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Intervention Markers of Physical Activity Maintenance in Older Adults

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Abstract

Objectives—To identify intervention components that may promote long-term changes of physical activity among older adults in a behavioral theory-based physical activity trial.

Methods—Participants (N = 24; aged 65±8.79 years) shared perceptions of intervention components at the end of the intervention and physical activity was assessed at 18 months. Mixed-methods analyses using a pragmatic content analysis of interview data were conducted.

Results—Active study participants (25%) cited more specific goals/actions to achieve goals and more social support from family/friends, and had significantly higher self-determined motivation mean scores at 18 months than insufficiently active study participants (75%).

Conclusions—Specific goal-setting behaviors and social support from family/friends may be key elements of physical activity maintenance in older adults.

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Human Subjects Statement

The University of Florida institutional review board approved all aspects of the study protocol (#2005-U-0813). All participants provided written informed consent.

Conflict of Interest Statement

The authors declare no competing interests or financial conflicts in the study or preparation of this paper.

Keywords

older adult; physical activity; Self-Determination Theory; Social-Cognitive Theory

Adults 50 years of age and older who engage in regular physical activity have lower rates of hypertension, cardiovascular disease, stroke, obesity, diabetes, and depression;^{1,2} moreover, they are able to maintain an independent lifestyle and enhanced quality of life.^{3,4} Nevertheless, almost two-thirds of older adults do not meet the United States national guidelines of 150 minutes of moderate physical activity a week.⁵ Moreover, physical activity trends continue to decline with age regardless of initial physical activity levels.⁶ Older adults have unique psychological, social, physical, and environmental influences compared to their younger counterparts. They have more chronic health conditions,⁶ a lack of knowledge or limited interest about physical activity and health,⁷ declining personal and community support systems, decreased social networks, increased perceptions of environmental barriers, and limited income.^{8–10} In light of these differences, it is imprudent to assume that effective strategies that increase physical activity in younger adults can readily be applied to older adults and achieve similar outcomes. Considering the explosive growth of the 60+ adult demographic in the United States—the fastest growing segment of the population⁶—a better understanding of strategies to maintain physical activity later in life is needed.

Several studies have reported on predictors of physical activity initiation (defined here as the beginning of physical activity adoption up to 6 months) in older adults. Motivators for physical activity initiation in this population include physical and psychological well-being,¹¹ maintenance of independent lifestyles,¹² and social connections and enjoyment.¹³ Unfortunately, participation rates in physical activity following initiation drop precipitously. Martin et al¹⁴ and Cooper et al¹⁵ report an average 50% drop in adherence to physical activity at 6–7 month follow-up. However, longer term achievement of physical activity is needed to maintain the health benefits of exercise.³ Older adults who initiate physical activity may discontinue participation due to changes in physical condition (eg, joint pain, cardiac changes),^{10,14,15} environmental barriers (eg, safety, lack of transportation),¹¹ and psychosocial issues (eg, lack of a partner, low confidence in physical activity abilities).¹⁰ Few studies have investigated how predictors for initiation of physical activity confer long-term achievement of physical activity. Additionally, most short-term and long-term physical activity behavior change studies focus on specific interventions with little discussion about the underlying strategies and constructs that they seek to target.¹⁶ Further investigation is needed to identify specific theoretical components that may provide better support for sustained physical activity behaviors in older adults.

Self-Determination (SDT)¹⁷ and Social-Cognitive (SCT)¹⁸ theories support the development of positive self-regulatory factors in individuals. Conceptually, these theories explain both initiation and maintenance of healthy behaviors. Central to SDT are constructs of autonomy, competence, and relatedness. Interventions supporting these basic psychological needs “foster the most volitional and high quality forms of motivation and engagement for activities, including enhanced performance and persistence...”¹⁷(p.60) Central to SCT are

self-efficacy beliefs, which are “the foundation of human motivation and action.”¹⁸(p.144) Previous accomplishments, relatedness, verbal persuasion, vicarious experience, and physiological arousal constructs are the primary supports for self-efficacy.¹⁸

SDT and SCT constructs primarily have targeted physical activity initiation^{19–23} and important limitations prevent understanding of the theoretical components for long-term physical activity maintenance. First, most studies are short-term (< 6 months), so long-term behaviors cannot be inferred. Second, most long-term studies (> 6 months) employ an intervention that is carried on throughout the length of trial, with evaluation of outcome measures performed immediately after intervention conclusion. This limits translation of the effects of intervening components on true behavior adoption and change. Lastly, few studies address the explicit relationship between intervening components and theoretical constructs (and changes in these components/constructs) and long-term behavior change in older adults. Intervening components often are not operationalized adequately, implemented, or they are delivered in “packaged interventions” so their individual efficacies cannot be ascertained. Further investigation is needed to identify SDT and SCT related intervening components and constructs that can be translated into interventions to support long-term achievement of physical activity in older adults.

