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# Walking Difficulty, Walking Speed, and Age as Predictors of Self-Rated Health: The Women's Health and Aging Study

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***Background.*** Older persons reporting disability are more likely to report poor self-rated health, but little work has been done to assess the independent relationships of reported walking difficulty and measured walking performance with self-rated health. This study examines the associations of walking difficulty, walking speed, and age with self-rated health in older women.

***Methods.*** The data are from the baseline of the Women's Health and Aging Study. Difficulty walking one quarter mile was used as a measure of mobility in the representative population aged 65 and older screened for the study ($n$ = 3841) and in the one third most disabled study group ($n$ = 1002). Maximal walking speed was measured in the study sample.

***Results.*** Increasing severity of walking difficulty (in the screened population and in the disabled study group), slower walking speed (in the study group), and younger age were all associated with fair or poor self-rated health, after simultaneous adjustment for these and other objective measures of physical performance and health. The associations of both measures of walking with self-rated health weakened with age.

***Conclusions.*** Both walking difficulty and walking speed are independent determinants of self-rated health. Adjusted for health and functioning, self-rated health tends to improve with age.

SELF-RATED health is a global, widely used measure of health status. The increasing epidemiological evidence that it is both a strong predictor of mortality and future functioning and an important constituent of the quality of life has led researchers to examine the structure and predictors of self-rated health itself. It has been shown to capture a wide range of health-related phenomena, such as chronic diseases, symptoms, depression (1), and even immunological processes (2).

Several studies indicate that disability is one of the main aspects of health that people take into account in their self-ratings. In this study, our focus is on the role of mobility in self-rated health. Problems in mobility increase rapidly with age, and they are a critical constituent of impaired function and functional dependence and a major predictor of subsequent institutionalization (3–6). The finding of Cress and colleagues (7) that walking speed was the strongest independent predictor of self-perceived physical function suggests the potential importance of gait with respect to self-rated health.

However, the effect of functional status in general and mobility in particular on self-rated health is poorly understood. There are two main reasons for this. First, most of the studies on the association of functioning and self-rated health have used summary indicators of activities of daily living and independent activities of daily living as measures of disability, without differentiating between dimensions of functioning. Second, in most of the studies on the predictors of self-rated health, both the predictors and potential confounders are all based on self report. Although moderate-to-high correlations have been demonstrated between self-reported disability and measured physical performance (4,8,9), it is possible that all self-reported health indicators are influenced by the same confounders or even a systematic reporting bias, either positive or negative, that is likely to increase the association between self-reported functioning and self-rated health. Depression is likely to influence self-rated health directly and to modify the way in which different conditions are reported (1,10), and it may also influence motivation in performance tests. Thus, to establish the relationship between mobility and self-rated health, measured performance indicators and reliable information on confounding factors such as chronic conditions and depression are needed. Until now there have been only a few studies that examined the association of objective measurements of health and functioning with self-rated health (11–14), and, to our knowledge, there have been no studies that focus specifically on the role of mobility.

The studies that cover an age range from young adulthood into early old age usually indicate deteriorating self ratings with age, but in older populations positive associations (15) and no association (13) between age and better self-rated health have also been reported. Interpretations of these findings are made on the basis of the sociological theories of Festinger (16) on social comparison and Merton (17) on relative deprivation. Tornstam, as early as in 1975

(18), and others after him (19,20) have suggested that awareness of the increasing likelihood of health problems with advancing age leads to decreasing aspiration level regarding health, and, thus, less and less is required for self-rated health to be assessed as "good."

Indirectly, this line of thinking suggests that, after adjusting for other indicators of health status, self-rated health in older populations should improve with age. [The theory does not, however, imply that the nonadjusted level of self-rated health in the overall population should improve with age, as Roberts (21) seems to assume.] There are several findings to support this theory (1,13,22), but there are very few studies to test the hypothesis directly.

In this study, we used data from the Women's Health and Aging Study (WHAS), a study conducted by the Johns Hopkins Medical Institution and sponsored by the Epidemiology, Demography, and Biometry Program of the National Institute on Aging, to examine the effects of mobility and age on self-rated health in older women. In the WHAS study, a comprehensive medical examination and a wide array of performance tests were administered. Self-reported difficulty in walking was used as a measure of mobility in a representative screened population sample of older women and in the one third most disabled study sample. Measured maximal walking speed was available as a measure of functioning only in the disabled study sample. Our goal was to determine how walking problems and age influence self-rated health in these groups of older women. We hypothesized that (i) self-reported walking difficulty is independently associated with self-rated health in both a representative population and a disabled subgroup; (ii) measured walking speed is independently associated with self-rated health in a disabled population; (iii) higher age is associated with higher levels of self-rated health, when mobility and other dimensions of functioning and health status are taken into account; and (iv) age modifies the association between measures of walking and self-rated health.

This study was approved by the Johns Hopkins University Institutional Review Board. All participants signed an informed consent.

