

## Behavioral Interventions and Physical Activity in Older Adults: Gains and Gaps

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There is strong evidence that older adults greatly benefit from regular physical activity. Yet, older age is consistently associated with lower levels of aerobic physical activity and strength training and higher levels of sedentary behavior, underscoring the need to better understand physical activity behavior in this population. Reviews of interventions to increase physical activity have overall yielded promising results. Interventions based on behavior theory appear to be more effective than non-theory-based interventions, yet strategies from these theories are underutilized in both research and practice. This paper discusses the importance of behavioral interventions, cites findings from the Active for Life initiative to illustrate several key concepts, and provides recommendations to address significant gaps in the literature, including the use of theory, mediation analyses, physical activity maintenance, diversity of participants, and dissemination and translational research.

**Keywords:** aging, older adults, exercise physical activity, behavioral interventions, behavior theory

Older adults are a group characterized by marked diversity along such dimensions as age, health status, functional abilities, cognitive abilities, socioeconomic status, and race and ethnicity. Jeanne Calmet of France, the person with the longest recorded lifespan to date, spent 57 years in what is considered older adulthood—from the age of 65 years to the age of 122 years. While she does not represent a typical older adult, a report from the U.S. Census Bureau projects that nearly 10% of older adults will be 90 years or older in the year 2050, up from 4.7% in 2010 (He & Muenchrath, 2011). Thus, any discussion of aging must recognize the heterogeneity of this age group. This diversity poses challenges for developing physical activity interventions for older adults, where a “one-size-fits-all” approach is especially problematic.

Physical activity plays a critical role in the health of older adults. The 2008 Physical Activity Guidelines for Americans (U.S. Department of Health and Human Services, 2008) recommend that for adults, including older adults, to achieve substantial health benefits, they should do at least 150 min a week of moderate intensity physical activity or 75 min a week of vigorous intensity physical activity, or an equivalent combination. The guidelines also recommend that all adults do muscle strengthening activities that are moderate or high intensity and involve all major muscle groups on two or more days a week. In addition to these guidelines that are recommended for adults in general, there are older adult-specific guidelines. Essentially, these guidelines allow for modifications to

the general recommendations in instances where chronic conditions limit the ability or safety to meet the general recommendations. In addition, the guidelines state that older adults at risk for falling should also do exercises that maintain or improve balance.

Many of the benefits that come from regular physical activity are seen regardless of age. For example, there is strong evidence that regular physical activity is associated with a lower risk of premature mortality, coronary heart disease, stroke, high blood pressure, type 2 diabetes, adverse lipid profile, metabolic syndrome, and colon and breast cancer; prevention of weight gain and falls; improved cardiorespiratory fitness and muscular fitness; and reduced depression (U.S. Department of Health and Human Services, 2008). But there are additional benefits for older adults that include better cognitive function and better functional health (Pahor et al., 2014; U.S. Department of Health and Human Services, 2008).

Despite evidence that physical activity cannot only increase *years* of life, but perhaps more importantly, *quality* of life in older adults, participation in physical activity is lowest and engagement in sedentary behaviors is highest in older age. These patterns are robust and are seen in self-reported aerobic physical activity (Centers for Disease Control and Prevention, 2014), self-reported strength training (Kraschnewski et al., 2014), objectively measured physical activity (Troiano et al., 2008), and objectively measured sedentary behavior (Matthews et al., 2008).

The increase in the proportion of older adults in the U.S. population, combined with increased disease and disability that is associated with the aging process, make it imperative to identify and implement effective strategies to increase physical activity in older adults. Thus,

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the purpose of this article is to present data regarding the effectiveness of behavioral interventions to promote physical activity in older adults and to identify major gaps in the intervention literature.

## The Use of Behavioral Theory and Behavioral Strategies to Guide Physical Activity Interventions in Older Adults

Interventions to increase physical activity can be designed in a number of ways. Many senior centers and community centers offer fitness classes. They largely involve delivering a group exercise program to older adults, and typically do not incorporate strategies or techniques based on behavior change theories. Social support is often provided, but largely through an encouraging exercise leader and regular group attendees. While these programs play a very important need in the community and appeal to older adults who wish to be active with other older adults who face similar life, social, and health issues, they may appeal largely to those who are relatively healthy and already at least somewhat active. In addition, these types of programs typically do not equip older adults with the skills required to deal with lapses in behavior or to make necessary adaptations when older adults face major life events. For example, a change in one's health status, becoming a caregiver, or losing a spouse, without substantial problem solving skills, can increase the risk of complete cessation of behavior.

