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Eileen S. Anderson, Janet R. Wojcik, Richard A. Winett, David M. Williams

Institutions: Virginia Tech

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Social–Cognitive Determinants of Physical Activity: The Influence of Social Support, Self-Efficacy, Outcome Expectations, and Self-Regulation Among Participants in a Church-Based Health Promotion Study

Eileen S. Anderson, Janet R. Wojcik, Richard A. Winett, and David M. Williams
Virginia Polytechnic Institute and State University

A social–cognitive model of physical activity was tested, using structural equation analysis of data from 999 adults (21% African American; 66% female; 38% inactive) recruited from 14 southwestern Virginia churches participating in the baseline phase of a health promotion study. Within the model, age, race, social support, self-efficacy, and self-regulation contributed to participants' physical activity levels, but outcome expectations did not. Of the social–cognitive variables, self-regulation exerted the strongest effect on physical activity. Independent of self-regulation, self-efficacy had little effect. Social support influenced physical activity as a direct precursor to self-efficacy and self-regulation. The model provided a good fit to the data and explained 46% of the variance in physical activity among the diverse group of adults.

Keywords: physical activity, social support, self-efficacy, outcome expectations, self-regulation

Healthy People 2010 (U.S. Department of Health & Human Services [USDHHS], 2000) detailed the central role of physical activity and fitness for disease risk reduction. The American College of Sports Medicine (ACSM), the Centers for Disease Control and Prevention (CDC), and the Surgeon General have recommended at least 30 min of moderate-intensity physical activity on most, and preferably all, days of the week (Pate et al., 1995; USDHHS, 1996), yet approximately two thirds of Americans are insufficiently physically active to confer health benefits (Brownson, Jones, Pratt, Blanton, & Heath, 2000). Even among people who classified themselves as regular walkers on a recent national survey, fewer than 40% met the Surgeon General's minimum guidelines (Rafferty, Reeves, McGee, & Pivarnik, 2002).

Traditional protocols for promoting physical activity involve relatively frequent, longer duration (≥30 min), moderate-intensity activities, sometimes coupled with shorter duration, vigorous-intensity activities. Although these protocols can produce significant gains in fitness and energy expenditure, adherence and maintenance of change have been difficult to achieve (Dishman & Buckworth, 1997; King et al., 1992; Seefeldt, Malina, & Clark, 2002). From a public health perspective, the problem becomes how to increase physical activity in a largely sedentary, increasingly overweight population that typically finds vigorous physical activity aversive and often cites inconvenience and lack of time as barriers (Dishman & Buckworth, 1997; King et al., 1992; Seefeldt et al., 2002). The present research was conducted to test a social–cognitive model of physical activity in a church-based population in the southern United States.

In an effort to better understand what factors lead to physical activity behavior, researchers have attempted to identify its correlates. For example, a number of demographic factors are related to physical activity. Lower physical activity levels have been reported for both African Americans and Hispanics as compared with Caucasians (Crespo, Smit, Anderson, Carter-Pokras, & Ainsworth, 2000). Higher socioeconomic status (education and income) may be associated with higher physical activity levels (Barnes & Schoenborn, 2003), but less so in African Americans and Mexican Americans than in Caucasians (Crespo et al., 2000). Men are generally more vigorously physically active than women, who have higher rates of sedentary behavior (Barnes & Schoenborn, 2003), but moderate physical activity levels sufficient to meet public health guidelines (Pate et al., 1995) appear similar across genders. Interestingly, although moderate physical activity typically declines with age (Barnes & Schoenborn, 2003), there are some data to suggest vigorous physical activity may be more common among persons aged 65–74 than among younger and middle-aged adults (Brownson et al., 2000).

In addition to isolating demographic factors, researchers have attempted to understand the psychosocial correlates of physical activity. Prominent among these variables is *self-efficacy*—one's confidence in one's ability to take the steps necessary to be regularly physically active—which numerous studies have found to be associated with physical activity (for a review, see McAuley & Blissmer, 2000) and which may mediate treatment effects on physical activity (Miller, Trost, & Brown, 2002). *Social support*—

Eileen S. Anderson, Janet R. Wojcik, Richard A. Winett, and David M. Williams, Center for Research in Health Behavior, Department of Psychology, Virginia Polytechnic Institute and State University.

David M. Williams is now at the Centers for Behavioral and Preventive Medicine, Brown Medical School, and The Miriam Hospital, Providence, Rhode Island.

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Correspondence concerning this article should be addressed to Eileen S. Anderson, Center for Research in Health Behavior, Department of Psychology, Mail Code 0274, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. E-mail: eileen@vt.edu

the perceived support for physical activity received from others, such as family and friends—has also been associated with physical activity (e.g., Courneya & McAuley, 1995). Although the relation of social support to other variables in a social–cognitive theory (SCT) model of physical activity has not been widely researched, Bandura (1997, p. 416) suggested that it "affects exercise adherence by influencing efficacy beliefs rather than directly." *Outcome expectations*—the expected positive and negative consequences of increasing physical activity—have been less consistent predictors, with some studies showing strong support and others revealing a null effect (see Williams, Anderson, & Winett, 2005, for a review). Although these studies have examined relationships between demographic and psychosocial variables and physical activity, they often lack a theoretical framework delineating how these variables operate together to influence physical activity.

SCT provides a framework that has been recommended by the Surgeon General as useful for organizing, understanding, and promoting physical activity (USDHHS, 1996). Generally, SCT posits that personal, environmental, and behavioral factors are reciprocally influential in determining behavior and behavior change. Personal factors influencing physical activity include the demographic variables described above, as well as potentially malleable psychosocial variables such as self-efficacy, outcome expectations, and self-regulation. Bandura (1997) specifically cited self-regulatory self-efficacy—one's faith in one's ability to maintain physical activity in the face of challenges and setbacks—as a key to success in regular exercise. Furthermore, physical activity success may depend on outcome expectations that are easy to realize—in terms of both time and accomplishment—especially for people with low levels of activity, self-regulatory self-efficacy, and self-regulation skills. Environmental factors key to adherence to physical activity involve social support such as modeling by family and friends, support from exercise partners, and feedback from exercise leaders (Bandura, 1997). Although social support, self-efficacy, and realistic outcome expectations are viewed in SCT as necessary for maintaining a physically active lifestyle, Bandura (1997, 2004) suggested that self-regulatory behavior is essential. As moderate physical activity involves motor skills most people know or can quickly learn, for people with low activity levels exercise success depends more on their ability to self-monitor (i.e., plan and track), set goals, and evaluate their exercise behavior (Bandura, 1997, p. 415).

