

ORIGINAL ARTICLES

Predictors of Physical Activity in Community-dwelling Elderly White Women

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OBJECTIVE: To describe patterns of physical activity and to determine factors associated with engaging in regular exercise, especially walking, in elderly white women.

DESIGN: Cross-sectional study of 9,442 independently living elderly white women aged 65 years and over participating in the Study of Osteoporotic Fractures.

MEASUREMENTS AND MAIN RESULTS: We studied the association between lifestyle habits, social factors, health status and self-reported physical activity (assessed by modified Paffenbarger scale) during the past twelve months. Walking was the most common form of exercise: 4,837 (51%) women reported doing so a mean of 12 (SD = 10) blocks per day, 3.9 (SD = 2.9) times per week. Other common activities were gardening (35%), swimming (16%), and bicycling (13%). Less than a third of women reported engaging in medium- or high-intensity exercise in the past year. In a multivariate age-adjusted analysis, factors independently ($P < .01$) associated with walking for exercise included greater than high school education (52% vs 48%), history of physical activity for exercise at ages 30 years (51% vs 46%) and 50 years (51% vs 45%), and stronger social network (51% vs 47%). Women who were current smokers, obese, or depressed were less likely to take walks for exercise. Marital status, self-reported arthritis, current estrogen use, and a history of falls in the past year were not independently associated with taking walks for exercise.

CONCLUSIONS: In this healthy cohort, walking for exercise is associated with other positive health behaviors. Given the mounting evidence about the health benefits of walking, and since many of these community dwelling women can and do walk for exercise, but rarely engage in other common prescribed physical activities, clinicians might best focus their efforts on encouraging walking.

KEY WORDS: aged; elderly women; exercise; physical activity; walking.

J GEN INTERN MED 2001;16:721-727.

There is mounting evidence that physical activity is beneficial for older adults. All-cause mortality rates are lower in men and women who are more physically fit.¹ Postmenopausal women who report regular physical activity had a 23% lower death rate during 7-year follow-up than women who did not exercise regularly.² In another study, leisure-time physical activity was associated with a 28% lower risk of death in individuals over age 60.³ In addition to its association with total mortality, physical activity has been associated with decreased coronary heart disease (CHD) mortality in women.⁴⁻⁶ Regular physical exercise has been suggested to be beneficial in several chronic conditions: hypertension,⁷⁻¹¹ non-insulin-dependent diabetes mellitus,^{12,13} obesity,¹⁴⁻¹⁷ falling,^{18,19} and osteoporosis and associated hip fractures.²⁰⁻²⁴ Finally, exercise may relieve symptoms and improve function among older individuals with osteoarthritis,²⁵⁻²⁷ may improve depressive symptoms and promote well-being,²⁸⁻³² slow the rate of functional decline,³³ and improve physical fitness.³⁴

Many adults do not get adequate amounts of physical activity, and studies in younger individuals have shown that the likelihood of engaging in regular physical activity decreases with increasing age. In cross-sectional studies, physical activity decreases with age, but there are few data on those aged 65 and older. One study of 1,411 individuals aged 20 to 74 found that adoption of vigorous activity decreased with age, but there was no relation between age and adoption of moderate activity, such as walking. Maintenance of physical activity was not related to age.³⁵

Although prior physical activity recommendations have promoted vigorous aerobic activity, increasing evidence suggests that moderate-intensity physical activity is also beneficial. Two recent studies showed that a lifestyle physical activity intervention was as effective as a structured exercise program in improving cardiovascular risk factors.^{36,37} A new report from the Nurses' Health Study suggests that brisk walking may be as effective in reducing CHD risk as vigorous exercise. Walking was inversely associated with the risk of coronary events. Women who walked 3 or more hours per week at a brisk pace had a

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relative risk of CHD 0.65 (confidence interval [CI], 0.47 to 0.91) times that of women who walked infrequently. Walking briskly and vigorous exercise were each associated with similar reductions in CHD, although the ability to assess the role of vigorous exercise was limited because only 26% of the cohort engaged in vigorous exercise regularly.³⁸