In contrast, interventions based on behavior change theories focus on teaching people strategies, skills, and techniques to adopt and maintain regular physical activity, particularly when faced with challenges, barriers, and setbacks. Examples of these strategies, skills, and techniques include self-monitoring and recording physical activity, setting goals, learning how to problem solve in the face of barriers, and instructing people how to identify and seek out needed social support. A number of reviews have shown that interventions based on theoretical frameworks and behavior change strategies are more effective than interventions not based on theory (Artinian et al., 2010). These findings have also been shown with older adults. For example, a 2003 review found that 70% of studies using a theory-based intervention with older adults led to positive findings versus just over 40% of studies that did not reference a theory (Conn, Minor, Burks, Rantz, & Pomeroy, 2003).

Yet, a consistent finding across review papers, including those focused on older adults, is that many studies do not reference a theory that guides the intervention—59% of intervention studies in the 2003 review (Conn et al., 2003) and 45% in a more recent review (Chase, 2013) cited the use of a theory. Of those interventions that were based on theory, the application of the theory is often not complete—so some, but not all, constructs of the theory are explicitly targeted (Chase, 2013) and many are not

measured. For older adults, like adults in general, social cognitive theory (Bandura, 1986), or key constructs from social cognitive theory such as self-efficacy, have been the most commonly applied in physical activity interventions (Chase, 2013; Conn et al., 2003). Within social cognitive theory, human behavior such as physical activity, is explained in terms of a **dynamic** and **reciprocal** model in which behavior, personal factors, and environmental influences (both physical and social) interact. Critical personal factors that influence behavior are an individual's ability to anticipate the outcomes of behavior, learn by observing others, have confidence in performing a behavior, and overcoming obstacles (a factor called self-efficacy), and the ability to self-regulate or self-control behavior.

Consistent with many of the constructs of social cognitive theory, the American College of Sports Medicine (ACSM) issued a best practices statement for physical activity programs and behavior counseling in older adults (Cress et al., 2004). The statement identified seven behavioral factors that are associated with initiating and maintaining physical activity. *Social support* and *self-efficacy*, the two most widely studied constructs, are included in most theories of behavior change. They may be especially important for older adults, who may not receive adequate support and encouragement to be active, and who may themselves experience a loss of control or confidence due to aspects of the aging process. *Active choices* refer to tailoring the exercise program to meet the needs, interests, and capabilities of the older person. A good match between the program and the person can increase self-efficacy. Indeed, a recent review of longer-term physical activity interventions for adults aged 55–70 years found that including individual tailoring with personalized physical activity goals appeared to be more successful than other approaches, and mode of delivery was not associated with effectiveness (Hobbs et al., 2013). *Health contracts* are written agreements between the participant and health professional, and usually include goal setting and self-monitoring. They also can help to enhance self-efficacy, particularly when the goals are realistic. Something unique to older adults is addressing concerns over *perceived risks* of exercise, including instruction on monitoring appropriate intensity levels, especially for those with no history of exercise. *Providing regular and accurate feedback* can be helpful in developing realistic expectations about physical activity progress. And finally, *positive reinforcement* includes tangible rewards for achieving goals, such as a prize or incentive, or less tangible rewards such as public recognition of attendance.

Although the ACSM statement does not explicitly recommend *self-control* as a behavioral factor associated with regular physical activity, elements of self-control are included in the description of *health contracts* and *providing regular and accurate feedback*. Self-control includes intention formation, feedback on performance, self-monitoring of behavior, specific goal setting, and review of behavioral goals (Michie, Abraham, Whitting-

ton, McAteer, & Gupta, 2009). The majority of behavioral interventions that are based on social cognitive theory emphasize these self-control or self-regulation strategies, yet very few studies explicitly measure the extent to which participants increase their use of these strategies and whether increases in the use of the strategies relate to better study outcomes (i.e., increased physical activity). Results of a meta-regression analysis underscored the importance of self-control/self-regulation (Michie et al., 2009). The authors classified all of the behavioral techniques used in each of 122 physical activity and healthy eating interventions and then examined associations between each strategy and outcomes. They found that interventions that combined self-monitoring with one other technique from control theory were significantly more effective than other interventions (effect size of 0.42 versus 0.26).

The behavioral strategies that are recommended and that have shown to be effective in increasing physical activity can be applied irrespective of setting, population, and delivery mode. They can be incorporated into individual face-to-face sessions (behavioral counseling or personal training), group-based sessions (behavioral counseling or group exercise), print-based interventions, telephone-based interventions (home exercise), or technology delivered interventions. They can be incorporated into health care provider counseling, senior center programs, or even commercial settings. And they can be applied to healthy older adults, those who are independent but with chronic disease, and even to those who are frail and in institutional settings.

