

Functional Fitness, Disease and Independence in Community-Dwelling Older Adults in Western Wisconsin

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ABSTRACT

Objective: Older adults are at higher risk for developing chronic conditions such as diabetes, heart disease, or arthritis. Despite the aging process, maintaining independence is a major goal for older adults. Functional fitness has been found to be predictive of one's ability to perform necessary everyday activities needed to maintain independence. We conducted functional fitness assessments with community-dwelling older adults and correlated the findings to other participant characteristics.

Methods: Participants completed 6 functional fitness tests and a health-screening questionnaire. Test performance was compared across demographic, behavioral, chronic illness, and activities of daily living categories.

Results: One hundred sixty nine adults over age 50 completed the tests. Thirty-seven percent performed at or above the population norm on all tests. There was a significant positive correlation between test performance and activities of daily living ($r=0.3520$, $P=0.0001$). In multivariate analysis, the best model to predict test performance included education, self-rated health, obesity, diabetes, and activities of daily living.

Conclusions: An objective test, such as the one reported here, may be helpful in predicting loss of independence. However, health care providers, using a few questions based on this study's key findings, may be able to screen for patients with poor functional status that are at risk of losing independence.

INTRODUCTION

Aging is currently the single most important demo-

graphic trend in the United States. Americans are living longer than ever before. Persons who survive to age 65 today can expect to live, on average, nearly 18 more years.¹ Arthritis, one of the most common chronic diseases affecting adults in the United States, comprises the leading cause of disability in this age group.² The prevalence of arthritis increases with age and affects approximately 60% of the population aged 65 and older.³ Thus, the impact of the disabling effects of arthritis on a longer-living society poses challenges that must be answered by the entire spectrum of health care today.

Lack of appropriate levels of physical activity can lead to declines in physical and physiological function that may affect the ability of people to perform functional activities. This potential impairment is important to all populations, but particularly so for older adults. Data from the 2002 National Health Interview Survey (NHIS) showed that 74% of US adults age 65-74 did not engage in any regular leisure-time physical activity; 83% of those age 75 or older were not regularly active. For all age groups, the 2002 NHIS found that women were less likely than men to engage in regular leisure-time physical activity.⁴

A staggering correlate of an aging population is that 40% of persons over 65 years report limitations in their ability to conduct the simple activities of daily living (ADLs).⁵ ADLs refer to a set of basic, everyday tasks, performance of which is required for personal self-care and independent living.¹ Many older adults who have become increasingly sedentary may be performing at their maximum capacity when doing normal daily activities and are at risk for losing independence or becoming disabled.⁶ Additionally, many are at risk for falling. It has been widely reported that sedentary behavior and lack of physical activity compromise health and physical function.

How people see their own well-being also influences their physical function and overall health. The concept

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of self-rated health, first advanced by Suchman, Phillips, and Streib in 1958,⁷ is widely accepted as a sensitive and reliable measure of health status. Self-rated health is conceptualized as a global measure and is measured most often using a 5-level scale ranging from excellent to poor.⁸ There is a highly correlated relationship between mortality and low self-rated health. In an authoritative review, Idler and Benyamini⁹ showed that global self-rated health independently predicted mortality even after accounting for known risk factors in 23 of 27 previous studies.

There is little debate about the importance of functional disability, particularly the inability to independently perform ADLs, as a predictor of mortality.¹⁰⁻¹³ Accordingly, “functional fitness”—the opposite of functional disability—is an important concept for older adults. Functional fitness is defined as having the physical capacity to perform normal everyday activities safely and independently without undue fatigue.¹⁴

Rikli and Jones have developed the Senior Fitness Test, a tool that has become one of the standard fitness assessments used with older adults.¹⁴ The Senior Fitness Test is a comprehensive assessment instrument that provides continuous-scale measures. All individual tests within the protocol were assessed for content-related validity, criterion-related validity, construct validity, and reliability against standard parameters. Rikli and Jones have published age- and gender-specific norms for each test based on research involving over 7000 older adults in 21 states.¹⁵ They indicate that approximately 70% of older adults are independent but have generally low activity levels that may cause physical declines leading to frailty.¹⁴ Identifying these individuals and providing an intervention plan is key to helping the individual maintain independence as long as possible.