## Methods

### *Study Populations*

The main objective of the WHAS is to examine the causes and course of disability in the one third most disabled older women living in the community. More detailed descriptions of the WHAS design, the study population, selection procedures, and the examinations have been published elsewhere (23–25). In brief, an age-stratified random sample (65–74 years, 75–84 years, and 85+ years), with oversampling of women aged 85 and older, was selected from Health Care Financing Administration Medicare files for 12 adjoining postal zip code areas in Baltimore City and Baltimore County. The sample totaled 6521 women, of whom 5316 were eligible for the screening interview. A total of 4137 women participated in the screening. In all, 3841 women personally completed the screening interview. We refer to this group as the screened population.

Among the screened population, 1409 met the eligibility criteria for the full WHAS examination. Criteria for study eligibility were scoring more than 17 on the Mini-Mental State Examination (MMSE) for cognitive function (26) and having difficulty or needing help from another person in tasks in two or more of the following functional domains: upper extremity abilities, mobility/exercise tolerance, higher functioning tasks of independent living, and basic self-care. Altogether, 1002 women agreed to study participation and completed the baseline interview and in-home clinical examination (25). We refer to the one-third most disabled group as the study group.

### *Measures*

The question on self-rated health read, "At the present time, would you say that your health is excellent, very good, good, fair, or poor?" In the analyses where the question was used as a dependent variable, the responses were combined into two categories: Category 1 (excellent, very good, and good) and Category 2 (fair and poor).

Difficulty in walking was assessed by asking, "By yourself, that is without help from another person or special equipment, do you have any difficulty in walking for a quarter of mile, that is about 2 or 3 blocks?" The possible answers were 1 = no difficulty; 2 = a little difficulty; 3 = some difficulty; 4 = a lot of difficulty; and 5 = not able to walk one quarter mile.

In the study group, maximal walking speed was measured over a 4-m course. In the homes of 85 women, adequate space was not found, and the test was carried out on a 3-m course. After demonstration of the fast walk, participants started from a standing position and were told to walk as fast as possible. Timing began when the command was given. The use of aids (canes or walkers) was allowed for this test. The measure of fast walk speed was categorized as quartiles of the distribution of maximal walking speed (25%, 0.625 m/s; 50%, 0.889 m/s; and 75%, 1.143 m/s).

The test of repeated chair stands was performed using an armless, straight-back chair found in each participant's home. Participants were first asked to stand from a sitting position without using their arms. If they were able to perform this activity, they were then asked to stand up and sit five times as quickly as possible. The time to complete the entire task was recorded. A dichotomized variable was constructed by using the median time of those who were able to complete the test ($\leq$14.20 seconds vs $>$14.20 seconds) as the cut point.

Grip strength was measured using a JAMAR hand dynamometer (Model BK7498; Fred Sammons, Inc., Burr Ridge, IL) in a sitting position with the wrist in a neutral position and the elbow flexed 90°. Grip strength was measured three times for each hand. During testing the participant was strongly encouraged to use the greatest possible force. The highest measure in the stronger hand is reported here. A dichotomized value was constructed using the median strength of those who were able to complete the test ($<$20.0 kg vs $\geq$20.0 kg) as the cut point.

For tests of standing balance, subjects were asked to maintain balance in three positions characterized by a progressive narrowing of the base of support: feet together

(side-by-side position), the heel of one foot beside the big toe of another foot (semi-tandem position), and the heel of one foot in front and touching the toes of the other foot (tandem position). Women who were able to maintain balance for 10 seconds in one position were permitted to attempt the next, more difficult position. Here, two categories of balance were constructed, with the better balance defined as being able to maintain side-by-side stand for 10 seconds, semi-tandem stand for 10 seconds, and tandem stand for at least 1 second.

Visual acuity was measured as Snellen fractions classified as 20/40 or better and <20/40, with the participant wearing her customary glasses. The participant was considered as hearing impaired if she had (i) a 40-dB loss at the 1000- or 2000-Hz frequency in both ears or (ii) a 40-dB loss at the 1000- and 2000-Hz frequencies in one ear.

The number of adjudicated diseases was calculated as the sum of 17 chronic conditions. They were ascertained with complex algorithms that used information from self reports, physical examination, current medications, physician questionnaire, and medical records (27).

Cognitive status was assessed with a MMSE score of less than 26 or 26 or more. Mild or high levels of depressive symptoms was defined as scoring more than 10 on the Geriatric Depression Scale (GDS) (28). Sociodemographic variables included years of education (8 years or less or more than 8 years) and race (black, white, and other; for our analyses race was combined as white and nonwhite).

### *Statistical Methods*

The differences between the age groups in self-rated health, walking difficulty, and quartiles of walking speed were examined using chi-square tests for linear associations. Associations between potential predictors and self-rated health were determined by using chi-square tests for between-group differences. Logistic regression models were used to determine odds ratios (OR) and 95% confidence intervals (CI) for walking difficulty and walking speed and age group as predictors of fair or poor self-rated health, adjusted for other indicators of health, functioning, and sociodemographic status. Logistic regression models were also used to analyze the associations of walking difficulty and walking speed with self-rated health separately for the three 10-year age groups and the associations of age group with self-rated health for different levels of walking difficulty and different quartiles of walking speed, respectively.