In summary, the literature to date indicates that behavioral interventions yield meaningful increases in physical activity in older adults. Consistent strategies, derived from behavioral theories, seem particularly important in helping adults of all ages adopt and maintain an active lifestyle, yet the use of these strategies and behavioral theories in general appear to be underutilized in both research and community settings.

### **Active for Life: An Example of Theory Application and Testing in a Translation Project**

Self-efficacy is perhaps the most commonly studied construct in physical activity behavior research (Bauman et al., 2012). Self-efficacy is consistently and positively associated with physical activity in adults in general (Bauman et al., 2012), as well as in older adults (van Stralen, De Vries, Mudde, Bolman, & Lechner, 2009). However, the evidence demonstrating a causal role of self-efficacy in changing physical activity behavior is less strong (French, 2013; Rhodes & Pfaeffli, 2010), in part because of limitations in study designs (French, Olander, Chisholm, & Mc Sharry, 2014).

The Active for Life initiative is presented as an example of how behavioral constructs, such as self-efficacy, can be studied to better understand their influ-

ence on older adult physical activity behavior. I chose to highlight this initiative because it still remains one of very few translational research studies focused on older adults (Wilcox et al., 2008).

The Active for Life initiative was funded by the Robert Wood Johnson Foundation and examined the translation of two evidence-based physical activity programs into community settings by diverse community-based organizations. Community-based organizations applied and were selected to implement one of two intervention programs. Both programs are grounded in social cognitive theory (Bandura, 1986) and the transtheoretical model (Prochaska, DiClemente, & Norcross, 1992). Active Choices was a six-month telephone-based physical activity program developed at Stanford University (King, Baumann, O'Sullivan, Wilcox, & Castro, 2002; King, Haskell, Young, Oka, & Stefanick, 1995; King et al., 2000). After a face-to-face session, the intervention was entirely delivered through brief, semistructured telephone calls. All participants received a pedometer, tracking calendar, and resource guide. Active Living Every Day was a 20-week lifestyle physical activity program (Dunn et al., 1997, 1999). Later in the initiative, it was modified to a 12-week program. Participants received a participant workbook, pedometer, and tracking tools. The program was delivered in small groups, but exercise was not incorporated into any of the sessions. Participants learned how to apply behavioral skills and strategies to increase physical activity, and participants were encouraged to choose physical activities of interest to them (i.e., they were not prescribed a specific type of physical activity). Active for Life was a quasi-experimental, pretest-posttest study. The selected community organizations enrolled just over 8,000 midlife and older adults who were inactive or underactive and delivered their choice of program (Wilcox et al., 2008).

The University of South Carolina conducted the outcome and process evaluation of the initiative. Both programs resulted in significant and moderately sized increases in moderate to vigorous intensity physical activity that were, interestingly, comparable to the initial efficacy studies that evaluated that programs (Wilcox et al., 2008). A noteworthy aspect of the initiative, consistent with the purpose of translational research, is that the participants looked much more like "typical older adults" than they did in the original efficacy studies—they were more racially and ethnically diverse, more educationally diverse, and had the chronic health conditions you would expect older adults to have relative to many studies of healthy older adults in the literature.

We examined the role of both social support and self-efficacy in a series of analyses in the Active for Life initiative. First, we examined whether levels of social support and self-efficacy upon entry into the program predicted how well participants would do in the program (Wilcox et al., 2009). That is, did baseline social support and self-efficacy predict the magnitude of increases in moderate to vigorous intensity physical activity? Our paper examined additional baseline predictors, but these

two variables are highlighted for illustration in this paper. We found that in the telephone-based program, baseline level of social support from friends and family was inversely related to increased physical activity. That is, those with lower levels of social support upon program entry made smaller increases in physical activity than those with higher levels of social support upon program entry. But it is important to note that even those participants with lower levels of baseline social support still had moderately large increases in physical activity. In the group-based program, however, baseline social support was unrelated to increased physical activity. Because this was not a randomized study, it is possible that participants who enrolled in Active Living Every Day sites were attracted to the group-based format and looked to it to provide support to make lifestyles changes, which is supported in part by the fact that baseline social support was significantly lower in the group-based participants as compared with the telephone-based participants. The group-based format may be particularly helpful for midlife and older adults who lack social support.

