Baseline Predictors of Physical Activity in a Sample of Adults with Arthritis Participating in a Self-directed Exercise Program

M. Baruth, PhD,
College of Health & Human Services, Saginaw Valley State University, 7400 Bay Road, University Center, MI 48710

S. Wilcox, PhD,
This work was done at the University of South Carolina, in Columbia, SC

P.A. Sharpe, PhD, MPH,
This work was done at the University of South Carolina, in Columbia, SC

D.E. Schoffman, BA, and
This work was done at the University of South Carolina, in Columbia, SC

K. Becofsky, MS
This work was done at the University of South Carolina, in Columbia, SC

Abstract

Objectives: To examine baseline predictors of moderate-to-vigorous intensity physical activity (MVPA) at the 12-week follow-up in a sample of adults with arthritis participating in a self-directed, multi-component exercise program.

Study design: Pretest-posttest. Analyses were limited to those randomized to the exercise intervention.

Methods: Participants (n=152) completed a survey assessing demographic, health-related, and arthritis-related factors, and completed anthropometric and functional measurements at baseline. Self-reported MVPA was assessed at baseline and 12 weeks. Participants were classified as engaging in 2.5 or <2.5 hours/week of MVPA at the 12-week follow-up. Baseline demographic, health-related, arthritis-related, and functional factors were examined as predictors of engaging in 2.5 hours of MVPA.

Results: At the 12-week follow-up, 66.5% (n=101) of participants engaged in 2.5 hours/week of MVPA. Those with a higher body mass index, more days with poor physical health, a greater number of health conditions, self-reported hypertension, self-reported high cholesterol, and greater pain and stiffness were less likely to engage in 2.5 hours of MVPA at the 12-week follow-up; those with greater arthritis self-efficacy and better performance on the 6-minute walk test were more likely. None of the other factors examined were associated with leisure-time MVPA.

corresponding author: College of Health & Human Services, Saginaw Valley State University, 7400 Bay Road, University Center, MI 48710, mbaruth@svsu.edu, Phone: 763-381-9065, Fax: 989-964-4024.

Conclusions: This study uncovered health-related, arthritis-related, and functional factors associated with MVPA that may help guide intervention strategies. Participants with less severe symptoms, better functional performance and fewer comorbidities at baseline were more likely to achieve the recommended MVPA level at 12 weeks; therefore self-directed PA interventions may be best suited for those with relatively good health status despite arthritis, while those with worse symptoms and health status may benefit more from other intervention delivery modalities such as structured, individualized programs where additional support for managing arthritis symptoms and comorbidities diseases can be addressed.

Keywords

arthritis; physical activity; intervention; public health; predictors

Introduction

Arthritis and other rheumatic conditions are a large and growing public health problem, ranking as one of the most common chronic health conditions,[1] the leading cause of disability among US adults,[2] and a major financial burden.[3] The prevalence of arthritis and the number of adults with arthritis-attributable limitations is expected to increase by approximately 34% and 18% from 2007–2009 to 2030.[2, 4]

Physical activity (PA) is one non-pharmacological approach for managing arthritis that has been recommended by professional organizations[5] and governmental agencies,[6–8] and a number of PA interventions have led to improvements in function and arthritis symptoms. [9–14] In line with the general adult PA recommendations, adults with arthritis should accumulate 150 minutes/week of moderate intensity aerobic PA and at least two days/week of muscle strengthening activities.[7] Despite these recommendations, a majority of adults with arthritis are not engaging in sufficient PA; most recent data shows that 37% are completely sedentary.[15]

Recognizing the beneficial effects of PA for those with arthritis, the Centers for Disease Control and Prevention's (CDC) Arthritis Program identified and promotes six PA programs that have been proven safe and effective in this population.[16] These programs have the potential to be widely disseminated, which could result in meaningful public health improvements.[16] Programs range from multi-component land-based or aquatic programs to a behavior change program; a majority of the programs are delivered by trained instructors, use a group-based format, and require participants to attend sessions multiple times per week.

Although these public health PA programs have been effective in increasing PA and improving other arthritis-related variables,[14, 16] studies have not examined who may benefit most from them. Certain programs may be more effective for individuals with particular demographic, health-related, arthritis-related, or functional characteristics. Understanding which programs may be most effective for particular subgroups is important for program promotion and marketing, and for maximizing the potential public health impact these types of PA programs can have.