In addition to delineating the psychosocial variables essential to physical activity, SCT specifies how these variables relate to each other (Bandura, 1997, 2004; see Figure 1). In the social–cognitive model of physical activity, self-efficacy (i.e., belief in one's ability to lead an active lifestyle; Bandura, 1997) is the preeminent determinant of consistent, health-promoting levels of physical activity. Self-efficacy for being physically active stems from personal variables, such as the individual's age, gender, and general health, and from environmental variables, such as access to safe exercise facilities and social support for physical activity (Bandura, 1997). Although SCT does not preclude social support from influencing all SCT variables, Bandura (1997, p. 416) has stated that social support influences physical activity through self-efficacy, suggesting social support may not directly influence other SCT variables as modeled in Figure 1. In addition to social support and self-efficacy, SCT further posits that individuals with stronger beliefs in their abilities to lead active lives will in turn expect to reap the benefits associated with being physically active, such as lower stress levels, greater sense of well-being, improved physical fitness, and avoidance of fitness-related health problems. Finally, SCT posits that individuals who believe they can be physically active (i.e., those with higher self-efficacy) and individuals who expect favorable results from physical activity (i.e., those with better outcome expectations) will be more likely to implement the self-regulatory strategies especially essential to adopting and maintaining an active lifestyle (Bandura, 1997, 2004).

Despite the widespread use of SCT among physical activity researchers, with two exceptions influences among the social–cognitive constructs and physical activity have not been examined within a single study. Rovniak, Anderson, Winett, and Stephens (2002) used structural equation modeling (SEM) to examine the social–cognitive determinants of physical activity among 277 university students. The model accounted for 55% of the variance in physical activity. Consistent with SCT, social support influenced physical activity through self-efficacy and through self-efficacy's effect on self-regulation; self-efficacy influenced physical activity directly and through self-regulation, but outcome expectations did not. Resnick (2001) also used SEM to model social–cognitive physical activity determinants among 201 older adults living in a continuing care retirement community. The model accounted for 40% of the variance in verified aerobic exercise. In addition to the older adults' levels of chronic illness, prior exercise behavior, and

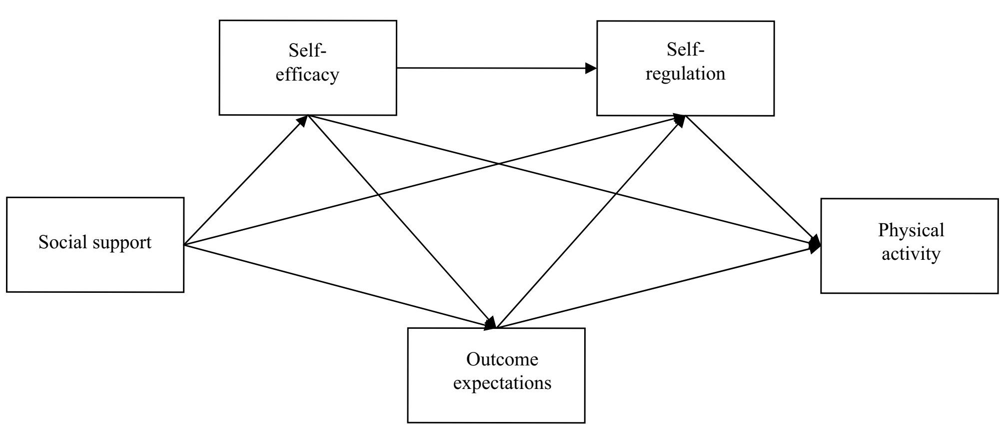

Figure 1. Social–cognitive model of physical activity.

mental and physical health, higher self-efficacy and higher positive outcome expectations were associated with higher levels of aerobic exercise. Although these studies were limited by relatively small, specific samples (i.e., university students, older adults) and somewhat restricted models (i.e., Rovniak et al., 2002, did not include demographic variables and Resnick, 2001, included neither social support nor self-regulation variables), their approaches were consistent with SCT. The purpose of the present study is to examine a more complete social–cognitive model of the determinants of physical activity among a larger, racially and age-diverse sample of adults.

Method

Sample and Procedures

Setting

The participants providing data for the current study were recruited as part of a large study to test the effectiveness of a health promotion intervention designed to reach adults living in nonmetropolitan areas through their churches. Although church attendance rates vary across the United States, in the southern and rural regions regular church attendance (once a month or more) is common (54% of adults over age 30; National Opinion Research Center, 1998), representing a strength of such communities (Eggebeen & Lichter, 1991), that, if recognized, could become an integral part of health behavior programs (Eng, Hatch, & Callen, 1985). The current analyses involve data from the baseline period of this larger church-based study.

Recruitment

Participants were recruited from 14 of 23 churches in southwest Virginia contacted because they reflect the largest religious denominations in the region (Baptist and United Methodist), with special effort given to recruiting three predominantly African American Baptist churches. Twenty-one of the churches initially contacted requested meetings with project investigators, which were followed by presentations about the research project to ministers, lay leaders, or administrative boards. Seven churches chose not to participate owing to lack of interest among the congregation or to changes in the church hierarchy. In church, face-to-face recruitment and data collection procedures were compatible with church schedules and protocols. Recruitment in each church began with a 4-week series of announcements at the pulpit before church services and in the church bulletin. Color brochures describing the research project were mailed to each person on the church mailing list 10–14 days before a project-sponsored kickoff luncheon. On the Sunday preceding the luncheon, more detailed information about the project was included in an insert to the church bulletin. The project was described as a test of the effectiveness of an "Internet-based program . . . designed to help church members make changes in their eating and physical activity habits." The insert also described eligibility, participant payments, and research design. The kick-off luncheon, planned for a number equivalent to the active membership of the church, included a short presentation about the project and the consent and enrollment procedures. Project enrollment began with the kickoff and continued for 4–8 weeks, depending on the size of the church. We estimated 2,454 adult members (60–340 per church) regularly attended (i.e., one or more times per month) the 14 churches participating in the study; about half (n = 1,194) expressed interest in participating in the study, 84% (999) of whom completed baseline assessments and contributed data to the current study. Assessments included measures of height and weight, demographic and psychosocial characteristics, and a log of daily physical activity and pedometer step counts. Participants received a $20 honorarium for completing these assessments.

Participants

Of the 999 recruited adults, 66% were female and 21% were African American; participants ranged in age from 18 to 92 years (M = 52.73 years, SD = 14.56 years). Participants had a median annual household income of about $55,000 and a mean of 14.88 years of education (SD = 2.37 years), similar to census statistics for the region (U.S. Census Bureau, 2006). Nine percent of the sample reported an income of $20,000 or less, and 20% reported 12 or fewer years of education. Sixty-five percent of participants lived in households with no children under 18 years of age; virtually all the participants attended church regularly (one time or more per month).