For barriers self-efficacy, however, baseline levels were not significantly associated with physical activity outcomes (Wilcox et al., 2009). So for midlife and older adults, confidence to engage in physical activity at program entry was not associated with the magnitude of change. Both programs strongly emphasized setting realistic, achievable goals, and building on small successes, factors known to increase self-efficacy. Thus, low self-efficacy did not appear to be a limiting factor in these behavioral interventions.

A more recent set of analyses from Active for Life examined whether social support and self-efficacy operated in a manner consistent with mediation (Becofsky, Baruth, & Wilcox, 2014). That is, these analyses sought to answer the question: Did the programs increase social support and self-efficacy, and if so, did these increases relate to increases in the outcome of physical activity? These analyses allowed us to examine whether social support and self-efficacy were consistent with more of a causal relationship to physical activity. Using MacKinnon's product of coefficients method to test for mediation (MacKinnon, Fritz, Williams, & Lockwood, 2007; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002), we first used single mediator models where we separately tested social support and self-efficacy. Then we used a multiple mediator model where both potential mediators were tested simultaneously in the model. This model allowed us to examine whether social support mediated the relationship between program dose and physical activity even when controlling for the role of self-efficacy, and vice versa. With this approach, we tested the alpha pathway; that is, is program dose related to change in the mediator (social support, self-efficacy)? Then we tested the beta pathway; that is, does change in the mediator relate to change in the outcome (moderate to vigorous intensity physical activity)? Then asymmetric confidence limits based on the distribution of the product of  $\alpha \times \beta$  were constructed to determine if the model

was consistent with mediation (models consistent with mediation do not contain zero).

For the telephone-based program (Active Choices), program dose was not related to increased social support, although those who did report increases in social support also showed significant increases in physical activity (beta path was significant in both single and multiple mediator models). Social support was not shown to be a mediator of change in this program. In contrast, program dose was associated with increased self-efficacy, and increased self-efficacy was associated with increased physical activity. Furthermore, the analyses indicated that self-efficacy was a mediator of outcome (in both single and multiple mediator models). For the group-based program (Active Living Every Day), analyses indicated that both self-efficacy and social support were mediators of outcome in the single mediator models. In the multiple mediator models, self-efficacy remained a mediator of outcome but social support did not, even though both the alpha and beta pathways were significant (i.e., program dose was related to increase social support, and increased social support was related to greater increases in physical activity).

The Active for Life initiative demonstrated that interventions grounded in behavioral theories result in meaningfully increased physical activity in diverse and generally representative midlife and older adults. Furthermore, the initiative indicates these improvements can be attained in programs that are delivered remotely, via telephone, or in group settings, and in programs where physical activity is done entirely outside of the program setting. Results from both programs indicate that low baseline self-efficacy does not appear to be a risk factor for poor outcomes, and that increased physical activity resulting from the programs appears to be a significant driver of increased physical activity. Group-based programs may be particularly useful for midlife and older adults who feel less supported to become physically active, and these programs appear to increase social support, which appears to be related to increased physical activity.

## Recommendations to Address Gaps in the Intervention Literature

### Use of Theory

There is a need to increase the use of theory in interventions—both to increase the effectiveness of interventions and to better test which constructs are most important for changing behavior. There is a solid body of evidence demonstrating that interventions to increase physical activity that use strategies from behavioral theories are superior to non-theory-based interventions. Yet, as described earlier in this paper, only about half of the physical activity intervention studies reviewed to date with older adults cite the use of behavior change theories (Chase, 2013; Conn et al., 2003), and even fewer studies measure whether

the constructs consistent with these theories actually change. In adults in general, strategies consistent with self-control and self-regulation appear to be particularly important (Michie et al., 2009), but few intervention studies actually measure these constructs to test whether they change and result in enhanced outcomes. The importance of these strategies in older adults, however, remains to be seen. Although one might not expect age differences in response to self-regulatory strategies, a recent review of studies that assessed change in self-efficacy following an intervention where participants had a mean age of at least 60 years found that commonly used self-regularly techniques were associated with *lower* levels of both self-efficacy and physical activity (French et al., 2014). The authors hypothesized that interventions based on self-regulatory or planning principles might be less acceptable or less relevant for older adults, who may have fewer competing demands on time. They underscore the importance of future work to determine whether their findings are spurious or real.

The use of theory has been applied largely to aerobic activity, and not to strength training or balance training, and largely to healthy populations. Much of the research focused on strength training, falls prevention, reducing frailty, and improving mobility focuses on factors such as the dose, mode, frequency, and duration of physical activity needed to achieve outcomes (Chou, Hwang, & Wu, 2012; de Vries et al., 2012; Shubert, 2011; Steib, Schoene, & Pfeifer, 2010), and little emphasis is placed on motivational or behavioral factors to support adoption and maintenance. Thus, application of theory to these populations and these modes of physical activity is needed.

