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# Goals and Intentions Mediate Efficacy Beliefs and Declining Physical Activity in High School Girls

Rod K. Dishman, PhD, Ruth P. Saunders, PhD, Gwen Felton, PhD, Dianne S. Ward, EdD, Marsha Dowda, DrPH, Russ R. Pate, PhD

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**Background:** According to theory, girls who set goals about increasing their physical activity and who are dissatisfied with their current activity level are likely to form intentions to be active and to carry out those intentions, especially if they have high efficacy and control beliefs about being physically active. We tested those ideas while observing naturally occurring change during high school.

**Methods:** A cohort of 431 black and white girls was tested at the end of their 9th- and 12th-grade academic years. Confirmatory factor analysis established the structural invariance of the measures across the 3-year study period. Structural equation modeling and panel analysis were used to determine whether changes in goal setting and satisfaction would mediate relations of self-efficacy and perceived behavioral control with changes in intention and physical activity. Testing occurred between February and May in 1999 and 2004. Data were analyzed in 2006.

**Results:** Goal setting and intention mediated the indirect relation between self-efficacy and change in physical activity. Perceived behavioral control and physical activity change were related directly and also indirectly by a path mediated through satisfaction and intention. Black girls had lower self-efficacy, but changes in other variables were unrelated to race.

**Conclusions:** These observations of longitudinal relations elaborate application of self-efficacy theory and the theory of planned behavior to physical activity by showing that goal setting and satisfaction mediate the relations of self-efficacy and perceived behavioral control with changes in intention and physical activity. The results encourage additional research to identify the sources and development of physical activity goals, and their attainment, among girls, and whether experimental manipulation of goals and intentions can mitigate the decline in girls' physical activity during high school.

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## Introduction

Insufficient levels of physical activity among adolescent girls is a public health concern in the United States. The rate of decline in physical activity during high school is nearly twice as great in girls compared to boys.<sup>1,2</sup> Nearly two of three girls and three of four boys in the United States participate in sufficient vigorous physical activity when they are in the 9th grade, but by the 12th grade only 46% of girls are sufficiently active compared to 64% of boys.<sup>2</sup> Black girls are the least active, despite having a rate of enrollment in physical education classes similar to white girls.<sup>2,3</sup>

A popular model for understanding mediators<sup>4</sup> of physical activity among adolescent boys and girls is the theory of planned behavior,<sup>5</sup> which proposes that the proximal (i.e., direct) cause of behavior is intention, which is determined by perceived behavioral control, attitude, and subjective norm. Perceived behavioral control also has a direct effect on behavior independent of intention.<sup>6</sup> The cumulative evidence from cross-sectional and prospective studies has supported those relationships for understanding adolescents' intentions to be physically active<sup>7–12</sup> and the relationship of intentions with physical activity.<sup>9,11–16</sup>

However, the studies used correlational analyses that failed to identify the functional network of direct and indirect relationships of the variables with physical activity, or they did not model change in both physical activity and its predictors across time. Those approaches can yield misleading results. Other research using structural equation modeling (SEM), which simultaneously estimates direct and indirect relationships, reported that self-efficacy about overcoming barriers

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From the Department of Kinesiology, University of Georgia (Dishman), Athens, Georgia; Department of Health Promotion and Education (Saunders), College of Nursing (Felton), and Department of Exercise Science, University of South Carolina (Dowda, Pate), Columbia, South Carolina; and Department of Nutrition, University of North Carolina (Ward), Chapel Hill, North Carolina

Address correspondence and reprint requests to: Rod K. Dishman, PhD, The University of Georgia, Ramsey Student Center, 330 River Road, Athens GA 30602-6554. E-mail: rdishman@uga.edu.

riers to physical activity accounted for the influences of subjective norm and perceived behavioral control on intention to be physically active.<sup>17</sup> Likewise, it was found that self-efficacy accounted for the relationships of physical activity with intention in cross-sectional samples of 8th- and 9th-grade girls,<sup>18,19</sup> but change in perceived behavioral control, rather than self-efficacy, was related to change in the girls' physical activity between the 8th and 9th grades.<sup>20</sup> Moreover, the relationship of self-efficacy with physical activity in the 8th grade was not direct. It was mediated by the girls' use of self-management strategies such as goal setting.<sup>19</sup>

