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ORIGINAL PAPER

Community-Based Healthy Aging Interventions for Older Adults with Arthritis and Multimorbidity

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Abstract Examine the impact of programs led by community health workers on health and function in older adults with arthritis and other health conditions. We conducted a cluster-randomized trial of the Arthritis Foundation Exercise Program (AFEP) enhanced with the "10 Keys"™ to Healthy Aging compared with the AFEP program at 54 sites in 462 participants (mean age 73 years, 88 % women, 80 % white). Trained Community health workers delivered the 10-week programs. Outcomes assessed after 6 months included physical performance [Short Physical Performance Battery (SPPB)], Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index, and preventive health behaviors. Both groups experienced improvements. Performance improved by 0.3 SPPB points in the AFEP/"10 Keys"™ group and 0.5 in AFEP alone; WOMAC scores declined by 3.0 and 3.9 points respectively. More participants had controlled hypertension at 6 months in both groups (60.1 % baseline to 76.7 % in AFEP/10 Keys and from 76.5 to 84.9 % in AFEP alone) and greater diabetes control (from 15.0 to 34.9 and 15.5 to 34.1 %, respectively). These community-based programs showed similar improvements in preventive health, mobility and arthritis outcomes.

The CONSORT Statement: The trial is registered at ClinicalsTrials.gov: NCT01616433. Figure 2 is the Consort Flow Diagram.

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Introduction

The number of adults over the age of 65 years in the United States will reach 70 million by the year 2030 (*Centers for Disease Control and Prevention and The Merck Company Foundation. The State of Aging and Health in America 2007*, 2007 Accessed March 30, 2016; Mazzeo, [17]). More than 60 % of these older adults will have more than one chronic condition [27]. Physical activity is one way to maintain physical function and decrease morbidity and disability; however, less than 20 % engage in enough physical activity (US Department of Health and Human Services), and less than half receive preventive services [27]. Older adults with arthritis are particularly prone to disability because of chronic pain, co-morbid chronic conditions, and a high rate of obesity. Thus, they represent a high-risk target population for health promotion.

Empowering older adults to engage in physical activity at the recommended levels and to use preventive services for primary and secondary prevention of chronic disease is an important public health goal. Participation in self-management programs may be one venue to increase knowledge and self-efficacy to promote behavior change and prevention of chronic disease. Delivering these programs where people work and live in the community could increase access and participation and ultimately impact outcomes.

In this research we used a collaborative approach to develop, implement, and evaluate a program to address multiple risk factors for disability in older adults with arthritis. We enhanced an existing exercise program targeting older adults with arthritis (Arthritis Foundation Exercise Program, AFEP) by adding a healthy aging behavioral activation program ("10 Keys"™ to Healthy Aging) [19]. We sought to determine if the enhanced program was superior to the AFEP alone in improving arthritis-specific outcomes (function, pain, and stiffness) and increasing preventive service use.

Methods

Study Design

The study methods and community development have been published [33]. Briefly, this study was a non-blinded cluster randomized trial with the community site as the unit of randomization. The study tested the effectiveness of the AFEP enhanced with the "10 Keys"™ compared with the AFEP alone with physical performance and arthritis outcomes as co-primary outcomes. Community health workers delivered both programs. Fifty-four sites were randomized. Sites included 13 (24.1 %) senior centers, 15 (27.8 %) residential facilities, 9 (16.7 %) churches, 5 (9.3 %) community centers, 4 (7.4 %) YMCAs, 4 (7.4 %) fitness centers/clubs, and 4 (7.4 %) libraries. The University of Pittsburgh Institutional Review Board approved the protocol.