Unique to this investigation is our focus on theoretical constructs with conceptual links reported in a previous randomized controlled trial.²⁴ In this study, the provision of social support, goal setting, and mental imagery were part of a peer-based intervention that resulted in long-term effects on physical activity behavior with older adults. Interventions employing goal setting and social support (eg, social contact between coaches and participants) have shown consistently positive results in physical activity initiation in older adults.^{14,19,20,25} Guided imagery also has been shown to impact exercise intentions, affect, and motives in randomized controlled trials.^{26–29} Together, social support, goal setting, and guided mental imagery are a unique and practical set of strategies that have potential to impact physical activity behavior in older adults.

The objective of the current study was to identify intervening components and theoretical constructs from a 4-month behavioral intervention that may influence achievement of physical activity (at 18 months) among older adults. We used a mixed-methods approach including qualitative analysis of interview data and quantitative analysis of psychosocial and behavioral outcome data. This is an expansive and creative form of investigation that incorporates multiple approaches (such as inductive and deductive methods) in answering research questions.

METHODS

Study Design

The present study was an embedded, or nested, mixed-methods secondary analysis of the Active Adult Mentoring Program (AAMP) that used quantitative and qualitative sources of data in an integrative manner.³⁰ The AAMP study was a 4-month randomized controlled trial with an 18-month follow-up that tested the impact of peer volunteers as delivery agents of a SDT-based and SCT-based, group-mediated, physical activity intervention in sedentary

adults aged 50 years and older living in a university community in the southeastern United States.²⁴ The full methods and results have been reported elsewhere²⁴ and are reviewed here briefly. Participants were randomized to one of 2 16-week study arms: (1) peer-led advice and support (based on SDT and SCT components) for physical activity initiation and maintenance; or (2) a “standard” community-based physical activity promotion and health education intervention. Both groups received pedometers and were encouraged to self-monitor their behavior. The main results suggested that, at 16 weeks, both arms had significant increases in physical activity, but no differences between arms. At 18 months however, the peer-led intervention arm had superior achievement of physical activity relative to the standard arm, despite cessation of the intervention 8 months earlier.

Given the theoretical nature of AAMP and multiple forms of data collected, our design and analyses involved the use of qualitative and quantitative data in tandem. Creswell and Plano-Clark³⁰ and others³¹ have characterized this approach as an embedded or nested study design with the intent to improve understanding of the experiences and outcomes of those randomized to the peer-led intervention arm of AAMP. For the current analysis, we focused on the process of long-term behavioral change by analyzing post-intervention interviews (at 4 months) of participants alongside our quantitative survey measures of physical activity and behavioral change at 18 months. Put another way, statements made by the participants during the qualitative interviews were embedded within results from follow-up surveys of physical activity behavior and motives for exercise administered 18 months later. Only individuals randomized to the peer-led intervention arm and who completed 18-month follow-up data collection were included in analyses as the standard intervention arm received only general health education information (in lieu of the SDT and SCT intervening components/theoretical constructs) and did not demonstrate significant group-level increases in physical activity at 18 months.²⁴ We have previously reported that there were no statistical differences between those lost to follow-up at 18 months and completers on any baseline demographic variables. Finally, an additional 10 completers were not asked to complete post-intervention interviews because saturation³² was reached in the initial set of interviews. Saturation was determined when no new themes emerged from the interviews.

Intervention and theoretical framework—Underpinned by SDT¹⁷ and SCT,¹⁸ Figure 1 shows the theoretical framework that guided the development of the AAMP intervention. The primary intervening components of the intervention included goal setting (Box 2), social support (Box 3), and mental imagery (Box 4). Goal-setting components included basic education of specific, measureable, action-oriented, realistic, and timed (SMART) goals,³³ identification of short-term and long-term goals and strategies to overcome barriers, and re-assessment of goals for long-term behavior change. Social support components included the use of same-age peer mentors to deliver the intervention, group-based problem solving activities, and activities to identify sources of support outside of the group (eg, significant other, friends). Mental imagery activities involved completion of imagery rating scales, reading a guided imagery script, and optional homework assignments.³⁴ These components were delivered within the context of a mentoring relationship, relying upon a combination of supportive questions, statements, discussions, and education from the peer mentor. Our team theorized that these intervention components would impact constructs

central to SCT and SDT (Boxes 5–7) which would in turn reflect improvements in self-efficacy and self-determined behavioral beliefs (Box 8). The intervention was designed to help individuals initiate and maintain regular physical activity at the level of physical activity guidelines (Box 9).

Interview guide—A semi-structured interview was conducted at the end of the 4-month intervention period with individuals in the active arm of AAMP. The interview guide was developed with open-ended questions followed by specific probes. The main elements of the interview guide focused on intervening components (Figure 1, Boxes 2–4) including the use of goal setting (eg, “Tell me ...about the goals you set...how did you feel when you accomplished them?”), social support (eg, “Tell me...your impressions of the group... the time in the group”), and mental imagery (eg, “Tell me a little about your experiences using imagery during the program”) and how these intervening components impacted key theoretical constructs (Boxes 5–7). The term “physical activity” was used throughout the interviews to reflect the broad range of physical activities that individuals may participate in and were discussed during the intervention. Using this specific term was intentional to not limit activities to exercise (“planned, structured, repetitive, and purposive”)³⁵(p126) alone, but also to include lifestyle activities that may also be beneficial for health. The same interview protocol was followed for all participants. Interview duration ranged from 20 minutes to 40 minutes.

