 0.76 and 0.77 for the cognitive and behavioral factors, respectively.

Construct Validity of Self-Management Strategies

Results of the path analysis were similar for the 6th- and 8th-grade girls and provided supporting evidence that the relations among self-efficacy, self-management strategies, and the social-cognitive variables were consistent with the functional network hypothesized by self-efficacy theory. Self-efficacy and self-management strategies had direct, independent effects on physical activity. Moreover, the measure of self-management strategies partially mediated the relationship between self-efficacy and physical activity, supporting its construct validity.

Model specification—The model tested with path analysis is presented in Figures 1 and 2, and was tested in the separate samples of 6th and 8th grade girls. Path analysis, which modeled observed variables (i.e., summed scores from the items for each scale), was used rather than latent variable structural equation modeling because of the high ratio of sample moments (n =1769) in the augmented variance–covariance matrix to the number of participants in each sample (*n* =309 and *n* =296). Item parcels were considered for use, but there is no uniform agreement about their appropriateness in covariance modeling because they can bias parameter estimates and influence fit statistics.[39] The model included paths (i.e., γs) between the exogenous variable of self-efficacy and the endogenous variables of self-management strategies, perceived barriers, outcome expectancy value, enjoyment, and physical activity. There were paths (i.e., βs) between the self-management strategies, perceived barriers, outcome expectancy value, enjoyment, and physical activity endogenous variables. There were correlated disturbance terms among the self-management strategies, perceived barriers, outcome expectancy value, and enjoyment endogenous variables to account for unexplained common variance that was not of a hypothesized directional nature.

Model fit: 6th-grade girls—The model in Figure 1 provided a perfect fit because it was completely saturated (i.e., χ^2=0, df=0, CFI=1.00). Significant paths are depicted in Figure 1. There were direct effects of self-efficacy on all variables, and self-efficacy and self-management strategies exhibited direct effects on physical activity independently of their relations with the other social-cognitive variables. Self-efficacy also exhibited an indirect effect on physical activity that was partially mediated by self-management strategies.

Model fit: 8th-grade girls—The model in Figure 2 provided a perfect fit because it too was completely saturated (i.e., χ^2=0, df=0, CFI=1.00). Significant paths are depicted in Figure 2. There were direct effects of self-efficacy on the social-cognitive variables, and direct effects of self-management strategies and perceived barriers on physical activity. Self-efficacy exhibited indirect effects on physical activity that were mediated by self-management strategies and perceived barriers.

Multigroup invariance analysis—To provide a statistical test of possible differences in the magnitude of the path coefficients between age groups, two nested models were compared. The first model constrained the five common, statistically significant paths between (1) self-efficacy and self-management strategies, (2) self-efficacy and perceived barriers, (3) self-efficacy and outcome expectancy value, (4) self-efficacy and enjoyment, and (5) self-management strategies and physical activity to be equal between the 6th- and 8th-grade girls. This model provided an excellent fit (χ^2=3.31, df=5, *p* =0.65, RMSEA [90% CI]= 0.00 [0.00–0.05], CFI=1.00, NNFI=1.02). The second model did not constrain any of the paths to be equal between groups, and provided a perfect fit as the model was saturated (i.e., χ^2=0, df=0, CFI=1.00). There was not a statistically significant difference between the fit of the two nested models (χ^2_{diff} = 3.31, df=5, *p* =0.65), indicating that the five common paths were similar in magnitude between groups of 6th- and 8th-grade girls.

Discussion

This study provides the initial test by covariance modeling of the validity and usefulness of the self-management strategies questionnaire among adolescent girls. Construct validity was supported by the evidence for factorial validity and invariance of the self-management strategies measure and its independent relationship with physical activity in both samples of 6th- and 8th-grade girls.

Two novel findings of the study are consistent with self-efficacy theory, but had not been previously demonstrated for physical activity. First, the association between self-efficacy and physical activity was mediated by self-management strategies. A recent school-based intervention that increased physical activity among adolescent girls also increased self-efficacy and goal setting, but only self-efficacy mediated the increased physical activity.[40] That finding and the present results suggest that self-management strategies other than goal setting are a possible mechanism by which self-efficacy influences self-initiated physical activity. Second,

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no direct association between self-efficacy and physical activity was observed among the 8th-grade girls. Rather, the association of self-efficacy with physical activity was indirect, mediated by self-management strategies and perceived barriers. This suggests that interventions should specifically target self-management strategies and perceived barriers to physical activity as girls progress during adolescence.