Self-efficacy conceptualizes a belief in personal capabilities to organize and execute the courses of action required to attain a behavioral goal.<sup>21</sup> Like self-efficacy, perceived behavioral control includes efficacy beliefs about internal factors (e.g., skills, abilities, and will power) and external factors (e.g., time, opportunity, obstacles, and dependence on other people) that are imposed on behavior.<sup>6</sup> Although both constructs represent personal efficacy judgments about the ease or difficulty of performing a behavior, perceived behavioral control also emphasizes beliefs about personal control over the performance of the behavior.<sup>6</sup> Each construct is distinguishable from outcome expectancy, which is the perceived likelihood that performing a behavior will result in a specific outcome. Although people are more likely to form an intention to behave when they value an expected outcome of the behavior (i.e., they have a positive attitude), that likelihood is increased when a proximal goal is set.<sup>22</sup> Self-efficacy theory<sup>21</sup> proposes that people who set goals about being more active and who are dissatisfied with their current activity level will be more likely to adopt physical activity, especially if they have high self-efficacy about their ability to be physically active. Like perceived behavioral control, self-efficacy affects behavior directly and also indirectly by influencing intentions.<sup>21</sup>

Although perceived behavioral control and self-efficacy each are theorized to influence intentions regarding goal-directed behavior, past studies of physical activity have not examined whether their effects on intentions and behavior are mediated by goal setting. Aside from studies of motivation in youth sports,<sup>23</sup> research on correlates of physical activity among adolescents has paid little attention to goals,<sup>24–26</sup> which are fundamental to self-initiated behavior change.<sup>27</sup> The Lifestyle Education for Activity Program (LEAP)<sup>28</sup> was successful in increasing physical activity goals among black and white girls during the 9th grade, but only the increases in self-efficacy, not goals, were related to increased physical activity after the intervention.<sup>29</sup> Notwithstanding those findings, it is possible that the influence of goals on physical activity might increase during high school when physical activity increasingly becomes a leisure choice and girls' physical activity levels decline.

This report describes a longitudinal, observational study of the relationship between naturally occurring changes in goals and physical activity during high school among black and white girls who were members of the experimental and control cohorts of the LEAP intervention. The girls were reassessed in the 12th grade, 3 years after the LEAP intervention ended.

Measurement properties of the instruments used in this study had not been reported among 12th-grade girls, so confirmatory factor analysis was used first to establish the factorial validity and longitudinal (i.e., 3 years) invariance of the measures in this sample. Factorial validity is the degree to which the structure of a measure conforms to the theoretical definition of its construct.<sup>30–33</sup> Longitudinal factor invariance is the degree to which a construct is measured similarly across points of time.<sup>33</sup>

Structural equation modeling and panel analysis were then used to determine whether the decline in physical activity observed between the ends of the 9th- and 12th-grade academic years was related to concurrently assessed changes in the girls' goals and intentions about physical activity and satisfaction with their current level of physical activity. The girls' perceived behavioral control and self-efficacy beliefs about overcoming barriers to physical activity were also assessed along with attitude and subjective norm.

Consistent with theory and previous studies of physical activity, it was hypothesized that self-efficacy would not have a direct effect on physical activity, but rather an indirect effect mediated by goal setting, satisfaction, and intention. In contrast, it was hypothesized that perceived behavioral control would have both a direct effect on physical activity and an indirect effect mediated by intention, independent of attitude and subjective norm.

## Methods

### Participants

Participants were from 22 public high schools in South Carolina who were in the LEAP trial. Recruitment and data collection are described elsewhere.<sup>28</sup> Three years after the LEAP intervention ended, 243 members of the intervention cohort ( $n=863$ ) and 200 members of the control cohort ( $n=741$ ) were assessed again at the end of their 12th-grade academic year. Loss to follow-up resulted mainly from failure to complete high school (45%), transferring out of the schools (10%), or nonattendance on testing days (5%). The two re-tested groups did not differ (mean  $\pm$  standard deviation) from other LEAP 9th graders who were subsequently lost to follow-up, or between each other in 9th and 12th grades, respectively, in age ( $14.6 \pm 0.6$  and  $17.7 \pm 0.6$  years), fitness (physical working capacity at a heart rate of 170 beats per minute) ( $10.6 \pm 3.2$  and  $11.2 \pm 3.6$   $\text{kg}^{-\text{m}}/\text{min}/\text{kg}$ ), body mass index ( $24.5 \pm 5.6$   $\text{kg}/\text{m}^2$  and  $24.2 \pm 5.5$   $\text{kg}/\text{m}^2$ ), physical activity ( $63.1 \pm 9.9$  and  $61.4 \pm 11.5$  metabolic equivalents [METs]/3 days), and in participation in organized sports or

enrollment in physical education classes. Compared to other LEAP 9th graders who were subsequently lost to follow-up, the participants had higher ( $p < 0.01$ ) scores on perceived behavioral control, attitude, and goal setting, but similar ( $p > 0.10$ ) scores on self-efficacy, satisfaction, subjective norm, and intention. The differences were small ( $\omega^2$  ranged from 0.001 to 0.03). The participants were all females and mainly black (56.9%) or white (40.5%), with only 2.7% reporting another race. Analyses were conducted on black ( $n = 252$ ) and white ( $n = 179$ ) girls. The proportion of black girls in the intervention cohort (151 of 243) was higher than in the control cohort (101 of 200) ( $p = 0.01$ ), so statistical models for hypothesis testing controlled race and cohort group.

