Predictors of adherence to physical activity in the Lifestyle Interventions and Independence for Elders pilot study (LIFE-P)

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Objectives: A prospective design was used to examine predictors of adherence to a physical activity intervention in older adults with compromised function.

Methods: The sample included 213 men (31.1%) and women (68.9%) with an average age of 76.53 years.

Results: The predictor variables accounted for 10% of the variance in percent attendance during adoption and transition, respectively. Adding percent attendance during adoption to the prediction of percent attendance during transition increased the explained variance in this phase to 21%. During maintenance, the predictors accounted for 13% of the variance in frequency of physical activity; this estimate increased to 46% when adding in percent attendance from the transition phase.

Discussion: These results are encouraging in that the physical activity intervention appears to have been well tolerated by diverse subgroups of older adults. The role of prior behavior in predicting downstream adherence underscores the importance of developing proactive interventions for treating nonadherence in older adult populations.

Keywords: Disability, Physical Activity, Older Adults, Adherence

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There is national sample evidence of a decline in physical activity with age (Stephens 1988) and an association between inactivity and increased risk for physical disablement (Keysor 2003). The LIFE Pilot study (LIFE-P) (Rejeski et al 2005a) is a randomized clinical trial that was designed to examine the feasibility of conducting a large multicenter trial on the effects of increasing physical activity in sedentary, functionally compromised older adults to delay or prevent the onset of mobility disability. Because adherence to lifestyle behavior change is problematic at any age (Dishman 1988), this investigation examines how well we were able to predict adherence to physical activity in LIFE-P.

The problem of nonadherence

In the general medical literature, poor treatment adherence is common to health behavior regimens even when the risk of nonadherence is immediately life-threatening (Meichenbaum and Turk 1987; Dimatteo et al 1993). Unfortunately, this situation has been similarly documented for physical activity (Dishman 1988). A recent review was published on older adults' adherence to randomized clinical trials of physical activity by Martin and Sinden (2001). Of the 21 studies reviewed, 14 involved non-clinical populations and 13 included participants in the age range from 65–75 years. Although the overall mean (SD) program attendance rate was 78.2% (16.4%), those studies that employed intention to treat analyses had lower attendance rates (63%) than those who eliminated drop-outs (88%). The duration of these studies ranged from 10 to 78 weeks with a mean (SD) of 31.85 weeks (18.1). In the current study, we examine predictors of adherence to physical activity in 3 phases of the LIFE-P physical activity study: adoption (the first 2 months of intervention), transition (months 3–6), and maintenance (months 7–12).

Predictors of physical activity adherence

As predictors of adherence, we consider 5 clusters of conceptually related variables. These include information on participant demographics (Dishman and Sallis 1994), disease burden (Rejeski et al 1997), physical functioning (Ytterberg, Mahowald, and Krug 1994; Rejeski et al 1997), self-reported symptoms (Dishman and Sallis 1994; Shaw, Cronan, and Christie 1994; Rejeski et al 1997), and process measures that were based on social cognitive theory (ie, performance efficacy, barriers efficacy, satisfaction with physical function, and desire for physical competence) (Garcia and King 1991; Bandura 1998; Rejeski et al 2005b). In addition, in the transition and maintenance phases, we examine the role that prior program attendance had on patterns of adherence. Reasons for considering prior program adherence as a predictor variable include the fact that the repetition of intentional behavior is related to habit formation (Maddux and DuCharme 1997). Moreover, participants with better adherence are exposed to greater and more consistent mastery experience, a known determinant of physical activity behavior (McAuley et al 2003).

Methods

Overview

After completion of informed consent, a total of 213 sedentary persons aged 70–89 years who were at elevated risk of disability were randomized to a physical activity intervention at four clinic sites: the Cooper Institute, Stanford University, the University of Pittsburgh, and Wake Forest University. The intervention lasted 12 months and was divided into three phases: adoption (months 1–2), transition (months 3–6), and maintenance (months 7–12). Walking was the primary mode of activity in the intervention with a goal of 150 min/wk. In addition, participants engaged in limited training for balance and the development of lower extremity strength. Attendance data for center-based physical activity sessions and the frequency of home-based physical activity that participants recorded in activity logs were entered by interventionists into a web-based data entry system. All procedures for LIFE-P were approved by the institutional review board of the medical school at Wake Forest University.