With the exception of perceived barriers among 8th graders, the other social-cognitive variables (i.e., outcome expectancy value, perceived barriers among 6th graders, and enjoyment) did not exhibit direct associations with physical activity. In contrast, physical activity has been inversely related to perceived barriers[41–43] and positively related to outcome expectancy value[44–50] and enjoyment[25,45,51–53] in other studies of children and adolescents. However, those studies did not directly compare the independent associations of self-efficacy, perceived barriers, outcome expectancy value, and enjoyment with physical activity among girls of different ages. The present results suggest that self-efficacy may account for the influence of those variables on physical activity among young girls. Self-efficacy exhibited a direct relationship with physical activity among the 6th grade sample, consistent with previous cross-sectional[44,49,54] and longitudinal[40,47,50,52] analyses of samples of adolescent girls and boys.

The used measure focuses on self-efficacy for overcoming barriers to being physically active. Bandura[12] has proposed that efficacy beliefs about overcoming barriers should predict exercise adoption, whereas efficacy beliefs about self-regulation of behavior should predict long-term exercise adherence. Accordingly, the results suggest that self-efficacy about overcoming barriers might represent an important initial target for a physical activity intervention during early adolescence, but it is recognized that other forms of efficacy, such as self-regulatory efficacy, might be more important for long-term changes in physical activity.

Bandura[11,12] has proposed that self-efficacy operates on behaviors through mediating effects of self-management strategies comprised of cognitive, motivational, affective, and selection dimensions such as strategies for choosing and controlling activities and environments. Those self-management strategies overlap conceptually with several processes of change included in the transtheoretical model (TTM) of stages of change.[55] Although self-efficacy has been incorporated within the TTM for studies of exercise among adults,[56] no other studies were found to have examined how self-management strategies may differentially mediate the effects of self-efficacy on long-term variations in physical activity among adolescent girls. Because it remains controversial whether fluctuations in self-initiated physical activity occur in distinct stages or represent a continuum,[57,58] studies of self-efficacy and self-management strategies should compare methodologies that manipulate or otherwise model changes in physical activity according to discrete stages or a behavioral continuum.[59]

The cross-sectional design of the study precludes the temporal sequencing of the measures with sufficient time (e.g., >2-week test–retest period) and the experimental manipulation needed to draw inferences about the causal nature of the paths observed between self-efficacy, self-management strategies, and physical activity. Nonetheless, the directional path model examined was derived from self-efficacy[11] and self-management[13] theories. Because the results are fully consistent with those theories, they are sufficiently positive to encourage experimental research which can confirm that self-management strategies mediate efficacy beliefs about barriers to physical activity among adolescent girls. The findings do not exclude the possibility that the use of self-management strategies might enhance self-efficacy. Research is also needed to examine whether efficacy beliefs about self-regulation influence long-term physical activity and are similarly mediated by self-management strategies.

What This Study Adds

Physical activity declines among girls during adolescence.

Self-efficacy is a putative mediator of successful intervention to increase physical activity.

This correlational study of 6th and 8th grade girls shows that self-management strategies (e.g., thoughts, goals, plans, and acts) that support physical activity can be measured validly, and help explain the relation between self-efficacy and physical activity.

Interventions designed to increase physical activity among adolescent girls by increasing self-efficacy should target and experimentally evaluate self-management strategies.

Acknowledgements

This research was supported by grants from the National Heart, Lung, and Blood Institute of the National Institutes of Health (U01HL66858, U01HL66857, U01HL66845, U01HL66856, U01HL66855, U01HL66853, and U01HL66852).