The sample exhibited the full range of body mass indexes (BMI), 16.50–58.18 (M = 29.04, SD = 6.05). Seventy-three percent of the participants were classified as overweight or obese: 35% had a BMI of 25–29.99, 23% had a BMI of 30–34.99, and 15% had a BMI of 35 or more. Although these rates are somewhat higher than expected from national estimates, the overall rate (73%) is not unduly high for an older sample (Flegal, Carroll, Ogden, & Johnson, 2002; USDHHS, 2000) using gold standard measures (i.e., measured vs. self-reported body weight; Newell, Girgis, Sanson-Fisher, & Savolainen, 1999). Thirty-eight percent of the participants were nonexercisers (e.g., they engaged in no amount of exercise during the week); 62% reported at least some amount of planned activity to improve or maintain physical fitness.

Indications of medical conditions that could limit physical activity, such as cardiopulmonary disease, metabolic disorders, or musculoskeletal problems, were reported by 444 of the 999 (46%) participants included in the present study. These conditions tended to be mild or well managed, with the most commonly reported conditions being joint problems aggravated by exercise (15%); diabetes (8%); thyroid disease (8%); pain, dizziness, or shortness of breath with exercise (6%); lung disease (5%); and cardiovascular disease (4%). Of the participants with such indications, 98% received clearance from their health care providers to participate in the physical activity component of the parent study; those who did not were restricted to the nutrition component when they received the health promotion intervention.

Across churches, the church with the oldest mean age differed (in age) from the church with the youngest mean age (60 years vs. 49 years), but these churches did not differ in level of physical activity, in the number of participants with medical conditions, on measures of social–cognitive variables, or on other demographic characteristics. One church also had members who took more daily steps than the members of several of the other churches (8,045 steps vs. 5,430, 5,738, and 5,893 steps, respectively); the metabolic equivalent hours per week (MET hr/week; see *Measures* section below for full explanation) expended by the members of this more active church (M = 17 MET hr/week) differed only from the church that also had the lowest mean step count (M = 6 MET hr/week). These churches did not differ on any of the social–cognitive or demographic variables assessed for this study, nor did they differ in the number of participants with indications of medical conditions that might limit their physical activity or in the number of participants receiving clearance from their health care providers.

Measures

The latent variables in the social–cognitive model of physical activity (enclosed in ellipses in Figure 2) were estimated from variables measured as part of the baseline assessment in the parent study (enclosed in rectangles in Figure 2).

Demographic Variables

Participants reported age, gender, and racial or ethnic background when they enrolled in the study. Gender was dummy-coded (female = 0, male = 1), as was race (African American = 1, not African American [97% Caucasian] = 0) for the purposes of this study. Age was measured in whole years.

Development of Social–Cognitive Variables

Formative and pilot research conducted in the 2 years before the current study helped define items used in our survey of physical activity–related psychosocial characteristics. Thirty-three elicitation interviews with a cross-section of church members similar to people who would be in our overall project (i.e., 49% male, 33% African American, 15% high school or less education, 50% overweight or obese) focused on current physical activity, exercise beliefs, and perceived barriers related to consistently engaging in healthy physical activity patterns. Interview information contributed to revising and refining our previous physical activity beliefs questionnaire (Rovniak et al., 2002), which was next piloted with 158 members of two church congregations (Wojcik, Anderson, Hohenshil, & Winett, 2002; Wojcik et al., 2003). The resulting 71-item physical activity beliefs questionnaire was administered to the participants in the current study. Responses to the items were evaluated as to their correlation with exercise MET hours per week and mean daily step counts, as well as for discriminant validity. In addition to items that correlated ($p < .05$) with physical activity measures, items were included in the current analyses if they distinguished between participants who had exercised at an intensity of 3 MET hr or more for any number of minutes during the week recorded or who had walked 10,000 pedometer steps per day and those who had not ($p < .01$). These final refinements yielded a 41-item instrument assessing social support, self-efficacy, outcome expectations, and self-regulation.

Social Support

Social support was measured with three items that asked participants to use a 5-point agree–disagree scale to rate their perceived support from family members for physical activity: "My family makes time to be more physically active," "My family takes short breaks to be physically active during the day," and "My family uses the stairs at work or school instead of an elevator." In addition to predicting physical activity, these items exhibited moderate interitem correlation (Cronbach's $\alpha = .68$); they were used as measures of social support in the structural model (see Figure 2). Four additional family social support items and seven items pertaining to social support from friends did not meet criteria for inclusion in the current analyses.

Self-Efficacy

Self-efficacy was measured with 20 items that asked participants to use a 10-point Likert-type scale to rate "how certain are you that you can—all or most of the time—for a long time—in a lot of different situations—do the following. . . ." Possible responses ranged from *very sure I cannot* (1) to *very sure I can* (100). Self-efficacy items focused on self-regulatory behaviors needed to initiate and maintain physical activity, such as "Get up early during the week to build up your daily step count" and "Increase your daily step count when you are tired." Responses to the self-efficacy items were subjected to principal axis factor analysis (oblique rotation); scree-plot and eigenvalue analysis (i.e., eigenvalue > 1.0) identified two factors in the self-efficacy instrument (pattern matrixes and interfactor correlations are available from Eileen S. Anderson). These factors resulted in two self-efficacy scales with satisfactory internal reliability. Items for each factor (pattern loading $\geq .40$) were averaged to form scale scores, which were used as measures of self-efficacy in the model (see Figure 2): (a) Self-Efficacy for Overcoming Barriers to Increasing Physical Activity (11 items, Cronbach's $\alpha = .91$) and (b) Self-Efficacy for Integrating Physical Activity in the Daily Routine (9 items, Cronbach's $\alpha = .89$). Four additional self-efficacy items were excluded from the current analyses.

Outcome Expectations

Outcome expectations were measured with nine items that asked participants to use a 5-point *agree–disagree* scale to rate what would happen if they "slowly and steadily increased their physical activity" (e.g., "I will have to change my normal routine" and "I will sleep better") and a 5-point *not at all–very much* scale to rate how much it would matter if the targeted outcome happened to them. For each item, we computed a valued expectation score by multiplying the two ratings. Valued expectation scores for these items were subjected to principal axis factor analysis (oblique rotation); scree-plot and eigenvalue analysis identified two unrelated factors (Pearson's $r = -.029$); hence, two outcome expectation variables were included in the model. The latent variable, positive physical outcome expectations, was measured with three items (see Figure 2) asking participants to rate whether they expected to sleep better, feel refreshed, and feel less stressed if they slowly and steadily increased their physical activity. These items exhibited good interitem correlation (Cronbach's $\alpha = .81$). The other variable, negative time outcome expectations, was measured with six items (see Figure 2) asking whether participants expected, as a result of increasing physical activity, to have to change their normal routine, give up normal activities, take more time to plan their day, have one more thing to worry about getting done, and have less time to spend with family, which exhibited good interitem correlation (Cronbach's $\alpha = .85$). Twelve additional outcome expectations items were excluded from the current analyses.