National health objectives for physical activity and fitness were recently described in *Healthy People 2010*.³⁹ According to this report, women are less active than men at all ages, and by the age of 75, 1 in 2 women engage in no regular physical activity. Healthy People 2010 goals include an increase in the proportion of adults who engage regularly, preferably daily, in moderate physical activity for at least 30 minutes per day.³⁹ The current recommendations of the Centers for Disease Control and Prevention and the American College of Sports Medicine are that each U.S. adult should accumulate 30 minutes or more of moderate-intensity physical activity on most if not all days of the week.⁴⁰ These recommendations, which are much more lenient than prior recommendations, are primarily directed at the large number of U.S. adults who engage in no leisure time physical activity.

Walking has many health benefits and is the most commonly performed physical activity in older adults.³² Although the elderly are at highest risk for many of the chronic conditions for which exercise, in particular, walking, is beneficial, most studies have not focused on factors associated with physical activity in the elderly population. To characterize the patterns and predictors of physical activity in a community-based population of older women, we compared women who participated in regular exercise, particularly walking, with those who did not. Determining the factors that are associated with performance of regular exercise in elderly women may facilitate the design of future interventions to increase participation in regular exercise in this age group.

METHODS

A total of 9,704 ambulatory women aged 65 years or older were recruited from September, 1986 to October, 1988 for the Study of Osteoporotic Fractures, a prospective study of risk factors for osteoporosis, hip fractures, and Colles' fractures in older women.⁴¹ Recruitment occurred at 4 clinical centers in Portland, Baltimore, Pittsburgh, and Minneapolis. Methods of recruitment included the use of membership lists for the Kaiser-Permanente Health Plan (Kaiser-Permanente Center for Health Research, Portland, Oregon); membership lists for Group Health Incorporated, lists used in the Hypertension Detection and Follow-up Study and the Systolic Hypertension in the Elderly Program, and jury selection lists for Hennepin County (University of Minnesota, Minneapolis, Minnesota); 1985 voter registration lists for the Monongahela Valley (University of Pittsburgh, Pennsylvania); and holders of driving licenses and identification cards within

Baltimore County (University of Maryland, Baltimore). Women in all 4 areas received a letter and a brochure inviting them to participate in the study. African-American women were not included because of their low incidence of osteoporotic fractures. Women unable to walk without the assistance of another person were also excluded. For this particular analysis, women who had severe difficulty walking on level ground or who had severe gait difficulties that would preclude involvement in regular exercise ($n = 262$) were excluded.

Participants completed a questionnaire that inquired about lifestyle habits, health status, and social factors. Lifestyle habits included smoking, use of alcohol, and current estrogen use. Health status variables included history of arthritis, perceived health status compared with other women of similar age (very poor/poor/fair vs good/excellent), number of falls in the past year, and fear of falling. Social factors included level of education, mood, and social support. Mood was assessed by score on the Geriatric Depression Scale (GDS).⁴² A score greater than 5 on the GDS indicates mild depression, and a score greater than 10 indicates severe depression. Measures of social support included marital status, living situation (alone vs with others), and social network (number of relatives and friends with whom participant is in contact, frequency of contact, and whether or not participant feels close to these individuals). All of these were measured at baseline (1986–1988) except for social network and mood, which were measured at a follow-up visit (1988–1990).

