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Change in Goal Ratings as a Mediating Variable between Self-Efficacy and Physical Activity in Older Men

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Abstract

Background—Few studies have examined the associations between exercise self-efficacy, goals, and physical activity over time.

Purpose—This study examines whether self-selected goals mediate the changes in exercise self-efficacy on physical activity over 12 months.

Methods—Data are derived from 313 older men participating in the Veterans Life Study.

Results—Changes in exercise self-efficacy were significantly associated with changes in physical activity both directly (βs = .25 and .24, $p < .05$) and indirectly (βs = .24 and .30, $p < .05$) through changes in health-related and walking goal ratings (βs = .19 and .20, $p < .05$). Both types of goal setting continued to partially mediate the relationship between exercise self-efficacy and physical activity when covariates were added to the models. This study extends the application of social cognitive and goal-setting theories to physical activity by showing that goals partially mediate the relationship between exercise self-efficacy and physical activity over time.

Keywords

goal setting; physical activity; self-efficacy; randomized controlled trial; older adults

Introduction

Insufficient levels of physical activity is a public health concern that pervades across all age groups [1]. Sedentary behavior is of particular risk to older adults, given the implications inactivity have for physical and functional health, and ultimately, independence. Social cognitive theory has been used to guide numerous studies of physical activity, and specifies

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that self-efficacy and goal setting are key components of behavior change [2]. Specifically, social cognitive theory proposes that self-efficacy, an individual’s belief in his/her ability to successfully complete a course of action, affects behavior both directly and indirectly by influencing goal setting. To date, much of the research examining the role of self-efficacy and physical activity has been limited to studies examining a direct association between these two factors [3]. To our knowledge, of the few studies which have examined an indirect path from self-efficacy to physical activity, none have included goal setting as an intermediate variable [4].

Although the effects of goal setting have long been studied in the areas of classroom and work performance [5], the literature examining the relationship between goal setting and physical activity remains small; smaller still is the number of studies that have examined goal setting and physical activity in older adults [6]. Previous studies of goal setting have largely conceptualized goal setting in one of two ways: 1) as a dichotomized variable in which the presence of a goal (i.e., yes/no) is identified as a predictor of change in physical activity without attention to any achievement or progress towards goal attainment, or 2) as a qualitative variable in which content or characteristics of goals are associated with changes in physical activity. As such, these studies operate under the assumption that behavior change is synonymous with goal attainment. Very few studies have assessed progress toward goals alongside changes in physical activity [6]. Both social cognitive theory and goal-setting theory identify goal setting as a motivating mechanism of behavior change [2,5,7]. Specifically, Bandura specifies an intermediary role of goal setting in the relationship between self-efficacy and behavior [2], such that the goals that individuals set for themselves are informed by perceived capabilities, and both influence behavior. Goal setting is fundamental to self-initiated behavior change, and as such, progress on self-selected goals is expected to result in progress on goal-specific behaviors. Conversely, failure to progress towards one’s goal is expected to result in the maintenance or decline of that same behavior. The value and effectiveness of goal setting, however, remains to be evaluated in older adults [8], particularly relative to changes in physical activity.

The primary objective of this study was to examine a social cognitive model in which goal setting mediates the relationship between self-efficacy and physical activity in older adults. Measures were collected at baseline and 12 months of the Veterans LIFE study [9]; a 12-month home-based physical activity counseling intervention. We hypothesized that increases in self-efficacy from baseline to 12 months would be associated with increases in self-selected goal ratings, both of which would be associated with increases in physical activity. Panel analyses were used to examine the direct and indirect effects of self-efficacy and goal ratings on physical activity..

Methods

Data for this study are from the Veterans Life Study [9], a 12-month home-based physical activity counseling intervention. A complete description of the study has been reported elsewhere [9]. In brief, the study was a randomized controlled trial comparing a multicomponent physical activity counseling (PAC) program with usual care (UC). The PAC program was guided by social cognitive theory [10] and the transtheoretical model of behavior change [11]. PAC consisted of an in-person baseline counseling session supplemented with 14 telephone calls throughout the study period, study endorsement by the primary care provider during a usual care clinic visit, monthly automated telephone encouragement from the primary care provider, and quarterly mailed tailored progress reports. The physical activity objectives for the PAC group were to walk 30 minutes or 5 days per week and to perform 15 minutes of lower extremity strength training 3 days per week. UC consisted of usual care received during visits to primary care providers within the same time frame. The Durham Veterans Affairs institutional review board reviewed and approved the research protocol, and written consent was obtained from all participants.