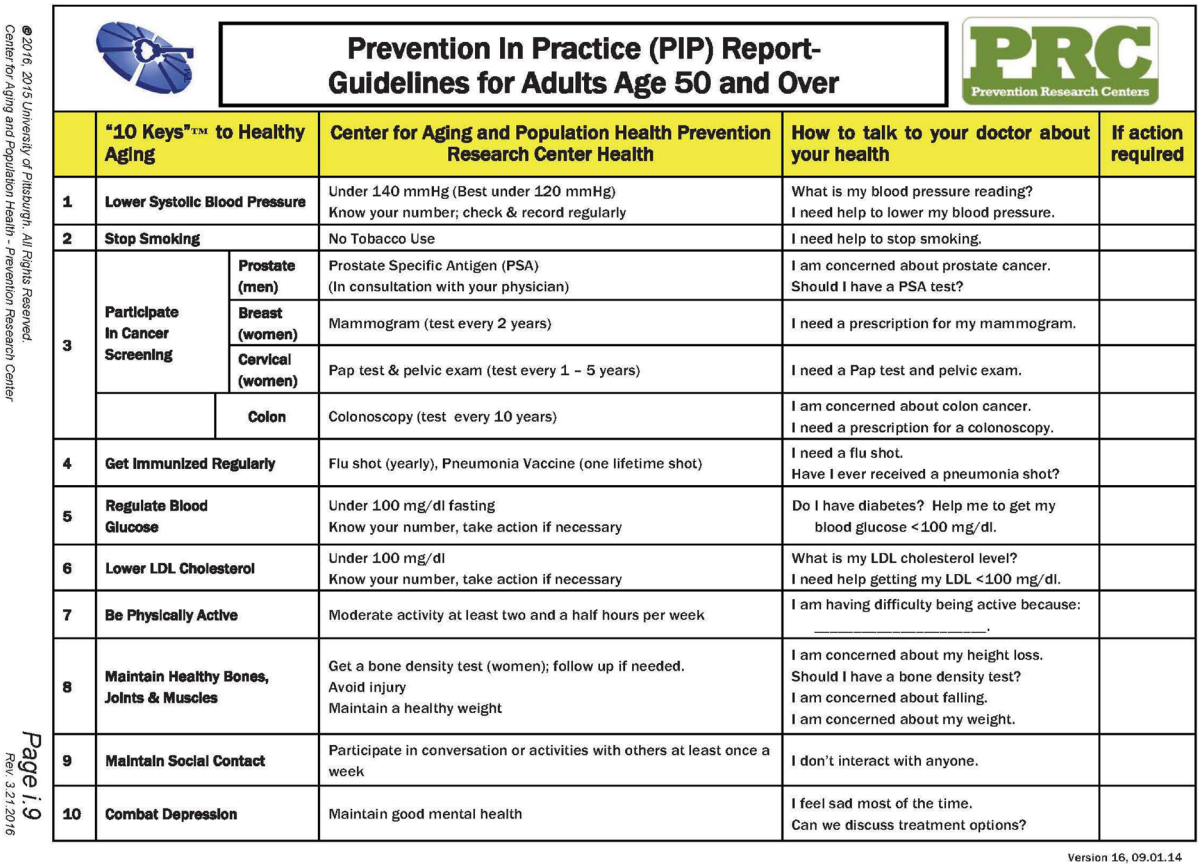
Site Identification

Communities with high morbidity and mortality in Allegheny County, Pennsylvania were targeted for recruitment. Morbidity and mortality rates were based on previous analyses that used data from the U.S. Bureau of the Census [3] and the Department of Health Vital Statistics, Pennsylvania (Department of Health Vital Statistics). Program sites were identified through networking at community events and referrals from community partners. Sites were matched on key community demographic characteristics derived from the U.S. Census data [28], including race and the proportion of the population ≥65 years and below the federal poverty level.

Potential community health workers were identified by sites or by word of mouth and participated in a 1-day training session provided jointly by the Arthritis Foundation and the University of Pittsburgh staff from the Center for Aging and Population Health-Prevention Research Center (CAPH-PRC). The community health workers were members of the local community who expressed interest in working with older adults. Most had a background in health or human services. Over a 2-year period, 77 community health workers were trained. All trained community health workers were required to be certified in CPR. They also received training in the "10 Keys"™ by completing an online educational module (http://www.caph.pitt.edu) (Center *for Aging and Population Health, University of Pittsburgh, Pittsburgh PA*. http://www.caph.pitt.edu/, 2016. Accessed April 15, 2016.). Ethical research conduct training was provided by CAPH-PRC staff, consisting of a 1-h session on ethics in human subjects' research, informed consent, social and educational research concepts, confidentiality, and study design. Case studies reflecting anticipated challenges of the research study were presented and discussed.