## Measures

Physical activity was assessed using the 3-Day Physical Activity Recall (3DPAR), which has been described elsewhere.<sup>34</sup> The 3DPAR required participants to recall physical activity behavior from 3 previous days of the week (first Tuesday, then Monday, and then Sunday); the instrument always was completed on Wednesday. Based on specific activities and level of intensity, each 30-minute block of time during the day is assigned a MET value (i.e., physical activity level expressed as multiples of basal metabolic rate). The MET values were then summed across the 3 days. The validity of the 3DPAR as a measure of usual activity has been established based on positive correlations with accelerometry counts.<sup>34</sup>

The measures of self-efficacy, perceived behavioral control, attitude, subjective norm, and intention have been described elsewhere.<sup>18,35,36</sup> They each conform to a single-factor model that is structurally invariant between black and white girls in the 8th grade and across time between the 8th- and 9th-grade years. Goal setting was assessed by the item, "a goal of mine now is to be physically active." Satisfaction was assessed by the item, "I am happy with the amount of physical activity I get now." The items were rated on a 5-point scale with anchors of 1 (disagree a lot) and 5 (agree a lot).<sup>29</sup>

The measure of self-efficacy for overcoming barriers contains eight items rated on a 5-point scale ranging from 1 (disagree a lot) to 5 (agree a lot).<sup>35</sup> Example items follow: "I can be physically active during my free time on most days," "I can be physically active during my free time on most days even if I could watch TV or play video games instead," and "I can be physically active during my free time on most days no matter how busy my day is."

The measure of perceived behavioral control contains four items rated on a 5-point scale ranging from 1 (very easy) to 5 (very difficult) and are reverse scored.<sup>35</sup> Example items follow: "I have control over my being physically active during my free time on most days," and "I believe I have all the things I need to be physically active during my free time on most days."

The measure of attitude includes eight items that consist of outcome-expectancy beliefs and corresponding value statements. The common stem is, "If I were to be physically active during my free time on most days." Example items follow: "It would help me make new friends," "It would get or keep me in shape," and "It would give me energy."

Belief statements were rated on a 5-point scale anchored by 1 (disagree a lot) and 5 (agree a lot). Value statements were rated on a 5-point scale with responses ranging from 1 (very

bad) to 5 (very good). The attitude items were formed as a product of the belief and corresponding value item scores.<sup>35</sup> The measure of subjective norm contains four items rated on a 5-point scale ranging from 1 (disagree a lot) to 5 (agree a lot).<sup>18</sup> An example item is "My best friend thinks I should be physically active during my free time on most days." The measure of intention contains four items rated on a 5-point scale ranging from 1 (disagree a lot) to 5 (agree a lot).<sup>18</sup> An example item is "I intend to be physically active during my free time on most days."