Participants

The medical records of male veterans aged 70 and older who were followed at the Durham VA Medical Center were reviewed for the following exclusion criteria: a terminal diagnosis, unstable angina, history of ventricular tachycardia, chronic obstructive disease requiring two hospitalizations within the previous 12 months, uncontrolled hypertension, stroke with moderate-to-severe aphasia, diagnosis of chronic pain, active substance abuse, diagnosis of mental or behavioral disorders, dementia, severe hearing loss, or severe visual loss. Additionally, patients were required to 1) be able to walk 30 feet without human assistance and 2) be sedentary, defined here as engaging in less than 150 minutes of physical activity per week. The primary care provider provided final eligibility using the same exclusion criteria. For patients meeting eligibility criteria, a recruitment letter was mailed out and followed by a telephone call. Participants were reimbursed for travel costs equal to $10 for each of the four assessment visits.

Study participants were male veterans (Black = 70, White = 238, Hispanic = 1, Other = 4), ranging in age from 70 to 92 years. Prior to randomization, 313 participants (Intervention group = 156 and Control group = 157) completed the health goal and walking goal assessments at baseline, and were subsequently retained for these analyses.

Measures

Goal Ratings—Goals were assessed by interview using the open-ended questions from the Personal Functional Goals (PFG) protocol [12]. At baseline, participants were asked to create one health-related goal and one walking goal for their participation in this exercise study. These goals were self-selected by the participants, without any guidance from the research staff. Next, participants were given a picture of a ladder and instructed, “Suppose the top rung of the ladder (10) represents the best possible that your goal of (insert stated goal here) could become, and the bottom rung (0) represents the worst it could be.” The interviewer then asked, “Thinking about your health-related goal, which is: (insert stated goal here), where would you say you are on the ladder at the present time?” Both the goal and rating were logged in the study database. These procedures were repeated for the walking goal.

At each follow-up assessment, participants were provided with a printout of the health-related goal they had set for themselves at baseline. Participants were then instructed, “Please look at your goal and the score you gave it in our last interview. Taking into account where you were before, where are you on the ladder today?” Participants were then instructed to rate their current status on this same goal, again using the ladder as a reference. These procedures were repeated for the walking goal. Other than during the assessment points, participants were not reminded of their goals during the program.

Exercise self-efficacy—Two items were used to assess self-efficacy separately for walking/endurance activities and strength training activities. The content of these two items was created to be consistent with the Veterans LIFE study counseling and was adapted from validated measures of self-efficacy [13]). The first question asked participants, “How sure are you that you could walk or do another type of endurance exercise for 30 minutes or more on five or more days of the week? The 30 minutes does not have to be all at the same time.” The second item asked, “How sure are you that you could do exercises for 15 minutes, three days a week to make your legs stronger?” Responses to these two items ranged from 1 (not at all confident) to 5 (extremely confident). A scale score was created by taking the average of the responses on the two items.

Physical activity—Time spent in moderate-intensity physical activity was determined using the Community Health Activities Model Program for Seniors questionnaire (CHAMPS) [14], as modified to be used in a continuous metric of minutes [15]. The CHAMPS questionnaire is a self-report assessment designed specifically for older adults and assesses average weekly frequency and duration of social and physical activities typically performed by older adults. Hours per week of moderate-intensity activity was derived using items that included brisk walking, jogging/running, cycling, aerobic machines, strength training, and general conditioning exercises.

Demographic and health information—Basic demographic information including age, race, and education were collected at baseline. Health status was assessed using a modified version of the Older Americans Resources and Services (OARS) co-morbidity index [16]. Participants were instructed to indicate if they currently had any of the thirty-five specific diseases or conditions included in this questionnaire.

Data Analysis

In order to examine the hypothesized relationships between self-efficacy, goal ratings, and physical activity, panel analyses within a covariance modeling framework were used. Two independent models were tested in this study (see Figure 1-health goals and Figure 2-walking goals). In Figure 1, we specified direct effects of exercise self-efficacy and health goal status on physical activity, as well as an indirect effect of exercise self-efficacy on physical activity through health goal status. In Figure 2, we specified direct effects of exercise self-efficacy and walking goal status on physical activity and an indirect effect of exercise self-efficacy on physical activity through walking goal status. According to Baron and Kenny [17], a mediating effect of goals in this model would be evidenced by significant paths from self-efficacy to goal ratings, and from goal ratings to physical activity, and the path from self-efficacy to physical activity would no longer be significant. A partial mediating effect of goals would be evidenced by significant paths from self-efficacy to goal ratings, from goal ratings to physical activity, and from self-efficacy to physical activity.