Quantitative measures—Self-Determined Motivation to Exercise was assessed via the Exercise Motivation Scale (EMS) at baseline, following the 4-month intervention, and at 18-month follow-up.³⁶ There is evidence to support an 8-factor structure for the EMS, but it can also be weighted across the 8 subscales to form a single index of self-determined motivation along the self-determination continuum, which is how we have used the EMS in the current investigation.³⁷ Previously we reported that the peer-led intervention arm showed significantly higher EMS scores relative to the standard intervention arm at 4 months, and that these differences persisted at 18 months.²⁴ In the current investigation we examine change (%) in EMS scores from baseline to 4 months and 4 months to 18 months among study participants to identify the time course of change in self-determined motivation during initiation and maintenance phases of the intervention. Using the Cronbach alpha criterion from Henson,³ the overall measure of internal consistency was good ($\alpha = 0.85$). Self-efficacy measures are reported for both groups for the intervention period but not at 18-month follow-up as they were not assessed at that time.

The Leisure-Time Exercise Questionnaire (LTEQ) was used to assess self-reported physical activity behavior during the intervention period and for an additional week at 18-month follow-up. The LTEQ is a 3-item scale that asks participants to rate the number of 20 minute bouts of mild, moderate, and/or strenuous leisure-time exercise, in which they participated. The LTEQ was reported daily to reduce recall bias and moderate and strenuous categories were summarized at the weekly level to reflect minutes of meaningful physical activity to achieve national guidelines.⁵ Study participants were subsequently defined as “active” if they (or ... for those who) reported 150 minutes of moderate or strenuous weekly minutes of activity during the 18-month follow-up week, or “insufficiently active” if they reported

few moderate or strenuous weekly minutes during the 18-month follow-up week. Previous research has supported the validity and reliability of LTEQ score interpretations in adults and older adult populations.^{39,40}

Data analytic procedures—Our intent was to identify which constructs from SDT and SCT predicted achievement of physical activity guidelines at 18 months. Our mixed-methods analyses integrated quantitative and qualitative data from surveys that measure physical activity behavior, and theory-based assessments of constructs that underpin physical activity behavior maintenance (eg, self-determined motivation and exercise motivation) with post-intervention interviews that were analyzed using a pragmatic content analysis.⁴¹ The embedded study design allowed us to improve understanding of the quantitative results from the AAMP intervention using semi-structured interviews. This involved several steps. First, the post-intervention interviews were transcribed verbatim and coded by research assistants previously unaffiliated with this investigation. Intervening components of the AAMP theoretical model were identified based upon a code list with explicit definitions of components in line with the guiding theoretical model (Figure 1). Participants' statements that reflected the use of goal setting, social support, and mental imagery were coded during this initial phase of the analysis. Coders retained new themes that emerged from the interviews including descriptions of their health behaviors, outcomes, and self-regulatory processes. A second phase of coding was conducted individually by the first, second, and last authors that linked initially identified codes to specific aspects of the theoretical model. We had 74% agreement of at least one construct following the first round coding of theoretical constructs. An iterative process of dialogue and consensus meetings resolved any discrepancies resulting in 100% agreement of theoretical constructs. Next, we used LTEQ scores to identify active and insufficiently active study participants. Finally, our analysis of self-determined motivation was evaluated using the EMS change scores for each participant at 3 measurement times. This process resulted in a matrix of data that merged the qualitative interviews with the quantitative findings from the LTEQ and EMS. Mean scores ($M \pm SD$) for the active and insufficiently active groups were computed using SPSS version 21. Criteria for meaningful active versus insufficiently active differences was a p value $< .05$ (2-sided test) or a moderate effect size (Cohen's $d = 0.40$).⁴²

RESULTS

Demographic Information and Behavioral Maintenance Results

Twenty-four participants completing the study had follow-up at 18 months (Table 1). The participants were predominately white females, with an average age of 65 years. At 18-month follow-up, 25% of participants reported meeting the recommended level of 150 minutes of physical activity each week ("active") and 75% of participants reported not meeting the physical activity guidelines ("insufficiently active"). Demographic characteristics were similar between groups.

Intervening Components

The data in Table 2 quantify the intervening components and theoretical constructs identified from interviews by both the active and insufficiently active study participants.

EMS change scores for 0–4 months and 4–18 months and self-efficacy scores for 0–4 months also are presented. These results are all in accordance with the theoretical framework of the intervention shown in Figure 1. The table details information about coded intervening components and shows the mean number of utterances shared by each participant during the qualitative interviews that were coded as intervening components, theoretical constructs, and emerging themes. Lastly, Table 3 presents exemplar quotations illustrating differences among the active and insufficiently active study participants related to the intervening components and theoretical constructs. Throughout these results, Exercise Self-Efficacy (EXSE) score changes from 0 to 4 months and Exercise Motivation Scale (EMS) score changes from 4 to 18 months are included for each study participant quotation.