Standing height was measured at end inspiration with a Harpendon Stadiometer. Weight was measured using a standard balance beam scale. Body mass index was then calculated (kg/m^2) and categorized according to the National Center for Health Statistics' definition of overweight as a body mass index of ≥ 27.3 kg, which corresponds to a body weight of 20% above desirable weight.⁴³

Leisure time physical activity was measured using a modified Paffenbarger scale.⁴⁴ Women were given a list of 33 activities from which to choose. Activity for the past week and averaged over the past year was assessed. Women were asked to list the type of activity, the average number of weeks per year, the number of times per week and the average number of minutes per episode of activity. Women were asked specifically if they took walks for exercise, and the frequency and duration. Activities were classified by intensity level. Examples of high-intensity activities included jogging and singles tennis; medium-intensity activities included doubles tennis, swimming, and bicycling; and low-intensity activities included walking and gardening. The average number of flights of stairs climbed per day and the number of city blocks walked per day (assuming 12 blocks = 1 mile) were also recorded. Activities of daily living were assumed to be similar among these community-dwelling women and were not included in this total. In addition, women were asked about their participation in sports and recreation at ages 30 and 50.

Table 1. Characteristics of 9,442 Older Women in Baltimore, Portland, Pittsburgh, and Minneapolis, Mean Age = 71.7 ± 5.3 Years*

Characteristic	n†	%
Social		
≤High school education	5,862	62
Married	4,662	49
Lives alone	3,908	41
Strong social network	4,810	51
Depressed mood		
Mild	571	8
Severe	100	1
Lifestyle habits		
Current smoker	936	10
Drinks >1 alcoholic drink per week	2,902	31
Current estrogen use	1,303	14
Overweight (BMI ≥ 27.3)	3,551	38
Engaged in leisure time physical activity		
Age 30	6,541	69
Age 50	6,726	71
Health		
Self-rated health: fair/poor	1,505	16
History of arthritis	5,793	61
≥1 Fall in past 12 mo	2,780	29
Fear of falling	4,229	45
Has physician	8,913	94
Current physical activity		
Takes walks for exercise	4,837	51
Currently engages in physical activity		
Low-intensity	7,703	77
Medium-intensity	2,852	30
High-intensity	328	3
Ten most common physical activities		
Walking	5,787	61
Gardening	3,260	35
Swimming	1,491	16
Bicycling	1,237	13
Calisthenics	930	10
Bowling	840	9
Dancing	832	9
Golf (walking, no cart)	440	5
Hiking	324	3
Yoga and stretching	305	3

* Total N = 9,442. Data available for mood on 7,415 women.

† Plus-minus values are mean ± standard deviation.

Two dependent variables were used: took walks for exercise (yes/no) and engaged in medium or high intensity activity at least once during the past year (yes/no).

Continuous data are presented as mean ± standard deviation (SD). Data analysis was performed with the Statistical Analysis System (SAS Institute Inc., Cary, NC). Univariate analyses included χ^2 , *t* tests, and ANOVA. Linear regression and logistic regression were used for multivariate analyses and to confirm independence of factors. Statistical significance was set at *P* = .05 (2-sided).

To estimate the rates associated with a particular variable (such as smoking), a logistic risk model that included "average" values for all other variables was used. For continuous variables, average was defined as the mean value of the population. For dichotomous variables, average was defined as the proportion of the population having a given characteristic. These average values were generally relatively similar to the unadjusted percentages, and for simplicity we report only these average values in the multivariate analyses and tables.

RESULTS

Characteristics of study participants are described in Table 1. Women in this study were generally healthy, with a mean age of about 72 years; over one quarter were 75 or older. Few of the women reported current cigarette smoking. Most of the women rated their health as good or excellent. Over half reported a strong social network. Few women were mildly (8 percent) or severely (1 percent) depressed. However, over one third of women were overweight. Over two thirds of the women reported participation in leisure time physical activities at ages 30 and 50 (Table 1). Participants were equally distributed among clinic sites. The 10 most commonly reported physical activities are listed. Walking, gardening, swimming, and bicycling were the most commonly performed physical activities.