Due to the presence of missing data, the full-information maximum (FIML) estimator in Mplus V5.0 was used. The extent of missing data was minimal: physical activity at baseline (<1%) and 12 months (<1%), exercise self-efficacy at baseline (<1%) and 12 months (<1%), health goal ratings at baseline (none) and 12 months (<1%), and walking goal ratings at baseline (<3%) and 12 months (<3%).

Demographic factors and health status are important correlates of physical activity. Therefore, an additional analysis was conducted for each model while controlling for treatment group, age, race, and number of comorbidities.

Results

This sample is comprised of a diverse group of older men. Forty-five percent reported some college or more advanced education, while 21 percent did not graduate from high school. At baseline, participants reported an average of 5 medical conditions, with hypertension (74%), arthritis (67%), and heart conditions (46%) being the most prevalent. The mean scores and standard deviations for all measures at baseline and 12 months are provided in Table 1. At baseline, participants were moderately/highly efficacious for exercise, provided moderate ratings of both health and walking goals, and engaged in approximately 50 minutes of moderate-intensity physical activity per week.

The self-selected health-related goals generally addressed symptom control (e.g., pain, fatigue), specific disease-related conditions (e.g., glucose), maintain or improve function, prevent functional losses and disability, restoration of function, to look better, longevity, and leisure goals. Examples of health-related goals identified by study participants include "decrease the amount of pain in my joints," "to be able to keep doing activities I am doing now," "to remain independent so I don't have to rely on others," "lose weight and build up my health," "to improve leg strength and breathing," "to stay healthy," "extend my life in good health," "improve my balance in daily activities," and "reduce my glucose levels." The self-selected walking goals generally addressed maintaining or improving function, increase walking distance, increase walking frequency, symptom control, recreational activities, balance and strength, and reduce dependence on assistive devices. Examples of walking goals identified by study participants include "to walk a mile every day," "to walk on uneven surfaces without falling," "strengthen my legs for walking," "increase my walking speed," "maintain the ability to walk without any assistance," "to get into a walking routine," "walk without losing balance and lose the cane," and "walking without shortness of breath or pain."

As can be seen in Table 2, both models provide a good fit to the data, meeting the accepted criteria (18–20). Significant paths ($p < .05$) for both models are depicted in Figures 1 and 2.

Baseline

No mediating effects of health goals or walking goals were observed, such that the paths from self-efficacy to goal ratings and goal ratings to physical activity were not all significant. However, both exercise self-efficacy (βs = .25 and .26) and walking goal ratings (β = .17) were significantly associated with physical activity.

Changes over time

A partial mediating effect for goals was observed longitudinally, as evidenced by the significant paths between self-efficacy, goal ratings, and physical activity. Specifically, changes in exercise self-efficacy were significantly associated with changes in physical activity both directly (βs = .24 and .25) and indirectly through changes in goal ratings (exercise self-efficacy to goal ratings βs = .24 and .30; goal ratings to physical activity βs = .19 and .20). Stability coefficients, a reflection of how much of the variance in the measure at 12 months is influenced by the measure at baseline, of all measured constructs across the 12-month period was also calculated and overall, was acceptable for all constructs ($p < .05$).

Covariates

The final set of analyses examined the extent to which age, race, number of comorbidities, and treatment group differentially influenced the fit of the model or the hypothesized relationships. The model fit indices for these models are provided in Table 2. The model fit was not substantially changed with the addition of these covariates on either of the models tested. Nearly all of the paths at baseline and over time remained statistically significant, with no substantial change in strength or direction. However, the inclusion of covariates rendered the previously significant pathway between exercise self-efficacy and *health goals* at baseline, non-significant.

Several significant relationships between covariates and individual model variables emerged. At baseline, men who were younger (βs = −.12), white (βs = .17), had fewer comorbidities (βs = −.25), and/or were randomized to the intervention group (βs = −.13), reported higher levels of exercise self-efficacy. Men who were older (βs = .12 and .13) and/or had fewer comorbidities (βs = −.25 and −.23) also reported higher ratings on health and walking goal status at baseline.