## Data Analysis

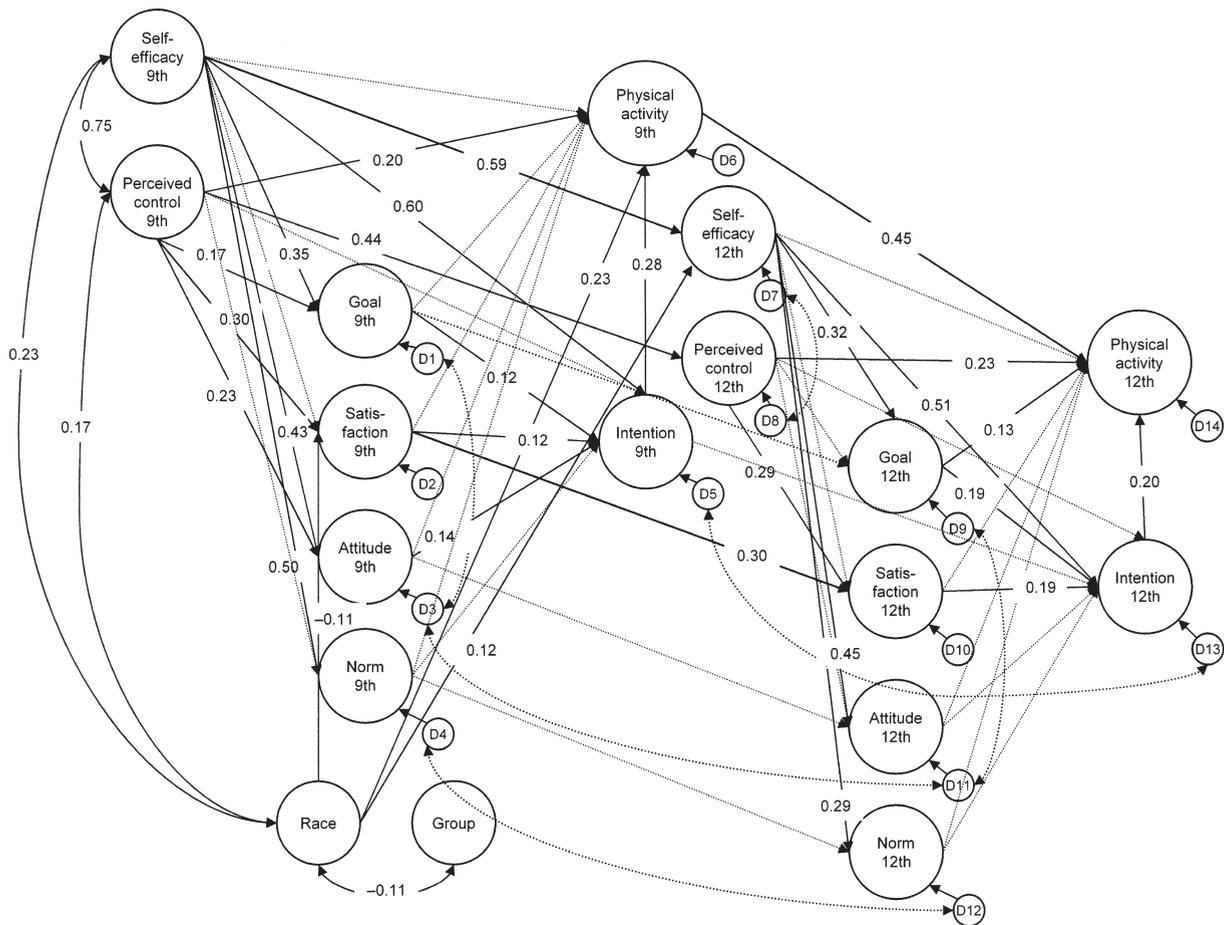
Confirmatory factor analysis (CFA) and SEM were performed using full-information maximum likelihood (FIML) estimation in AMOS, version 5.0 (SmallWaters Corp., Chicago IL, 2004). The FIML uses iterative simultaneous equations to estimate missing data by computing a likelihood function for each individual based on all the available data.<sup>37</sup> In contrast to other techniques such as pairwise and listwise deletion of cases, FIML yields accurate fit indices and parameter estimates with up to 25% of simulated missing data.<sup>38,39</sup>

Descriptive statistics were computed using SPSS, version 13.0 (SPSS Inc., Chicago IL, 2004). Missing responses to items on the questionnaires ranged from 0.7% to 1.1% for the measures of physical activity goals and satisfaction to 4% for the measure of attitude.

Model fit was assessed using multiple indices. The  $\chi^2$  statistic is too sensitive to sample size and assumes the correct model,<sup>32,40</sup> so other fit indices are commonly used for judging model fit. Values of the root mean square error of approximation (RMSEA) equaling 0.08, 0.06, and 0 (and the 90% confidence interval [CI]) represent acceptable, close, and exact fit, respectively.<sup>41</sup> 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.<sup>42</sup> Values exceeding 0.90 and 0.95 indicate minimally acceptable and good fit, respectively.<sup>41,43</sup>

The analysis of longitudinal factorial invariance involved a single-group, two-factor correlated measurement model with autocorrelations specified between the uniquenesses of identical indicators of the single factor model assessed at the 9th-grade baseline and the 12th-grade follow-up. Successive models were compared that imposed restrictions on model parameters for the equality of: overall structure (Model 1), factor loadings (Model 2), factor variance (Model 3), and item uniquenesses (Model 4).<sup>32,40</sup> The comparison of the successive nested models was based on  $\chi^2$  difference tests and changes in the values of the RMSEA, CFI, and NNFI. The criterion of decreases of  $\leq 0.01$  in the NNFI and CFI (e.g.,  $CFI_{\text{Model } 2} - CFI_{\text{Model } 1}$ ) is robust for testing longitudinal invariance.<sup>44</sup> Invariant factor structure and loadings (i.e., Models 1 and 2 have acceptable fit and do not differ) are conventionally viewed as sufficient evidence for structural invariance.<sup>43</sup>

Structural equation modeling and panel analysis were used to test the hypothesized relationships among perceived behavioral control, self-efficacy, goal setting, satisfaction, attitude, subjective norm, and intention as influences on naturally occurring change in physical activity between the 9th and 12th grades, as depicted in Figure 1. In panel analysis, relationships observed at the follow-up measurement (12th