Population

The CAPH-PRC provided materials to support recruitment, including mailed brochures to age-eligible people within nearby zip codes and ads in newspapers, church bulletins, local newspapers, and websites. Interested members of the community either contacted the CAPH-PRC staff directly, or sites provided a list of interested participants who were subsequently called by the research staff. During this call, potential participants were given information about the program and were screened for eligibility. Eligibility criteria



Prevention In Practice (PIP) Report- Guidelines for Adults Age 50 and Over

PRC Prevention Research Centers

	"10 Keys"™ to Healthy Aging		Center for Aging and Population Health Prevention Research Center Health	How to talk to your doctor about your health	If action required
1	Lower Systolic Blood Pressure		Under 140 mmHg (Best under 120 mmHg) Know your number; check & record regularly	What is my blood pressure reading? I need help to lower my blood pressure.	
2	Stop Smoking		No Tobacco Use	I need help to stop smoking.	
3	Participate In Cancer Screening	Prostate (men)	Prostate Specific Antigen (PSA) (In consultation with your physician)	I am concerned about prostate cancer. Should I have a PSA test?	
		Breast (women)	Mammogram (test every 2 years)	I need a prescription for my mammogram.	
		Cervical (women)	Pap test & pelvic exam (test every 1 – 5 years)	I need a Pap test and pelvic exam.	
		Colon	Colonoscopy (test every 10 years)	I am concerned about colon cancer. I need a prescription for a colonoscopy.	
4	Get Immunized Regularly		Flu shot (yearly), Pneumonia Vaccine (one lifetime shot)	I need a flu shot. Have I ever received a pneumonia shot?	
5	Regulate Blood Glucose		Under 100 mg/dl fasting Know your number, take action if necessary	Do I have diabetes? Help me to get my blood glucose <100 mg/dl.	
6	Lower LDL Cholesterol		Under 100 mg/dl Know your number, take action if necessary	What is my LDL cholesterol level? I need help getting my LDL <100 mg/dl.	
7	Be Physically Active		Moderate activity at least two and a half hours per week	I am having difficulty being active because: _____.	
8	Maintain Healthy Bones, Joints & Muscles		Get a bone density test (women); follow up if needed. Avoid injury Maintain a healthy weight	I am concerned about my height loss. Should I have a bone density test? I am concerned about falling. I am concerned about my weight.	
9	Maintain Social Contact		Participate in conversation or activities with others at least once a week	I don't interact with anyone.	
10	Combat Depression		Maintain good mental health	I feel sad most of the time. Can we discuss treatment options?	

Version 16, 09.01.14

Page i.9
Rev. 3.21.2016

Fig. 1 Prevention in Practice (PIP) Report

included age ≥50 years, no surgery or cardiac event in the past 6 months, and no use of oxygen therapy. Those not interested in the research study were still invited to participate in the program. Those who participated in the research were younger (age 72.7 [SD = 7.8] years vs. 75.0 [SD = 9.8], $p = 0.004$), more likely to have college education (63.0 vs. 51.4%, $p < 0.001$), and more likely to report arthritis (83.4 vs. 75.0%, $p = 0.002$) than people attending the programs who did not consent to the research assessments. The two groups did not differ in baseline physical activity or the proportion of women or minorities. All participants signed the Arthritis Foundation release form and completed a survey of demographic information, self-reported arthritis diagnosis, and pre-program exercise patterns.

Interventions

The AFEP sessions were 60 min long and consisted of exercise and 3–5 min of health education about chronic disease risk factors. The exercise included a joint check, warm-up, active range-of-motion, strengthening, joint check, cool down, and relaxation. Sessions for the enhanced AFEP/"10 Keys"™ consisted of the same exercises and 10–20 min of health information and health behavior change strategies from the "10 Keys"™. The "10 Keys"™ is a health promotion behavior change program addressing the major risk factors for disease and disability, including blood pressure control; smoking cessation; immunizations; cancer screening; regulating blood glucose and cholesterol; physical activity; maintaining healthy bones, joints, and muscles; promoting social contact; and combating depression. The essential components of the "10 Keys"™ portion of the program included: (1) the Personal Goals and Action Steps for each "Key" and (2) the Prevention in Practice Report (Fig. 1). At the final session of the program, every participant received a certificate of completion and a manual from the Arthritis Foundation with a detailed description and diagram of each exercise. The AFEP/"10 Keys"™ participants also received the "*10 Keys*"™ *to Healthy Aging Resource Guide* (*Center for Aging and Population Health. The "10 Keys"™ to Healthy Aging Instructor Manual. Healthy Aging Resource Guide. 2016 ed. University of Pittsburgh, Pittsburgh PA*. http://www12.edc.gsph.pitt.edu/CHA_OAEP/, 2016. Accessed April 15, 2016.).