The majority of study participants reported positive perceptions of goal setting (Figure 1, Box 2); however, there were marked differences in the nature of goal-setting responses between the active and insufficiently active study participants. Active participants mentioned specific goal-setting behaviors (ie, making specific goals, actions to achieve goals, and evaluation of goals) frequently, whereas insufficiently active study participants did not. Insufficiently active study participants often mentioned general goal statements that may not have been related to physical activity but toward managing their overall health. Table 3 shows exemplar quotations.

Social support (Figure 1, Box 3) from the mentor and within the peer group setting was perceived as helpful by a majority of active and insufficiently active study participants; however, there was a difference between groups related to social support from family and/or friends outside the intervention setting, as the active participants cited significantly more support for physical activity from family or friends than did the insufficiently active participants (Table 3).

Both active and insufficiently active study participants cited similar amounts of tangible social support for physical activity such as “having this [facility] every week as a place where I could connect with people” (female, age 65, insufficiently active, EXSE = −26.1%, EMS = 143.0%) and “...the facility there is wonderful and the people were very pleasant” (female, age 63, active, EXSE = 1.27%, EMS = 162.1%). However, some insufficiently active participants cited concerns about their community exercise environment or lack of exercise facilities: “...walking early in the morning I’m not going to do it in an unsafe area” (female, age 67, insufficiently active, EXSE = 7.6%, EMS = 20.2%) and, “It’s too bad the one [facility] where I lived closed” (female, age 61, insufficiently active, EXSE = −7.9%, EMS = 60.7%).

Perceptions of mental imagery (Figure 1, Box 4) and its use were similar among both the active and insufficiently active study participants. Positive comments were “I did do it several times. I would focus in on how best to do [technique], maybe the best time to do them, how I was going to do them” from an active participant (age 67, EXSE = −44.4%, EMS = 355.7%) and, “Part of it is just imagining myself walking along, good posture, just feeling confident... just the whole sense of wellness, feeling good...” from an insufficiently active participant (female, age 65, EXSE = −26.1%, EMS = 143.0%). As Giacobbi et al³⁴ have reported, 9 intervention group participants from AAMP shared negative comments

related to mental imagery and indicated they would not continue, whereas 13 indicated they would continue using this psychological technique.

Theoretical Constructs

There was a larger effect of feelings of autonomy (Figure 1, Box 5) in the active study participants compared to the insufficiently active participants. Active participants also mentioned autonomous decisions or actions related to physical activity more frequently, whereas the insufficiently active participants made more general autonomy statements related to health (Table 3).

Perceptions of competence (Figure 1, Box 5) were mentioned frequently by both the active and insufficiently active study participants. As the effect size suggests ($d=-0.56$), insufficiently active study participants made more statements of competence than did their active counterparts (Table 2); however, this difference was due largely to more negative competency-related statements (Table 3). Many of the active study participants shared positive perceptions or discussed ways they overcame personal barriers to feel more confident to perform physical activity or other health-related activities (Table 3).

Both active and insufficiently active study participants had positive statements regarding previous performance accomplishments (Figure 1, Box 5). Comments centered on improving their physical activity level such as, “I actually got the point where I was jogging for about, closing in on half the time. Not completely but about 4.5 or 4.6, not a fast jog” (male, age 65, insufficiently active, EXSE -9.9% , EMS -15.8%), or related to improvement of a specific aspect of health such as “I had a couple times when in the beginning where I had pain and I learned that if I went ahead and exercised anyway, the pain reduced, or the pain was reduced” (female, age 68, active, EXSE 633% , EMS 806.6%). One active study participant cited previous experiences exercising in warm weather as rationale for protecting her health by limiting outdoor summertime physical activity, “I would get a headache from exercising in an extreme heat...” (female, age 69, EXSE -7.7% , EMS 212.1%).

Relatedness was also a common theoretical construct (Figure 1, Box 6) with similar positive statements reported by study participants from both the active and insufficiently active groups. Participants mentioned feeling cared for, being connected with the peer group, and having use of a facility: “...he [mentor] accepted us for what we were and I think he really helped all of us...” (female, age 54, insufficiently active, EXSE -20.0% , EMS -9.7%) and “I guess I enjoyed it mainly because of the other women...there was motivation from the other women” (female, age 73, active, EXSE -19.7% , EMS -81.2%). Six insufficiently active participants had negative comments regarding relatedness, with some referring to lack of support from family/friends or lack of community support (discussed earlier in results), and 2 citing a lack of cohesion in the peer group setting such as “I think I could have done without them personally...not supportive...” (male, age 65, insufficiently active, EXSE -9.9% , EMS -15.8%). One active study participant also described a negative group dynamic, “the situation that developed in the group with that one person and the mentor was just too weird...” (female, age 68, active, EXSE 633.0% , EMS 806.6%).

The insufficiently active study participants referred to verbal persuasion (Figure 1, Box 6) more than the active study participants ($d=-0.46$) (Table 2); however, comments from both groups were mostly positive and focused on the mentor providing individual or group encouragement. One insufficiently active study participant shared that he felt his mentor was not supporting her appropriately when saying, “ ‘you’re going to really get in a groove and you’re going to like the exercises’ ...no, that’s not going to be the case with me” (male, age 65, EXSE -9.9%, EMS -15.8%).