Inclusion criteria

- Aged 70–89 years
- At risk for mobility disability (SPPB score <10) (Guralnik et al 1995)
- Ability to complete the 400 m walk test (usual pace) within 15 minutes without sitting and without the use of an assistive device (Simonsick et al 2001)
- Sedentary lifestyle, ie, has spent less than 20 minutes per week in the past month in regular physical activity
- Willing to give informed consent to be randomized to intervention
- Successful completion of the behavioral run-in

Exclusion criteria

- Failure to provide informed consent
- Residence in a nursing home
- Cognitive impairment defined as a Mini-Mental State Exam score <21
- Development of chest pain or severe shortness of breath on the baseline 400 m self-paced walk test
- Unable to communicate due to hearing or speech disorder
- Severe visual impairments
- Progressive, degenerative neurologic disease, eg, Parkinson's Disease, multiple sclerosis, ALS
- Severe arthritis or orthopedic condition that would prevent participation in a physical activity program
- Terminal illness with life expectancy less than 12 months, as determined by a physician
- Lung disease requiring either oral or injected steroids, or the use of supplemental oxygen
- New York Heart Association Class III or IV congestive heart failure, clinically significant aortic stenosis, history of cardiac arrest, use of a cardiac defibrillator, or uncontrolled angina
- Renal disease requiring the use of dialysis
- Cancer being actively treated with radiation or chemotherapy
- Other significant disease/condition that would impair ability to safely participate in the exercise-based intervention as determined by a physician
- Severe psychiatric disorder
- Excessive alcohol use (>14 drinks per week)

- Member of household already enrolled in the study
- Lives outside of the study site or is planning to move out of the area in the next 3 years or leave the area for more than 3 months during the next year

Temporary exclusion criteria

- Myocardial infarction, CABG, or valve replacement within the past 6 months
- Serious conduction disorder (eg, 3rd degree heart block), uncontrolled arrhythmia, or ST-segment depression (>3 mm) on ECG
- Pulmonary embolism or deep venous thrombosis within past 6-months
- Uncontrolled diabetes with recent weight loss, diabetic coma or frequent insulin reactions
- Stroke, hip fracture, hip or knee replacement, or spinal surgery in the past 6 months
- Receiving physical therapy for gait, balance, or other lower extremity training
- Severe hypertension (systolic blood pressure >200 mmHg and/or diastolic blood pressure >110 mmHg)
- Currently enrolled in another randomized trial involving a pharmaceutical or lifestyle intervention

Measures

For the adoption and transition phases, the outcome measure was adherence to scheduled center-based sessions calculated as the number of sessions attended divided by total number of sessions offered multiplied by 100. For the maintenance phase, the outcome measure was an average of the total number of self-reported exercise sessions performed each week that was recorded on logs. For the purposes of this study, we grouped the predictor variables into one of five conceptually related categories (see Table 1). A brief description of each measure is provided below.

Participant demographics and disease burden

Using a structured interview method, we obtained data on participant's education, age, sex, race/ethnicity, and disease burden. Disease burden required discrete yes/no responses to the following chronic health conditions: arthritis, heart attack, heart failure, pacemaker, lung disease, cancer, and diabetes. In addition, data from standard physical measurements of height and weight were used to calculate body mass index (Rejeski et al 2005a).

Physical functioning

Measures of physical functioning included (a) grip strength (Rantanen et al 1999), (b) the Short Physical Performance Battery (SPPB) (Guranlik et al 1995), and (c) the time to complete a 400 m self-paced walk without sitting and without the use of an assistive device (including a cane) or the help of another person (Simonsick et al 2001). The SPPB involves 3 areas of performance: balance, chair stands, and a 4 m self-paced walking speed. Performance in each of these three areas is assigned a categorical score ranging from 0 to 4, with 4 indicating the highest level of performance and 0 an inability to complete the test. A summary score ranging from 0 (worst performers) to 12 (best performers) is calculated by adding walking speed, chair stands, and balance scores.