References

1. Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999–2000. JAMA 2002;288:1728–32. [PubMed: 12365956]
2. Wang G, Dietz WH. Economic burden of obesity in youths aged 6 to 17 years: 1979–1999. Pediatrics 2002;109:E81, 1–6. [PubMed: 11986487]
3. Duke J, Huhman M, Heitzler C. Physical activity levels among children aged 9–13 years – United States, 2002. Morb Mortal Wkly Rep 2003;52:785–8.
4. Caspersen CJ, Pereira MA, Curran KM. Changes in physical activity patterns in the United States, by sex and cross-sectional age. Med Sci Sports Exerc 2000;32:1601–9. [PubMed: 10994912]
5. Centers for Disease Control and Prevention. Youth risk behavior surveillance—United States, 1997. MMWR Surveill Summ 1998;47:1–89.
6. Kimm SYS, Glynn NW, Kriska AM, et al. Decline in physical activity in black girls and white girls during adolescence. N Engl J Med 2002;347:709–15. [PubMed: 12213941]
7. Grunbaum JA, Kann L, Kinchen SA, et al. Youth risk behavior surveillance—United States, 2001. MMWR Surveill Summ 2001;51:1–64. [PubMed: 12102329]
8. Lewis BA, Marcus BH, Pate RR, Dunn AL. Psychosocial mediators of physical activity behavior among adults and children. Am J Prev Med 2002;23(suppl 2):26–35. [PubMed: 12133735]
9. Bandura A. Health Promotion by social-cognitive means. Health Educ Behav 2004;31:143–64. [PubMed: 15090118]
10. Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. Med Sci Sports Exerc 2000;32:963–75. [PubMed: 10795788]
11. Bandura, A. Self-efficacy: the exercise of control. New York: W.H. Freeman and Company; 1997.
12. Bandura A. Human agency in social-cognitive theory. Am Psychol 1989;44:1175–84. [PubMed: 2782727]
13. Bagozzi RP. The self-regulation of attitudes, intentions, and behavior. Soc Psychol Q 1992;55:178–204.
14. Nigg CR. Explaining adolescent exercise behavior change: a longitudinal application of the transtheoretical model. Ann Behav Med 2001;23:11–20. [PubMed: 11302350]
15. Messick S. Validity of psychological assessment: validation of inferences from persons' responses and performances as scientific inquiry into score meaning. Am Psychol 1995;50:741–9.
16. Dishman RK, Motl RW, Saunders RP, et al. Factorial invariance and latent mean structure of questionnaires measuring social-cognitive determinants of physical activity among black and white adolescent girls. Prev Med 2002;34:100–8. [PubMed: 11749102]
17. Motl RW, Dishman RK, Trost SG, et al. Factorial validity and invariance of questionnaires measuring social-cognitive determinants of physical activity in adolescent girls. Prev Med 2000;31:584–94. [PubMed: 11071840]