Self-Regulation

Using a 5-point *never–repeatedly* scale, participants reported how often, in the 3 months before the assessment, they used seven self-regulation strategies related to physical activity: Set aside time daily for physical activity, take breaks for physical activity, walk instead of drive, park further away to walk, get together with someone else, write down on a calendar their physical activity plans, and make plans for bad weather. Primary axis factor analysis of responses to these items revealed one factor with a Cronbach's alpha of .83; hence, these individual items were used as measures of self-regulation in the model (see Figure 2). Three additional self-regulation items were excluded from the current analyses.

Physical Activity

MET hours per week in moderate intensity exercise. Participants received a pedometer and a "Step Counter and Physical Activity Log" to keep track of their physical activity for 1 week. In addition to wearing a pedometer and recording the number of steps taken each day (see below), participants were instructed to record any morning, afternoon, and evening physical activity "comparable to how you feel when you are walking at a normal pace." For each activity recorded, participants indicated how many minutes the activity lasted and rated "how hard" it was (*light, moderate, hard,* or *very hard*). Although physical activity diaries may be susceptible to subject reactivity (Newell et al., 1999), they have been found to significantly correlate with activity monitors (Matthews & Freedson, 1995), and coupling the diaries with the verified step-count procedure (see below) was expected to maximize the diaries' accuracy (Newell et al., 1999). Participants' recorded activities were entered into the Center for Research in Health Behavior's Activity Log Recording Program (CRHB-ALRP), which automatically assigned a MET value to each activity recorded. CRHB-ALRP MET values were obtained from the updated compendium of physical activities (Ainsworth et al., 2000), which defined the MET "as the ratio of work metabolic rate to a standard resting metabolic" (p. S498).

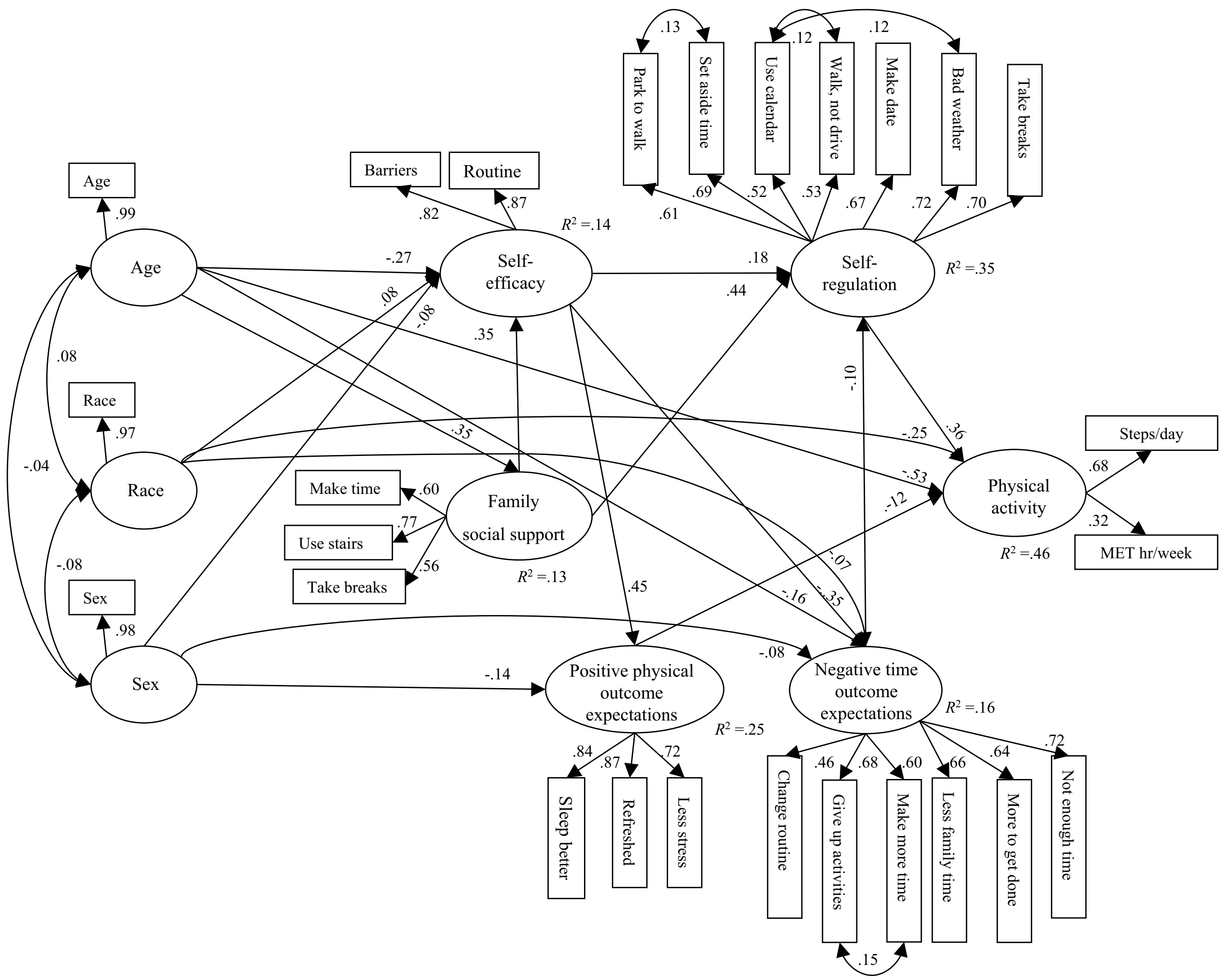

Figure 2. Structural equation analysis of the social–cognitive model of physical activity among participants enrolled in a church-based health promotion project: significant standardized parameter coefficients. MET = metabolic equivalent.

The compendium included activities ranging from 0.9 MET hr (sleeping) to 18 MET hr (running at 10.9 miles per hour). For the current analysis, we used the ACSM definition for at least moderate intensity (MET value of 3 or more) exercise: "planned, structured, and repetitive body movement done to improve or maintain . . . physical fitness" (ACSM, 2000, p. 4); hence, we did not include moderate-intensity household or occupational activities in the exercise MET hours variable. For each participant, we computed the total number of MET minutes engaged in each exercise of at least 3 MET hr intensity (total minutes × MET value) and summed across activities to calculate moderate exercise MET hours per week. In our pilot work (Wojcik et al., 2002), exercise MET hours per week computed from the physical activity diary significantly correlated with step counts (r = .34, a level commensurate with other church-based field research). Participants' MET hours per week served as one measure of physical activity in our model (see Figure 2).