Gundersen Lutheran Health System in La Crosse, Wis, offers “healthy aging programs” as part of its service plan, including exercise programs specifically designed and developed for the older adult population. A Functional Fitness Assessment is also part of ongoing programming offered by the health system, and has been offered annually over the past 4 years to older adults in the service area. Participants were assessed to correlate functional fitness with ADLs, self-rated health, and other health issues, and the findings are reported here.

METHODS

Test Sites

Testing took place in May in each of 4 years. Test sites were chosen each year based on accessibility and space

considerations. The first year, testing was done at a local senior center, the second year at Gundersen Lutheran Health System’s Education and Wellness Center, the third year at the University of Wisconsin-La Crosse, and the fourth year at a local church, in conjunction with a Wellness Expo for older adults.

Participants

Participants were recruited from Gundersen Lutheran Health System’s senior membership program “Care Connection,” from its exercise programming for older adults (“Swing into Shape”), and through advertising in the local media, mailings, and flyers. Adults any age could participate; however only those over age 50 were included in the analysis described here. Each participant was required to sign an informed consent form and to participate in a pre-screening process that involved completing a questionnaire and having their blood pressure checked, followed by a consult with an exercise physiologist.

Questionnaire

Participants completed a 4-page questionnaire prior to participation, which included demographic information (age, gender, education level, marital status, and living arrangements), and current behaviors (smoking status and level of physical activity). In addition, participants indicated if a health care provider had ever told them they had 1 or more medical conditions listed in the questionnaire, if they had fallen in the past year, and the number of prescription medications they were taking.

Participants were asked to rate their overall health (excellent, very good, good, fair, or poor), and whether or not they could do the following ADLs without assistance: getting in and out of a car, grocery shopping, shoveling light snow, lifting 5 pounds, walking up and down stairs, getting in and out of the bathtub, gardening or weeding, and performing housekeeping tasks. Lastly, a physical activity readiness questionnaire (PAR-Q) asked participants to answer yes/no to 6 specific symptoms (shortness of breath, dizzy spells, chest pain, skipped heart beats, racing pulse, and blurred vision) that could occur when they exercise.¹⁶

Testing Procedures

Occupational therapy students from the University of Wisconsin-La Crosse administered the tests under the direction of their supervisor and the coordinator of the Functional Fitness Assessment. Prior to test day, training was held for all test administrators. Testing followed the Senior Functional Test protocol developed by Rikli and Jones.¹⁵ Those participants with blood

Table 1. Brief Description of Senior Fitness Test Items*

Test Item	Assessment Category	Description
Chair stand	Lower body strength	Number of full stands in 30 seconds with arms folded across chest
Arm curl	Upper body strength	Number of biceps curls in 30 seconds holding hand weight (women 5 lb, men 8 lb)
Two-minute step	Aerobic endurance	Number of full steps completed in 2 minutes, raising each knee to midway between patella and iliac crest
Chair sit-and-reach	Lower body flexibility	From sitting position at front of chair, with leg extended and hands reaching toward toes, number of inches (+ or -) from extended fingers to tip of toe
Back scratch	Upper body flexibility	With one hand reaching over shoulder and one up middle of back, number of inches between extended middle fingers (+ or -)
Eight-foot up-and-go	Agility/dynamic balance	Number of seconds required to rise from seated position, walk 8 feet, turn, and return to seated position on chair

*Full test descriptions can be found in Rikli and Jones.¹⁵

pressures over 160/90 were not allowed to participate; the PAR-Q was also used as a screen for the exercise physiologist to determine if it was safe for the participant to continue with the testing.

All test stations were set up in circuit style. After a 10-minute warm-up led by an exercise instructor, participants proceeded to complete the Senior Fitness Test items. The Senior Fitness Test consists of 6 different assessments: chair stand to assess lower body strength, arm curl to assess upper body strength, 2-minute step to assess aerobic endurance, chair sit-and-reach to assess lower body flexibility, back scratch to assess upper body flexibility, and the 8-foot up-and-go to assess agility and dynamic balance (see Table 1). Participants were encouraged to do their best, but not go to a point

of over-exertion. After testing, each participant met with a fitness specialist to discuss the results of her/his test. Recommendations were given for specific exercises or referrals if scores were below the normal ranges for an individual.