Age-related decreases were seen for all types of physical activity, and are shown in Table 2 for the 4 most common types of activity and for participating in medium- or high-intensity activity. For example, 56% of women aged 65 to 69 reported walking for exercise compared with 40% of those aged 80 and over. The distance in number of blocks walked declined with age (13.1 blocks in the 65–69-year-old age group vs 9.3 blocks in the ≥85-year-old age group; *P* < .001), although the frequency of walking

Table 2. Percentage of Older Women in Baltimore, Portland, Pittsburgh, and Minneapolis Who Performed Common Physical Activities Any Time in the Past Year by Age Group*

Age	n	Walking, %	Gardening, %	Swimming, %	Bicycling, %	Participates in Medium- or High-intensity Exercise, %
65 to 69	4,066	66	38	20	16	36
70 to 74	2,968	62	35	16	14	31
75 to 79	1,496	54	31	11	9	21
80 to 84	721	50	23	5	7	14
≥85	190	46	20	2	5	15

* χ^2 for trend of declining activity with age: all *P* < .001.

Table 3. Factors Associated with Taking Walks for Exercise and with Engaging in Medium- or High-intensity Activity in 9,442 Older Women

	Take Walks for Exercise*, %	Engage in Medium- or High-intensity Physical Activity†, %
Demographic		
Clinic site		
Minneapolis	60	37
Portland	59	32
Pittsburgh	45	33
Baltimore	40	19
Social		
Education		
High school or less	48	23
>High school	52	34
Strong social network		
Yes	51	30
No	47	25
Depressed mood (data available on 7,415 women)		
No	50	NS
Mild or severe	44	
Lifestyle habits		
Smoking		
Current	34	NS
Past or never	51	
Overweight		
Body mass index ≥27.3	46	25
Body mass index <27.3	52	29
Estrogen use		
Current	NS	30
Ever/never		27
Regular physical activity at age 30 years		
Yes	51	25
No	46	28
Regular physical activity at age 50 years		
Yes	51	18
No	45	30
Takes walks for exercise		
Yes	N/A	32
No		22
Health		
Self-rated health		
Good/excellent	NS	28
Fair/poor		21
Fear of falling		
Yes	NS	24
No		30

* All rates were adjusted for age and clinic site, using logistic regression models and calculated for "average" woman who differed only with respect to the variable in question. Percentages are shown for all factors that were independently associated with taking walks for exercise in multivariate analysis ($P < .01$).

† All rates were adjusted for age and clinic site, using logistic regression models and calculated for "average" woman who differed only with respect to the variable in question. Percentages are shown for all factors that were independently associated with medium- or high-intensity physical activity in multivariate analysis ($P < .05$).

NS, not significant; N/A, not applicable.

(average of 3.9 times per week) did not change ($P = .8$). There were significant ($P < .01$) differences among clinic sites in the proportion of women taking walks for exercise. Women in Minneapolis ($n = 1,440$ or 60%) and Portland ($n = 1,378$ or 59%) walked more than women in Pittsburgh ($n = 1,064$ or 45%) or Baltimore ($n = 955$ or 40%). Given these strong relationships, all further analyses are adjusted for age and clinic site.

Walking for Exercise

Over 60% of women reported walking for exercise sometime in the past year, whereas just over half of the women ($n = 4,837$) reported currently walking for exercise. Women who walked for exercise did so a mean of 3.9 (± 2.9) times per week, with a mean daily distance of 12 (± 10) blocks or 1 mile.

Several factors in addition to age and clinic site were independently associated with walking for exercise (Table 3). Social factors included greater than high school education and stronger social network. Although women with a stronger social network were more likely to take walks for exercise, those who lived alone were not less likely to do so. Lifestyle habits associated with taking walks for exercise included history of physical activity for exercise at ages 30 and 50. Current smokers, obese women, and depressed women were less likely to take walks for exercise. Other factors that were not independently associated with taking walks for exercise included self-perceived health status, history of arthritis, history of falls or fear of falling, current estrogen use, and alcohol use.

The rate of walking differed by month of enrollment, ranging from 46% to 56%. The highest rate (56%) was reported in April; the lowest rate was reported in June (46%).