**Figure 1.** Path model showing direct and indirect relationships among residual change in perceived behavioral control, self-efficacy, goal setting, satisfaction, and intention with change in physical activity between the 9th and 12th grades among adolescent black and white girls. Note: Significant path coefficients are shown, while nonsignificant paths between covariates of race and group are not shown. D1 to D14 are disturbance terms. Dotted lines between endogenous variables indicate paths that were tested but not significant. Dotted lines between disturbance terms indicate significant paths.

grade) can be interpreted in terms of standardized residual change from the baseline measurement (9th grade).<sup>45</sup> Path analysis was used to model observed variables (i.e., summed scores from the items for each scale) rather than latent variable SEM because of the high ratio of sample moments in the augmented variance-covariance matrix to the number of participants. Item parcels were not used because they can bias parameter estimates and influence fit statistics.<sup>46</sup> Single-item measures of goal setting and satisfaction were modeled as observed variables. The other measures were modeled with a single indicator using the observed reliability of the items (i.e., Cronbach  $\alpha$ ) and the variance of the mean to set the factor loading (i.e., the square root of  $r$ ) and variance (i.e.,  $[1 - r] \times S^2$ ) for each variable.

After Bonferroni adjustment for multiple comparisons, variables did not differ significantly ( $p > 0.05$ ) across schools, and intraclass correlation coefficient (ICC[1])<sup>47</sup> values were small (mean = 0.012, range 0.00 to 0.046), indicating that school accounted for <5% of the variance in the study variables. Nonetheless, to correct for any nesting effect of schools in the SEM, each variable was adjusted for school by linear regression, and residuals from the regression were used in the analysis.<sup>48</sup>

The model tested (Figure 1) included paths (i.e., gammas) among the exogenous variables of self-efficacy and perceived behavioral control and the endogenous variables of goal setting, satisfaction, attitude, subjective norm, intention, and physical activity at Time 1 (9th grade) and Time 2 (12th grade). There were endogenous paths (i.e., betas) among goal setting, satisfaction, attitude, subjective norm, intention, and physical activity at each time. There was a path between each variable assessed at Time 1 and Time 2. There were autocorrelated disturbance terms for the measures of attitude, subjective norm, and intention and correlated disturbance terms between goal and attitude and between self-efficacy and perceived behavioral control to account for common variance not explained by the hypothesized model. Group was coded as control (0) and treatment (1) groups. Race was coded as black (0) and white (1) groups.

## Results

### Descriptive Statistics

Descriptive statistics and mixed-model analysis of variance results for the variables are found in Table 1. The

**Table 1.** Descriptive statistics and mixed-model analysis of variance results for the social-cognitive and physical activity measures across time

Measure	Black girls		White girls		Time	<i>p</i> values	
	M	SD	M	SD		Race	Time × race
<b>Goal</b>							
9th grade	4.42	0.84	4.65	0.73	<b>0.019*</b>	<b>&lt;0.001***</b>	0.975
12th grade	4.31	0.86	4.54	0.65			
<b>Satisfaction</b>							
9th grade	3.53	1.35	3.41	1.36	<b>0.001**</b>	0.521	<b>0.012*</b>
12th grade	3.06	1.45	3.34	1.42			
<b>Attitude</b>							
9th grade	18.13	3.79	19.46	3.14	0.699	<b>&lt;0.001***</b>	0.604
12th grade	18.13	3.40	19.31	2.96			
<b>Self-efficacy</b>							
9th grade	3.65	0.75	3.98	0.71	0.400	<b>&lt;0.001***</b>	0.954
12th grade	3.68	0.77	4.02	0.63			
<b>Perceived behavioral control</b>							
9th grade	4.03	0.74	4.27	0.75	<b>0.001***</b>	<b>&lt;0.001***</b>	0.607
12th grade	3.91	0.83	4.11	0.77			
<b>Subjective norm</b>							
9th grade	3.21	0.89	3.33	0.76	<b>0.014*</b>	<b>0.007**</b>	0.151
12th grade	3.03	0.92	3.28	0.77			
<b>Intention</b>							
9th grade	3.80	0.98	4.10	0.94	0.354	<b>&lt;0.001***</b>	0.649
12th grade	3.77	0.95	4.03	0.91			
<b>Physical activity</b>							
9th grade	61.40	9.14	65.49	10.40	<b>0.001**</b>	<b>0.002**</b>	<b>0.014*</b>
12th grade	60.90	12.31	62.00	10.21			

\**p* < 0.05;  
 \*\**p* < 0.01;  
 \*\*\**p* < 0.001 (all bolded).  
 M, mean; SD, standard deviation.

correlations among the variables and ICC(2) reliability coefficients for observed scores across time between the 9th and 12th grades are provided in Table 2.