## Results

### *Self-Rated Health*

In the screened population (Table 1), self-rated health was significantly related to age, although the gradient was quite moderate. Among the participants aged 65 to 74 years, 75 to 84 years, and 85 years and older, the percentages of those reporting fair or poor self-rated health were 26.9, 31.0, and 35.5, respectively. In the study group (Table 1), self-rated health was also related to age, but in the opposite direction. In this disabled group, the percentage of women with poor or fair self-rated health was highest among the 65- to 74-year-old subgroup (56.8%), slightly lower among those 75 to 84 years old (55.4%), and lowest in those aged 85 years or older (43.1%).

### *Self-Rated Health and Walking Difficulty in the Screened Population*

Difficulty in walking for one quarter mile was strongly associated with age group in the population sample (Table 1). From the youngest to the oldest age group in the screened population sample, the percentage of women without any difficulty in this task decreased from 72.2 to 42.5, and the percentage of those unable to walk one quarter mile increased from 6.4 to 30.5. A similar but less precipitous increase with age in inability to walk was seen for the study group.

The association of walking difficulty and age with self-rated health in the screened population was examined by using multiple logistic regression models (Table 2). There was a strong graded association of fair or poor self-rated health with the increasing severity of walking difficulty in the age-

Table 1. Self-rated Health and Difficulty in Walking One Quarter Mile in the Screened Population and in the Study Group

| | Screened Population | | | | Study Group | | | |
|---|---|---|---|---|---|---|---|---|
| Characteristic | 65–74 y | 75–84 y | 85+ y | All | 65–74 y | 75–84 y | 85+ y | All |
| Self-rated Health[†] | | | | | | | | |
| Excellent | 10.3 | 9.4 | 8.8 | 9.8 | 2.0 | 3.4 | 7.9 | 3.5 |
| Very good | 28.7 | 27.0 | 22.9 | 27.5 | 11.6 | 13.5 | 18.5 | 13.4 |
| Good | 34.0 | 32.6 | 32.9 | 33.4 | 29.5 | 27.7 | 30.5 | 28.9 |
| Fair | 20.8 | 22.2 | 24.8 | 21.7 | 38.4 | 34.1 | 30.5 | 35.4 |
| Poor | 6.1 | 8.8 | 10.7 | 7.6 | 18.4 | 21.3 | 12.6 | 18.7 |
| Difficulty in Walking One Quarter Mile[‡] | | | | | | | | |
| None | 72.2 | 61.3 | 42.5 | 65.1 | 29.5 | 22.4 | 17.6 | 24.8 |
| A little | 7.5 | 10.2 | 9.1 | 8.7 | 14.1 | 17.4 | 9.5 | 14.8 |
| Some | 7.2 | 8.6 | 7.5 | 7.8 | 14.7 | 16.7 | 12.2 | 15.2 |
| A lot | 6.6 | 9.3 | 10.4 | 8.0 | 20.9 | 19.9 | 14.2 | 19.5 |
| Not able | 6.4 | 10.5 | 30.5 | 10.4 | 20.9 | 23.6 | 46.6 | 25.8 |

*Note*: Values are percentages.

[†]Differences between the age groups (Chi-square test for linear association): screened population, $p = .022$; study group, $p = .004$.

[‡]Differences between the age groups (Chi-square test): screened population, $p < .001$; study population, $p = .001$.

Table 2. The Association of Age and Walking Difficulty With Self-rated Health Within the Screened Population

| Characteristic | Unadjusted | | Adjusted for Other Variables[†] | |
|---|---|---|---|---|
| | OR for Fair and Poor SRH | 95% CI | OR for Fair and Poor SRH | 95% CI |
| Age, y | | | | — |
| 65–74 | 1.00 | — | 1.00 | — |
| 75–84 | 1.01 | 0.84–1.21 | 0.95 | 0.78–1.14 |
| 85+ | 0.72 | 0.59–0.88 | 0.64 | 0.51–0.82 |
| Difficulty in Walking One Quarter Mile | | | | |
| None | 1.00 | — | 1.00 | — |
| A little | 2.76 | 2.15–3.53 | 2.23 | 1.72–2.90 |
| Some | 3.87 | 3.00–5.00 | 3.34 | 2.55–4.34 |
| A lot | 7.08 | 5.50–9.10 | 5.67 | 4.35–7.40 |
| Unable | 8.10 | 6.47–10.1 | 5.84 | 4.59–7.42 |

*Note*: OR = odds ratio; SRH = self-reported health; CI = confidence interval.

[†]ORs are adjusted for reported chronic conditions (myocardial infarction, angina, diabetes, stroke, arthritis, vision problems, and hearing problems), Mini-Mental State Examination, race, and years of education.

adjusted model, and this association remained after adjusting also for reported chronic conditions, MMSE, race, and years of education. Compared with women aged 65 to 74 years, women aged 85 and older were less likely to report fair or poor self-rated health, but the difference between the two youngest age groups was not significant.