18. Hoyle RH, Smith GT. Formulating clinical research hypotheses as structural equation models: a conceptual overview. J Consult Clin Psychol 1994;62:429–40. [PubMed: 8063970]
19. Loevinger J. Objective tests as instruments of psychological theory. Psychol Rep 1957;3:635–94.
20. Bollen, KA. Structural equations with latent variables. New York: John Wiley and Sons; 1989.
21. Vandenberg RJ, Lance CE. A review and synthesis of the management invariance literature: suggestions, practices, and recommendations for organizational research. Org Res Methodol 2000;3:4–69.
22. Saelens BE, Sallis JF, Calfas KJ, Sarkin JA, Caparosa S. Use of self-management strategies in a 2-year cognitive-behavioral intervention to promote physical activity. Behav Ther 2000;31:365–79.
23. Taylor WC, Sallis JF, Dowda M, Freedson PS, Eason K, Pate RR. Activity patterns and correlates among youth: differences by weight status. Pediatr Exerc Sci 2002;14:418–31.
24. Ajzen I. The theory of planned behavior. Org Behav Hum Decisional Process 1991;50:179–211.
25. Motl RW, Dishman RK, Saunders R, Dowda M, Felton G, Pate RR. Measuring enjoyment of physical activity among adolescent girls. Am J Prev Med 2001;21:110–7. [PubMed: 11457630]
26. Crocker PRE, Bailey DA, Faulkner RA, Kowalski KC, McGrath R. Measuring general levels of physical activity: preliminary evidence for the physical activity questionnaire for older children. Med Sci Sports Exerc 1997;29:1344–9. [PubMed: 9346166]
27. Kowalski KC, Crocker PRE, Faulkner RA. Validation of the physical activity questionnaire for older children. Pediatr Exerc Sci 1997;9:174–86.
28. Kowalski KC, Crocker PRE, Kowalski NP. Convergent validity of the physical activity questionnaire for adolescents. Pediatr Exerc Sci 1997;9:342–52.
29. Arbuckle, JL.; Wothke, W. Amos 4.0 user’s guide. Chicago: SmallWaters Corporation; 1999.
30. Enders CK. A primer on maximum likelihood algorithms available for use with missing data. Structural Equation Modeling 2001;8:128–41.
31. Arbuckle, JL. Full information estimation in the presence of incomplete data. In: Marcoulides, GA.; Schumacker, RE., editors. Advanced structural equation modeling: issues and techniques. Mahwah NJ: Lawrence Erlbaum; 1996. p. 243-77.
32. Enders CK, Bandalos DL. The relative performance of full information maximum likelihood estimation for missing data in structural equation models. Structural Equation Modeling 2001;8:430–57.
33. Jöreskog, KG. Testing structural equation models. In: Bollen, KA.; Long, JS., editors. Testing structural equation models. Newbury Park CA: Sage; 1993. p. 294-316.
34. Raykov, T.; Marcoulides, GA. A first course in structural equation modeling. Mahwah NJ: Lawrence Erlbaum; 2000.
35. Jöreskog, KG.; Sörbom, D. LISREL 8: User’s reference guide. Chicago: Scientific Software International; 1996.
36. Hu L, Bentler PM. Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. Structural Equation Modeling 1999;6:1–55.
37. Bentler PM. Comparative fit indices in structural models. Psychol Bull 1990;107:238–46. [PubMed: 2320703]
38. Cheung GW, Rensvold RB. Evaluating goodness-of-fit indices for testing measurement invariance. Structural Equation Modeling 2002;9:233–55.
39. Hall RJ, Snell AF, Foust MS. Item parceling strategies in SEM: investigating the subtle effects of unmodeled secondary constructs. Org Res Methodol 1999;2:233–56.
40. Dishman RK, Motl RW, Saunders RP, et al. Self-efficacy partially mediates the effect of an intervention to increase physical activity among black and white adolescent girls. Prev Med 2004;38:628–36. [PubMed: 15066366]
41. Tappe MK, Duda JL, Ehrnwald PM. Perceived barriers to exercise among adolescents. J Sch Health 1989;59:153–5. [PubMed: 2716290]
42. Tappe MK, Duda JL, Menges-Ehrnwald P. Personal investiment predictors of adolescent motivational orientation toward exercise. Can J Sports Sci 1990;15:185–92.

43. Zakarian JM, Hovell MF, Hofstetter CR, Sallis JF, Keating KJ. Correlates of vigorous exercise in a predominantly low SES and minority high school population. Prev Med 1994;23:314–21. [PubMed: 8078852]

44. Strauss RS, Rodzilsky D, Burack G, Colin M. Psychosocial correlates of physical activity in healthy children. Arch Pediatr Adolesc Med 2001;155:897–902. [PubMed: 11483116]

45. Bungum T, Dowda M, Weston A, Trost SG, Pate RR. Correlates if physical activity in male and female youth. Pediatr Exerc Sci 2000;12:71–9.

46. O'Loughlin J, Paradis G, Kishchuk N, Barnett T, Renaud L. Prevalence and correlates of physical activity behaviors among elementary schoolchildren in multiethnic, low-income, innercity neighborhoods in Montreal, Canada. Ann Epidemiol 1999;9:397–407. [PubMed: 10501407]

47. Reynolds KD, Killen JD, Bryson SW, et al. Psychosocial predictors of physical activity in adolescence. Prev Med 1990;19:541–51. [PubMed: 2235921]

48. Stucky-Ropp RC, DiLorenzo TM. Determinants of exercise in children. Prev Med 1993;22:880–9. [PubMed: 8115345]

49. Trost SG, Pate RR, Ward DS, Saunders R, Riner W. Correlates of objectively measured physical activity in preadolescent youth. Am J Prev Med 1999;17:120–6. [PubMed: 10490054]

