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A Profile for Predicting Attrition from Exercise in Older Adults

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Abstract

Objectives—The purpose of this study was to determine a profile for predicting attrition among older adults involved in a 12-month exercise program.

Methods—The parent study was a single-blinded randomized controlled trial. The study took place between 2006 and 2009 within a university setting. Older adults (N = 179) completed baseline assessments of functional performance and psychosocial measures. Participants who relinquished their consent to participate were considered “dropouts” and those remaining were classified as “completers.”

Results—A discriminant function analysis differentiated dropouts (n = 35) from completers (n = 144) at likelihood much better than chance (72% accurate overall) across four measures: frequency of forgetting, barriers self-efficacy scale, balance, and stair performance. Study dropouts exhibited a higher frequency of forgetting, lower efficacy for overcoming barriers to exercise, poorer single leg balance, and longer times to walk down stairs.

Conclusions—The results provide an initial validation of a profile for discriminating between “dropouts” and “completers,” one that may have considerable utility for screening older adults prior to study entry.

Keywords

exercise; attrition; dropout; older adults

Introduction

Initiating exercise behavior is far less difficult than maintaining this behavior over time (Dishman, 1991; McAuley, 1993). Whereas some individuals adhere to exercise programs over long durations, overcoming the many obstacles associated with this complex behavior, the majority fail to do so. Statistics suggesting that exercise programs experience an approximate 50% attrition rate within the first 3 to 6 months (Dishman, 1991) parallel attrition rates in other health regimens (Van Dulmen et al., 2007) and represent a significant challenge for researchers and clinicians. Strategies for reducing the problem of retention within behavioral interventions have included emphasizing program benefits, decreasing participant burden, increasing incentives, eliciting social support, increasing contact with participants, and maintaining strong tracking systems (Coday et al., 2005; Robinson, Dennison, Wayman, Pronovost, & Needham, 2007). However, these strategies assume some initial level of early participation and in reality many participants drop out very early during the course of an exercise intervention. Thus, being able to identify criteria or characteristics

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associated with the probability of attrition from exercise programs could have both practical and clinical significance.

Physical, psychological, and demographic characteristics have been associated with attrition from exercise programs. For example, (Schmidt, Gruman, King, & Wolfson, 2000) reported that usual gait speed and 6-minute walk distance were the strongest predictors of dropout among older adults involved in structured exercise programs. Jancey et al. (Jancey et al., 2007) found that older adult dropouts from physical activity programs tended to be those who were overweight, less physically active at baseline, of lower socioeconomic status, and had lower walking self-efficacy and higher loneliness scores. Herman et al. (Herman et al., 2002) found that greater anxiety and lower life satisfaction at baseline predicted patient dropout among middle-aged and older adults involved in an exercise therapy program for depression. Although these findings suggest some commonalities among recidivists across studies, a more coherent, theoretical perspective is needed to develop a reliable profile capable of explaining the underlying relationships among these variables.

Both social cognitive theory (Bandura, 1986) and neurocognitive science (Miyake et al., 2000); (Stuss & Alexander, 2000) have emphasized the importance of self-regulatory capacity in successful maintenance of health behaviors. Maintaining health behaviors involves self-regulatory processes (i.e., executive functions), such as multi-tasking and inhibitory control, and having a greater capacity to self-regulate likely contributes to greater participation throughout an exercise intervention. For example, (Hall, Fong, Epp, & Elias, 2008) have reported that inhibitory control predicted physical activity behavior among adults. It should be noted that the aging process is associated with diminished self-regulatory processing (Drag & Bieliauskas, 2010) and impairments in self-regulation may “spill-over” across areas of cognitive functioning (Linville, 1987) and regulatory control (Mata et al., 2009).