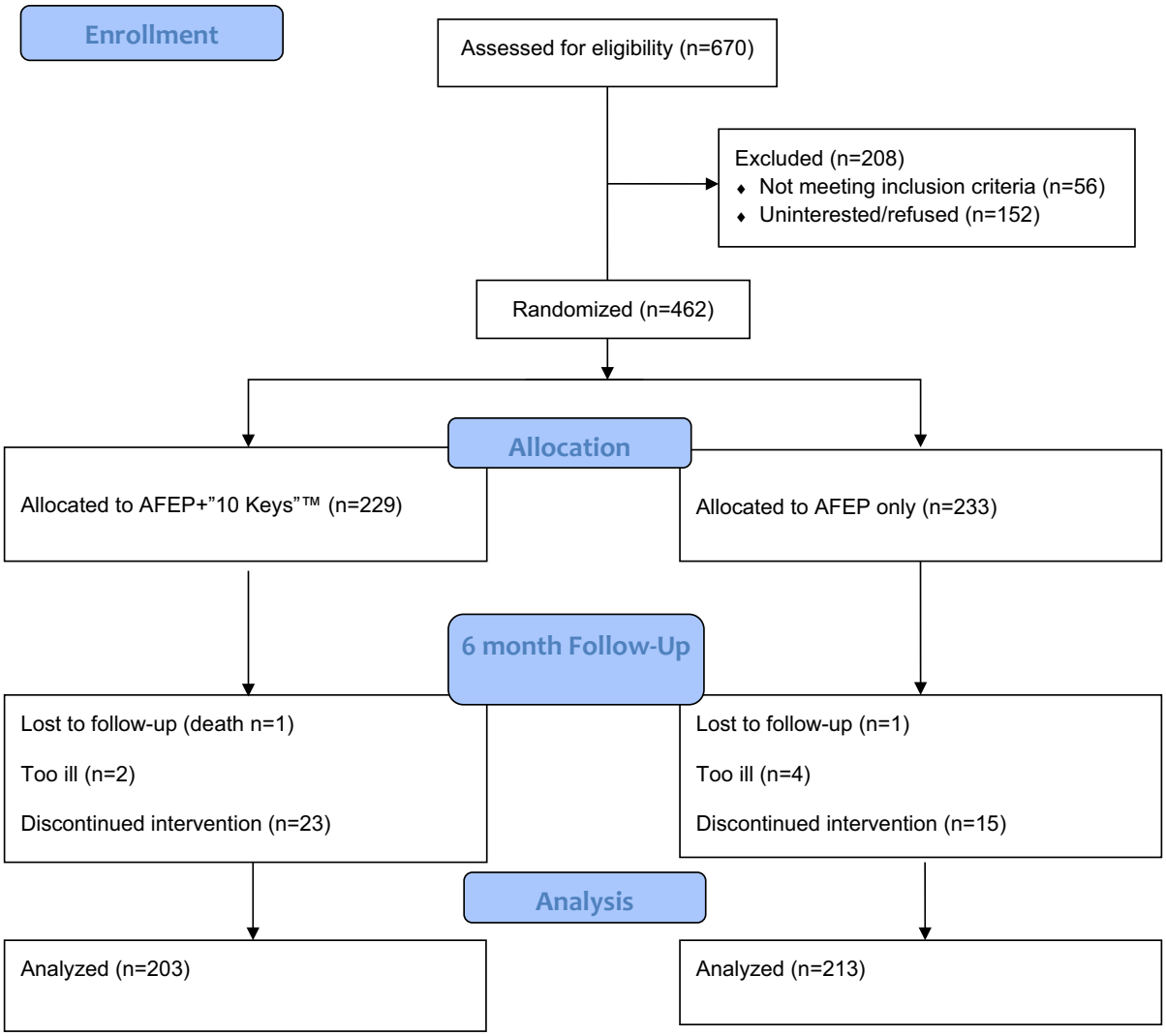


Fig. 2 CONSORT flow diagram

Maintenance

Sites randomized to the combined AFEP and "10 Keys"™ were also offered four monthly booster or maintenance sessions after the 10-week program. These sessions were added after the initial 10 weeks to enhance awareness and reinforce behavior change strategies.