Self-report symptoms

Symptoms that were assessed in study participants included: (a) a 12-item pain scale (with instructions modified to assess all body pain as opposed to knee pain) that has been used in previous physical activity trials and captures both pain intensity (6 items) and pain frequency (6 items) associated with the performance of 6 different basic physical tasks/movements (Rejeski et al 1995); (b) a six-item scale that

Table 1 Grouping of variables for multiple regression analyses

Participant demographics	Disease burden	Physical functioning	Self-reported symptoms	Social cognitive measures
Education	Arthritis	Grip Strength	Pain severity	Body satisfaction
Age	Heart attack	400M Walk	Pain frequency	Desire for PC
Sex	Heart failure	SPPB-Chair	Energy/fatigue	Barriers efficacy
Race	Pacemaker	SPPB-Balance	Depression	400M Walk efficacy
	Lung disease	SPPB-Walk		Goal setting efficacy
	Cancer			
	Diabetes			
	BMI			

Legend. BMI = Body Mass Index; SPPB = Short Physical Performance Battery; PC = Physical Competence.

assessed energy/fatigue (Rejeski et al 1999); and (c) the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff 1977).

Social cognitive process measures

For purposes of this study, we collected data on several social cognitive process measures that were conceptually related to the intervention. These included: (a) a measure of performance efficacy related to the 400 m walk, (b) a barriers efficacy scale (Garcia and King 1991), (c) a measure of satisfaction with physical function (Reboussin et al 2000), and an 8-item measure of desire for physical competence that was adapted from work by Rejeski and colleagues (Rejeski et al 2006).

The 400 m walk efficacy scale was completed after participants had finished the 400 m walk test. The instructions read: "You have just completed a walk that was about ¼ mile. Please answer the following questions that concern your confidence (or certainty) in being able to walk at a similar pace for different distances one week from now." Five questions were rated on a 0 (no confidence) to 10 (complete confidence) scale with responses summed and converted to a 0–100 point scoring system. The first item was written as follows: How much confidence do you have in your ability to walk half as far as you did today, at the same pace, one week from now? The other four items were similar in content except that the italicized content changed. For item two, it read the same distance that you did today, item three read half again as far (the same distance plus half of that distance), item four read twice as far, and item five read three times as far.

The 8-item desire scale included the following items from the original scale (Rejeski et al 2006): (a) having the ability to do heavy work in the house or yard; (b) having the ability to stand up from a low, soft couch/chair; (c) having the ability to carry a ten pound object (ie, a bag of groceries) while climbing one flight of stairs; (d) having the ability to walk at a quick pace for a mile; (e) having the ability to get into and out of a car; (f) having the ability to do light work in the house or yard; and (g) having the ability to walk up and down a flight of stairs (hand rails available).

Physical activity intervention

The physical activity intervention employed a combination of aerobic, strength, balance, and flexibility exercises (see Table 2). Since the details of this intervention have been published elsewhere (Rejeski et al 2005a), we will outline only the major elements in this paper. First, the intervention was divided into 3 phases: adoption (months 1–2), transition (month 3–6) and maintenance (month 7–12).

Table 2 Description of activities for the physical activity intervention

Major components with brief description of time and content
1. Warm-up and cool down ~5 minutes each
• Hamstring and calf stretch
• Quadriceps stretch
• Chest and arm stretch
• Upper back stretch
2. Walking ~30 minutes (RPE target of 12–14)
3. Strength training ~10 minutes (2 sets of 10 repetitions; 3X each week; RPE target of 15–16)
• Squats into a chair
• Standing leg curls with ankle weights
• Knee extensions with ankle weights
• Hip side raises with ankle weights
• Toe stands
4. Balance ~10 minutes (3X each week)
• Hip circles with hand support
• Two foot toe stands with hand support
• One foot toe stands with hand support
• Side steps with hand support

Note: Prescriptions were individualized for each participant. Balance exercises were made more challenging based on individual abilities. Details of the intervention may be obtained from the first author.

The physical activity intervention was based on social cognitive theory (Bandura 1986) and a recent group-mediated approach for promoting physical activity among older adults (Rejeski et al 2003). In addition to specific training on the endurance, strength, flexibility, and balance portions of the regimen, the training regimen included 10 weekly closed-group behavioral counseling sessions that focused on physical activity adherence and the prevention of physical disability. Emphasis was placed on the development of motivation and skills to promote adherence and an increase of all forms of physical activity throughout the day. Moderate intensity walking was the primary mode of physical activity (King 1998; US Department of HHS 1996) and the ultimate goal was a 150 minutes of physical activity each week achieved by being active on most, if not all, days of the week. Sessions were preceded by a brief warm-up period and followed by a brief cool-down period. In the adoption phase (months 1–2), participants attended center-based exercise (40–60 min) 3 times each week, had group behavior counseling sessions once a week, and received a telephone contact one time each month. A gradual phasing in of home-based physical activity began in week 4.