### Factorial Validity and Invariance of Measures

Results of the confirmatory factor analyses of responses to the questionnaires are provided in Table 3. The

measures of perceived behavioral control, self-efficacy, attitude, subjective norm, and intention each conformed to a single-factor structure. The overall pattern of fit indices indicated acceptable fit and supported the factorial validity of the measures in this sample, consistent with the prior results from the LEAP cohorts between the 8th and 9th grades.<sup>35,36</sup> Correlated

**Table 2.** Bivariate Pearson correlation coefficients among the variables<sup>a</sup>

Variables	Year	1	2	3	4	5	6	7	8
1. Goal	9th grade								
	12th grade	<i>0.31</i>							
2. Satisfaction	9th grade	0.08							
	12th grade	0.00	<i>0.55</i>						
3. Attitude	9th grade	<b>0.45*</b>	0.05						
	12th grade	<b>0.38*</b>	0.01	<i>0.64</i>					
4. Self-efficacy	9th grade	<b>0.41*</b>	<b>0.26*</b>	<b>0.47*</b>					
	12th grade	<b>0.28*</b>	<b>0.30*</b>	<b>0.37*</b>	<i>0.68</i>				
5. Perceived behavioral control	9th grade	<b>0.41*</b>	<b>0.26*</b>	<b>0.47*</b>	<b>0.57*</b>				
	12th grade	<b>0.28*</b>	<b>0.30*</b>	<b>0.37*</b>	<b>0.51*</b>	<i>0.52</i>			
6. Subjective norm	9th grade	<b>0.41*</b>	<b>0.26*</b>	<b>0.23*</b>	<b>0.36*</b>	<b>0.24*</b>			
	12th grade	<b>0.28*</b>	<b>0.30*</b>	<b>0.37*</b>	<b>0.14*</b>	0.04	<i>0.58</i>		
7. Intention	9th grade	<b>0.41*</b>	<b>0.26*</b>	<b>0.47*</b>	<b>0.68*</b>	<b>0.54*</b>	<b>0.35*</b>		
	12th grade	<b>0.36*</b>	<b>0.36*</b>	<b>0.35*</b>	<b>0.55*</b>	<b>0.41*</b>	<b>0.16*</b>	<i>0.58</i>	
8. Physical activity	9th grade	<b>0.19*</b>	<b>0.16*</b>	<b>0.16*</b>	<b>0.25*</b>	<b>0.24*</b>	<b>0.14*</b>	<b>0.27*</b>	
	12th grade	<b>0.17*</b>	<b>0.24*</b>	<b>0.14*</b>	<b>0.18*</b>	<b>0.24*</b>	<b>0.13*</b>	<b>0.30*</b>	<i>0.49</i>

\**p* < 0.01 (bolded).  
 Italicized values in the diagonal are intraclass correlation (ICC[2]) reliability coefficients across time (9th to 12th grade).

**Table 3.** Fit indices and internal consistency reliabilities (Cronbach  $\alpha$ ) for the measures assessed in the 9th and 12th grades

Measure year	$\chi^2$ (df)	RMSEA (90% CI)	CFI	NNFI	Cronbach $\alpha$
<b>Self-efficacy</b>					
9th grade	45.6 (20)	0.05 (0.03–0.07)	0.97	0.94	0.80
12th grade	76.6 (20)	0.08 (0.06–0.09)	0.93	0.90	0.80
<b>Perceived behavioral control</b>					
9th grade	7.5 (3)	0.06 (0.00–0.11)	0.99	0.98	0.76
12th grade	13.5 (3)	0.08 (0.04–0.14)	0.98	0.96	0.77
<b>Attitude</b>					
9th grade	27.8 (20)	0.03 (0.00–0.05)	0.99	0.98	0.75
12th grade	56.6 (20)	0.06 (0.04–0.08)	0.93	0.90	0.72
<b>Subjective norm</b>					
9th grade	32.8 (19)	0.04 (0.01–0.06)	0.98	0.97	0.72
12th grade	76.6 (20)	0.07 (0.05–0.09)	0.95	0.93	0.72
<b>Intention</b>					
9th grade	16.7 (2)	0.10 (0.08–0.12)	0.99	0.96	0.91
12th grade	26.5 (2)	0.10 (0.09–0.14)	0.98	0.94	0.91

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

uniquenesses between Items 1 (my fellow students) and 2 (my best friend) were modeled for the subjective norm measure.