Measures

Within the first week of the program, research staff obtained informed consent from the subset of participants expressing interest in the research study. The research study included a detailed assessment of health and function at baseline, post-program, 6 months, and 1-year to evaluate the effectiveness of the enhanced program (AFEP/"10 Keys"™) compared to AFEP alone. Assessments included height, weight, and blood pressure, the Short Physical Performance Battery (SPPB) [11, 12], and questionnaires preventive behaviors; Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index scales: pain, stiffness, and function [1, 2]; Stanford Patient Education Research Center Self-efficacy scale [16]; and the Preventive Services Use Self-efficacy Scale [13]. During the last session of the program, participants completed an anonymous survey to evaluate the instructor, exercises, health messages, and overall satisfaction with the program.

Statistical Analysis

Statistical analyses were conducted using SAS version 9.3 (SAS Institute, Cary, NC). Significance was set at 0.05 for two-sided hypothesis testing. Summary statistics were reported as mean and SD for continuous variables and frequency and percentage for categorical variables.

Table 1 Characteristics of study participants by intervention group: AFEP exercise vs. AFEP alone

Characteristics	Intervention AFEP +"10 Keys"™ (N = 229)	Control AFEP alone (N = 233)	P value
Socio-demographics			
Age, mean (SD), years	72.4 (7.6)	73.1 (8.0)	0.74
Women, n (%)	203 (88.7)	203 (87.1)	0.84
Race, n (%)			0.58
White	173 (77.2)	193 (83.2)	
Non-White	51 (22.8)	39 (16.8)	
Education, n (%)			0.54
High school or less	76 (34.2)	92 (39.7)	
Some college or higher	146 (65.8)	140 (60.3)	
Income, n (%)			0.21
<$25,000	92 (45.8)	111 (53.9)	
≥$25,000	109 (54.2)	95 (46.1)	
Chronic diseases			
Self-reported arthritis, n (%)	180 (81.5)	178 (79.5)	0.69
Confirmed diabetes, n (%)	60 (27.2)	58 (25.9)	0.77
Confirmed hypertension, n (%)	165 (72.4)	152 (67.3)	0.45
Health behaviors			
BMI, mean (SD), kg/m^2	30.9 (6.8)	31.4 (7.7)	0.51
Smoking status, n (%)			0.48
Non-smokers	120 (54.6)	113 (51.4)	
Former smokers	93 (42.3)	90 (40.9)	
Current-smokers	7 (3.2)	17 (7.7)	
Exercise routine, n (%)			0.05
Never exercise	13 (6.0)	38 (16.7)	
Exercise sometimes	119 (54.6)	124 (54.6)	
Exercise regularly	86 (39.5)	65 (28.6)	

BMI body mass index

Table 2 Physical performance and arthritis outcomes over time by intervention group

	Intervention AFEP +"10 Keys"™ mean (SD)			Control AFEP alone mean (SD)			P value[a]
	Baseline	Post	6 month	Baseline	Post	6 month	
SPPB total	9.7 (2.4)	9.9 (2.3)	9.9 (2.4)	9.3 (2.8)	10.0 (2.6)	10.1 (2.5)	0.07
SPPB 5 stand	2.8 (1.3)	2.9 (1.4)	2.9 (1.4)	2.8 (1.4)	3.2 (1.3)	3.1 (1.4)	0.26
SPPB gait speed	3.5 (0.8)	3.6 (0.7)	3.6 (0.7)	3.4 (0.9)	3.5 (0.8)	3.6 (0.8)	0.15
SPPB balance	3.3 (1.0)	3.5 (0.9)	3.4 (1.0)	3.1 (1.2)	3.3 (1.1)	3.5 (1.0)	0.48
WOMAC total	23.8 (17.9)	20.3 (17.2)	21.2 (17.4)	28.4 (16.9)	23.3 (14.7)	24.4 (17.5)	0.92
WOMAC pain	5.1 (4.1)	4.6 (3.9)	4.4 (3.8)	6.3 (3.7)	5.3 (3.5)	5.5 (4.0)	0.81
WOMAC stiffness	2.6 (1.8)	2.1 (1.6)	2.3 (1.7)	2.9 (1.8)	2.6 (1.6)	2.6 (1.8)	0.88
WOMAC function	16.1 (12.8)	13.6 (12.3)	14.5 (12.73)	19.0 (12.4)	15.6 (10.8)	16.3 (12.6)	0.88

SPPB short physical performance battery

WOMAC western ontario and mcmaster universities osteoarthritis index

[a]Group difference at 6 month controlling for baseline value

Hierarchical generalized linear models were used to assess program effects adjusting for social-demographic factors, prevalence of chronic diseases, and common health behaviors at baseline between two groups.