50. Trost SG, Pate RR, Saunders R, Ward DS, Dowda M, Felton G. A prospective study of the determinants of physical activity in rural fifth-grade children. Prev Med 1997;26:257–63. [PubMed: 9085396]

51. Bungum TJ, Vincent ML. Determinants of physical activity among female adolescents. Am J Prev Med 1997;13:115–22. [PubMed: 9088448]

52. DiLorenzo TM, Stucky-Rupp RC, Vander Wal JS, Gotham HJ. Determinants of exercise among children. II. A longitudinal analysis. Prev Med 1998;27:470–7. [PubMed: 9612838]

53. Welk GJ, Wood K, Morss G. Parental influences on physical activity in children: an exploration of potential mechanisms. Pediatr Exerc Sci 2003;15:19–33.

54. Motl RW, Dishman RK, Saunders R, et al. Examining social-cognitive determinants of intention and physical activity among black and white adolescent girls using structural equation modeling. Health Psychol 2002;21:459–67. [PubMed: 12211513]

55. Prochaska, JO.; Marcus, BH. The transtheoretical model: applications to exercise. In: Dishman, RK., editor. Advances in exercise adherence. Champaign IL: Human Kinetics; 1994. p. 161-80.

56. McAuley E, Blissmer B. Self-efficacy determinants and consequences of physical activity. Exerc Sport Sci Rev 2000;28:85–8. [PubMed: 10902091]

57. Bandura A. Editorial: the anatomy of stages of change. Am J Health Promot 1997;12:8–10. [PubMed: 10170438]

58. Rosen CS. Is the sequencing of change processes by stage consistent across health problems? A meta-analysis. Health Psychol 2000;19:593–604. [PubMed: 11129363]

59. Weinstein ND, Rothman AJ, Sutton SR. Stage theories of health behavior: conceptual and methodological issues. Health Psychol 1998;17:290–9. [PubMed: 9619480]

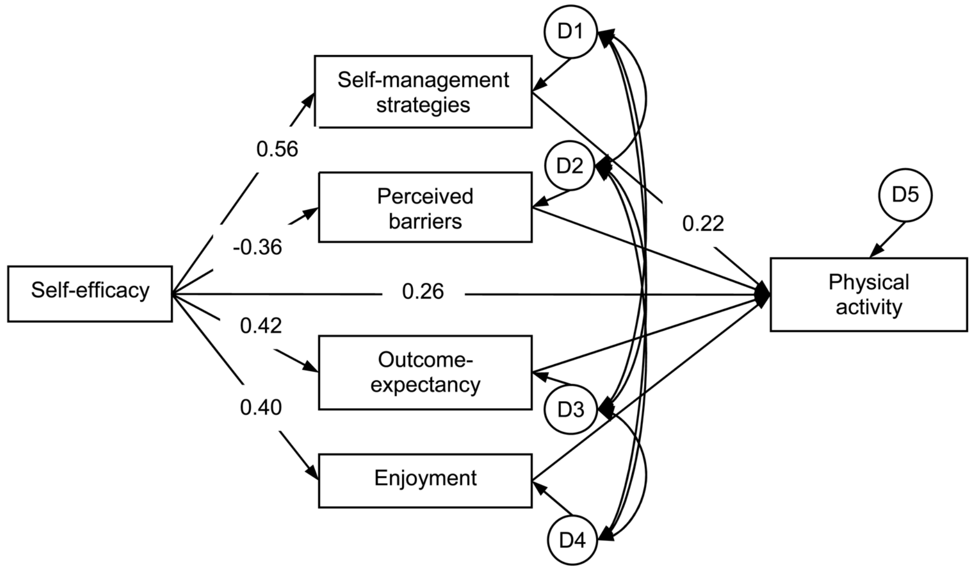

Figure 1.
Model depicting the hypothesized associations among self-efficacy, self-management strategies, perceived barriers, outcome expectancy value, enjoyment, and physical activity among 6th grade girls. Coefficients are provided for the significant paths. D1 to D5 represent disturbance terms.