### *Self-Rated Health, Walking Difficulty, and Walking Speed in the Disabled Study Group*

By definition, women who participated in the examination belonged to the one-third most disabled group of the screened population but were not severely cognitively impaired. By age group, the proportion of those who had no difficulty in walking one quarter mile varied from 29.5% to 17.6%, and the proportion of those not able to walk varied from 20.9% to 46.6% (Table 1). Maximal walking speed was also significantly dependent on age group ($p < .001$): 34.2% of the 65- to 74-year-old subgroup, 23.3% of those 75 to 84 years old, and 7.6% of those 85 and older belonged to the highest walking speed quartile, and 11.1%, 23.3%, and 46.0%, respectively, to the lowest quartile.

Table 3 gives the distributions of self-reported walking difficulty, measured walking speed, and other performance and health measures, and the sociodemographic variables for the two categories of self-rated health in the study group. Women in fair or poor health were more likely to report walking difficulty and to have slow walking speed than women with excellent, very good, or good self-rated health. The number of adjudicated diseases, depressive symptoms, time to do five chair stands, race, and level of education were also significantly associated with self-rated health.

The independent associations of walking difficulty and walking speed and age on self-rated health were examined by using multiple logistic regression models, adjusting for other health and sociodemographic variables (Table 4). Only the participants who were able to do the fast-pace walking test were included ($n = 917$). In Model 1, self-reported walking difficulty was used as a measure of walking. Compared with those who had no difficulty in walking one quarter mile, women who reported a lot of difficulty or who were not able to walk that distance were more likely to report poor or fair self-rated health. There was a tendency for better self-rated health with age, and the likelihood of reporting poor or fair self-rated health was significantly lower in the age group 85 and older than in the younger age groups. Grip strength of less than 20 kg, higher number of adjudicated diseases, scoring more than 10 in the GDS, and being nonwhite were also independently associated with fair or poor self-rated health. Time to perform chair stands and balance had no independent effect on self-rated health.

Model 2 examined the association of measured walking speed with self-rated health (Table 4). Compared with the highest quartile of walking speed, the OR for fair or poor self-rated health increased gradually with slower walking speed. In the lowest quartile of walking speed, the OR of reporting fair or poor self-rated health was 3.06 (95% CI 1.78–5.23). Again, the likelihood of fair or poor self-rated health decreased with age. The number of diseases, depressive symptoms, and race remained significant predictors of self-rated health, but grip strength was no longer significant.

In Model 3, reported walking and measured walking speed were included simultaneously. Adjusted for age and measures of health, performance, and socioeconomical status, both reported severity of walking difficulty and slower measured walking speed were independently associated with fair or poor self-rated health (Table 4). Compared with the previous models, the magnitudes of OR were only slightly lower. Also in this model, there was a gradient for better self-ratings with increasing age, with women aged 85 and older having an OR of 0.27 for fair or poor self-rated health (95% CI 0.17–0.40) compared with women aged 65 to 74 years. The number of diseases, depressive symptoms, and race were, again, independently associated with self-rated health.

As the next step of our analyses, we looked more closely at the combined effects of each walking indicator and age group on self-rated health. First, eleven indicator variables were constructed to compare other age and walking difficulty subgroups with the self-rated health of women aged 85 and older with no walking difficulty (Figure 1). Both more severe walking difficulty and younger age group increased the likelihood of fair or poor self-rated health. What

Table 3. Characteristics of the Study Group According to Self-rated Health

| | Excellent, Very Good, or Good (%) | Fair or Poor (%) | Total (%) | *p* Value |
|---|---|---|---|---|
| Difficulty in Walking One Quarter Mile | | | | |
| None | 31.3 | 19.5 | 24.9 | <.001 |
| A little | 19.4 | 10.6 | 14.6 | |
| Some | 16.3 | 14.3 | 15.2 | |
| A lot | 14.1 | 23.8 | 19.4 | |
| Not able | 18.8 | 31.8 | 25.9 | |
| Walking Speed | | | | |
| 1st quartile (fastest) | 32.1 | 18.0 | 24.6 | <.001 |
| 2nd quartile | 25.2 | 23.2 | 24.1 | |
| 3rd quartile | 21.7 | 29.4 | 25.8 | |
| 4th quartile (slowest) | 14.7 | 23.4 | 19.4 | |
| Not able | 6.3 | 6.0 | 6.1 | |
| Grip Strength | | | | |
| ≥20 kg | 52.6 | 46.9 | 49.5 | NS |
| <20 kg | 47.4 | 53.1 | 50.5 | |
| Time to do Five Chair Stands | | | | |
| ≤14.20 s | 42.4 | 34.6 | 38.2 | .01 |
| >14.20 s or not able | 57.6 | 65.4 | 61.8 | |
| Tandem Stand | | | | |
| Can hold tandem stand at least for 1 s | 53.9 | 48.2 | 50.9 | .07 |
| Cannot hold tandem stand | 46.1 | 51.8 | 49.1 | |
| Number of Adjudicated Diseases | | | | |
| None or 1 | 64.4 | 50.6 | 57.0 | <.001 |
| ≥2 | 35.6 | 49.4 | 43.0 | |
| Hearing Impairment | | | | |
| None | 60.7 | 59.1 | 59.9 | NS |
| Present | 39.3 | 40.9 | 40.1 | |
| Visual Acuity | | | | |
| >20/40 | 72.4 | 67.8 | 69.9 | NS |
| ≤20/40 | 27.6 | 32.2 | 30.1 | |
| MMSE | | | | |
| ≥26 | 72.5 | 66.7 | 69.4 | .05 |
| <26 | 27.5 | 33.3 | 30.6 | |
| GDS | | | | |
| ≤10 | 81.0 | 64.1 | 71.8 | <.001 |
| >10 | 19.0 | 35.9 | 28.2 | |
| Race | | | | |
| White | 78.8 | 65.1 | 71.3 | <.001 |
| Nonwhite | 21.2 | 34.9 | 27.7 | |
| Education | | | | |
| >8 y | 64.0 | 55.8 | 59.6 | .009 |
| ≤8 y | 36.0 | 44.2 | 40.4 | |