Analyses assessed group effects on SPPB or WOMAC as co-primary outcomes at 6 months controlling for baseline values. Within-group SPPB and WOMAC differences were analyzed by testing least square means of change scores at

Table 3 The change of physical performance and arthritis outcomes over time by intervention group

	Intervention AFEP +"10 Keys"™ mean (SD)		Control AFEP alone mean (SD)		P value[a]
	Post	6 month	Post	6 month	
SPPB total	0.3 (1.5)*	0.3 (1.7)	0.5 (1.5)*	0.6 (1.7)*	0.07
SPPB 5 stand	0.2 (1.0)*	0.1 (1.0)	0.3 (0.8)*	0.2 (1.0)	0.37
SPPB gait speed	0.03 (0.5)	0.1 (0.6)	0.1 (0.6)*	0.1 (0.6)*	0.11
SPPB balance	0.1 (1.0)	0.1 (1.0)	0.1 (1.1)	0.3 (1.1)*	0.37
WOMAC total	−3.0 (10.7)*	−2.0 (11.6)*	−3.9 (9.3)*	−3.3 (13.3)*	0.30
WOMAC pain	−0.4 (2.5)	−0.5 (3.2)*	−0.9 (2.4)*	−0.8 (2.9)*	0.13
WOMAC stiffness	−0.4 (1.4)*	−0.2 (1.5)	−0.4 (1.4)*	−0.4 (1.6)*	0.71
WOMAC function	−2.2 (7.8)*	−1.3 (8.3)*	−2.8 (7.1)*	−2.2 (10.1)*	0.39

SPPB short physical performance battery

WOMAC Western Ontario and McMaster Universities Osteoarthritis Index

*Significant within group difference comparing to baseline, $P < 0.05$

[a]Group difference controlling for time

follow-up in linear mixed models. For "10 Keys"™ outcomes, generalized linear mixed models were employed to examine group effects at 6 months controlling for baseline values using linear contrasts.

Results

In total, 670 program participants expressed initial interest in the research study, and 462 consented to participate. Of 670 screened, 56 did not meet eligibility criteria and 152 declined to participate. By the 6-month follow-up visit, 416 participants were evaluated, 203 in the enhanced program and 213 in AFEP alone (Fig. 2).

The study population had a mean age of 73 years and 88 % were women. Eighty percent self-identified as white, 18 % black, and the remainder as other race groups. Two-thirds of the population had some education beyond high school and half had an income above $25,000. There were no significant differences between the groups in sociodemographic characteristics, prevalence of common chronic health conditions, body mass index (BMI), or health behaviors (Table 1).

Table 2 shows the results of the primary outcomes of physical performance and arthritis outcomes assessed at baseline, post-program (10 weeks), and at 6 months. Using linear mixed models controlling for baseline values, there were no significant differences in SPPB or WOMAC between the two study arms at 6 months. As shown in Table 3, both groups experienced similar and significant improvements in physical performance and arthritis outcomes. Physical performance improved by 0.3 units in the AFEP/10 Keys group and 0.5 units in AFEP alone; WOMAC scores improved by 3.0 and 3.9 points in the two groups, respectively.

Table 4 shows the proportion of people achieving the goals of the "10 Keys"™ to Healthy Aging over the 6-month follow-up. For all components, improvements in the "10 Keys"™ were not significantly different between the two groups at 6 months controlling for baseline values. At 6 months, more participants had controlled hypertension in both groups, increasing from 60.1 to 76.7 % in the AFEP/"10 Keys"™ group and from 76.5 to 84.9 % in the AFEP alone group. Diabetes control was also improved, from 15.0 to 34.9 and 15.5 to 34.1 %, respectively. When examining subgroups of individuals who had the greatest opportunity to improve, such as those who had uncontrolled hypertension, diabetes, were smoking, had not had cancer screenings or immunizations, etc., improvements were seen in both groups, ranging from about 10 to 50 %. Again, however, there were no differences in these improvements between those who had participated in the combined AFEP "10 Keys"™ program vs. those who participated in the AFEP exercise program alone.

Finally, we explored interactions between sociodemographic factors and the treatment groups in order to determine whether those of lower education or income might have been more likely to benefit and found that the group differences did not vary by education or income status.