Vicarious experiences (Figure 1, Boxes 6 and 7) were mentioned infrequently by both study groups, though all were positive comments such as, “...he [mentor] put his experiences in there...talked about his exercise activity and how he and what he does and variety of things. He was encouraging to both myself and the other participants” from an active study participant (female, age 67, -44.4%, EMS 355.7%).

Lastly, physiological arousal (Figure 1, Box 7) was the least coded with only one active and 4 insufficiently active participants making statements related to this construct. Comments from 2 insufficiently active study participants related to general feelings from exercise: “...and I feel like I have a lot more energy to do that kind of stuff” (female, age 72, EXSE -7.5%, EMS 185.5%) or feelings elicited by mental imagery experiences: “So you visualize that, you envision how it feels on a crisp morning going outside” (female, age 67, EXSE 7.6%, EMS 20.2%).

Psychosocial Measures

Measures of self-determined motivation are reported in Table 2 by means of change scores calculated for the EMS. Active participants had larger magnitude changes in EMS scores during both initiation (0–4 months) and maintenance (4–18 months) phases. Perceived self-efficacy levels changed moderately but did not show significance from baseline to 4 months for either the active or insufficiently active study participants. Scores were similar across groups. As reported previously²⁴ due to insignificant changes at the end of the intervention and to reduce participant burden self-efficacy was not reassessed at 18 months follow-up.

New Emergent Themes

The inductive analysis process identified a possible new emergent theme that we coded as “awareness for physical activity” and was characterized by greater appreciation, or mindfulness for how exercise promotes overall health (Table 3). Participants in both study groups made statements supporting this theme; however, there were a few differences. All but one active study participant (83.3%) shared feelings of awareness for physical activity, whereas only 7 of 18 (38.8%) insufficiently active study participants made statements related to this theme. Additionally, many statements from the active study participants described specific components of physical activity that contributed to their health, whereas statements from several of the inactive study participants were generalized toward overall health (Table 3).

DISCUSSION

The goal of these analyses was to identify behavioral theory-based intervening components and constructs from SCT and SDT that may support achievement of physical activity guidelines among older adults. Using a mixed-methods approach we investigated specific theoretical elements and intervention strategies that targeted SDT and SCT constructs that may be the focus for future interventions to support long-term physical activity in older adults. Our results support focusing on a variety of intervention components to support SDT and SCT constructs that may in turn invoke positive and long-lasting physical activity behaviors. Findings from this study support and expand on previous studies presenting some of the elements of SDT and SCT in promoting physical activity adherence among older adults.^{22–24} Using the original theoretical model we have connected outcomes of self-efficacy (at intervention end) and self-determined behavior (at 18 months) and found that behavior was associated with some of the components of the intervention. Our qualitative findings through participant interviews support the quantitative EMS score results and suggest behavioral and social elements that may be responsible for differences in physical activity between the active and insufficiently active study participants at long-term follow-up. Intervention components utilized in the original study—which were derived from these theories—that specifically target self-regulatory behaviors may be among the most important factors supporting long-term physical activity.

Goal setting interventions may affect autonomy, competence, and previous performance accomplishments.^{19,20,23} Specific or action-oriented goal-setting behaviors and their evaluation were a significant difference between the active and insufficiently active study participants. Setting specific goals allows measurability for success and can quantify shortcomings so that individuals can realistically evaluate their progress.⁴³ Actionable goals, such as reviewing a goal card every day may provide further encouragement in attainment of physical activity goals. The ability of some of the study participants to carry out strategies based on the SMART goal framework may have been a result of the peer-assisted coaching. This warrants further analysis of mentor sessions to identify if certain peer-mentors brought more information to their groups that improved support for the use of SMART goals. Additionally, competence in older adults appears to play an important role in supporting goal setting for continued engagement in physical activity and negative perceptions of competence may be as important as positive perceptions to understand the implications on physical activity behavior. This trend was reported by Springer et al⁴⁴ who focused on behavioral components in adults aged 29–73 who reported being physically active for more than 3 years. As their feelings of competence needs were satisfied, participants reported longer term success in engagement of physical activity.

Social support interventions may impact feelings of relatedness through verbal persuasion and vicarious experiences.^{44,45} Previous studies cite improved physical activity initiation when social support is included in the intervention^{20,43,46} but are limited in explaining *how* it promoted successful adoption. Our study identified specific social support elements that may be critical for long-term achievement of physical activity (eg, social support from family/friends outside the intervention setting). These findings also appear to be in line with the retrospective study by Springer et al⁴⁴ that found participants indicating support from

significant others and “like-minded individuals,” thereby promoting their continued engagement in long-term physical activity. Future studies should address the role of family/friends in supporting long-term physical activity behavior change explicitly and should include measures that encourage older adults to seek support from those close to them. Feelings of relatedness are bolstered further through continued social support in the individual’s personal environment. This significant finding may aid future researchers in developing interventions that include matching peer group members and fostering relationship building within the group that may continue after the intervention is terminated. Verbal persuasion may support older adults to feel more competent in achieving their physical activity goals. The use of peer mentors and support groups to provide positive verbal persuasion should receive further investigation.