Verified step counts. In addition to recording activity, participants wore an Accusplit 120E step-counter pedometer (San Jose, California) and made a daily record of steps accumulated during the week. Participants were instructed to not reset their pedometers during the week and to let the steps accumulate until the 7th day. At the end of the week, participants brought their step logs and pedometers to the church or sent them to the research office via a business-reply envelope, where staff then used the weekly accumulation of steps on the pedometer to verify the step counts recorded by participants. This verification procedure was designed to maximize the accuracy of the self-report logs (see Newell et al., 1999); 77% of participants complied. Those who did not comply did not differ from those who did in mean steps, exercise MET hours per week, or in any of the demographic variables; thus, all step-count data were included in the study. Mean daily step counts calculated from the verified step-log served as a second measure of physical activity in the model (see Figure 2).

Data Analysis

We used latent-variable SEM (LISREL 8.54; Jöreskog & Sörbom, 2003) to test the fit of the social–cognitive model of physical activity (see Figure 2). We assumed no measure to be error free, so for latent variables with only one indicator (age, gender, and race) we set error terms to the measure's variance times the estimated error. To make full use of the available data, we used full information maximum likelihood estimation. Fit of the model to the data was evaluated with root-mean-square error of approximation (RMSEA) equal to or less than .05 (p close fit $>$ .99 or $p <$ .01) and chi-square equal to or less than three times the degrees of freedom in deference to our large sample size (Kline, 1998). Before conducting the SEM analysis, variables were examined for normality; not surprisingly, among a sample with a wide range of ages and BMI, moderate-intensity MET hours per week fell beyond acceptable normality assumptions (kurtosis = 5.38 [SE = .17]; skewness = 2.12 [SE = .08]). The MET hour scores of 10 participants indicated 21 or more hours per week of at least moderate exercise during the week (range = 21–101 hours and 68–359 MET hr/week); we eliminated these scores from the analyses as we judged them to be extreme outliers in the sample or invalid measures. Using a Log10 transformation of the remaining data resulted in a more normally distributed MET hours per week variable. The resulting MET hour transformations, along with the measures of step counts, age, gender (male = 1, female = 0), race (African American = 1, Caucasian or other = 0), and social–cognitive variables were used as measures in the latent-variable structural analysis.

Results

Descriptive Statistics

Physical Activity Levels

Nontransformed means and standard deviations for measured variables used in the structural analysis are presented in the last two rows of Table 1. The overall level of physical activity among participants was low and wide ranging. Overall, church members spent a mean of 21.47 min/day (SD = 27.79 min/day) in at least moderate-intensity exercise during the recorded week, which translated into about 12 MET hr/week of moderate-intensity exercise; 73% did not meet the CDC/ACSM and Surgeon General recommendations of 30 min/day (Pate et al., 1995; USDHHS, 1996), and 33% reported virtually no exercise (<3 min/day). On the other hand, 20% of the sample reported 40-plus min of at least moderate exercise per day. Similarly, although the observed mean of about 6,900 daily steps taken by the church members falls in the low-active range (Tudor-Locke & Bassett, 2004), 30% of the participants took fewer than 5,000 steps/day; 32%, 5,000–7,499 steps/day; 21%, 7,500–10,000 steps/day; and 17%, more than 10,000 steps/day.

Univariate analyses examining the relations among demographic and physical activity variables revealed that although MET hours per week were consistent across demographic groups, verified step-count levels varied with participants' age, race, and gender within race. Caucasian participants took 27% more steps per day than did African American participants (Ms = 7,198.89 and 5,657.88, SDs = 3,357.59 and 3,247.64, respectively), $F(1, 864) = 30.84$, $p < .001$, and participants in the younger half of the sample (ages 53 and younger; M = 7,766.24, SD = 3,223.20) took 29% more daily steps than did participants in the older half of the sample (M = 6,023.82, SD = 3,318.13), $F(1, 886) = 62.92$; $p < .001$. Although Caucasian male and female participants' steps were equivalent (~7,200/day), African American men in the sample took 19% more steps (M = 6,642.41, SD = 3,663.23) than did African American women (M = 5,412.73, SD = 3,105.17), $F(1, 874) = 4.05$, $p < .05$.

Social–Cognitive Characteristics

Participants' responses to the family social support items (see means and standard deviations in Table 1) suggested that they perceived some, although not strong, support for physical activity among their families (i.e., scores of about 3 on the 5-point Likert-type scale). Mean self-efficacy scores indicated that participants had positive, but not complete, confidence in their ability to increase physical activity in their daily lives (i.e., mean of about 73 on a 100-point scale). Participants' confidence in being able to overcome barriers to physical activity, on the other hand, was more neutral (mean of about 58 on a 100-point scale). Responses to the time outcome expectation items indicated that participants had neutral to low expectations that increasing physical activity would result in time management problems. Participants rated the likelihood and importance of having to change their normal routines to increase physical activity as close to 13 on a 25-point scale; expectations of other time-related outcomes were rated somewhat lower. Participants' responses to the physical outcome expectations items indicated that participants had positive, but not strong, expectations (scores of 17–19 on a 25-point scale) that increasing physical activity would lead them to sleep better, feel refreshed, and feel less stress.

Overall, participants indicated they had seldom (rated 2 on the scale) or occasionally (rated 3 on the scale) implemented physical activity self-regulatory strategies in the 3 months before the assessment. The participants reported seldom walking for lunch or to run errands or keeping a calendar of physical activity plans, although their responses indicated that they were more likely to plan alternatives on days with bad weather, exercise with others, park their cars further away, or take breaks during the day to increase walking. Finally, participants reported occasionally making time for physical activity.

Within the social–cognitive variables in the model, older participants (54-plus years) perceived higher support than did younger participants on the three family social support items: family takes time to be physically active (older: M = 3.67, SD = 1.21; younger: M = 3.19, SD = 1.24), $F(1, 902) = 34.69$, $p < .001$; family takes breaks (older: M = 2.93, SD = 1.34; younger: M = 2.21, SD = 1.19), $F(1, 902) = 70.11$, $p < .001$; and family uses stairs (older: M = 3.58, SD = 1.38; younger: M = 3.10, SD = 1.43), $F(1, 902) = 24.33$, $p < .001$. Female participants exhibited higher expectations on each of the physical outcome items than observed among male participants: sleep better (female: M = 19.63, SD = 7.20; male: M = 17.11, SD = 7.78), $F(1, 818) = 21.62$, $p < .001$; feel refreshed (female: M = 19.12, SD = 7.11; male: M = 17.10, SD = 7.41), $F(1, 823) = 14.73$, $p < .001$; and feel less stress (female: M = 17.79, SD = 7.58; male: M = 15.34, SD = 8.08), $F(1, 815) = 18.67$, $p < .001$.