First Step to Active Health® is a 12-week, self-directed, multi-component exercise program placed on the CDC Arthritis Program's 'Watch List' in 2009.[14] At the time, this program met arthritis-appropriate criteria, but was in the process of building its evidence base.[14] This program is unique in that it does not require weekly attendance at group or exercise sessions, which may appeal to those for whom regular group attendance and participation is difficult or undesirable.[6] The results of the evaluation of this program have been reported elsewhere.[17] The purpose of this paper was to examine baseline predictors of moderate to vigorous intensity PA (MVPA) at program completion. More specifically, we examined baseline demographic, health-related, arthritis-related, and functional factors as predictors of engaging in 2.5 hours of MVPA at the 12-week follow-up.

Methods

STEPS to Health was a randomized, controlled trial evaluating the effects of a 12-week, self-directed exercise program for people with arthritis. Participants were randomized to a self-directed exercise program (First Step to Active Health®) or to an attention control self-directed nutrition program (Steps to Healthy Eating). Primary outcomes of the study were arthritis symptoms, lower body strength, functional exercise capacity, flexibility, PA, and arthritis management self-efficacy. Because this study aimed to examine predictors of PA among those receiving the self-directed exercise program, this study only included those randomized to the exercise program.

Participant recruitment

The most common and successful recruitment strategies were emails to worksite listservs and newspaper advertisements. Because this study evaluated the effects of a public health intervention, a public health definition of arthritis, consistent with what is used in the National Health Interview Survey and the Behavioral Risk Factor Surveillance System,[16] was used. Interested participants contacted the study office and completed a telephone screening to assess eligibility status (see Table 1).

Procedure

Participants deemed eligible following the telephone screening were scheduled to take part in a measurement session at the University of South Carolina. A total of 24 baseline measurement sessions were conducted to meet recruitment goals; sessions included 6 to 30 participants. Prior to the scheduled measurement session, participants were mailed a survey and an informed consent form.

At the baseline measurement session, participants completed an informed consent form that was approved by the university's Institutional Review Board, turned in their survey, completed measurements, and were randomized. Study staff oriented participants to their self-directed program, however no exercise or nutrition advice was provided.

Prior to the 12-week visit, participants received a reminder email (if provided) and telephone call. The same survey and measurement procedures were followed at the 12-week follow-up visit. Participants received a small cash incentive for taking part in each measurement session and for returning self-monitoring logs.

Intervention

First Step to Active Health® is a self-directed, evidenced-based, multi-component progressive exercise program. Each participant received a First Step to Active Health® kit and a folder containing weekly self-monitoring logs, postage-paid return envelopes (for the logs), a safety handout, and a study expectations calendar.

The First Step to Active Health® kit contained a program manual that included tools that helped participants set goals, customize their program, enhance motivation, and ensure safety; a Thera-Band; and illustrated fold-outs that described each of the four "Steps". Each step targeted a different exercise component: Step 1 focused on cardiovascular activities; Step 2 flexibility; Step 3 strength (upper and lower body; Thera-Band provided); and Step 4 balance. Once participants were comfortable with Step 1, they were instructed to add Step 2 into their routine, and so on. Although progression through the program was self-paced, participants were encouraged to incorporate all four steps by the end of the 12-week program. Foam balance pads were necessary for two of the ten balance exercises. Participants received a handout on where to purchase them, but were also given no-cost alternatives they could use instead (e.g. firm pillow).

Measures

Demographic/health-related variables.

Participants reported their age, gender, education, race, and marital status; rated their general health status; reported the number of years they have had arthritis; and self-reported presence of hypertension, high cholesterol, osteoporosis, stroke, and cancer. Height and weight were measured to calculate BMI.

Medication use.

Participants reported use of Tylenol or acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDS), COX-2 inhibitors, oral steroids, narcotic pain relievers, or any other over-the-counter and prescription medications for their arthritis (open-ended question). Open-ended medications were coded to drug class. An additional category for disease-modifying antirheumatic drugs (DMARDS) was created due to frequent use. Participants reporting current use or at least one day of use in the past 7 days were considered to be using (yes) a particular arthritis medication.