During the transition phase (months 3–6), center-based exercise was conducted 2 times each week, with group behavioral counseling contacts occurring during the first two weeks and phone contacts each month. During the maintenance phase, center-based exercise sessions were offered one time each week (optional) with monthly phone contacts to monitor and promote home-based physical activity.

Restarting a suspended physical activity program

Participants were placed on suspended status when they encountered a hospitalization, injury, or other health event that required them to miss more than 2 consecutive weeks of physical activity. The details of how these patients were managed can be found in the design paper for LIFE-P (Rejeski et al 2005).

Statistical procedures

For the adoption and transition phases, percent attendance was modeled as the dependent variable; whereas, to accommodate skewness of the untransformed data, a square root transformation was used when modeling frequency of physical activity from the maintenance phase. Backward stepwise elimination regression models were developed for each of the 5 separate groups of variables described in Table 1 for each phase of the physical activity program. Because these models were intended to identify variables for entry into a composite model, the alpha level for variables retained in each of these analyses was set at $p < 0.15$. Subsequently, composite backward elimination regression models were conducted for each phase of the intervention. In these analyses, the demographic variables were forced into each model along with those variables that met the 0.15 criterion in the individual analyses of the variable groupings. For the composite models, variables were eliminated by a backward elimination procedure until all variables in the model (with the exception of the demographic variables) had a p-value less than 0.05.

Results

Table 3 provides descriptive statistics on the LIFE study participants that were part of the physical activity intervention arm. Of this group, 68.5% were women, 75.1% were Caucasian/White, and 17.4% were African American. Participants were relatively equally distributed across three age groups – 70–74 yrs, 75–79 yrs, and 80–89 yrs – with only 2.3% being 85+. A large proportion of the participants were highly educated with 66.7% having college or post graduate training. The most common co-morbidities were hypertension (69.48%), arthritis (23.47%), and diabetes (27.23%). At baseline, participants were sedentary (see inclusion criteria) and had compromised physical function as is evident from a mean (SD) total SPPB score of 7.57 (1.45).

Adherence rates to center-based sessions during the intensive and transition phases were 70.7% and 60.9%, respectively. From home-based logs collected during the physical activity maintenance period, we determined that participants were physically active an average of 3.7 sessions/wk during the maintenance phase. The top three reasons for missing scheduled center-based exercise sessions across the study intervention period were as follows: illness/health (16.9%), being too busy (16.1%), and traveling/vacation (10.1%).

Predictors of adherence within the three phases of intervention

Table 4 provides the results of the backwards elimination modeling for the adoption phase. Recall that variables considered in all composite models included demographic variables by forced entry and any variable from the five independent group regression models that had a p-value below 0.15 in the final step. Examination of the first 3 columns of data in this Table reveals that the following variables passed the 0.15 criterion in the variable group regression analysis: heart attack, heart failure, lung disease, and BMI from the chronic disease category, SPPB balance score, along with desire for physical competence, barriers efficacy, and 400 m performance efficacy from the process measures category. However, as shown in the last 3 columns of data, only the presence of lung disease and low barriers efficacy scores remained significant at the $p < 0.05$ level, with the overall R^2 for the model = 0.10.

When conducting the analyses for adherence in the transition phase (Table 5), only two variables passed the 0.15 criterion in the variable group regression analysis. These predictor variables included participants who wore a pacemaker and those with slower 400 m walk times. When combined in the final composite model, both of these variables were significant predictors ($p < 0.05$) of percent attendance with an R^2 of 0.10. Those with slower walking times at baseline had poorer attendance in the transition phase of the study, whereas those with a pacemaker had better attendance. Because we knew that prior behavior might be an important predictor of future behavior, we added percent attendance in the adoption phase to the model as an additional predictor variable of percent attendance in the transition phase. In fact, prior physical activity percent attendance was a significant predictor in this model ($p < 0.0001$) increasing the R^2 to 0.21.