Data Analysis

Survey data and results from the testing were entered into a secure database and analyzed using SAS statistical package.¹⁷ Scores from each test were compared to the national norm by subject's age and gender and coded as performing above the norm, within the norm, or below the norm. An overall test score was calculated by adding together the number of tests the subject scored above or within the norm. Similarly, ADLs were coded as able to perform the activity with or without assistance. A total ADL score was calculated by finding the sum of the number of activities the subject could perform without assistance and standardizing the number to a scale of 100.

Because the overall test score was not normally distributed, the score was transformed by taking the square root of the score plus 1. This resulted in a nearly normal value in which the distance between the median and the 25th and 75th percentiles were equal. Univariate analysis of variance and correlations were conducted and any variable significantly related to test performance at a $P < 0.200$ was included in a multivariate, stepwise linear regression. The regression was conducted to determine the best multivariate model to predict overall test performance after adjusting for other significant variables. Following the analysis, the transformed, adjusted test score means were converted to the original metric for interpretation.

RESULTS

One hundred sixty-nine adults over the age of 50 participated in the fitness assessments over the testing period. A majority of the participants were female, with an average age of 73. They ranged in age from 50 to 92 (see Table 2). About half of those tested were married. Only 5 of the participants were current smokers, 43% exercised less than 3 times per week, and 21% reported that they had been told by a health care provider they were obese. Heart disease was the most common illness reported (71%), followed by arthritis (48%) and osteoporosis (28%). Nearly 20% reported they had fallen in the previous year. On average, participants reported taking 2.3 medications per day. Nine percent of participants rated their overall health as fair or poor, 39% rated it as good, and 52% as very good or excellent. The ability to perform ADLs was fairly high among

participants. On average, participants were able to perform 91% of the 8 tasks without assistance.

Functional fitness test performance based on age and gender normative scores is shown in Table 3. In general, performance was better on strength tests (chair stand and arm curl) than cardiovascular tests (2-minute step, and 8-foot up-and-go) or flexibility tests (sit-and-reach, and back scratch). Thirty-seven percent of subjects performed at or above the population norm on all 6 tests, while an additional 23% were at or above the norm on 5 of the 6 tests. Two percent were below the population norm on all tests. On average, participants performed 4.6 tests at or above the norm.

Test performance did not differ by gender, age, or marital status (see Table 4). It did differ by education ($P=0.0069$). Those with the highest level of education performed better on the test. Performance did not differ by smoking status or amount of physical activity the participant reported on a weekly basis; however, those that reported that they were obese performed 3.5 tests at or above the mean, compared to 4.7 for those that reported they were not obese ($P=0.0005$). Those that rated their health as excellent or very good tested at or above the norm on 4.8 tests, those that rated their health as good tested at or above the norm on 4.3 tests, and those rating themselves with fair or poor health tested at or above the norm on 3 tests ($P=0.0003$). There was a significant positive correlation between test performance and activities of daily living ($r=0.3573$, $P=0.0001$). The correlation between test performance and number of medications was nearly significant ($r=-0.1577$, $P=0.0406$), indicating the greater the number of medications the poorer the test performance.

Test performance differed by several health conditions. Those who reported having arthritis, diabetes, or cancer had poorer test performance. Those with arthritis performed at or above the norm on 4.1 tests, compared to 4.7 tests for those without arthritis. Arthritic participants' overall ADL scores were lower (88.7%) than non-arthritic participants (93.3%, $P=0.0698$.) Those with arthritis were more likely to score below the norm on the tests focused on joint movements. Overall, 34% of those with arthritis scored below the norm on the 2-minute step test, and 26% scored below the norm on both the arm curl and chair stand tests, compared to non-arthritic participants (21%, 13% and 15% respectively.) There were no differences in performance for the flexibility tests (sit-and-reach and back scratch).

In multivariate analysis, the best model to predict test performance included education, self-rated health, obesity, diabetes, and ADLs. Adjusted mean number of

Table 2. Subject Characteristics (N=169)