As expected, being randomized to the intervention group was significantly associated with more minutes of moderate-intensity physical activity (βs = −.18) and higher ratings on health (βs = −.15) and walking goals (βs = −.17) at 12 months. Finally, younger age (βs = −.13) and fewer comorbidities (βs = −.13) were associated with higher levels of exercise self-efficacy at 12 months. All reported associations were significant ($p < .05$). For the sake of clarity, these relationships are not shown in Figures 1 and 2.

Discussion

This study examined a social cognitive model for physical activity behavior, in which goals were specified to play a mediating role in the pathway between self-efficacy and physical activity. Increases in exercise self-efficacy over time were associated with improvements in health and walking goal ratings, both of which were associated with increases in physical activity. These longitudinal assessments extend previous applications of social cognitive and goal-setting theories [2,5,7,10] by demonstrating that goals are indeed important indicators of physical activity behavior and partially mediate the relationship between self-efficacy and physical activity in older adults.

The means reported in this sample (*M* baseline health goal rating = 5.25, *M* baseline walking goal rating = 4.71, Range = 0–10) suggest that these participants selected moderately-challenging health and walking goals for participation in a physical activity counseling intervention. Importantly, progress on these self-selected goals was observed for both the intervention and control groups. However, participants in the intervention group reported significantly greater improvements on both goals compared to participants in the control group. These group differences were also observed for physical activity, such that the intervention group significantly increased time spent in moderate physical activity compared to controls.

The findings of this study are also consistent with a social cognitive perspective and our hypothesis: those individuals with strong self-efficacy would demonstrate significantly greater improvements on self-selected goals and physical activity. Although baseline exercise self-efficacy was not significantly associated with walking goal ratings, longitudinally, exercise self-efficacy was significantly associated with changes in physical activity. These effects were both direct and indirect, through health and walking goals. To our knowledge, no studies have examined self-efficacy, goal progression, and physical activity in older adults in this fashion [4]. Our results confirm that programs to increase physical activity would do well to include not only efficacy-enhancing strategies but also personally relevant health or exercise goals along with methods for monitoring *progress* towards goals, as both significantly influence physical activity in older adults.

It should be noted that, contrary to previous intervention studies that assess exercise self-efficacy and physical activity [21,22], no significant change in exercise self-efficacy from baseline to 12 months was observed in this study. These results are surprising, considering that the physical activity counseling intervention was based on social cognitive theory [9], and addressed the many sources of efficacy beliefs (e.g., verbal persuasion, mastery experiences). However, this is likely attributable to the manner in which exercise self-efficacy was measured; using a two-item 5-point Likert scale. Bandura [2] specifies that measures of self-efficacy ought to include varying degrees of task demand, as such measures are better able to distinguish between individuals who differ in their perceived efficacy for higher or lower level demands. Thus, we acknowledge that our results may be strengthened in the presence of a multiple-item measure of exercise self-efficacy that includes a broader response scale, as we would expect to capture more of the variability in exercise self-efficacy over the course of the intervention. Additionally, the use of a measure to assess efficacy specific to goal attainment also warrants further consideration.

This study is not without limitations. Specifically, this study was not designed to explore reciprocal influences of physical activity change on exercise self-efficacy or goal status. However, the statistical models employed here allowed us to explore these reciprocal pathways and none were significant (data not shown); although we were likely underpowered. Research studies that are designed specifically to assess the causal sequencing between physical activity and goal setting are needed. Furthermore, we acknowledge that the influences of other social cognitive factors, such as self-regulation or social support, which may also serve as mediators, were not included in this study. Finally, the methodology specified by the developers of the PFG protocol [12] deserves consideration. Prior to rating their present status on the health-related goal and walking goal at 12 months, participants were reminded of the rating they selected at their prior assessment. It is conceivable that such prompting encouraged participants to slant their responses in a socially desirable way; choosing a rating that reflected progression on those goals. Although the authors note that this methodology was adopted to prevent participants from rescaling their goals at subsequent time points, they also note that in their pilot study, no differences in the magnitude of change were observed between those who saw their previous ratings and those who did not. In an effort to minimize social desirability distortion, future studies might consider the use of computer-assisted goal setting [23,24] or ask participants to rate their current status without seeing their previous ratings. Clearly, the most suitable methods for measuring goals and assessing changes over time have yet to be identified.