There were no differences between the active and insufficiently active participants with respect to the use of mental imagery. However, the act of goal setting in the AAMP was designed to foster mental images of physical activity behavior. This part of the intervention was based on the close associations between verbalization and mental imagery.⁴⁷ Although many of the participants did not endorse the use of mental imagery, it is likely that they were using mental imagery during their discussions about goals. Mental imagery in AAMP was intended to target self-efficacy expectations focused on physiological arousal and vicarious experiences.

A new theme we identified as awareness for physical activity may be an area to investigate further to develop interventions to support older adults’ adoption of healthy lifestyles and engagement in physical activity. Many active and insufficiently active participants referred to their feelings related to the intervention as a development of an awareness of the needs of their body, awareness of general health principles, or increasing awareness of physical activity benefits. This awareness may aid the older adult in developing “an attitude of willingness that reflects an inner acceptance of the value or utility of [physical activity].”¹⁷(p.55) This, in turn, may support the older adult in becoming more motivated toward long-term physical activity maintenance activities.

Overall, future studies that employ social support, goal setting, and perhaps, guided mental imagery, intended to target elements of SCT and SDT, are warranted. Whereas the use of guided imagery may not appeal to some adults, this cognitive strategy has shown positive results in previous trials and can be useful when talking about physical activity and health-related goals.³⁴

Limitations

Our study includes several limitations. The original study targeted specific theoretical components for the intervention; thus, this analysis only can attempt to interpret these results. Both SDT and SCT include other theoretical components that warrant investigation in future studies. The sample size was small and study participants were predominantly white, educated females from one geographic area, thereby limiting generalizability to the larger population. However, inasmuch as the majority of older adults in previous studies^{7,9,10} describe similar barriers to physical activity regardless of sex, this factor may be mitigated in part. Participant characteristics were similar between the 2 study groups with

the exception of widowhood. No active study participants identified themselves as widowed, whereas over one-fourth of insufficiently active participants did. Investigators in the original study did not ask about the specific effect of widowhood on components such as social support. This is a limitation of our analysis and warrants further research. Another limitation may be the effect of the interviewer on the participant interview. Demand characteristic bias could be a possible influence on our interview results; however, any influence should be relatively similar among active and insufficiently active participants. Due to the qualitative nature of the interviews, respondents were permitted to complete their full thoughts before the next question was asked, and this may have resulted in a single participant mentioning a construct multiple times. To minimize this occurrence, the interviewer used a script and asked the same initial and follow-up questions. Another limitation is that by the nature of this retrospective study, accurate analysis of past events has the potential for misinterpretation from the vantage point of the present. The use of multiple coders and discussion sessions during the analysis process among the first, second, and last authors provided opportunity for group evaluation and supported consistency in interpretation, thereby minimizing this risk. Another limitation was our inability to analyze possible relationships between intervening components and self-efficacy as self-efficacy was not assessed at 18-month follow-up. Though there were no differences at the end of the intervention between study groups, we were not able to ascertain if intervention components had an effect on self-efficacy long-term. This would be an area to investigate in future studies. Finally, the LTEQ is a self-reported measure of physical activity, and therefore, more prone to bias. However, our use of a self-reported measure to align with national physical activity guidelines is consistent with how the guidelines were developed, and we attempted to minimize recall bias in the LTEQ by summarizing 7 consecutive daily recalls instead of using a single weekly recall as has been done traditionally with this measure. Additionally, the LTEQ was not able to provide a formal assessment of resistance forms of exercise, and was reported in bouts of 20 minutes or longer; therefore, some activities may have been underreported.

Conclusions

Regular engagement in physical activity by older adults is imperative to improve or maintain health. Our findings propose that to best support older adults to achieve long-term physical activity changes in line with US guidelines, a combination of behavioral intervention strategies based on SDT and SCT may be necessary. Older adults need more than exercise instruction and supervised interventions to achieve lasting physical activity behaviors. Peer teaching and continued support of self-regulatory behaviors during an intervention may be essential for older adults to feel connected and confident in adopting strategies to maintain their health. Additionally, attention to continued social support outside intervention settings may be necessary to assist older adults to achieve their physical activity levels long-term.

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Figure 1.
Guiding Theoretical Framework for the Active Adult Mentoring (AAMP) Trial