Characteristic	Number	Percent
Male	23	13.7%
Age (mean)	72.96	(8.12)
50-64	35	20.7%
65-74	58	34.3%
75-84	65	38.5%
85+	11	6.5%
Marital Status		
Married	81	47.9%
Widowed	43	25.4%
Single	45	26.6%
Highest Level of Education		
≤ High school graduate	58	34.3%
Some college	56	33.1%
College or advance degree	55	32.5%
Behaviors		
Current/former smoker	75	44.4%
Obese (self-reported "obese")	35	20.7%
Sedentary (exercise < 3 times/week)	72	42.6%
Self-Reported Illnesses		
Heart Disease (CVD, MI, hypertension, stroke, hypercholesterolemia)	120	71.0%
Arthritis	81	47.9%
Osteoporosis	47	27.8%
Depression	29	17.2%
Diabetes	22	13.0%
Cancer	20	11.8%
Asthma	17	10.1%
Total # illnesses (mean, sd)	1.99	(1.21)
Other Symptoms/Health Concerns		
Tendonitis	31	18.3%
Back Pain	36	21.3%
Fallen in past year	33	19.5%
Total # Medications (mean, sd)	2.3	(2.2)
0	41	24.3%
1-2	68	40.2%
3-5	44	26.0%
6-10	16	9.5%
Self-Rated Health		
Fair/Poor	15	8.9%
Good	66	39.1%
Excellent/Very good	88	52.1%
Activities of Daily Living (% Can Do Without Assistance)		
Get in and out of car	168	99.4%
Grocery shop	162	95.9%
Shovel light snow	136	80.5%
Lift 5 pounds	159	94.1%
Walk up and down stairs	162	95.9%
Get in and out of bathtub	150	88.8%
Garden or weed	131	77.5%
Perform household tasks	164	97.0%
% of all ADLs without assistance		91.1%

Table 3. Senior Fitness Test Performance (Based on Age and Gender Normative Scores)

Test	Worse than Norm	Same as Norm	Better than Norm
Chair Stand	18.7%	65.1%	16.3%
Arm Curl	18.9%	69.2%	11.8%
Two-Minute Step	23.1%	58.1%	18.8%
Chair Sit-and-Reach	25.4%	58.0%	16.6%
Back Scratch	29.5%	53.6%	16.9%
Eight-Foot Up-and-Go	17.8%	62.0%	20.2%

tests performed at or above the norm for the significant independent variables are shown in Table 5. This final model predicted 28% of the variability in test performance. Presence of arthritis, cancer, or number of medications did not contribute significantly to the prediction of test performance after the other characteristics were included in the model.

DISCUSSION

Functional fitness, the ability to perform normal everyday activities independently and safely, is one of the single most important issues for older adults today. Remaining independent and taking care of oneself is essential, but it is also an increasing challenge for an aging cohort suffering from a variety of chronic illnesses. This study explored the relationship among ADLs, self-reported health, chronic illness, and their correlation to functional fitness in community-dwelling older adults.

We found that functional fitness was significantly related to education level, ADLs, obesity, the presence of diabetes, and self-rated health. It was not related to age, number of medications taken, or other significant chronic illnesses such as arthritis and heart disease.

The significant relationship between functional fitness and education level supports the ever-growing realization that persons with lower levels of education (an indicator for socioeconomic status) are much more likely to have lower levels of functionality, increased numbers of chronic conditions, and decreased health-related quality of life.¹⁸ Older adults with higher educational levels may have a greater ability to modify their behavioral risk factors and to comply with the complexities of medical care needed for chronic conditions. Consequently, they would also score higher in functional fitness.¹

Test performance overall was significantly different by presence or absence of arthritis alone, but when combined with other characteristics was not. This was likely due to the high correlation between arthritis

and ADLs, and the correlation of ADLs to test performance. That the Senior Fitness Test includes tests other than those affected by participants' arthritis would suggest the ability to perform at the norm on some of the tests. A prospective study would need to be conducted to determine the threshold in the spectrum of the illness where limitation becomes too great for the patient with arthritis and, leading to a loss in function, would ultimately cause the loss of independence.

While the prevalence of diabetes and arthritis in our study may be similar to the national population, the overall self-rated health and ADLs were much better in our study population.^{3,19} Among Wisconsin adults over age 65 in 2001, 22% reported their overall health was fair or poor, 37% indicated it was good, and 41% indicated it was excellent or very good. The ADLs that participants reported not being able to do without help were mainly seasonal (shoveling snow, gardening, or weeding).

Our study population was a volunteer sample of older adults who were more active and reported better overall health despite a level of disease similar to the general population. While this limitation may be of concern, the population is similar to the sample in which the norms were developed¹⁵ and similar to community-dwelling older adults that would likely take this test in other situations. The goal of this test is to predict who will remain independent among those fully functional with potential for physical declines leading to frailty. Due to the cross-sectional nature of this study, we are unable to determine if the test accurately predicts independence in our population. A prospective study would better address this issue.