Self-reported physical activity.

The Community Health Activities Model Program for Seniors (CHAMPS) questionnaire measured leisure-time MVPA (3.0 METs; excluded household activities).[18] Participants reported whether they had engaged in each activity in a typical week during the past 4 weeks (yes/no), the number of times per week, and the total number of hours/week they engaged in the activity using the following scale (hours assigned in parentheses): Less than 1 hour (0.5), 1–2.5 hours (1.75), 3–4.5 hours (3.75), 5–6.5 hours (5.75), 7–8.5 hours (7.75), 9 or more hours (9.75). Total hours/week of MVPA was calculated, and participants were classified as engaging in 2.5 hours or <2.5 hours of MVPA at 12 weeks.

Depressive symptoms.

The 10-item Center for Epidemiological Studies Depression Scale (CES-D)[19–21] measured symptoms of depression. On a scale of 0 to 3, participants rated the frequency with which they experienced 10 symptoms of depression during the past week. Responses can range from 0 to 30 with higher scores indicating greater depressive symptoms.

Unhealthy days.

Two items from the Centers for Disease Control and Prevention's Healthy Days Core Module measured the number of days with poor physical and mental health.[22] Participants reported the number of days (in the past 30) their physical and mental health (separately) were not good. Each score can range from 0 to 30.

Arthritis symptoms.

Visual Numeric Scales[23] measured arthritis symptoms (pain, stiffness, and fatigue separately) in the past 2 weeks from 0 (no symptoms) to 10 (severe symptoms).

Arthritis management self-efficacy.

An 8-item version of the Arthritis Self-Efficacy Scale[24] assessed participants' confidence in their ability to manage symptoms of arthritis on a scale of 1 to 10. Scores can range from 8 to 80, with a higher score indicating greater confidence.

Disability.

The 20-item Health Assessment Questionnaire (HAQ) Disability Index[25] measured self-reported disability. On a scale of 0 to 3, participants reported the amount of difficulty they had in performing two or three specific activities in eight different categories over the past week. The total score was the mean of the eight categories. Scores can range from 0 to 3, with a higher score indicating greater disability.

Functional exercise capacity.

The 6-minute walk test measured functional exercise capacity. Participants were instructed to walk as quickly as possible for 6 minutes on a 38-meter walking course. Usual assistive devices were allowed during the test. The score was the total distance walked (in meters) in 6 minutes.

Lower body flexibility.

The seated reach test measured lower body flexibility. Participants sat on a raised mat with their feet positioned against a sit and reach box. Participants slowly bent forward, reaching as far forward as possible toward their toes and pushing a marker forward. Participants were given two practice and three test trials. The score was the total distance to the nearest 0.5 cm.

Upper body strength.

Grip strength (dominant hand) in kilograms using a calibrated Jamar dynamometer[26, 27] measured upper body strength. Participants stood with their dominant arm at their side and

their elbow bent to 90 degrees. On the signal, participants squeezed the dynamometer with as much force as possible. Participants were given one practice and three tests trials; the best of three trials was used.

Lower body strength.

The 30-second chair stand test measured lower body strength. On the signal, participants rose to a full stand and returned to a fully seated position, without using their arms. One practice of 1–3 repetitions was followed by one 30-second trial.[28] The score was the total number of unassisted stands.

Gait.

A portable walking mat with software (GAITRite®) measured gait speed in meters/second. [29, 30] Participants walked on the instrumented walkway without shoes at their normal walking pace. Assistive devices were allowed if needed. The score was the average of three trials.

Balance.

Postural sway (i.e. displacement of the center of pressure, COP) was measured with an AMTI (Advanced Mechanical Technology, Inc) force platform (AccuSway[PLUS]). Participants stood without shoes in a closed stance with their arms to the side, and eyes focused on a target located at eye level 5 feet away. A smaller displacement indicates greater stability.