To our knowledge, this is the first study to examine changes in goal status over time as a mediating variable between self-efficacy and physical activity in older men. These findings support the concept of goal-setting as an important self-regulatory mechanism in social cognitive theory [2], and lend further support to the emphasis that Bandura places on self-efficacy and goal setting as discrete indicators that influence behavior. This study also provides support for physical activity interventions using social cognitive theory as an underlying framework. In this study, individuals not only improved their physical activity levels, but also improved on self-selected, personally meaningful, goals. Clearly, individual progression toward achieving one’s goals is an important factor underlying behavior change, and as such, goal setting/goal attainment, and related factors, should be a central component of any effort to change physical activity behavior in older adults.

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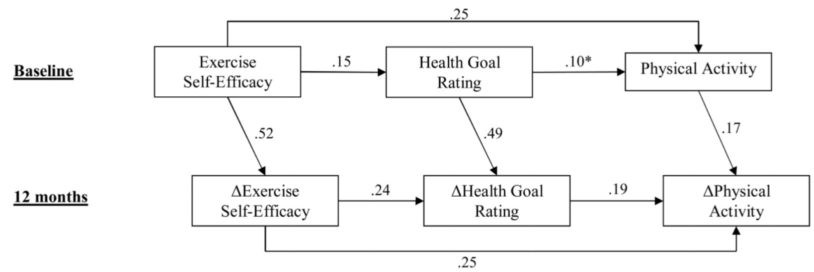

Figure 1. Panel model of exercise self-efficacy, health goal rating, and physical activity

Note. *Indicates path was tested but not significant, all other paths are significant $p < .05$. Variables in the bottom panel reflect *change*.

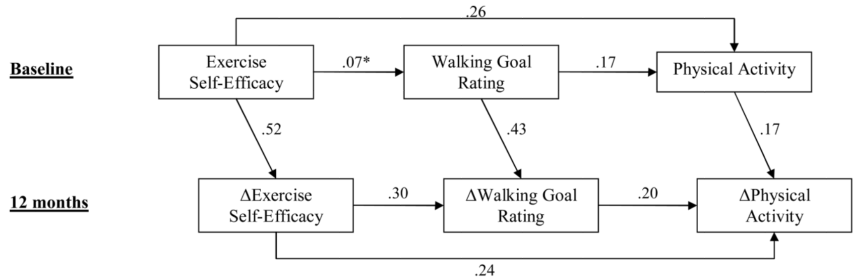

Figure 2. Panel model of exercise self-efficacy, walking goal rating, and physical activity

Note. *Indicates path was tested but not significant, all other paths are significant $p < .05$. Variables in the bottom panel reflect *change*.

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Table 1

Means and standard deviations for exercise self-efficacy, health goal and walking goal ratings, and physical activity at baseline and 12 months

Variable	Total Sample	Intervention Group	Control Group	Possible Range
Exercise self-efficacy-baseline	3.38(0.9)	3.52(1.0)	3.25(0.9)	1 = not at all confident 5 = extremely confident
Exercise self-efficacy-12 months	3.36(1.0)	3.52(1.0)	3.20(1.0)	
Health goal ratings-baseline	5.25(2.25)	5.37(2.16)	5.13(2.34)	0 = the worst it could be 10 = the best it could be
Health goal ratings-12 months	6.72(2.47)	7.25(2.38)	6.19(2.44)	
Walking goal ratings-baseline	4.71(2.30)	4.75(2.32)	4.66(2.29)	0 = the worst it could be 10 = the best it could be
Walking goal ratings-12 months	6.46(2.70)	7.07(2.62)	5.87(2.64)	
Physical activity-baseline[a]	56.61 (93.9)	59.61(102.1)	53.65(85.3)	0–550.0[b]
Physical activity-12 months[a]	92.48(122.0)	124.14(138.9)	61.22(93.1)	0–863.0[b]

Note.

[a] Values represent minutes spent in moderate-intensity exercise over the course of 7 days;

[b] Values represent the range reported by study participants.

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Table 2

Model fit indices

Model*	**χ^2(df)**	**RMSEA (90% CI)**	**SRMR**	**CFI**
Health Goal	15.1(6)	0.07(0.03–0.11)	0.03	0.97
Walking Goal	8.0(6)	0.03(0.00–0.09)	0.03	0.99
Health Goal + covariates	15.8(6)	0.07(0.03–0.12)	0.02	0.98
Walking Goal + covariates	7.7(6)	0.03(0.00–0.08)	0.02	1.00

Note.

*Model is differentiated by the intervening variable; df = degrees of freedom; RMSEA = root mean square error of approximation; CI = confidence interval; SRMR = standardized root mean square residual; CFI = comparative fit index; covariates include treatment group, age, race, and number of comorbidities.