Table 1Participant Baseline Characteristics by Activity Status^a

	Active (N = 6, 25%)	Insufficiently Active (N = 18, 75%)	Total (N = 24)
Age, M ± SD	66.7 ± 4.59	64.4 ± 9.85	65 ± 8.79
Age group, n (%)			
0–64 years	2 (33.3)	7 (38.9)	9 (37.5)
65+ years	4 (66.7)	11 (61.1)	15 (62.5)
Sex, n (%)			
Male	0 (0)	3 (16.7)	3 (12.5)
Female	6 (100)	15 (83.3)	21 (87.5)
BMI, kg/m², M ± SD	22.78 ± 2.72	29.17 ± 6.58	27.96 ± 6.51
Race, n (%)			
Caucasian	6 (100)	15 (83.3)	21 (87.5)
African-American	0 (0)	1 (5.6)	1 (4.1)
Other	0 (0)	2 (11.1)	2 (8.3)
Ethnicity, n (%)			
Hispanic/Latino	0 (0)	2 (11.1)	2 (8.3)
Marital Status, n (%)			
Married	3 (50)	10 (55.6)	13 (54.2)
Divorced	3 (50)	3 (16.7)	6 (25)
Widowed	0 (0)	5 (27.8)	5 (20.8)
Single	0 (0)	0 (0)	0 (0)
LTEQ (b) M ± SD			
Post intervention	157.23 ± 130.94	92.72 ± 152.57	106.06 ± 140.14
At 18 months follow-up	173.52 ± 250.75	95.65 ± 107.65	145.73 ± 264.42

Note.

All differences were not significant ($p > .10$) except reported physical activity levels ($p < .05$)

^aDefined as meeting the recommended level of 150 minutes of physical activity/week at 18 months following the intervention as measured by the Leisure-Time Exercise Questionnaire (b).

Table 2

Intervening Components and Theoretical Constructs (a), Self-Determined Motivation and Self-Efficacy (b)
Results among Active and Insufficiently Active Participants (N = 24)

	Active	Insufficiently Active	p value	Cohen's d ^c
Intervening Components, M ± SD				
Goal Setting (Box 2)				
Specific action/evaluation	1.83 ± 1.72	0.56 ± 0.98	0.03	0.91
General goal toward physical activity	1.17 ± 1.60	1.61 ± 1.82	0.60	-0.26
General goal toward health	0.33 ± 0.82	0.89 ± 1.13	0.28	-0.57
General goal statement	0.00 ± 0.00	1.39 ± 1.33	0.02	-1.48
Social Support (Box 3)				
From mentor	1.00 ± 1.18	1.83 ± 1.76	0.28	-0.55
From peer support group	2.33 ± 1.15	2.22 ± 1.59	0.88	0.07
From family/friends	1.00 ± 0.89	0.28 ± 0.57	0.03	0.96
Tangible support	0.67 ± 0.82	0.78 ± 1.26	0.84	-0.10
Mental Imagery (Box 4)	1.33 ± 1.75	1.44 ± 1.38	0.87	-0.07
Theoretical Constructs				
Box 5				
Autonomy	2.67 ± 3.20	1.72 ± 1.32	0.31	0.39
Competence	6.33 ± 4.18	9.33 ± 6.31	0.29	-0.56
Previous performance	3.17 ± 2.79	3.82 ± 2.86	0.63	-0.23
Box 6				
Relatedness	5.17 ± 4.54	4.72 ± 2.82	0.78	0.12
Verbal persuasion	0.33 ± 0.52	0.72 ± 1.07	0.41	-0.46
Boxes 6 and 7				
Vicarious experience	0.67 ± 1.03	0.78 ± 1.40	0.86	-0.09
Box 7				
Physiological arousal	0.17 ± 0.41	0.22 ± 0.43	0.78	-0.13
New Emerging Themes				
Awareness of Physical Activity	2.83 ± 2.32	1.72 ± 1.84	0.24	0.53
Self-Determined Motivation (Box 8)				
0-4mo change	104.74 ± 128.09	26.76 ± 69.78	0.07	0.76
4-18mo change	290.37 ± 293.75	85.44 ± 126.55	0.02	0.90
Self-Efficacy (Box 8)				
Barriers self-efficacy				
0-4mo change	8.21 ± 27.87	-4.74 ± 23.59	0.60	0.50
Exercise Self-Efficacy				
0-4mo change	0.83 ± 37.64	-16.46 ± 26.24	0.58	0.53

Note.

^aRepresents the mean number of utterances by each participant during post-test interviews.

^bRepresents change score in quantitative measure.

^c Cohen's⁴² suggested parameters for effect size: small, $d = .2$, medium, $d = .4$ and large, $d = .8$ Box numbers refer to Figure 1.

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Table 3**Exemplar Quotations Illustrating Differences among Active and Insufficiently Active Participants**