Statistical analyses

Baseline differences among those lost versus retained at the 12-week follow-up were tested with t-tests and chi squares (χ^2). Baseline demographic, health-related, arthritis specific, and functional variables were examined as predictors of engaging in 2.5 hours/week of MVPA at the 12-week follow-up using SAS PROC GLIMMIX. A separate model was conducted for each baseline predictor examined, and MVPA (2.5 or <2.5 hours/week) was the dependent variable in all models. All models controlled for age, gender, education (high school graduate or less vs. at least some college), marital status (married vs. not), and hours/week of baseline MVPA. Odds ratios (OR) and the associated 95% confidence intervals (CI) for engaging in 2.5 hours of MVPA at follow-up were calculated for each model.

Results

A detailed description of the study recruitment and enrollment has been reported elsewhere. [17] At the baseline measurement session, 197 participants were randomly assigned to the exercise group. Of these, 152 (77%) completed PA measures at the 12-week follow-up and were included in this study. There were no differences between those included and those who were lost to follow-up. As shown in Table 2, participants were, on average, 57.0±9.9 years of age, had a BMI of 32.4±8.7 kg/m^2, and had arthritis for 11.1±9.1 years. A majority of participants were women (88%), white (63%), married (66%), and had at least some college education (88%). Baseline values of the demographic, health-related, arthritis specific, and functional predictor variables examined are shown in Table 2.

At the 12-week follow-up, 66.5% (n=101) of participants engaged in 2.5 hours/week of MVPA. The odds ratio, 95% confidence interval, and p-value for each predictor variable examined are also presented in Table 2. Participants with a higher BMI, more days with poor physical health, a greater number of health conditions, self-reported hypertension, self-reported high cholesterol, greater pain, and greater stiffness were less likely to engage in 2.5 hours of MVPA at the 12-week follow-up. Participants with greater arthritis self-efficacy and better performance on the 6-minute walk test at baseline were more likely to engage in 2.5 hours of MVPA at the 12-week follow-up. None of the other baseline demographic, health-related, arthritis-related, or functional factors examined were associated with MVPA at the 12-week follow-up.

Discussion

Despite the fact that the CDC's Arthritis program recommends a number of evidence-based PA programs for widespread dissemination among individuals with arthritis,[16] studies have not examined who is most likely to respond to these types of public health PA programs. This study examined baseline predictors of engaging in 2.5 hours of MVPA at the completion of the 12-week First Step to Active Health® program, and offers valuable insight into who might respond best to self-directed exercise programs such as this one. Understanding which subgroups are most likely to benefit is important for effective program promotion, and ultimately, for maximizing (collectively) program effects.

This program targeted a community-based sample of adults with self-reported, doctor-diagnosed arthritis, and therefore it is imperative to examine whether variables specific to an arthritic population predict who responds to the intervention. These types of factors may have the most significant impact on program participation and success. For example, although PA can successfully alleviate arthritis symptoms, these same symptoms (e.g., pain, fatigue, stiffness) often deter individuals from engaging in regular PA.[31, 32] Individuals with greater levels of pain and stiffness in this study were less likely to engage in at least 2.5 hours of MVPA at follow-up, supporting the idea that arthritis symptoms may preclude arthritic individuals from engaging in adequate levels of PA. These consequences of arthritis may bring about additional challenges to exercise interventions, particularly self-directed programs where support and encouragement from a group leader and/or other individuals with arthritis is not readily available and where strategies to effectively manage pain may be lacking. Furthermore, those with greater arthritis self-efficacy, in other words, those who were more confident in their abilities to manage arthritis symptoms, were more likely to engage in MVPA. Adding a 'symptoms management' component to a self-directed exercise program may be beneficial to individuals struggling to cope with arthritis-related pain, fatigue, and stiffness. This may be particularly beneficial for those with low confidence in their ability to manage such symptoms.

In addition to higher pain and stiffness, those with a higher BMI, more days with poor physical health, more chronic health conditions, self-reported hypertension, self-reported high cholesterol, poorer functional exercise capacity, and lower arthritis self-efficacy were less likely to engage in 2.5 hours of MVPA at the completion of the 12-week First Step to Active Health® program. Although those with chronic health conditions, a higher BMI,

higher arthritis symptoms, and poorer physical functioning potentially have the most to gain from increases in exercise, these individuals did not respond as well to this self-directed exercise program. It is likely that some of these conditions (e.g., high BMI, chronic health conditions) were *caused*, at least in part, by a sedentary lifestyle, and changing this lifestyle may be particularly challenging.