However, comprehensive assessments of self-regulatory processes are impractical due to the length of implementation and scoring procedures. Thus, proxy measures of self-regulation are required for screening purposes. One such measure is self-efficacy for overcoming barriers to exercise, which has been consistently associated with adherence (DuCharme & Brawley, 1995); (McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003; Motl et al., 2005). Memory complaints may also serve as an indirect indicator of older adults' self-regulatory capacity and have been associated with objective measures of brain structures involved in memory (i.e., hippocampus) and with measures of cardiorespiratory fitness (Szabo et al., 2011), and frequency of life-style activity (Whitbourne, Neupert, & Lachman, 2008). Additionally, measures of balance and gait performance have been associated with executive functioning among healthy and diseased populations (Huh et al., 2011; Li et al., 2010; Liu-Ambrose et al., 2010; Yogev Seligmann, Hausdorff, & Giladi, 2008), as well as attrition (Schmidt, et al., 2000). Therefore, it may be feasible to include relatively brief physical and mental performance assessments as indicators of self-regulatory capacity.

The purpose of this secondary data analysis was to determine the utility of a profile for predicting exercise program dropout among older adults using relatively brief psychological and physical performance assessments. We hypothesized that barriers self-efficacy, memory complaints, balance, and gait speed would successfully differentiate dropouts from those who remained in a yearlong exercise program.

Method

Participants

One-hundred seventy-nine older adults were randomized to the exercise intervention (M age = 66.43 years; 65.4% females; 88.3% Caucasian). The primary outcomes of the study were exercise intervention effects on executive functioning, hippocampal volume, and functional limitations. The present study involved analysis of baseline data and dropout records. Thirty-five participants in total dropped out after randomization and 144 completed the study. We defined study “dropouts” as anyone who relinquished their consent to participate (see Table 1 for reasons). The majority (82.4%, $n = 28$) dropped out within the first phase of the intervention (first 52 sessions) whereas 8.8% ($n=3$) dropped out in the second (between session 53 and 104) and another 8.8% ($n=3$) dropped out in the third (between sessions 105 to 156). Among the dropouts, only one participant was “non-compliant,” but this was related to 6-month testing (brain scans) and the participant subsequently dropped from the study. A university institutional review board approved the study.

Procedure

Inclusion/exclusionary criteria have been previously described (Erickson et al., 2011; Voss et al., 2010). Briefly, participants were initially screened for cognitive impairment, depression, and prior physical activity involvement. Participants were included in the study if they scored > 51 on the modified Mini-Mental State Exam (Stern, Sano, Paulson, & Mayeux, 1987), were low active (< 3 days per week of physical activity), and signed the informed consent and received medical clearance. Upon completion of these materials, they were subsequently scheduled for baseline testing and mailed a questionnaire packet. Participants were then randomly assigned into either a walking condition or flexibility-toning-balance (FTB) condition. Both intervention arms exercised three days per week for approximately one hour. The Walking group engaged in distance-walking at specified intensities, whereas the FTB group engaged in variety of age-appropriate exercises (see (McAuley et al., 2011), for further details of the intervention).

Measures

Demographics—Age, gender, race, education, and marital status were assessed.

Barrier self-efficacy—To assess barriers efficacy, we used four items from the 13-item Barrier-specific Self-efficacy (BARSE) scale (McAuley, 1992). We selected four items that best reflected participants’ confidence to self-regulate in the face of actual barriers, including exercising regularly in the face of bad weather, while on vacation, without encouragement, and when under personal stress. A confirmatory factor analysis indicated that this model fit the data well ($\chi^2 = 2.23$ (2), $p = .33$, RMSEA = .03, CFI = 1.00, TLI = 1.00) based on cutoff values that met or exceeded recommendations (Hu & Bentler, 1999) (Marsh, Hau, & Grayson, 2005) and had sufficient internal consistency based on McDonald’s (McDonald, 1999; Zinbarg, Yovel, Revelle, & McDonald, 2006) reliability coefficient ($\alpha = .78$). The abbreviated barriers efficacy score correlated very well with the full 13-item measure ($r = .90$).

Frequency of forgetting—The general memory complaints item, i.e., “How would you rate your memory in terms of the kinds of problems that you have?” (1 = Major problems, 7 = No Problems), from the 10-item version of the Memory Functioning Questionnaire {Zelinski, 2004 #38} was used to assess frequency of forgetting (i.e., the degree of regularity that memory problems occur in one’s life). Item-to-item correlations typically exceed .90, as was the case in this study.