Table 3 Descriptive characteristics on total sample and treatment arms

Variables	Total randomized (N = 424)	Physical activity (n = 213)	Successful aging (n = 211)	p-value
Age	76.77 ± 4.24	76.53 ± 4.17	77.01 ± 4.31	0.241
Race/Ethnicity				0.865
African American	77 (18.2%)	37 (17.4%)	40 (19.0%)	
Caucasian	315 (74.3%)	160 (75.1%)	155 (73.5%)	
Latino, Hispanic or Spanish	20 (4.7%)	10 (4.7%)	10 (4.7%)	
Other/mixed	11 (2.6%)	6 (2.8%)	5 (2.4%)	
Refused/missing	1 (0.2%)	0 (0.0%)	1 (0.5%)	
Sex				0.885
Women	292 (68.9%)	146 (68.5%)	146 (69.2%)	
Men	132 (31.1%)	67 (31.5%)	65 (30.8%)	
Education				0.856
< High school	11 (2.6%)	5 (2.3%)	6 (2.8%)	
High school	116 (27.4%)	58 (27.2%)	58 (27.5%)	
>High school	284 (67.0%)	142 (66.7%)	142 (67.3%)	
Other	13 (3.1%)	8 (3.8%)	5 (2.4%)	
Marital status				0.647
Married	167 (39.4%)	78 (36.6%)	89 (42.2%)	
Separated	2 (0.5%)	1 (0.5%)	1 (0.5%)	
Divorced	63 (14.9%)	36 (16.9%)	27 (12.8%)	
Widowed	173 (40.8%)	86 (40.4%)	87 (41.2%)	
Never married	16 (3.8%)	10 (4.7%)	6 (2.8%)	
Other	3 (0.7%)	2 (0.9%)	1 (0.5%)	
Body mass index	30.33 ± 6.53	30.78 ± 6.90	29.87 ± 6.11	0.149
Arthritis	93 (21.98%)	50 (23.47%)	43 (20.48%)	0.766
Heart attack	39 (9.20%)	24 (11.27%)	15 (7.11%)	0.138
Congestive heart failure	24 (5.66%)	11 (5.16%)	13 (6.16%)	0.657
Hypertension	293 (69.10%)	148 (69.48%)	145 (68.72%)	0.865
Cancer	74 (17.45%)	38 (17.84%)	36 (17.06%)	0.833
Diabetes	92 (21.70%)	58 (27.23%)	34 (16.11%)	0.005
SPPB score	7.52 ± 1.42	7.57 ± 1.45	7.46 ± 1.38	0.432

Table 4 Composite backwards elimination regression model: adoption phase

	Variables considered in full model[1]			Variables in final composite model[2]		
Variable	Parameter estimate	Standard error	Pr > F	Parameter estimate	Standard error	Pr > F
Intercept	44.28477	41.19629	0.2838	82.76922	32.99849	0.0129
Education: ≤HS	–3.30956	3.62463	0.3624	–3.42198	3.63993	0.3483
Age	0.03313	0.43432	0.9393	–0.22487	0.40248	0.5770
Sex	0.97809	3.64094	0.7885	0.24664	3.51056	0.9441
Race: African Am.	–10.40696	6.98646	0.1380	–10.14982	6.94055	0.1452
Race: Caucasian	–4.71209	6.14355	0.4440	–5.58722	6.12545	0.3628
Heart attack	3.98726	5.22117	0.4460			
Heart failure	–8.99803	6.84445	0.1902			
Lung disease	–9.99246	4.54259	0.0290	–10.93624	4.52088	0.0165
BMI	0.34994	0.26113	0.1818			
SBBP balance	2.41263	1.55958	0.1235			
Desire for PC	–2.98340	2.42773	0.2206			
Barriers efficacy	2.01188	0.98745	0.0430	2.14358	0.82063	0.0097
400M walk efficacy	0.11452	0.09994	0.2533			

[1]Exceeded 0.15 criterion for separate models.
[2]Exceeded 0.05 criterion for composite model; demographic variables were forced into this model.

Table 5 Composite backwards elimination regression model: Transition phase[1]

Variable	Parameter estimate	Standard error	Pr > F
Intercept	55.16368	35.07646	0.1175
Education: ≤HS	–9.38245	4.20131	0.0267
Age	0.40031	0.46141	0.3867
Sex	1.58985	4.05115	0.6952
Race: African Am.	–14.45430	7.92090	0.0696
Race: Caucasian	–2.79435	6.98583	0.6896
Pacemaker	23.75471	11.91198	0.0476
400m Walk Time	–2.30496	1.00084	0.0224

[1] The results of the full and composite models were identical in the transition phase. All variables exceeded 0.05 criterion and demographic variables were forced into this model.