*Note*: NS = not significant; MMSE = Mini-Mental State Examination; GDS = Geriatric Depression Scale.

was striking here was the very strong association with fair or poor self-rated health in the youngest age group, if they were either unable or had a lot of difficulty walking one quarter mile, as opposed to the 75- to 84-year-old group, where a very strong association was found only for those unable, and the oldest age group, where the association was modest even for those unable.

We used logistic regression models to test the trend for worse self-rated health with increasing self-reported walking difficulty in each age group and the trend for worse self-rated health with younger age group at each level of walking difficulty. In every age group, increasing difficulty of walking one quarter mile was associated with worse self-rated health, but the association weakened with age (age group 65–74, $p \leq .001$; age group 75–84, $p = .003$; age group 85 and older, $p = .045$). We also found a trend ($p < .05$) for worse self-rated health with the younger age group in the groups that had no difficulty, a lot of difficulty, or were nor able to walk one quarter mile but not for those who reported a little or some difficulty. The potential confounders were adjusted for in all of these models.

Second, eleven indicator variables were constructed to compare self-rated health of the age and walking speed subgroups with self-rated health of those aged 85 and older who belonged to the highest quartile of walking speed (Figure 2). Again, the general picture is that both slower walking speed and younger age increased the likelihood of fair or poor self-rated health. There was a significant trend for worse self-rated health with slower walking speed in the two younger age groups (age group 65–74, $p = .001$; age group 75–84, $p = .017$) but not in the oldest age group ($p = .14$).

Also, there was a significant trend ($p < .01$) for worse self-rated health with younger age in all walking speed groups except the fastest quartile of walking speed.

Table 4. Association of Age Group, Difficulty in Walking One Quarter Mile, Walking Speed, Performance Measures, Adjudicated Chronic Conditions, Cognitive Functioning, Depressive Symptoms, Demographic Characteristics, and Difficulty in Walking with Fair or Poor Self-rated Health in the Study Group

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| Characteristic | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Age Group, y | | | | | | |
| 65–74 | 1.00 | — | 1.00 | — | 1.00 | — |
| 75–84 | 0.87 | 0.60–1.26 | 0.80 | 0.57–1.10 | 0.85 | 0.58–1.23 |
| 85+ | 0.31 | 0.20–0.50 | 0.34 | 0.21–0.58 | 0.27 | 0.17–0.40 |
| Difficulty in Walking One Quarter Mile | | | | | | |
| None | 1.00 | — | — | — | 1.00 | — |
| A little | 0.78 | 0.49–1.26 | — | — | 0.73 | 0.45–1.19 |
| Some | 1.19 | 0.75–1.90 | — | — | 1.10 | 0.68–1.78 |
| A lot | 2.60 | 1.66–4.01 | — | — | 2.31 | 1.47–3.63 |
| Not able | 2.74 | 1.73–4.36 | — | — | 2.20 | 1.34–3.59 |
| Walking Speed | | | | | | |
| 1st quartile (fastest) | — | — | 1.00 | — | 1.00 | |
| 2nd quartile | — | | 1.52 | 1.02–2.25 | 1.33 | 0.86–2.06 |
| 3rd quartile | — | | 2.30 | 1.50–3.53 | 1.98 | 1.24–3.17 |
| 4th quartile (slowest) | — | | 3.06 | 1.78–5.23 | 2.32 | 1.29–4.17 |
| Grip Strength (0 = <20 kg; 1 = ≥20 kg) | 1.40 | 1.01–1.94 | 1.18 | 0.86–1.61 | 1.31 | 0.94–1.82 |
| Time to do Five Chair Stands (0 = 14.20 s; 1 = >14.20 s or not able) | 1.08 | 0.77–1.50 | 0.97 | 0.70–1.35 | 0.92 | 0.65–1.30 |
| Tandem Stand (0 = can hold tandem stand for at least 1 s; 1 = cannot hold tandem stand) | 0.91 | 0.63–1.28 | 0.92 | 0.65–1.29 | 0.81 | 0.56–1.16 |
| Number of Adjudicated Diseases (0 = none or 1, 1 = ≥2) | 1.66 | 1.22–2.24 | 1.66 | 1.24–2.22 | 1.60 | 1.17–2.16 |
| Hearing Impairment (0 = none; 1 = present) | 1.13 | 0.82–1.57 | 1.12 | 0.82–1.54 | 1.14 | 0.82–1.59 |
| Visual Acuity (0 = ≤20/40 or less; 1 = >20/40) | 1.17 | 0.83–1.66 | 1.13 | 0.80–1.59 | 1.12 | 0.80–1.59 |
| MMSE (0 = ≥26 or higher; 1 = <26) | 0.98 | 0.69–1.39 | 0.96 | 0.68–1.34 | 0.93 | 0.66–1.31 |
| GDS (0 = ≤10 or less; 1 = >10) | 2.14 | 1.50–3.05 | 2.13 | 1.52–3.00 | 2.14 | 1.51–3.06 |
| Race (0 = white; 1 = nonwhite) | 2.31 | 1.61–3.30 | 1.87 | 1.31–2.65 | 2.11 | 1.47–3.03 |
| Education (0 = ≤8 y; 1 = >8 y) | 1.20 | 0.87–1.61 | 1.04 | 0.77–1.43 | 1.13 | 0.82–1.56 |