Evaluation of the Measurement Model

Measures of demographic variables, social–cognitive characteristics, and physical activity were incorporated as indicators of corresponding latent variables in a structural equation model (see Table 1 for the means, standard deviations, and intervariable correlations associated with these measures). Before analyzing the structural model, we evaluated the measurement model to confirm the factor structure of the latent variables. The arrows in Figure 2

Table 1
Intervariable Correlations, Means, and Standard Deviations Associated With Measured Variables Used in the Structural Equation Analysis of the Social–Cognitive Model of Physical Activity

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1. Gender	—																									
2. Age	−.04	—																								
3. Race	−.08	.08	—																							
Family social support																										
4. Make time	−.04	.21	.02	—																						
5. Take breaks	−.02	.29	.05	.45	—																					
6. Use stairs	−.04	.15	−.01	.36	.44	—																				
Self-efficacy																										
7. Barriers	−.12	−.14	.06	.17	.16	.16	—																			
8. Daily routine	−.04	−.08	.08	.15	.19	.09	.71	—																		
Time outcome expectations																										
9. Change routine	.04	.02	.00	−.05	−.03	.01	−.10	−.14	—																	
10. More to get done	−.06	−.08	−.13	−.15	−.09	−.07	−.18	−.27	.32	—																
11. Less family time	.02	−.17	−.05	−.12	−.06	.02	−.14	−.19	.28	.43	—															
12. Not enough time	−.04	−.11	−.06	−.11	−.09	−.02	−.21	−.27	.29	.46	.49	—														
13. Give up activities	−.04	−.07	−.02	−.10	−.12	−.06	−.16	−.22	.36	.41	.43	.51	—													
14. More time to plan	−.09	−.06	.01	−.13	−.12	−.08	−.15	−.23	.33	.40	.37	.41	.55	—												
Physical outcome expectations																										
15. Sleep better	−.16	.01	.08	.12	.09	.10	.35	.29	.10	−.09	.01	−.10	−.01	.01	—											
16. Feel refreshed	−.13	.00	.08	.12	.13	.14	.37	.34	.05	−.12	−.02	−.13	−.07	−.02	.73	—										
17. Feel less stress	−.15	.01	.04	.08	.10	.10	.30	.23	.04	−.07	−.02	−.08	.00	.03	.60	.62	—									
Self-regulation																										
18. Make time	−.02	.06	.02	.21	.26	.13	.20	.20	−.19	−.22	−.11	−.14	−.13	−.16	.15	.18	.18	—								
19. Use calendar	−.02	.07	.13	.16	.24	.10	.11	.19	−.07	−.13	−.02	−.04	−.07	−.03	.06	.06	.07	.32	—							
20. Plan bad weather	−.06	.17	.07	.26	.26	.18	.21	.23	−.16	−.18	−.10	−.11	−.12	−.14	.15	.16	.16	.54	.50	—						
21. Park further away	−.15	.06	.02	.16	.25	.23	.24	.18	−.05	−.11	−.02	−.04	−.05	−.08	.14	.11	.09	.28	.34	.39	—					
22. Walk, not drive	.01	.06	.12	.15	.21	.15	.17	.23	−.08	−.14	−.03	−.08	−.07	−.07	.10	.13	.08	.29	.40	.40	.40	—				
23. Take breaks	−.07	.13	.06	.22	.42	.24	.18	.19	−.07	−.10	−.08	−.04	−.08	−.10	.13	.14	.16	.46	.43	.49	.46	.43	—			
24. Make date	−.10	.05	−.01	.23	.21	.16	.32	.23	−.11	−.15	−.10	−.12	−.11	−.15	.18	.15	.16	.49	.35	.50	.39	.32	.43	—		
Physical activity																										
25. Steps/day	.03	−.37	−.18	.00	−.05	−.02	.13	.08	−.12	−.03	.06	.05	−.02	.01	−.01	.00	.05	.21	−.03	.08	.04	.07	.01	.14	—	
26. MET hr/week	.06	−.03	−.05	.16	.13	.05	.12	.17	−.13	−.19	−.06	−.09	−.10	−.15	.01	.05	.06	.32	.18	.28	.07	.20	.18	.23	.24	—
M	0.34	52.70	0.21	3.42	2.55	3.32	72.90	58.20	12.70	8.72	8.20	6.84	8.25	8.88	18.80	18.40	16.90	2.99	1.69	2.45	2.55	1.99	2.14	2.54	6,896.00	11.60
SD	0.47	14.60	0.40	1.25	1.31	1.42	19.80	21.20	7.43	7.18	6.54	5.99	6.47	6.56	7.50	7.28	7.85	1.31	1.11	1.37	1.38	1.18	1.22	1.39	3,380.00	16.10

Note. MET = metabolic equivalent.

leading from the latent variables (in ellipses) to the measured variables (in rectangles) represent the measurement portion of the model. The fit of the measurement model was assessed in a single model for all latent variables independent of the structural model (see below). The latent variables were allowed to correlate. This model provided a good fit to the data (RMSEA $< .05$), but examination of modification indexes provided by LISREL suggested several adjustments to the measurement model to improve model fit. In this case, fit could be improved by allowing correlations between the errors associated with two negative time outcome expectation measures ("give up activities" and "take more time") and with several self-regulation measures ("set aside time" with "park to walk" and "use a calendar" with "plan for bad weather" and with "walk, not drive"). These adjustments seemed reasonable as they reflected a method effect that might explain additional covariation in the measured variables (i.e., multiple items with similar wording and Likert-type response scales) and are illustrated in Figure 2 by double-arrowed lines between the indicators involved. The fit associated with the measurement model represented in Figure 2 was also good (RMSEA $< .05$).

Evaluation of the Structural Model

Once an acceptable measurement model was established, we added the structural parameters posited by SCT (the arrows leading from one latent variable, enclosed in ellipses, to another in Figure 2 represent the structural portion of the model) to test the extent to which SCT variables influenced physical activity and to determine whether background variables influenced participants' social–cognitive characteristics and their levels of physical activity. The structural model was also designed to determine whether social support influenced physical activity independently or if (as posited by Bandura, 1997) its effect was totally mediated by other SCT variables. The structural model was fully recursive (i.e., each variable was directly influenced by each variable preceding it in the model) with the exception that the outcome expectation variables did not influence each other; it provided a good fit to the data (RMSEA = .040, p [close fit] = 1.00), $\chi^2(263, N = 999) = 683.96$, $p = .000$, χ^2/df ratio = 2.60. Significant ($p < .05$), standardized, direct effect coefficients and factor loadings generated by the structural analysis are displayed in Figure 2, along with the variance explained (R^2) for each endogenous variable in the model.