Balance, stair climbing, walking performance and endurance—The balance task required participants to balance on one leg for up to 30 seconds. Total time that participants were able to maintain balance before touching the ground was recorded in seconds. Both the right and left legs were assessed. The stair-climbing task required participants to walk up and down a flight of 15 stairs as quickly as possible. Stair ambulation is one of the most challenging and hazardous loco-motor activities older adults engage in, and substantial evidence suggests that stair ascent and stair descent may provide a “benchmark” for assessing physical impairment (e.g., {Novak, 2011 #103}. Note also that some participants required use of handrail, however it has been shown that this does not increase the biomechanical stability among healthy older adults (Reid, Novak, Brouwer, & Costigan, 2011. Time to complete each task was recorded in seconds. The 8ft Up and Go task, a measure of leg strength and agility was also conducted and recorded in seconds. Finally, as a measure of endurance, all participants completed the Rockport (Kline et al., 1987) 1-mile walk protocol which was recorded in minutes. All assessments were recorded using a handheld stopwatch.

Data Analysis

Data were analyzed via SPSS version 18.0 (Chicago, IL). We conducted descriptive statistics followed by mean comparisons to evaluate substantive differences in the established and theorized predictors of attrition. Various methods have been used in the past to examine predictors of attrition, including signal detection methodology {King, 2006 #97} and logistic regression, but we did not adopt any of these methods because we were only interested in the combined utility of predictors (and not the single best predictor). Thus, we conducted a discriminant function analysis to discriminate study participants who completed a 12-month intervention from those who dropped out. One participant from each group had missing data on a single discriminating variable and means were imputed for these missing values. We examined predictor quality quality

Results

Descriptive Statistics

Table 1 shows the descriptive statistics on all measures for both dropouts and completers. As can be seen, there were no significant differences between the two groups on right leg balance, the 8ft Up and Go, or Rockport one mile walk. Therefore, these items were excluded from subsequent analyses. Note that 6 “dropouts” (8.6%) and 17 (11.8%) “completers” used a hand rail for stairs up, stairs down, or both.

Discriminant Function Analysis

This analysis confirmed that the two groups could be significantly differentiated: Wilk’s $\lambda = .89$, $F(4) = 21.19$, $p < .001$. The discriminant function had an eigenvalue of .13 and a canonical correlation of .34. Overall, 72% of the total sample ($N = 179$) could be correctly classified as “dropouts” ($n = 35$) and “completers” ($n = 144$). Almost two-thirds (65%) of participants were correctly predicted as dropouts, which is superior to a random assignment based on prior group membership probabilities. Generally, in discriminant function analyses, loadings $> |.32|$ are considered to be eligible for interpretation (Comrey and Lee, 1992). As seen in Table 2, all variables appear to contribute substantially to the differentiating between the two groups.

Discussion

The purpose of this study was to test the initial validity of a profile for determining dropout from an exercise program for older adults. Based on an integrated social-cognitive and

neuroscience framework, and prior research on predictors of attrition, we examined a set of variables theorized to differentiate those who dropped out versus those who completed a 12-month exercise intervention. Specifically, our profile of barriers efficacy, frequency of forgetting, and two functional performance measures involving single leg balance and stair performance predicted a significant amount of the variance in participant scores and differentiated between groups relatively well.

Our findings are consistent with prior research showing that lower self-efficacy predicts dropout (Jancey et al., 2007) and higher self-efficacy predicts adherence (McAuley, 1993). Similarly, we replicated prior work showing that lower-body functional performance predicts dropout (Schmidt et al., 2000). Moreover, we found further evidence of general self-regulatory capacity, as measured by memory complaints, contributing to the prediction of exercise-specific self-regulation, which is consistent with recent work showing the relationships between executive function and physical performance (Huh et al., 2011). A possible reason for the unbalanced relationship between single-leg stand and attrition is that we excluded left-handed adults from the parent study. This may be a “dominance effect”, as the left side could be poorer among right-handers, and the imbalance could be further amplified by selection bias. Although more work is needed to validate the predictive utility in additional samples, such profiles represent potentially important information for researchers and clinicians, for screening purposes and targeted interventions.