*Note*: OR = odds ratio; CI = confidence interval; MMSE = Mini-Mental State Examination; GDS = Geriatric Depression Scale.

## Discussion

In this study, we analyzed the influence of mobility and age on self-ratings of health in older women using the data from the WHAS. A particular strength of the study was that we have been able to employ a comprehensive array of data on physical and mental health and functional performance, both self-reported and objectively measured. We found that mobility was a central constituent of self-rated health for older women, independent of several indicators describing physical and mental health, including depression. This result was confirmed in a representative sample of older women and in a moderately to severely disabled subsample. There was a very strong graded association of increasing severity of self-reported difficulty in walking one quarter mile with poorer self-rated health in the screened population, and there was a significant, although less strong, association in the disabled study group. In the study group, we found significant graded associations between self-rated health and walking speed on one hand, and self-rated health and self-reported walking difficulty on the other, which weakened only slightly when both measures were introduced in a model together. The other performance measures (chair stands, balance and grip strength) had no significant independent effect on self-rated health once mobility was accounted for. However, having two or more chronic diseases, expressing a mild or high level of depressive symptoms, or being nonwhite independently increased the risk of fair or poor self-rated health. In models where mobility and other health and sociodemographic indicators were included, younger age group predicted worse self-rated health.

In the context of the disablement process (29) it would be plausible to hypothesize that the association between functional limitations in walking (measured walking speed) and self-rated health would be mediated by self-reported disability (reported walking difficulty). Our study indicates that this is only partly so: in a model containing both variables, we observed an independent effect not only between walking difficulty and self-rated health but also between walking speed and self-rated health. This is consistent with the findings by Hoeymans and colleagues (13) that measured usual walking speed had an effect on self-rated health when adjusting for mobility disability.

Our main results indicating an independent effect of both walking difficulty and measured walking speed on self-rated health raise questions about the relationship between walking speed and walking difficulty. It seems that, although strongly associated, objective walking speed and reported walking difficulty are not equivalent but are likely to measure somewhat different dimensions of the same phenomenon. From previous studies, we know that poor performance is possible without disability (30,31), but the amount of reported disability may also be greater than observed limitation in performance (9). Furthermore, reported difficulty is always based on subjective assessment. As no gold standard can be given, several personal and cultural factors may influence what is understood and reported as "difficulty"