## Mediation Analyses

More studies designed to test for mediation are needed to advance behavioral interventions. A 2010 review of interventions in nonclinical populations concluded that studies examining mediators of physical activity are still relatively rare, and that results are not clear, although there appears to be some evidence that changes in self-regulatory constructs may be particularly important (Rhodes & Pfaeffli, 2010), but this review was not specifically focused on older adults. Very few mediation analyses have been conducted in intervention studies with older adults (Becofsky et al., 2014). This type of research will help identify strategies that may be more or less effective for older adults, and has the potential to make our interventions more efficient and our theories more predictive and thus useful.

## Maintenance of Behavior

Longer-term studies are needed to understand whether interventions result in the maintenance of physical activity behavior. In the behavioral science literature in general, we often do not study the long-term maintenance of physical activity, in part due to the typical duration of

federally funded studies, and many of the studies that have been done are not particularly encouraging. Hobbs et al. (2013) reviewed randomized clinical trials that examined the long-term ( $\geq 12$  months) effect of physical activity interventions for adults aged 55–70 years. They found that while interventions were effective at increasing physical activity at 12 months, very few trials examined effectiveness at 24 months or greater, and those that did were not particularly encouraging. Some have speculated that the lack of success with long-term maintenance of physical activity behavior may relate, in part, to the types of theories that are being employed. For example, it may be that theories and techniques that are effective in helping people adopt physical activity programs may be less helpful in promoting long-term maintenance (Rothman, 2000; Williams et al., 2008). In a review of the determinants of initiation and maintenance of physical activity in older adults, van Stralen et al. (2009) found different predictors of physical activity initiation and maintenance. For example, outcome expectations, action planning, and social support from family and friends were more important in the initiation of physical activity (first six months), whereas coping planning and support from health care providers, sport instructors, and exercise group members better predicted maintenance of physical activity (after six months). Self-determination theory and motivational interviewing approaches are gaining popularity for their potential in enhancing maintenance (Patrick & Williams, 2012; Teixeira, Carraca, Markland, Silva, & Ryan, 2012; Teixeira, Palmeira, & Vansteenkiste, 2012). Both focus on fostering intrinsic forms of motivation for behavior change, which may result in better long-term effects.

## Population Diversity

Much of the intervention literature with older adults is limited by its focus on largely White, relatively healthy, well-educated samples (Conn et al., 2003). One cannot assume that interventions will work the same way across populations. Increasing diversity in behavioral interventions will help to generalize findings to groups that may have the most to benefit from regular physical activity.

## Dissemination and Translational Research

There is a significant gap between research and practice. Many evidence-based interventions and programs are never translated into real-world settings (Green, Ottoson, Garcia, & Hiatt, 2009). The underlying reasons for this lack of translation are complex and multiple (Damschroder et al., 2009; Glasgow & Emmons, 2007) and include such factors as the complexity or cost of interventions, the failure to design interventions with dissemination in mind (Brownson, Jacobs, Tabak, Hoehner, & Stamatakis, 2013), the lack of dissemination and implementation research that could guide community uptake, and a tendency for agencies to prefer “tried and true” programs they are familiar with, combined with a lack of awareness

of evidence-based programs. To increase the reach of evidence-based interventions and thereby make a public health impact, there's a need to conduct more dissemination and translation studies. Frameworks such as RE-AIM (Reach, Efficacy/Effectiveness, Adoption, Implementation, and Maintenance) help us to think about the public health impact of our work (Dzewaltowski, Estabrooks, & Glasgow, 2004; Glasgow, Vogt, & Boles, 1999). Application of RE-AIM illustrates that interventions that have small to moderate effects, but reach large numbers of individuals, are likely to have a greater public health impact than interventions that produce large effects but reach very small numbers of people. Studying the feasibility and impact of disseminating behavioral interventions to community settings where older adults spend their time is an important next step. For example, community centers, senior centers, volunteer organizations, and faith-based organizations are promising settings to target.

## Summary and Conclusions

Physical activity interventions that are guided by behavior theories and incorporate proven strategies from these theories have great potential for increasing physical activity in older adults. Although there are many existing questions that would advance behavioral intervention science, many of the most pressing questions address how to reach more diverse older populations with behavioral interventions, how to translate these interventions from research to practice, and how to promote long-term maintenance of physical activity. The evidence that physical activity plays a major role in enhancing health and quality of life in older adults is strong, and it is imperative to better understand how to promote behavior change in individuals and communities of older adults.

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