A major goal of the CDC's Arthritis program, and public health professionals in general, is to find programs that have the infrastructure and program characteristics necessary to facilitate widespread dissemination and implementation in public health settings.[14] The self-directed nature of First Step to Active Health® makes it a very appealing and low-cost program option that can be implemented in a variety of settings. However, our findings suggest that this type of exercise program may be best suited for those who have less severe arthritis symptoms and those with fewer health comorbidities. Subgroups with more severe arthritis symptoms and other health comorbidities may need additional and/or more intense intervention strategies; alternatively, these subgroups may respond better to a different intervention format or delivery modality. For example, it is possible that an intervention that includes more individualized support (in person or by telephone) or group-based exercise sessions may be more effective.

Despite the large number of PA interventions conducted in populations with arthritis,[9–14] only two studies[11, 33] have examined predictors of PA at follow-up among adults with arthritis. However, both studies examined baseline predictors of the intervention and control groups combined; therefore direct comparisons to this study cannot be made. Predictor studies are valuable for developing new intervention programs that can successfully increase PA and thus improve arthritis-related variables. As arthritis PA programs are available in a variety of formats and delivery options,[16] predictor studies are also important for targeted marketing. Understanding which format and delivery works best for particular subgroups can direct public health researchers and agencies to recommend the best program available for a given population or community.

We recognize study limitations, including the use of a self-report measure of PA, arthritis diagnoses, and chronic health conditions, which have inherent inaccuracies. Second, our sample was largely well-educated women, with relatively few chronic health conditions, low to moderate symptom severity, and low levels of disability, which may reduce the generalizability of our findings. However, arthritis prevalence is higher in women,[2, 4] as is participation in PA interventions.[13]

Arthritis and its associated disabilities are a large and growing public health problem. Public health efforts aimed at alleviating the consequences of arthritis in terms of cost and disability are warranted, and interventions aimed at increasing PA may be one channel for accomplishing this. Although developing and implementing interventions that can successfully increase PA is important, understanding who is most and least likely to respond to the intervention is also critical. The findings from this study can be used by public health professionals when promoting and marketing PA programs to adults with arthritis.

Acknowledgements

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Table 1.

Eligibility Criteria for Steps to Health

Participants were eligible to participate if they:

- were told by a health care professional that they have some form of arthritis

- reported at least one symptom of arthritis (joint pain, stiffness, tenderness, decreased range of motion, redness and warmth, deformity, crackling or grating, fatigue)

- were ≥ 18 years of age

- were the only one in their household participating in the study

- were not planning to move out of the area in the next nine months

- were able to read and write in English

- were not participating in another research study (unless it was an observational study without and intervention or medication)

Participants were ineligible to participate if they:

- endorsed an item on the PA Readiness Questionnaire (PAR-Q) [34] :

   ○ were told by a health care provider that they had a heart condition and should only do exercise recommended by a doctor

   ○ experienced chest pain during rest or exercise

   ○ experienced dizziness or loss of consciousness

   ○ had a bone or joint problem (besides arthritis) that could be made worse by exercise

   ○ knew of any other reason they should not do exercise

- had uncontrolled hypertension (≥ 160/100) (participants were not excluded if they took medication for hypertension and their blood pressure was controlled)

- had a fall in the past year that required medical assistance

- were pregnant, breastfeeding, or planning to become pregnant in the next year (women)

- were diabetic and taking insulin

- could not walk longer than 3 minutes without a rest

- could not stand without assistance for more than 2 minutes

- could not sit in chair without arms for more than 5 minutes

- were already physically active (aerobic activities ≥ 3 days/week for ≥ 30 minutes/day or strength training ≥ 2 days/week for ≥ 20 minutes/day)

Table 2.