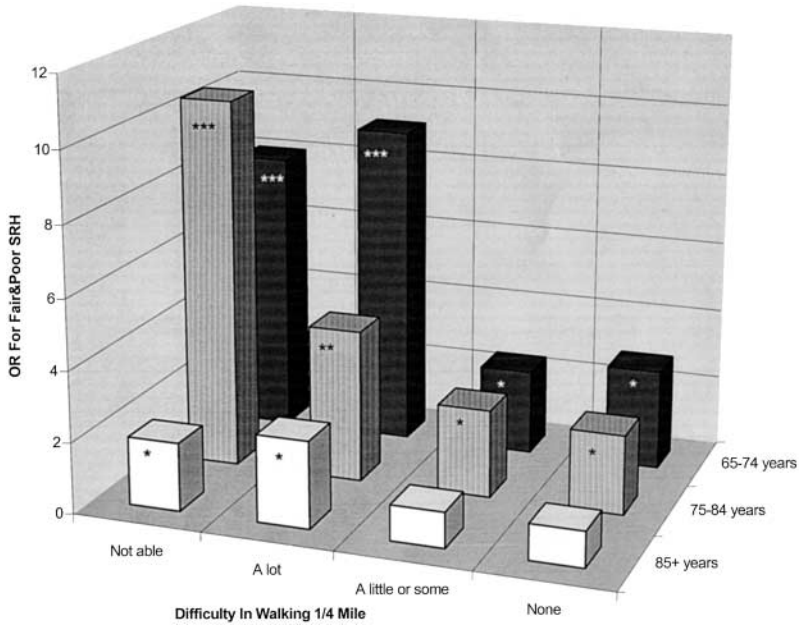


Figure 1. Odds ratios (OR) for fair or poor self-rated for the three 10-year age groups and four levels of walking disability. OR are adjusted for grip strength, chair stand time, balance, number of chronic diseases, hearing impairment, visual acuity, Mini-Mental State Examination, depression, race, and education. Women aged 85 and older, with no difficulty in walking one quarter mile, are the reference group. *$p < .05$; **$p < .01$; ***$p < .001$.

(32,33). In the future, the relationship of reported walking difficulty and measured walking performance and the specific causal pathways leading to these problems deserve more detailed analysis to help us to understand the specific nature of these measures.

In our study, age was a highly significant predictor of self-rated health but showed a complex pattern of association. In a random screened population, older women reported worse self-rated health than younger women, but in the study group that already, because of the eligibility criteria, was "adjusted for"

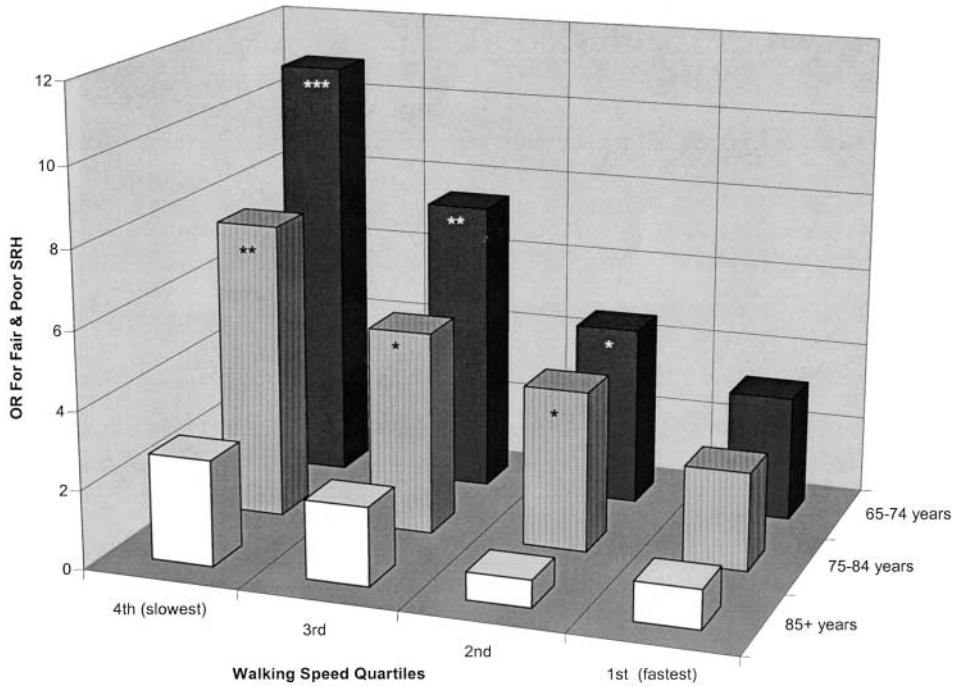


Figure 2. Odds ratios (OR) for fair or poor self-rated for the three 10-year age groups and four quartiles of walking speed. OR are adjusted for grip strength, chair stand time, balance, number of chronic diseases, hearing impairment, visual acuity, Mini-Mental State Examination, depression, race, and education. Women aged 85 and older in the highest quartile of walking speed are the reference group. *$p < .05$; **$p < .01$; ***$p < .001$.

the level of disability (all were moderately to severely disabled, and, thus had a much more limited range of functioning than a random population), the oldest assessed their health as better than younger age groups. In multivariate analyses, which adjusted for multiple indicators of health status, higher age was consistently associated with better self-rated health both in the screened random population and in the disabled study group. Adjusted for measures of mobility and other indicators of health and sociodemographic status, the 65- to 74-year-old women were 3.7 times and the 75- to 84-year-old women were 3.1 times more likely to report poor or fair self-rated health than the women aged 85 and older. Younger age was significantly associated with worse self-rated health for every level of walking difficulty, except for those having a little or some difficulty, and for every quartile of walking speed except the fastest. These findings support the theory of decreasing aspiration level concerning health with increasing age (18).

At equal levels of illness and functioning, nonwhite women were 2.1 times more likely than white women to assess their health as fair or poor. Given the comprehensive set of possible predictors of self-rated health we could take into account in the study, this difference is not likely to be caused by health characteristics specific to nonwhite women that were not adjusted for in our study. Rather, it is possible that, similar to what has been reported in other cross-cultural comparisons (34,35), nonwhite women are using the preset response scale differently from white women, and their ratings therefore are more likely to concentrate on the negative end of the scale. The finding, however, again implies that direct comparisons of the levels of self-rated health across cultural and ethnic groups should be done with caution.