Standardized total, indirect, and direct effect coefficients (including insignificant parameter coefficients) are listed in Table 2. A variable's total effect is composed of its direct effect plus its indirect effects. The direct effect is the portion of a variable's total effect that is independent of other variables in the model (significant direct effects are represented by the single-headed arrows in Figure 2). A variable's indirect effect is the portion of its total effect that is dependent on other variables in the model; positive physical outcome expectations, for example, influences physical activity indirectly through self-regulation. Indirect effects are calculated by summing the products of the path coefficients associated with each of these indirect routes. The indirect effect for positive physical outcome expectations on physical activity (.03) is the product of the coefficients of the direct effect of positive physical outcome expectations on self-regulation (see Table 2) and of the direct effect of self-regulation on physical activity ($.08 \times .36 = .03$).

Table 2
Standardized, Direct, Indirect, and Total Effects of Variables in the Social–Cognitive Model of Physical Activity

Variable	Race[a]	Gender[b]	Age	Social support	Self-efficacy	Physical expectations	Time expectations	Self-regulation
Social support								
Direct	.02	−.05	.35***					
Indirect								
Total	.02	−.05	.35***					
Self-efficacy								
Direct	.08*	−.08*	−.27***	.35***				
Indirect	.01	−.02	.12**					
Total	.09*	−.10**	−.15**	.35***				
Physical expectations								
Direct	.04	−.14***	.04	.05	.45***			
Indirect	.04	−.05**	−.05*	.16***				
Total	.08*	−.18***	.01	.20***	.45***			
Time expectations								
Direct	−.07†	−.08*	−.16***	−.04	−.35***			
Indirect	−.03	.03*	.04	−.12***				
Total	−.10**	−.05	−.13**	−.16**	−.35***			
Self-regulation								
Direct	.00	−.05	−.01	.44***	.18***	.08†	−.10*	
Indirect	.04*	−.05*	.14***	.10***	.07**			
Total	.04	−.10**	.13***	.54***	.25***	.08*	−.10*	
Physical activity								
Direct	−.25***	.06	−.53***	−.04	.08	−.12*	.00	.36***
Indirect	.01	−.02	.02	.20***	.04	.03	−.04*	
Total	−.24***	.04	−.50***	.16**	.12*	−.09	−.04	.36***

[a] Caucasian = 0, African American = 1. [b] Female = 0, male = 1.
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Effects on Physical Activity

Total effects. Within the model, age exerted the strongest total effect on physical activity ($\beta_{total} = -.50$; see the last row in Table 2); greater age was associated with lower levels of physical activity. A participant's race also influenced physical activity ($\beta_{total} = -.24$); African American participants had lower levels of physical activity than did participants of other races (97% of whom were Caucasian). Gender did not exert an overall effect on physical activity (i.e., its total effect was insignificant). Of the potentially malleable variables in the model, self-regulation exerted the strongest total effect on physical activity ($\beta_{total} = .36$); participants who set aside time and made arrangements for exercise were more physically active. Support from family members and self-efficacy were also associated with higher levels of physical activity (β_{total}s = .16 and .12; respectively); the two outcome expectations variables, overall, did not influence participants' physical activity levels.

Direct and indirect effects. An examination of the effects within the demographic and psychosocial variables in the model reveals a complex set of relations. The effect of social support from family members on the physical activity levels of participants was, for example, largely indirect ($\beta_{indirect} = .20$; $\beta_{direct} = -.04$) through its effects on self-efficacy ($\beta_{total} = .35$) and self-regulatory strategies ($\beta_{total} = .54$). In addition, although older participants reported much higher levels of social support for physical activity ($\beta_{total} = .35$) and greater use of self-regulatory strategies ($\beta_{total} = .13$) than did younger participants, this positive effect of age was not enough to overcome the negative independent effect of age on physical activity ($\beta_{direct} = -.53$). Similarly, the higher levels of social support reported by older participants were not enough to overcome the negative direct effects of age on self-efficacy ($\beta_{direct} = -.27$); despite better social support, older participants had lower levels of self-efficacy overall ($\beta_{total} = -.15$). Gender did not influence physical activity in the model ($\beta_{total} = .04$), but women were more likely to use self-regulation strategies than were men ($\beta_{total} = -.10$) and were more likely to expect positive physical outcomes from physical activity ($\beta_{total} = -.18$).

The effect of self-efficacy on physical activity was largely direct ($\beta_{total} = .12$; $\beta_{direct} = .08$) and was somewhat diluted by its strong effect on positive physical outcome expectations ($\beta_{total} = .45$), which had a negative overall effect on physical activity. Positive physical outcome expectations (sleeping and feeling better) had a negative direct effect on physical activity ($\beta_{direct} = -.12$). The negative direct effect and the small but positive indirect effect of physical outcome expectations were counterbalanced, yielding an insignificant total effect on physical activity. Finally, although negative time management expectations exerted a small indirect effect on physical activity through self-regulation ($\beta_{indirect} = -.04$), this variable had no independent effect, yielding an insignificant total effect.

Of the potentially malleable variables in the model, self-regulation, as noted above, exerted the strongest effect on physical activity. SCT suggests self-regulatory behaviors increase as self-efficacy and outcome expectations improve—relations supported in the current analyses. Participants with higher perceived social support for physical activity exhibited higher levels of self-regulation ($\beta_{total} = .54$), as did participants with greater self-efficacy ($\beta_{total} = .25$). Expectation of time management problems among participants was associated with lower levels of self-regulation ($\beta_{total} = -.10$), whereas the effect of positive physical expectations on use of these strategies was not significant.

Alternative model. Although SCT does not preclude social support from influencing all SCT variables (as modeled above), Bandura (1997, p. 416) has stated that social support influences physical activity through self-efficacy, suggesting the effect of social support on other SCT variables would also be indirect. To determine whether allowing social support to directly influence self-regulation increased the fit of the model, we compared an alternative model that allowed social support to directly influence only self-efficacy (but not self-regulation, outcome expectations, or physical activity) with the model proposed here. Although the fit of this alternative model was good (RMSEA = .043, *p* [close fit] = 1.00), $\chi^2(267, N = 999) = 770.97$, $p = .000$, χ^2/df ratio = 2.89, a nested test showed that it did not fit as well as the proposed model, $\Delta\chi^2(5) = 75.14$; $p < .001$, suggesting that enacting the self-regulatory behaviors believed necessary for adopting an active lifestyle stems directly from the perceived social support those behaviors receive.