The longitudinal invariance analyses (Table 4) indicated that the factor structure, factor loadings, and the factor variance were invariant (i.e., Models 1 through 3

were similar) between 9th and 12th grades for attitude and subjective norm; and the factor structure, factor loadings, factor variance, and item uniquenesses were invariant (i.e., Models 1 through 4 were similar) for the measures of self-efficacy, perceived behavioral control, and intention. Stability coefficients ( $p < 0.01$ ) across the

**Table 4.** Confirmatory factor analysis testing for longitudinal invariance of the measures

Model	df	$\chi^2$	$\chi^2$ diff	RMSEA (90% CI)	CFI	NNFI
<b>Self-efficacy</b>						
Model 1	95	177.5		0.044 (0.034–0.054)	0.96	0.94
Model 2	102	180.00	4.5 <sup>†</sup>	0.042 (0.031–0.051)	0.96	0.95
Model 3	103	180.10	0.1 <sup>†</sup>	0.041 (0.031–0.051)	0.96	0.95
Model 4	111	188.2	8.1 <sup>†</sup>	0.040 (0.030–0.049)	0.96	0.95
<b>Perceived behavioral control</b>						
Model 1	16	34.6		0.069 (0.037–0.101)	0.97	0.95
Model 2	18	34.9	0.03 <sup>†</sup>	0.046 (0.022–0.069)	0.98	0.97
Model 3	19	40.4	5.5 <sup>**</sup>	0.050 (0.029–0.072)	0.98	0.97
Model 4	23	49.1	8.7 <sup>*</sup>	0.051 (0.031–0.070)	0.97	0.97
<b>Attitude</b>						
Model 1	95	158.4		0.039 (0.028–0.049)	0.96	0.94
Model 2	102	170.2	11.8 <sup>†</sup>	0.039 (0.028–0.049)	0.96	0.94
Model 3	103	172.3	2.1 <sup>†</sup>	0.039 (0.029–0.049)	0.95	0.94
Model 4	111	211.1	38.8 <sup>***</sup>	0.045 (0.036–0.054)	0.93	0.92
<b>Subjective norm</b>						
Model 1	93	160.7		0.041 (0.030–0.051)	0.96	0.95
Model 2	100	172.4	11.7 <sup>†</sup>	0.042 (0.031–0.051)	0.96	0.95
Model 3	101	172.9	0.05 <sup>†</sup>	0.040 (0.030–0.050)	0.96	0.95
Model 4	111	216.8	43.9 <sup>‡</sup>	0.047 (0.038–0.056)	0.94	0.93
<b>Intention</b>						
Model 1	20	58.0		0.066 (0.046–0.086)	0.98	0.98
Model 2	22	69.7	11.7 <sup>**</sup>	0.070 (0.052–0.089)	0.98	0.98
Model 3	23	69.8	0.1 <sup>†</sup>	0.068 (0.050–0.086)	0.98	0.98
Model 4	27	85.3	15.5 <sup>**</sup>	0.070 (0.053–0.087)	0.98	0.98

\* $p < 0.05$ ;

\*\* $p < 0.01$ ;

\*\*\* $p < 0.001$ ;

<sup>†</sup> $p > 0.10$ ;

<sup>‡</sup> $p < 0.10$ .

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

3-year period for scores on the constructs derived by the CFA were 0.55, 0.39, 0.53, 0.47, and 0.45 for self-efficacy, perceived behavioral control, attitude, subjective norm, and intention, respectively.

### Structural Equation Model

The model shown in Figure 1 provided an acceptable fit ( $\chi^2=147.7$ ,  $df=71$ ,  $p<0.01$ ,  $CFI=0.96$ ,  $NNFI=0.91$ ,  $RMSEA=0.05$ ,  $95\% CI=0.04-0.06$ ). The fit and parameter estimates were the same regardless of the direction of paths between goal setting and intention. The fit was better than an alternative model that specified self-efficacy, perceived behavioral control, goal setting, satisfaction, attitude, subjective norm, and intention in the 9th grade as correlated exogenous variables ( $\chi^2 = 419.7$ ,  $df=81$ ,  $p<0.001$ ,  $CFI=0.84$ ,  $NNFI=0.66$ ,  $RMSEA=0.10$ ,  $95\% CI=0.09-0.11$ ). Significant paths ( $p<0.05$ ) and their standardized coefficients are depicted in Figure 1. In the 9th grade, physical activity was directly related to race and intention. The relationships of self-efficacy and perceived behavioral control with physical activity were indirect, each mediated by intention but through different paths. The path from self-efficacy to intention was mediated by goal setting, attitude, and social norm. The path from perceived behavioral control to intention was mediated by goal setting, satisfaction, and attitude.

Change between the 9th and 12th grades in physical activity was directly related to changes in perceived behavioral control, goal setting, and intention, and was indirectly related to change in self-efficacy by paths mediated through goal setting and intention. Perceived behavioral control was also indirectly related to physical activity by a path mediated through satisfaction and intention. Black girls were initially less active, more satisfied, and had lower levels of self-efficacy and perceived behavioral control than white girls, but the changes in all variables except self-efficacy were unrelated to race or group.