We relied on self-reported data on chronic illnesses and medications that were likely underreported. The impact of this would be to misclassify some individuals as "no disease" when they have disease. Thus, the significant relationships reported in this study may have been even stronger without this bias. Furthermore, this study's size may have limited our ability to test some relationships.

Our study showed that older adults with a significant number of chronic illnesses were not overly limited in their ability to perform on a functional fitness test. However, caution should be exercised when interpreting these results. First, our study used only 1 set of measurements to evaluate functional fitness. Reliance on 1 measurement does not take into account the natural day-to-day changes in functional ability experienced by persons with chronic conditions. Additionally, the use

Table 4. Univariate Predictors of Senior Fitness Test Performance

Characteristic	Mean Number of Tests at or Above Norm (0-6)	P-value	Characteristic	Mean Number of Tests at or Above Norm (0-6)	P-value
Gender		0.7205	Arthritis		0.0342
Female	4.41		Yes	4.13	
Male	4.55		No	4.70	
Age		0.9429	Osteoporosis		0.0700
50-64	4.55		Yes	4.83	
65-74	4.62		No	4.27	
75-84	4.47		Depression		0.2315
85+	4.76		Yes	4.07	
Marital status		0.4070	No	4.50	
Married	4.30		Diabetes		0.0002
Widowed	4.34		Yes	3.22	
Single	4.73		No	4.62	
Highest Level of Education		0.0069	Cancer		0.0364
≤ High school graduate	3.86		Yes	3.67	
Some college	4.60		No	4.53	
College or advance degree	4.86		Asthma		0.2938
Smoking Status		0.2810	Yes	4.00	
Current/former smoker	4.26		No	4.47	
Never smoker	4.56		Other Symptoms/Health Concerns		
Obesity status		0.0005	Tendonitis		0.6777
Obese	3.54		Yes	4.30	
Not obese	4.66		No	4.45	
Sedentary		0.1824	Back Pain		0.4286
< 3 times per week	4.21		Yes	4.22	
3 or more times per week	4.58		No	4.48	
Self-rated health		0.0003	Fallen in past year		0.4308
Fair/Poor	2.97		Yes	4.64	
Good	4.28		No	4.37	
Excellent/Very good	4.80		Total # medications		0.0456
Self-Reported Illnesses			0	4.41	
Heart Disease		0.5336	1-2	4.70	
Yes	4.37		3-5	4.41	
No	4.56		6-10	3.36	

of 1 measurement gives a static picture of the ability, rather than a pattern of change in functioning over time. Seeman and Chen²⁰ recently reported that levels of functioning and, importantly, patterns of change in functioning over time were found to be influenced by potentially modifiable factors—physical exercise, social support, self-efficacy beliefs, and psychological symptomatology—independent of the presence of chronic conditions or other aspects of health status and of differences in sociodemographic characteristics.

While fitness assessment screening within the community is important as an objective screen to match physical activity needs with effective programs, there

is a significant role that health care providers can play in slowing the decline of function in older adults. With the use of a few questions (self-rated health and ADLs) and a few patient characteristics (education level, obesity status, and presences of diabetes), a health care provider may be able to accurately screen those patients at risk of losing functional fitness and independence. The patient-physician relationship over time will also assist in noting declines in patients at risk. By screening or identifying patients, appropriate referrals can be made to community-based programs or specific exercises can be recommended to slow this decline.

Table 5. Multivariate Model to Predict Test Performance

Characteristic	Adjusted Mean Number of Tests at or Above Norm	Regression Coefficient (Standard Error)	P-value
Diabetes		-0.196 (0.079)	0.0142
Yes	3.29		
No	4.06		
Education		0.047 (0.022)	0.0324
≤ High school degree	3.31		
Some college	3.78		
College/advanced degree	3.92		
Obesity		-0.175 (0.065)	0.0076
Yes	3.28		
No	4.08		
Activities of Daily Living		0.007 (0.002)	0.0001
Self-rated health		-0.074 (0.030)	0.0153
Fair/poor	3.15		
Good	3.80		
Excellent/very good	4.08		
Intercept		1.801 (0.188)	0.0001

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