Additional analyses. The negative direct and total effects of positive physical outcome expectations on physical activity were counter to the relation posited by SCT; individuals who expect to feel refreshed, to sleep better, and to feel less stress as a result of physical activity ought, according to SCT, to be more active. The zero-order correlations of the measured physical outcome expectations and physical activity variables suggest only a small relation between the variables (see Table 1). Indeed, when modeled with only demographic variables, the total effect of physical outcome expectations on physical activity was very small ($\beta_{total} = .01$). When self-efficacy was added to the demographics-only model as a precursor to physical outcome expectations and physical activity, self-efficacy predicted both ($\beta_{physical\ activity} = .11$; $\beta_{physical\ outcome\ expectations} = .46$), resulting in a negative effect of physical outcome expectations on physical activity ($\beta_{total} = -.06$). Adding self-regulation to the model yielded a similar negative total effect ($\beta_{total} = -.09$), but further indicated that this total effect was composed of a negative direct effect ($\beta_{direct} = -.12$) that was counterbalanced by physical outcome expectations' positive indirect effects through self-regulation ($\beta_{indirect} = .03$).

Discussion

The present study incorporated measures of demographic and social–cognitive variables in a latent variable social–cognitive model explaining the physical activity of a group of 999 adults recruited from 14 southwest Virginia churches as part of a health promotion study. Although they were somewhat older and more likely to regularly attend church than the overall population of the region, the sample was racially and socioeconomically diverse and had body composition and activity levels similar to national samples (Flegal, Carroll, Ogden, & Johnson, 2002; USDHHS, 2000). Structural equation analysis indicated the theoretical model provided a good fit to the data and explained 46% of the variance of the adults' physical activity levels.

Within the model, age, race, social support, self-efficacy, and self-regulatory strategies contributed to the physical activity levels observed among the participants. Although self-efficacy routinely emerges as a strong predictor of exercise adoption and maintenance in exercise research, the total effect of self-regulation on physical activity among participants in the current study by far exceeded the total effect of self-efficacy, underscoring the importance of self-regulation to an active lifestyle (Bandura, 1997). Consistent with an earlier study of college students (Rovniak et al., 2002), the current study suggests that independent of self-regulatory behaviors, self-efficacy has little effect on physical activity. Self-regulation, which is the key to social–cognitive approaches to changing health behavior (cf. Bandura, 1997, pp. 303–305), was the most influential social–cognitive variable in the model. Furthermore, the current analyses suggest that although self-efficacy is an important precursor to self-regulation, family social support was an even stronger predictor. Social support influenced self-regulation indirectly through self-efficacy, but social support also directly made it much more likely that participants would use self-regulation strategies and subsequently be more physically active. Finally, as Bandura (1997, pp. 21–24) suggested might occur when modeled behaviors are closely linked to (expected) outcomes, outcome expectations did not contribute to the understanding of physical activity beyond self-efficacy and its precursors.

Independent of the social–cognitive variables in the model, race and age contributed to the participants' physical activity levels. African American participants in the sample were less active than Caucasian participants, and African American women were less active than African American men; this effect of race on physical activity was not substantially explained by the social–cognitive variables in the model. Although African American participants had somewhat higher levels of self-efficacy and physical outcome expectations and somewhat better time management expectations, race did not influence social support or self-regulation, the strongest social–cognitive predictors of physical activity in the model. Although the negative effect of age on physical activity is well established in the literature (Barnes & Schoenborn, 2003), these results suggest that for many older adults the psychosocial stage may be set for increased activity. With increased age, participants perceived much stronger social support for physical activity, were less concerned about time management issues related to physical activity, and tended to implement self-regulation strategies more frequently. Older participants' stronger social support and better self-regulation, however, were not accompanied by increased self-efficacy. The confidence of older adults in their abilities to self-regulate physical activity might, then, have less to do with their perceived abilities to be consistent than with their perceived physical limitations.

Strengths of this study include a verified physical activity measure, a large diverse sample of adults, and the use of SEM. The study has several limitations. First, although large, the sample composition presents two challenges—the high rate of church attendance by participants and the expressed interest in changing health behaviors is not typical of most adults, such that the model will need to be verified in a more representative population. Second, the racial differences observed among the participants in psychosocial and physical activity variables suggest the social–cognitive model may operate differently among African American and Caucasian adults. The current sample size (209 African American participants) could not support the multigroup analyses that could isolate these differences. Third, although the psychosocial measures incorporated in the model stemmed from three stages of formative research and had adequate internal consistency, items were selected on the basis of their ability to distinguish between exercisers and nonexercisers in the current sample, so these results would need to be confirmed by using the measures to model physical activity in a separate sample of adults. Fourth, there is something amiss in the current findings concerning positive physical outcome expectations. Bandura (1997) allowed that outcome expectations can theoretically make no additional or only a small contribution to understanding certain behaviors after accounting for self-efficacy (see Bandura, 1997, pp. 21–24), which is consistent with the current findings. SCT does not suggest, as found here, that positive outcome expectations would have a negative effect on behavior independent of its positive effect through self-regulation. Although Polivy and Herman (2002) have posited a false hope syndrome, which might suggest that recruits for a physical activity intervention who have low levels of activity may be unrealistic about the benefits of physical activity, such that when self-efficacy and self-regulation are taken into account what remains is "false hope," and although an inverse relation between baseline positive outcome expectations and adherence to exercise interventions has previously been observed (Desharnais, Bouillon, & Godin, 1996; Sears & Stanton, 2001), it can be argued that the social–cognitive model of physical activity should be rejected on the basis of this theory-inconsistent result (Ogden, 2003). The relation of positive physical outcome expectations to SCT variables not represented (such as personal, situational, or environmental impediments; Bandura, 2004) or only partially represented (goal setting and self-incentive self-regulatory strategies) in the current model, however, should be explored first. Finally, although cross-sectional data are commonly used in explanatory models of behavior, the current analyses would be enhanced by a longitudinal design, allowing causal relations to be chronologically ordered.

These results suggest physical activity interventions should focus on increasing self-regulatory behaviors such as planning, scheduling, and incorporating physical activity into the daily routine, as well as goal-setting and self-incentives that round out the self-regulatory process. Furthermore, physical activity interventions targeting the behavioral norms and modeling of family members may be more successful in increasing the self-efficacy and the self-regulation behaviors essential to being more physically active. Similarly, interventions that shape self-regulation efficacy through practice and reinforcement may be more successful in decreasing negative outcome expectations and, hence, in getting individuals to plan and schedule physical activity. Finally, the current findings suggest that physical activity interventions with older adults may need to address the perceived and real physical aspects of increasing activity, as well as the psychosocial aspects.

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