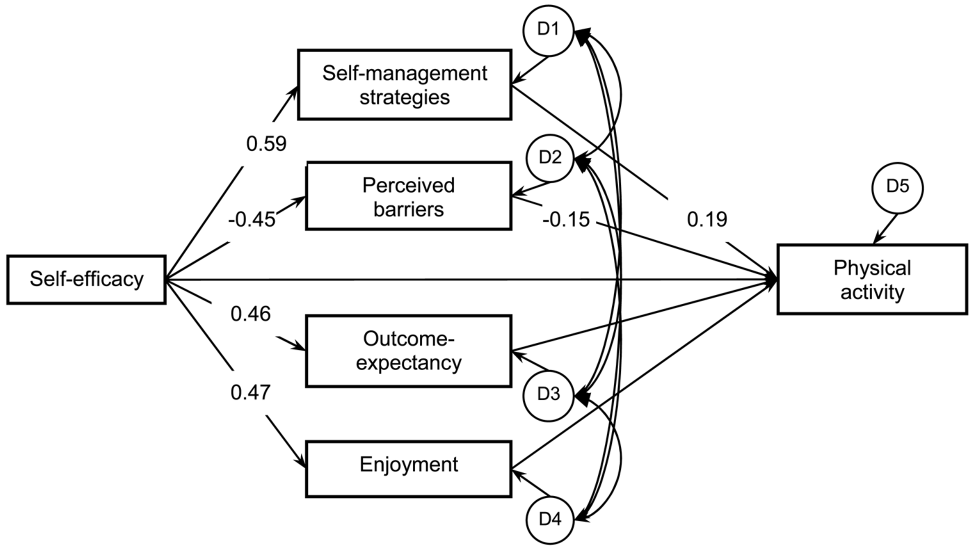

Figure 2.
Model depicting the hypothesized associations among self-efficacy, self-management strategies, perceived barriers, outcome expectancy value, enjoyment, and physical activity among 8th grade girls. Coefficients are provided for the significant paths. D1 to D5 represent disturbance terms.

Table 1

Items assessing self-management strategies, perceived barriers, outcome expectancy, and physical activity

Self-management strategies	
1	I do things to make physical activity more enjoyable.
2	I think about the benefits I will get from being physically active.
3	I try to think more about the benefits of physical activity and less about the hassles of being active.
4	I say positive things to myself about physical activity.
5	When I get off track with my physical activity plans, I tell myself I can start again and get right back on track.
6	I try different kinds of physical activity so that I have more options to choose from.
7	I set goals to do physical activity.
8	I make backup plans to be sure I get my physical activity.
Perceived barriers to physical activity	
1	Physical activity is boring.
2	The weather is bad.
3	I don’t know how to do the physical activity that I want to do.
4	I don’t have a place to do physical activity.
5	I’m chosen last for teams.
6	I don’t like to sweat.
7	It would take time away from my friends.
8	I might get hurt or sore.
9	It would make me embarrassed.
10	It would make me tired.
Outcome expectancy	
1	It would help me spend more time with my friends.
2	It would help get or keep me in shape.
3	It would help me control my weight.
4	It would put me in a better mood.
5	It would make me better in sports, dance, or other activities.
6	It would be fun.
7	It would make me look better.
8	I would make new friends.
9	I would feel better about myself.
Physical activity	
1	In the last 7 days, during PE classes, how often were you very active (playing hard, running, jumping, throwing)? 1=I did not have PE; 2=hardly ever; 3=sometimes; 4=quite often; 5=always
2	In the last 7 days, what did you normally do AT LUNCH (besides eating lunch)? 1=sat down (talking, reading, doing school work); 2=stood around; 3=walked around a little; 4=ran around and played quite a bit; 5=ran around and played hard most of the time
3	In the last 7 days, RIGHT AFTER SCHOOL, how many days did you do sports, dance, or play games in which you were active? 1=none; 2=1 day; 3=2–3 days; 4=4 days; 5=every day
4	In the last 7 days, on how many EVENINGS did you play sports, dance, or play games in which you were very active? 1=none; 2=1 evening; 3=2–3 evenings; 4=4–5 evenings; 5=6–7 evenings
5	LAST WEEKEND, how many times did you play sports, dance, or play games in which you were very active? 1=none; 2=1 time; 3=2–3 times; 4=4–5 times; 5=6 or more times

PE, physical education.