Discussion

These two interventions targeted older adults with arthritis who had limitations in physical function, comorbid conditions, and arthritis-specific symptoms including pain and stiffness. Participants in each intervention group showed similar improvements in these parameters over 6 months. In spite of our efforts to promote better function, reduce symptoms, and promote preventive health behaviors with

Table 4 Adherence to the 10 Keys to healthy aging: baseline and 6 month follow-up status by intervention group

10 Keys to healthy aging	Intervention AFEP +"10 Keys"™ N = 229		Control AFEP alone N = 233		P value[a]
	Baseline n (%)	6 month n (%)	Baseline n (%)	6 month n (%)	
1. Control blood pressure					
SBP <140 mmHg	131 (60.1)	122 (76.7)*	169 (76.5)	140 (84.9)*	0.85
Controlled hypertension (from 317 confirmed hypertension at baseline)	73 (44.2)	82 (70.7)*	99 (65.1)	84 (77.8)*	0.99
Improved hypertension (from 317 confirmed hypertension at baseline)		100 (57.8)		105 (58.0)	0.94
2. Stop smoking					
Not smoking	213 (96.8)	183 (98.4)	203 (92.3)	171 (92.4)	0.31
Stopped smoking (from 21 current smokers at baseline)		3 (50.0)		2 (13.3)	N/A
3. Participate in cancer screenings					
Mammogram	188 (96.4)	157 (96.9)	191 (98.0)	160 (98.2)	0.99
Start having mammogram (from 9 never had at baseline)		2 (33.3)		1 (33.3)	N/A
Colonoscopy	188 (85.5)	154 (83.2)	191 (85.7)	166 (87.8)	0.31
Start having colonoscopy (from 53 never had at baseline)		3 (10.3)		3 (12.5)	N/A
Pap test/pelvic exam	185 (94.9)	153 (94.4)	181 (93.3)	154 (95.1)	0.55
Start having Pap test/pelvic exam (from 21 never had at baseline)		6 (75.0)		9 (69.2)	N/A
4. Get immunized regularly					
Influenza vaccine	174 (79.1)	146 (78.5)	175 (78.5)	147 (77.8)	0.93
Start having influenza vaccine (from 77 without at baseline)		8 (22.2)		13 (31.7)	N/A
Pneumonia vaccine	169 (76.8)	149 (80.1)	168 (75.3)	145 (76.7)	0.57
Start having pneumonia vaccine (from 91 without at baseline)		9 (20.9)		9 (18.8)	N/A
5. Regulate blood glucose					
Glucose <110 mg/dl	148 (78.7)	132 (79.0)	154 (77.8)	130 (78.3)	0.82
Controlled diabetes (from 118 confirmed diabetes at baseline)	9 (15.0)	15 (34.9)*	9 (15.5)	15 (34.1)*	0.42
Improved diabetes (from 118 confirmed diabetes at baseline)		33 (19.6)		36 (21.3)	0.96
6. Lower LDL cholesterol					
LDLc <100 mg/dl	83 (44.2)	73 (44.2)	90 (45.2)	71 (42.8)	0.73
Lower LDLc to <100 mg/dl (from 175 LDL ≥100 mg/dl at baseline)		10 (11.6)		12 (13.5)	N/A
7. Be physically active					
Exercise at least 2½ h a week	140 (63.9)	103 (55.4)	96 (43.1)	93 (50.3)	0.94
Start to be active (from 166 not active at least 2½ h at baseline)		21 (32.3)		35 (34.7)	N/A
8. Build strong bones, muscle, joints					
Bone mineral density test	179 (81.0)	153 (82.3)	175 (79.2)	152 (80.4)	0.36
Start having bone test (from 76 never had at baseline)		12 (30.8)		4 (10.8)	N/A
Able to get up from chair	169 (77.2)	157 (84.9)	169 (76.8)	152 (80.9)	0.67
Became able to get up from chair (from 79 could not at baseline)		18 (45.0)		24 (61.5)	N/A
9. Maintain social contact					
At least once per week	206 (93.2)	172 (92.5)	203 (91.4)	173 (91.5)	0.93
Start to maintain contact (from 24 did not at baseline)		6 (66.7)		7 (46.7)	N/A
10. Combat depression					
Cheerful all/most of the time	165 (74.7)	149 (80.1)	146 (65.8)	126 (66.7)	0.30
Start to be cheerful all/most of time (from 103 did not at baseline)		16 (39.0)		24 (38.7)	N/A