Finally, examination of the data from the maintenance phase (Table 6) illustrates that 3 chronic disease variables– arthritis, having a pacemaker, and BMI – in combination with energy/fatigue from the symptom category, and barriers efficacy from the process measures category met the $p < 0.15$ criterion in the variable group regression models. Data for the final step of the composite model appears in the final 3 columns of Table 5 and illustrates that only the presence of a pacemaker and low energy/fatigue (ie, feeling tired) scores were significant predictors of frequency of physical activity with an R^2 of 0.13. When we entered percent attendance during phase 2 into this composite model, the R^2 increased dramatically from 0.13 to 0.46, and the only other significant variables in the model with prior physical activity percent attendance present were gender and the energy/fatigue score.

Relationship of suspended status to center-based adherence

An important feature of the study design was the placement of participants on "suspended status" when they missed more than 2 consecutive weeks of center-based physical activity training due to an illness. Because it was difficult to identify a clear start date for suspension when participants were at home in the maintenance phase of intervention, we only report data on the first two phases of intervention – the adoption and transition phases.

Of the 213 participants who were part of the physical activity intervention in the LIFE study, 91 were placed on suspended status at some point during the intervention and 48 of these returned to an active status. Not surprisingly, suspended status was inversely related to adherence to center-based visits during both the adoption ($r_s = -0.49$) and the transition phases of intervention ($r_s = -0.54$). In examining potential correlates of suspended status, we found that, of those who had congestive heart failure (n = 14), 71.4% were placed on suspended status as compared to 39.8% who did not have this condition, RR = 1.79; 95% C.I. = 1.24, 2.61. In addition, of 5 participants who had pacemakers, 80% were placed on suspended status as compared to 41.2% who did not have pacemakers, RR = 1.94; 95% C.I. = 1.21, 3.10.

Discussion

The purpose of the present study was to examine the ability of several conceptually related clusters of variables to predict adherence of older adults who were at risk for disability

Table 6 Composite backwards elimination regression model: Maintenance phase

	Variables considered in full model[1]			Variables in final composite model[2]		
Variable	Parameter estimate	Standard error	Pr > F	Parameter estimate	Standard error	Pr > F
Intercept	3.87855	2.93445	0.1879	2.23806	2.49019	0.3699
Education: ≤HS	–0.01535	0.29013	0.9579	–0.03575	0.29022	0.9021
Age	–0.01319	0.03276	0.6878	–0.00032	0.03105	0.9917
Sex	0.47334	0.28212	0.0951	0.55766	0.27761	0.0460
Race: African Am.	–0.61303	0.53549	0.2538	–0.55341	0.53781	0.3048
Race: Caucasian	0.53260	0.47417	0.2628	0.66529	0.47509	0.1631
Arthritis	0.48057	0.31151	0.1246			
Pacemaker	1.52088	0.83106	0.0689	1.81371	0.82327	0.0288
BMI	–0.03365	0.02118	0.1139			
Energy/Fatigue	0.28169	0.13101	0.0328	0.31509	0.12676	0.0138
Barriers Efficacy	0.08240	0.06557	0.2105			

[1] Exceeded 0.15 criterion for separate models.
[2] Exceeded 0.05 criterion for composite model; demographic variables were forced into this model.

to the LIFE-P physical activity intervention. Our results indicate that demographic variables, disease burden, self-reported symptoms, physical functioning and social cognitive variables together predicted 10% of the variance in percent attendance during both the adoption phase and the transition phase. Furthermore, when we added percent attendance in the adoption phase to the prediction of percent attendance in the transition phase, the amount of explained variance increased from 10% to 21%. During the maintenance phase, the conceptually-based clusters of predictor variables accounted for 13% of the variance in predicting frequency of physical activity; however, this estimate increased to 46% when adding attendance to center-based visits to the model for the transition phase. Clearly, prior behavior in relation to center-based attendance is an important predictor of how frequently participants engage in physical activity when involved at home in an independent environment (Rejeski et al 1997).