Baseline Characteristics of the Sample and Baseline Predictors of Engaging in ≥ 2.5 Hours of MVPA at the 12-week Follow-up

Demographic Characteristics		Baseline Value	Predictor of 12-week MVPA	
	N	Mean (SD) or %	OR (95% CIs)[a]	p-value
Age, years	152	57.0 (9.9)	.98 (0.94, 1.02)	0.2689
Gender				
Male	19	12.5	2.58 (0.49, 13.63)	0.2613
Female	133	87.5	Reference	
Education				
High school gradate or less	18	11.8	0.92 (0.29, 2.90)	0.8883
At least some college	134	88.2	Reference	
Marital, not married				
Not married	52	34.2	1.20 (0.53, 2.71)	0.6550
Married or partnered	100	65.8	Reference	
Race				
White	96	63.2	2.06 (0.88, 4.85)	0.0971
Non-white	56	36.8	Reference	
Health-related Characteristics				
BMI, kg/m^2	152	32.4 (8.7)	0.94 (0.89, 0.99)	0.0106
Health status				
Excellent or very good	50	32.9	3.89 (1.18, 12.79)	0.0578
Good	72	47.4	1.48 (0.53, 4.14)	
Fair or poor	30	19.7	Reference	
Days with poor physical health	151	6.7 (9.5)	0.96 (0.92, 1.00)	0.0415
Days with poor mental health	150	4.7 (7.6)	1.00 (0.94, 1.05)	0.8684

Demographic Characteristics		Baseline Value	Predictor of 12-week MVPA	
Number of health conditions	150	1.2 (0.9)	0.61 (0.38, 0.98)	0.0423
Hypertension				
Yes	77	50.7	0.41 (0.18, 0.93)	0.0337
No	75	49.3	Reference	
High cholesterol				
Yes	64	42.4	0.42 (0.18, 0.97)	0.0433
No	87	57.6	Reference	
Cancer				
Yes	19	12.7	1.59 (0.48, 5.33)	0.4481
No	131	87.3	Reference	
Stroke				
Yes	3	2.0	2.08 (0.15, 29.82)	0.5880
No	148	98.0	Reference	
Osteoporosis				
Yes	21	13.9	0.73 (0.24, 2.23)	0.5739
No	130	86.1	Reference	
Depressive symptoms (0–30)	152	6.0 (4.7)	0.98 (0.90, 1.07)	0.7014
Arthritis-specific Measures				
Arthritis duration, years	152	11.1 (9.1)	1.02 (0.97, 1.06)	0.4698
NSAID use				
Yes	104	68.4	1.13 (0.50, 2.56)	0.7608
No	48	31.6	Reference	
COX-2 inhibitor use				
Yes	21	13.8	1.27 (0.40, 4.03)	0.6823
No	131	86.2	Reference	

Demographic Characteristics		Baseline Value	Predictor of 12-week MVPA
Oral steroid use			
Yes	16	10.5	1.84 (0.49, 6.94)	0.3645
No	136	89.5	Reference	
Narcotic pain reliever use			
Yes	21	13.8	0.62 (0.19, 1.97)	0.4131
No	131	86.2	Reference	
DMARDS use			
Yes	18	11.8	2.54 (0.72, 8.93)	0.1461
No	134	88.2	Reference	
Acetaminophen use			
Yes	54	35.5	0.64 (0.29, 1.43)	0.2763
No	98	64.5	Reference	
Fatigue (0–10)	152	4.8 (2.6)	0.91 (0.78, 1.06)	0.2258
Pain (0–10)	152	4.6 (2.3)	0.74 (0.61, 0.89)	0.0017
Stiffness (0–10)	152	5.1 (2.5)	0.76 (0.64, 0.89)	0.0011
Self-reported Disability (0–3)	152	0.6 (0.5)	0.77 (0.36, 1.63)	0.4917
Arthritis self-efficacy (8–80)	152	6.3 (2.1)	1.32 (1.08, 1.61)	0.0073
Functional Measures			
Balance, displacement COP, cm	149	36.9 (7.6)	1.03 (0.97, 1.10)	0.2718
6- minute walk distance, m	151	497.8 (90.3)	1.01 (1.00, 1.02)	0.0014
30-second chair stands, #	152	10.0 (3.4)	1.04 (0.92, 1.17)	0.5360
Gait speed, m/s	152	1.1 (0.2)	3.86 (0.57, 26.03)	0.1644
Seated reach, cm	152	21.9 (8.8)	1.05 (1.00, 1.10)	0.0529

Demographic Characteristics		Baseline Value	Predictor of 12-week MVPA
Grip strength, kg	152	27.3 (9.7)	0.97 (0.91, 1.02) 0.2256