*Significant within group difference at 6 month comparing to baseline, $p < 0.05$

[a]Group difference at 6 month controlling for baseline value

the enhanced program, improvements were not significantly different. Both groups had improvements in physical performance and arthritis outcomes. This was not unexpected given that both groups had an exercise intervention previously documented to be effective for individuals with arthritis [4]. The magnitude of these improvements was similar to that seen in our pilot study [25] and are considered to be clinically meaningful [15]. In addition to improved physical performance and arthritis outcomes, both groups had improvements in control of hypertension and diabetes. However, the rates of control and improvement in cholesterol, vaccine rates, and bone density screening were less than those previously seen in our report of the benefits of the "10 Keys"™ to Healthy Aging program [19]. Thus, it would appear that the exercise program itself was effective for hypertension and diabetes, as has been reported in other studies of exercise benefits [9, 10].

These benefits were achieved in a community setting with an intervention delivered by community health workers, making the programs more translatable than those requiring health professionals [24]. Community health workers have been shown to improve health outcomes in other groups such as children with asthma and patients with human immunodeficiency virus [20] and for prevention as well as treatment [14]. Given the increase in the aging population, needs for better prevention and limitations in health care resources, community health workers could make important contributions. The benefits achieved here provide a realistic view of the benefits of physical activity in the community, demonstrating a meaningful improvement in physical performance, arthritis outcomes, hypertension, and diabetes. The high level of community engagement in this model can support sustainability [26].

Several potential aspects of this study are important to consider in the planning of prevention programs for older adults. First, our intermediate outcomes did not detect differential improvements in the short 6-month time frame of the evaluation, but further improvements might have occurred with longer follow-up. Potential downstream effects in the prevention of major disabling conditions such as myocardial infarction, stroke, and hip fracture are possible. Second, we may not have had adequate reach to individuals who were less likely to participate in community-based research programs, and these individuals may be those at greatest need for improvement in physical performance, arthritis outcomes, and/or preventive health behaviors. Similar to other programs [19, 21, 23], participants tended to have higher levels of education and have better compliance with preventive behaviors than the general population. The high rates of blood pressure control, glucose regulation, non-smoking and many of the other prevention targets suggest that participation in the research assessments was biased towards healthier persons.

It is possible that our efforts and time dedicated to the added prevention messages were insufficient to achieve behavior change. The time devoted to the "10 Keys"™ was limited compared to the original program [19]. The original "10 Keys"™ program included 3.5 h per person of individual in-person and telephone contacts to actively address problem solving to achieve written goals [19], whereas individual follow-up time in this program was not provided. By design, this aspect of the program was more limited in the AFEP/"10 Keys"™ program, with only group-based follow-up. The group exercise component appears to have been the key ingredient of the program. The community health workers who delivered the programs were not university research staff as in our previous report [19], but we believe that it is the individual follow-up time that would be more critical for behavior change.

Finally, we think it is important to point out that our programs did not address the rather high average BMI in the participants. We are currently testing a weight loss program to determine whether this would result in further improvements in physical performance, and cardiometabolic risk factors [10, 18, 22, 31, 32].

Public Health Implications

Because older adults are at risk for multiple chronic disabling conditions, it is imperative that programs consider the problem of multimorbidity. Community health workers can be trained to successfully deliver prevention interventions to older adults in community settings. Based on these results, we believe that next steps should include greater efforts to reach individuals in need of intervention with greater emphasis on goal setting and follow-up.

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Compliance with Ethical Standards

Conflict of Interest Anne B. Newman, Steven M. Albert, Robert M. Boudreau, Jane Brandenstein, Molly B. Conroy, Mini E. Jacob, Elizabeth A. Rodgers, Elizabeth A. Schlenk, Joni Vanderbilt, Lei Ye, Janice C. Zgibor have no conflicts to disclose.

Human Participation Protection Human subjects: The University of Pittsburgh Institutional Review Board approved the study. Because the intervention was a research study that took place in community sites and was delivered by a lay member of the community, instructors were required to complete training in ethical conduct of research, which was provided by CAPH-PRC research staff. The training consisted of a 1-h session on ethics in human subject research. The content included materials available from the Institutional Review Board and those developed by CAPH-PRC specific to the research study. Subject matter included the Belmont Principles (United States. National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research., 1978), informed consent, social and educational research concepts, confidentiality, and study design. Case studies reflecting anticipated challenges of the research study were presented and discussed.

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