	Active	Insufficiently Active
Intervening Components		
Goal Setting		
Specificity	I had the step thing [pedometer] and my goal was to do 12,000...and I did that... [female, 73, EXSE -19.7%, EMS -81.2%] 10,000 steps is the optimum, you should be aiming for that and if you didn't do it yourself then you didn't complete your goal for the day [female, 60y, EXSE -1.5%, EMS 286.9%]	I just want to be able to do tasks around the house [male, 65y, EXSE -9.9%, EMS -15.8%] I need to lose 50 pounds [female, 51y, EXSE -40.0%, EMS 67.4%]
Action	I tried to make that a goal to increase the steps each day as much as possible...whether it was around the house or outside or going places [female, 67y, EXSE -44.4%, EMS 355.7%] If I was shopping, I tried to park farther away than you normally would [female, 60y, EXSE -1.5%, EMS 286.9%]	...the goal setting I think is good. It allows you to make your goals and...allows you room to adjust [male, 51y, EXSE 2.6%, EMS 383.4%]
Evaluation	I had set goals and they were very modest goals, they were to exercise 3 times a week for 40 minutes...I wasn't consistent with it...and so I would have liked to have been a little more consistent... I'm very sensitive to when I don't hit it on target, you know. That I want to try to focus on [female, 63y, EXSE 1.3%, EMS 162.1%] I feel myself having internalized a continuing commitment to exercise every day for the rest of my life...I work [on] that every day [female, 69y, EXSE -7.7%, EMS 212.0%]	You know what your goals are...it's just that you don't write them down. I think in terms of yes, you confronted with them when you write them down so they stand out... [female, 73y, EXSE 0%, EMS -33.0%]
General health goal		...redid the goals and I made it that I would study more on being healthy, eating right [female, 54y, EXSE -20.0%, EMS 6.2%] If I can just walk really fast for 30 minutes and not huff and puff, I'll be really happy That was my one thing I didn't get to do. But I will one of these days [female, 51y, EXSE -40.0%, EMS 67.4%]
General goal statement		... I pushed myself and my goal was to do absolutely everything I could [male, 51y, EXSE 2.6%, EMS 383.4%] But my goal is to do more, even if it is less, to do it daily [female, 72y, EXSE -7.5%, EMS 185.5%]
Social Support		
From mentor	... the mentor was good, you know he was knowledgeable [female, 63y, EXSE 1.3%, EMS 162.1%]	I think that you felt that he [mentor] was part of you. He has been there, done this [296 female, 73y, EXSE 0.0%, EMS -33%] I liked that [having a mentor]. So that if you had a question, you could ask - get more information about something. Very soft-spoken, very easy going. I like that [the mentor] [female, 51, EXSE -40.0%, EMS 67.4%]
From family/friends	If I saw the kids, my granddaughter took me walking so I got it in. I had cooperation with everyone [female, 73, EXSE -19.7%, EMS -81.2%] ... it was walking with my friends at the mall [female, 67y, EXSE -44.4%, EMS 355.7%] my walking partners who I really like, I think they're getting sick of me {laughing} because I am always trying to find little ways to change it, motivate them... [female, 69y, EXSE -7.7%, EMS 212.0%]	I may have a very big barrier by living by myself [female, 72y, EXSE -7.5%, EMS 185.5%] I'm still looking for a partner to do that walk [female, 54y, EXSE -20.0%, EMS 6.2%]
Theoretical Constructs		

	Active	Insufficiently Active
Autonomy	And what I was doing was reaching out in a number of different directions, this being one of them, to find what was comfortable for me... [female, 68y, EXSE 633.0%, EMS 806.6%] ...that [facility] has an exercise gym...I intend to look into that [female, 73, EXSE -19.7%, EMS -81.2%]	I'm going to swim as soon as I can... [female, 80y, EXSE -87.5%, EMS 186.2%] [I'm] doing something to make me feel better, to make me healthy, to make me be around for my grandchildren [female, 67y, EXSE 7.6%, EMS 20.2%] I'm trying now I'm trying to build strength so that's one thing I did was just request physical therapy [female, 61y, EXSE -7.9%, EMS 60.7%]
Competence	we all kind of set our own goals ... we say 10,000 steps is the optimum, you should be aiming for that [female, 60y, EXSE -1.5%, EMS 286.9%]	...I feel like I've sort of overcome that and...I'm going to go find a personal trainer and I'm going to try to keep this going... [female, 65, EXSE -26.1%, EMS 143.0%] ...did not do the stairs because my knees are kind of iffy [female, 67y, EXSE 7.6%, EMS 20.2%] I don't have the athletic ability or what it is but I never put myself on the line completely [female, 67y, EXSE -66.2, EMS 9.3%]
Verbal persuasion	Coming to the wellness center and hearing the faculty and staff talk to us...and how they're going to help us... [female, 63y, EXSE 1.3%, EMS 162.1%]	He knew...where you were going and could give you good advice [296 female, 73y, EXSE 0.0%, EMS -33.0%]
New Emerging Themes		
Awareness for physical activity	I found myself reading a whole lot more about exercise and health – all the magazines had articles during this last spring about cognitive function and exercise [female, 69y, EXSE -7.7%, EMS 212.0%] that's when I realized that my body needed the exercise to get me going [female, 68y, EXSE 633.0%, EMS 806.6%] I think I became more cognizant of what my activity level was so that would stay with me I think... So I can kind of do that in my mind now and know which activity level I've achieved that day [female, 60y, EXSE -1.5%, EMS 286.9%]	it keeps you young and fit. I mean there's no question, if you sit around you deteriorate if you don't exercise [female, 80y, EXSE -87.5%, EMS 186.2%] I liked seeing the number every day and realizing basically I'm really lazy [female, 52y, EXSE 45.5%, EMS 19.7%] I felt good about that. I was a lot more active and aware of it [female, 54y, EXSE -20.0%, EMS -9.7%]

Note.

Each quote is followed by participant description in brackets with sex, age, 0–4 month Exercise Self-Efficacy (EXSE) score change (), and 4–18 month Exercise Motivation Scale (EMS) score change ().