Defining a “dropout” can be a considerable challenge for researchers. Non-compliance and non-responders are not necessarily dropouts. In these cases, participants may still be involved in the study, but may have substantial missing data. Also, we would not refer to attrition among individuals involved in a “wait-list” to receive an exercise intervention as a “dropout” either, as this is may be attributable to dissatisfaction with their assigned experimental group (Atlantis et al., 2004). Moreover, Shields et al. (2005) have pointed out that although some people may discontinue a study, this is not isomorphic with failure. Thus, participants with a favorable profile of social-cognitive characteristics may resume an exercise program at a later date, and future longitudinal studies should test the likelihood of such instances. Additional testing is also necessary to assess the generalizability of such a screening approach across different age groups, races/ethnicities, educational and socioeconomic status.

This study has several limitations. First and foremost, this profile may not work as well as a “screening instrument” for flagging dropouts among more diverse samples, as older adult barriers to physical activity may differ from other segments of the population. Our sample also mainly consisted of healthy and highly educated adults. Moreover, the list of variables included in our initial profile for determining attrition among older adults is by no means all-inclusive, as several studies have shown that disease, educational and socioeconomic statuses are also associated with attrition. That said, screening at the level of demographic information may be irrelevant from a physical activity behavior change perspective unless interventionists are prepared to individualize treatment in response to such variables.

The present study has a number of strengths. Although predictors of exercise program dropout among adults have been identified in the literature, these approaches have not been conducted within a theoretical context exploring the cognitive basis and potential self-regulatory mechanisms underlying the dropout phenomenon. Second, given that we investigated attrition in the context of a 12-month exercise intervention, we were able to clearly define our “dropouts” and compare them to older adults who completed the intervention. Third, we implemented a thorough battery of physical and psychosocial assessments to examine dropout classification accuracy based on established and novel measures.

Conclusions

In conclusion, we have provided preliminary support for a profile that may be useful for predicting attrition among older adults involved in an exercise intervention. Such a profile could be implemented quickly, and with relative ease, as a first step, as a means of developing tailored physical activity programs.

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Table 1

Sample Characteristics

Variables	Dropouts (<i>n</i> = 35)	Completers (<i>n</i> = 144)
<i>Demographics</i>	<i>M (SD)</i> or %	<i>M (SD)</i> or %
Age	65.94 (5.73) years	66.55 (5.66) years
Gender	40% male, 60% female	33% male, 67% female
Education	40% college degree	54% college degree
Marital Status	63% married	59% married
Race	74% White, 6% Asian, 20% Black/African American	92% White, 3% Asian, 6% Black/African American
<i>Screening Variables</i>	<i>M (SD)</i>	<i>M (SD)</i>
Mini-Mental State Exam	53.91 (2.54)	54.73 (2.37)
5-item Geriatric Depression Scale	.62 (.82) [†]	.36 (.58)
<i>Efficacy, Cognitive Function, and Physical Performance</i>	<i>M (SD)</i>	<i>M (SD)</i>
Freq of Forgetting item #1	5.26 ^a (1.05)	4.83 ^b (1.13)
Abbreviated Barriers SE	67.35 ^a (24.33)	74.79 ^b (19.10)
Rockport Walking Speed	17.92 (2.23) min	17.71 (2.24) min
8ft Up & Go	5.84 (1.19) s	5.71 (1.14) s
Stairs Down	8.42 ^a (4.23) s	7.23 ^b (1.69) s
Stairs Up	8.39 (3.26) s	7.62 (1.58) s
Left Leg Stand	21.53 ^a (10.99) s	18.33 ^b (11.53) s
Right Leg Stand	19.07 (11.23) s	19.24 (11.30) s

Note.

^{a,b} $p < .05$. Only variables with different superscripts were significantly different.

[†] Levene's test of equal variances significant; mean differences not significant ($p < .09$). The study took place between 2006 and 2009 in a university setting.

Table 2

Standardized Canonical Coefficient of Discriminant Analysis

Variables	Standardized Canonical Coefficient
1. Stairs Down Time	.73
2. Abbreviated Barrier SE	-.57
3. Frequency of Forgetting (Q1)	.52
4. Left Leg Balance Time	.49

Note. The study took place between 2006 and 2009 in a university setting.