Medium- and High-intensity Activity

Over three quarters ($n = 7,703$) of the participants reported engaging in some type of low-intensity activity in the past year, while <5% ($n = 328$) of participants reported engaging in any type of high-intensity physical activity over that time. The frequency of participation in medium- or high-intensity exercise declined markedly with each succeeding age group (Table 2).

As expected, many of the factors associated with engaging in medium- or high-intensity activity were also associated with taking walks for exercise (Table 3). These included education, history of physical activity, social network, and obesity. However, smoking and mood, which were associated with taking walks for exercise, were not independently associated with engaging in medium- or high-intensity activity. By contrast, several factors were just associated with performing medium- or high-intensity activity. Women who had a higher self-rated health, who consumed more than 1 alcoholic drink per week, who currently used estrogen, or who were not afraid of falling were more likely to engage in medium- or high-intensity activity. Factors not associated with engaging in

medium- or high-intensity activity included history of arthritis and history of falls. Women who walked for exercise were more likely to engage in medium- or high-intensity physical activity.

DISCUSSION

Walking is one of the most common forms of physical activity among older adults^{32,45} and has many health benefits. In this healthy cohort, 60% of the participants took walks for exercise in the past year, averaging a mile approximately 4 times a week. Walkers were more likely to engage in medium- or high-intensity exercise, consistent with the results of a previous study that showed that walkers were more likely to engage in nearly every form of exercise.³² Other popular physical activities included gardening, swimming, and bicycling. Consistent with previous reports, participation in all activities decreased in older age groups.⁴⁶⁻⁴⁹

Walking was associated with other positive health behaviors, such as maintaining ideal body weight and not smoking. Current smokers were less likely to take walks for exercise than any other group. Interestingly, estrogen use, which has been associated with positive health behaviors,⁵⁰ was not independently associated with taking walks for exercise, although it was associated with engaging in medium- or high-intensity exercise. Similarly, moderate alcohol use was associated with engaging in medium- or high-intensity exercise, although not with taking walks for exercise. These results are consistent with another longitudinal study of elderly individuals where moderate alcohol consumption and not smoking were associated with maintenance of mobility over the 4-year follow-up period.⁵¹

Past exercise behavior was associated with current walking and engaging in medium- or high-intensity activity. A history of physical activity at age 50 seems to be a particularly important correlate of participation in medium- or high-intensity activity later in life. Current rates of physician counseling about exercise are low^{52,53} Clinicians should consider counseling about exercise habits in their perimenopausal patients in order to establish exercise patterns that may persist in later years.

Women with a stronger social network walked more than those without one. This result is in agreement with that of Sallis et al., that women's adoption of exercise is influenced by family and friend support.⁵⁴ Our measure of social network included living situation, marital status, and social network. Living with others, however, was not independently associated with taking walks for exercise. Hence, it appears that other components of the social network may be more important. The relationship between walking and strong social network need not be causal. In fact, it may be effect-cause: individuals who are out walking may meet and socialize with others more than those who are sitting at home. However, regardless of the direction of the association, intervention directed toward one of them may result in positive changes in the other. For

this and for many other reasons, clinicians caring for older adults should inquire about and consider intervention in both social support and exercise habits.

Women who were depressed were less likely to walk for exercise, perhaps because they are less motivated to do so. Conversely, walking may improve mood and decrease symptoms of depression. Cohort studies have shown that low levels of physical activity are a predictor of subsequent depression and suggest a dose-response effect.^{28,29} In a randomized study of sedentary women, a 15-week program of moderate exercise improved general psychological well-being.⁵⁵ The association between walking and depression may be mediated by a third unmeasured variable such as health status such that individuals who are healthy might be more likely to exercise and less likely to be depressed. We cannot eliminate this possibility, since we adjusted for self-reported, not actual, health status. Since the nature of the association between depression and walking is unclear and since there are generally no contraindications to encouraging exercise in depressed individuals, it would be prudent for clinicians to encourage depressed patients to walk for exercise.