Table 2

Descriptive statistics for self-management strategies, social-cognitive variables, and self-reported physical activity

Measure	**Overall sample *n* = 605**	**6th graders *n* = 309**	**8th graders *n* = 296**
Self-management strategies	29.8 (6.9)	30.5 (6.9)	29.1 (6.9)
Self-efficacy	29.4 (6.1)	30.2 (6.2)	28.6 (5.9)
Perceived barriers	21.5 (6.4)	20.9 (6.3)	22.2 (6.4)
Outcome expectancy	162.3 (41.1)	164.3 (41.9)	160.3 (40.3)
Enjoyment	29.5 (5.4)	29.7 (5.5)	29.2 (5.3)
Physical activity	14.9 (4.0)	15.9 (3.8)	13.9 (3.9)

Note: Values represent mean score (standard deviation). Mean scores for each scale were computed by summing the individual item scores based on unity weights.

Table 3

Correlations among self-management strategies, social-cognitive variables, and self-reported physical activity

Variables	Sample	1	2	3	4	5	6
1. Self-management strategies	Overall	—					
	6th grade	—					
	8th grade	—					
2. Self-efficacy	Overall	0.58	—				
	6th grade	0.56	—				
	8th grade	0.59	—				
3. Barriers	Overall	−0.34	−0.42	—			
	6th grade	−0.26	−0.36	—			
	8th grade	−0.41	−0.45	—			
4. Outcome expectancy	Overall	0.46	0.44	−0.25	—		
	6th grade	0.44	0.42	−0.17	—		
	8th grade	0.48	0.46	−0.32	—		
5. Enjoyment	Overall	0.34	0.44	−0.59	0.33	—	
	6th grade	0.28	0.40	−0.61	0.27	—	
	8th grade	0.39	0.47	−0.56	0.40	—	
6. Physical activity	Overall	0.37	0.38	−0.28	0.18	0.26	—
	6th grade	0.36	0.38	−0.19	0.15	0.19	—
	8th grade	0.34	0.33	−0.33	0.20	0.31	—

Note: The correlations were computed using a confirmatory factor analytic approach using AMOS 4.0 with all measures modeled as observed variables. All correlations were statistically significant (p<0.05).

Table 4

Fit indices and reliabilities for the self-management strategies, social–cognitive, enjoyment, and physical activity measures

Measure sample	χ^2 (df)	RMSEA (90% CI)	CFI	NNFI	Combined samples	
					Cronbach α	Stability
Self-management strategies						
6th grade	28.1 (19)	0.04 (0.00–0.07)	0.98	0.97	0.83	0.84
8th grade	45.0 (19)	0.07 (0.04–0.09)	0.97	0.94		
Self-efficacy						
6th grade	43.4 (20)	0.06 (0.04–0.09)	0.96	0.94	0.79	0.78
8th grade	32.5 (20)	0.05 (0.01–0.07)	0.97	0.96		
Perceived barriers						
6th grade	41.5 (35)	0.02 (0.00–0.05)	0.99	0.98	0.77	0.77
8th grade	69.2 (34)	0.06 (0.04–0.08)	0.94	0.92		
Outcome expectancy value						
6th grade	59.8 (24)	0.07 (0.05–0.09)	0.97	0.95	0.86	0.64
8th grade	72.0 (24)	0.08 (0.06–0.11)	0.96	0.93		
Enjoyment						
6th grade	50.6 (14)	0.09 (0.07–0.12)	0.94	0.91	0.84	0.73
8th grade	35.1 (14)	0.07 (0.04–0.10)	0.97	0.96		
Physical activity						
6th grade	1.3 (5)	0.00 (0.00–0.02)	1.00	1.04	0.61	0.81
8th grade	5.5 (5)	0.02 (0.00–0.09)	1.00	0.99		

CI, confidence interval; CFI, comparative fit index; NNFI, non-normed fit index; RMSEA, root mean square error of approximation.