### Discussion and Conclusion

These longitudinal observations extend past applications of the theory of planned behavior and self-efficacy theory by demonstrating that goal setting and satisfaction mediated relationships of self-efficacy and perceived behavioral control with changes in intention and physical activity between the 9th and 12th grades among adolescent girls. This analysis does not determine potentially reciprocal influences of physical activity change on the variables. Experimental research is needed to determine the causal primacy of goal setting or intention for explaining change in physical activity.

Goal setting has been effectively used to increase physical activity among adults, but surprisingly few studies have examined goal setting as an influence on

physical activity among adolescents.<sup>29,49</sup> Two known experimental studies included goal setting in comprehensive self-management interventions with boys and girls in the 4th and 5th grades, but the interventions did not increase physical activity.<sup>24,25</sup> The magnitude of the direct relationships among changes in physical activity and changes in goals, perceived behavioral control, and intention that is reported here ranged from 0.13 to 0.23 of a standard deviation, which is small when judged by conventional standards for sample statistics.<sup>50</sup> However, when judged as a binomial effect,<sup>51</sup> the practical impact of relationships this size approximates an effect of 14% above a control rate, hypothetically influencing the physical activity of about 60 girls in this sample.

Contrasted with a previous report that change in physical activity during the 9th grade was unrelated to goal setting,<sup>29</sup> the present findings suggest that fluctuations in the goals that girls have about physical activity may assume more importance to their behavior as they progress from the 9th to the 12th grades. Although the black girls were initially less active, more satisfied, and had lower levels of perceived behavioral control and self-efficacy than white girls, the changes in the variables, and their relationships, were unrelated to race or group, with the exception that black girls still had lower self-efficacy in the 12th grade.

The observation that goal setting and satisfaction mediated the relationships of intention with self-efficacy and perceived behavioral control also helps reconcile previous reports on the LEAP cohorts in which self-efficacy and perceived behavioral each were related to physical activity in a cross-sectional sample of 8th-grade girls,<sup>18</sup> but change in perceived behavioral control, rather than self-efficacy, was related to change in the girls' activity between the 8th and 9th grades.<sup>20</sup> The results indicate that relationships of perceived behavioral control and self-efficacy with physical activity, goals, satisfaction, and intentions are independent, not redundant.<sup>6,21</sup> Also, this factor analysis indicated that perceived behavioral control is best conceptualized as one dimension,<sup>52</sup> rather than as two dimensions of efficacy and control, although the factor structure might have been under-identified. Additional research is needed to clarify that efficacy and control beliefs differently influence physical activity goals. The findings agree with other reports<sup>7,9,17</sup> that subjective norm is not independently related to physical activity intention among adolescents. They contrast with previous cross-sectional reports that self-efficacy accounts for the relationship between intention and physical activity in adolescents.<sup>9,18</sup> Consistent with theory,<sup>22,27</sup> attitude change was not independently related to intention when goal setting was included in the model.

The influences of other social-cognitive or environmental influences on physical activity<sup>53</sup> that undoubtedly change during the high school years were not

controlled. In other analyses, self-efficacy accounted for the cross-sectional relationship between physical activity and girls' perceptions about environmental access in the 9th grade<sup>54</sup> and the 12th grade,<sup>55</sup> and accounted for part of the relationship between perceived social support and physical activity in the 12th grade.<sup>55</sup> However, the naturally occurring decline in physical activity between the 8th and 12th grades among the LEAP cohorts was not explained by change in self-efficacy or those environmental perceptions (R.K. Dishman et al., University of Georgia, unpublished observation, 2006). In contrast, self-efficacy had an indirect effect on the linear decline in physical activity by its moderation of perceived social support. Viewed collectively, these studies suggest that self-efficacy about overcoming barriers to physical activity does not directly influence physical activity among adolescent girls. Instead, self-efficacy operates as a moderator (i.e., an effect modifier), influencing the relationships of other cognitive variables that are more directly involved with decision making about being physically active, which in this study were goal setting and intention.

Goal-setting theory proposes that goals influence behavior through the mobilization, direction, and persistence of effort, as well as by the development of new behavioral strategies to achieve the goal.<sup>27</sup> Girls were asked whether increasing physical activity was a goal now, but specific aspects of goal behavior or the goal's context of place or type of physical activity were not assessed, and it was not determined whether the goals were perceived as challenging or attainable. Also, there was no assessment of the girls' levels of intention, commitment, or confidence about goal achievement, all factors that are believed to affect goal pursuit.<sup>56</sup> Future studies of physical activity goals should assess or manipulate those aspects of goal setting. Nonetheless, these longitudinal observations of correlated changes in goal setting and physical activity encourage additional research to identify the sources and development of physical activity goals and their attainment among adolescent girls and whether experimental manipulation of goal setting and intentions can mitigate the decline of physical activity among girls during high school.

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