There were striking differences in rates of walking and rates of engaging in medium- or high-intensity activity between the clinics. A significantly higher proportion of women in Minneapolis and Portland walked for exercise compared with those in Baltimore and Pittsburgh. For example, 60% of women in Minneapolis (some of whom were recruited from health maintenance organizations) took walks for exercise compared with 40% in Baltimore (who were recruited from population-based listings). The reasons for these differences are unclear. Women who belong to health maintenance organizations may be more health conscious. Although women in Portland might be more likely to walk due to a milder climate, this would not explain the higher rates of walking in Minneapolis. Bad climate is an unlikely explanation for any of the observed differences in walking, given that 50% of women who enrolled in January reported walking for exercise, whereas only 46% of women who enrolled in June took walks. There may be other differences between the participants at the different sites that we did not measure.

Women with greater than a high school education were more likely to walk and more likely to engage in medium- or high-intensity activity. This is similar to a finding in the Alameda County study that men and women with less than a college education showed a greater decline in physical activity over the 9-year follow-up period.⁵⁶ Although individuals who are less educated might be more likely to engage in strenuous jobs involving manual labor, they may have had fewer opportunities to pursue leisure time physical activities. Exercise counseling by physicians may also be a factor: in a recent study of physicians and exercise counseling, physicians were more likely to counsel college graduates and individuals with higher incomes than they were to counsel those in lower socioeconomic groups.⁵²

In this study, self-reported arthritis did not interfere with walking for exercise, nor did it interfere with participation in medium- or high-intensity activity. Many of these older women would be expected to have arthritis of the knee or hip, which is often thought to interfere with walking. Several studies have shown that regular moderate exercise programs are associated with symptom relief and improved function among people with osteoarthritis.^{26,27,57} Our results are consistent with the results of a randomized trial that found that supervised fitness walking actually improved functional status in patients with osteoarthritis of the knee.⁵⁸

Some previous studies suggested that lack of physical activity in individuals aged 70 and older was associated with an increased risk of falling.¹⁹ In this cohort, neither actual falls nor fear of falling was associated with taking walks for exercise or total kilocalories expended per week. Regardless of actual falls, women who were afraid of falling were less likely to engage in medium- or high-intensity exercise. Fear of falling appears to be a more important factor in the decision to engage in vigorous physical activity than in the decision to take walks for exercise.

There are several limitations to this study. The participants were ambulatory volunteers and may not be representative of all community-dwelling women. They are, however, representative of the reasonable target population for exercise promotion. We have no information on exercise habits in African-American women who were not recruited for this study. Mood and social support were assessed at the second clinic visit, whereas the other variables were assessed at baseline. Because this was a secondary data analysis of a study focused on osteoporotic fractures, psychosocial and behavioral factors not measured in the original study cannot be included. Physical activity data were gathered at baseline during the Study of Osteoporotic Fractures, and it is possible that overall patterns of physical activity have changed since that time; however, data from *Healthy People 2010* show that the proportion of adults engaging in moderate-intensity physical activity 3 or more times per week did not change significantly between 1990 and 1997.³⁹

This population-based study of physical activity patterns in older women may have important clinical implications. Encouraging physical activity at earlier ages may influence exercise behavior in older adults. Low levels of social support and depression are associated with low levels of physical activity, and the nature of these associations deserves further investigation. Self-reported arthritis and history of falls do not interfere with taking walks for exercise. Physician counseling about exercise is very important. Rates of physician counseling about exercise are currently quite low,^{52,53} particularly among physicians who do not feel successful in their ability to effect changes in exercise behavior.⁵³ Since many of the community-dwelling older women in our study can and do walk for exercise, but rarely engage in other commonly prescribed physical activities,

clinicians might best focus their efforts on encouraging walking.

Dr. Walsh was a fellow in General Internal Medicine at the Veterans Affairs Medical Center in San Francisco when this work was done.

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