There was a lack of consistency in the variables that predicted adherence across the various phases of LIFE-P. For example, in the adoption phase, the presence of lung disease and low efficacy to manage barriers to physical activity met the inclusion criteria for the composite model. In the transition phase, both poorer performance on the baseline 400 m walk and presence of a pacemaker were significant predictors of percent attendance in the composite model, whereas predictors in the maintenance phase for this model included the presence of a pacemaker and higher levels of self-reported fatigue. Moreover, the variance accounted for by any of the three composite models never exceeded 13%. We view this evidence as encouraging from a public health perspective in that the LIFE-P intervention appears to be tolerated quite well by diverse subgroups of older adults.

The observed pattern of the individual predictor variables across the different phases of the intervention in LIFE-P is supportive of past research (McAuley 1993). For example, although self-efficacy has been consistently found to be a reliable predictor of physical activity in older adults (Brassington et al 2002; McAuley et al 2003), it has been found to play different roles at different phases in physical activity interventions (McAuley et al 1993; Oman and King 1998; Brassington et al 2002; McAuley et al 2003). Similar to the present study, McAuley and colleagues (2003) also found that self-efficacy was a significant predictor of adherence during the adoption phase of an older adult physical activity intervention, not during the transition phase. This finding is consistent with the position that self-efficacy is most influential in predicting behavior during challenging situations (Bandura 1997) such as attempting to integrate physical activity into the lives of sedentary older adults who have compromised physical function. As physical activity becomes more habitual, different variables become important such as past experience or complications from co-morbidities (McAuley et al 1993; Brassington et al 2002; McAuley et al 2003). Interestingly, in contrast to a study by McAuley and his colleagues (2003), the present investigation did not find self-efficacy to be a significant predictor of adherence during the maintenance phase of the intervention; only past attendance and energy/fatigue were significant predictors among LIFE-P participants. We can only speculate about the failure of self-efficacy to predict adherence in the maintenance phase of LIFE-P. In this regard, the adherence problems in the maintenance phase may be rooted in the lack of desire to be physically active as opposed to lacking confidence in the ability to do so, a hypothesis that is indirectly supported by the powerful role that physical activity behavior in the transition phase had in predicting adherence in the maintenance phase – a partial R^2 of 33%.

The contribution that the predictor variables had on explaining variance in physical activity attendance is consistent with our previous work with older adults with knee osteoarthritis (OA) (Rejeski et al 1997). In that study, the predictor variables also accounted for ~10% of the variance in attendance in the adoption phase. Additionally, the most consistent and potent predictor of attendance in LIFE-P was exercise behavior in the previous phases of the trial, a finding that also parallels data from our research on older adults with knee OA. As we mentioned in the introduction, the repetition of intentional behavior is related to habit formation (Maddux and DuCharme 1997). However, it is also true that participants with better adherence are exposed to greater and more consistent mastery experience. Mastery experience is the most potent source for enhancing self-efficacy beliefs (Bandura 1997) and self-efficacy is a known determinant of physical activity behavior (McAuley et al 2003).

The role that CHF had on days spent in suspended status is intriguing. One might be tempted to conclude from these data that older adults who have CHF are not good candidates for a physical activity intervention similar to the one employed in LIFE-P. However, we have examined the consequence of having CHF on return from suspended status. The evidence suggests that the probability of returning from suspended status in this subgroup is no worse than other causes of suspended status. Thus, instead of using CHF as an exclusion criterion, we would argue that these individuals might have the most to gain from being physically active.

We conclude that the adherence of older adults at risk for disability to physical activity interventions is not related to differences in demographic profiles. Similarly, there was not strong, consistent evidence that adherence is related in a consistent manner to comorbidities, level of physical functioning, physical symptoms, or even social cognitive variables related to functioning and physical activity that exist prior to the onset of an intervention. Although the percent variance accounted for by the models in each phase of the intervention was statistically significant, there was not a single instance where the composite models explained more than 13% of the variability in adherence. These results are heartening in that the physical activity intervention appears to have been well tolerated by diverse subgroups of older adults. In contrast, prior behavior accounted for an additional 11% of the variance in the transition phase and an additional 33% in the maintenance phase. These data underscore the importance of being proactive in countering nonadherence and in responding quickly to individuals who begin to develop patterns of nonadherence. We would caution readers to recognize that the results of this study are limited to older adults in the target population who are motivated to volunteer for a 12 month randomized controlled trial. We do not yet know, but must conduct research on theoretically relevant predictors of adherence to longer term interventions. To this end, our aim is to conduct a large multi-center trial that builds on the experience acquired in LIFE-P.

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