Our study has demonstrated that mobility is an essential constituent of self-rated health. The research also supports our previous conclusions (34) about self-rated health as a global summary measure in which different health-related aspects are taken into account in relation to different contextual frames (e.g., in the context of one's own age and what is considered usual at that age). Better understanding of these interpretative processes could help doctors and others working with older people to communicate with their patients and diagnose their problems. Further research should shed light on cultural and individual determinants of different dimensions of mobility problems and the ways in which older people cope with them in their everyday life. Maintaining and improving mobility, and the ability to walk in particular, is one of the key issues in our attempts to enhance independent living and quality of life in old age.

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## References

1. Mulsant BH, Ganguli M, Seaberg EC. The relationship between self-rated health and depressive symptoms in an epidemiologic sample of community-dwelling older adults. *J Am Geriatr Soc.* 1997;45:954–958.
2. Cohen HJ, Pieper CF, Harris T, Rao KM, Currie MS. The association of plasma IL-6 levels with functional disability in community dwelling elderly. *J Gerontol Med Sci.* 1997;52A:M201–M208.
3. Guralnik JM, LaCroix AZ, Abbott R, Wallace RB, Satterfield S. Maintaining mobility in late life. I. Demographic characteristics and chronic conditions. *Am J Epidemiol.* 1993;137:845–857.
4. Guralnik JM, Simonsick EM, Ferruci L, et al. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. *J Gerontol Med Sci.* 1994;49:M85–M94.
5. Ensrud KE, Nevitt MC, Yunis C, et al. Correlates of impaired function in older women. *J Am Geriatr Soc*. 1994;42:481–489.
6. Gill TM, Williams CS, Tinetti ME. Assessing risk for the onset of functional dependence among older adults: the role of physical performance. *J Am Geriatr Soc.* 1995;43:603–609.
7. Cress ME, Schechtman KB, Mulrow CD, Fiatarone MA, Gerety MB, Buchner DM. Relationship between physical performance and self-perceived physical performance. *J Am Geriatr Soc.* 1995;43:93–101.
8. Elam JT, Graney MJ, Beaver T, el Derwi D, Applegate WB, Miller ST. Comparison of subjective ratings of function with observed functional ability of frail older persons. *Am J Public Health.* 1991;81: 1127–1130.
9. Ferrer M, Lamarca R, Orfila F, Alonso J. Comparison of performance-based and self-rated functional capacity in Spanish elderly. *Am J Epidemiol.* 1999;149:228–235.
10. Leibson CL, Garrad J, Nitz N, et al. The role of depression in the association between self-rated physical health and clinically defined illness. *Gerontologist.* 1999;39:291–298.
11. Jylhä M, Leskinen E, Alanen E, Leskinen AL, Heikkinen E. Self-rated health and associated factors among men of different ages. *J Gerontol.* 1986;41:710–717.
12. Schulz R, Mittelmark M, Kronmal R, et al. Predictors of perceived health status in elderly men and women. *J Aging Health.* 1992;6:439–447.
13. Hoeymans N, Feskens EJM, Kromhout D, van den Bos GA. Ageing and the relationship between functional status and self-rated health in elderly men. *Soc Sci Med.* 1997;45:1527–1536.
14. Leinonen R, Heikkinen E, Jylhä M. A path analysis model of self-rated health among older people. *Aging.* 1999;11:209–220.
15. Ferraro KF. Self-ratings of health among the old and old-old. *J Health Soc Behav.* 1980;24:377–383.
16. Festinger LA. A theory of social comparison processes. *Hum Relations.* 1954;7:117–140.
17. Merton RK. *Social Theory and Social Structure*. New York, NY: Free Press; 1968.
18. Tornstam L. Health and self-perception. *Gerontologist*. 1975;15:264–270.
19. Rakowski W, Cryan CD. Associations among health perceptions and health status within three age groups. *J Aging Health.* 1990;2:58–80.
20. Suls J, Marco CA, Tobin S. The role of temporal comparison, social comparison, and direct appraisal in the elderly's self-evaluations on health. *J Appl Soc Psych.* 1991;21:1125–1144.
21. Roberts G. Age effects and health appraisal: a meta-analysis. *J Gerontol Soc Sci*. 1999;54B:S24–S30.
22. Hoeymans N, Feskens EJ, Kromhout D, van den Bos GA. The contribution of chronic conditions and disabilities in poor self-rated health in elderly men. *J Gerontol Med Sci.* 1999;54A:M501–M506.
23. Guralnik JM, Fried LP, Simonsick EM, et al., eds. *The Women's Health and Aging Study: Health and Social Characteristics of Older Women with Disability.* Bethesda, MD: National Institute on Aging; 1995. NIH publication 95-4009.
24. Kasper JD, Shapiro S, Guralnik JM, Bandeen-Roche KJ, Fried LP. Designing a community study of moderately to severely disabled older women: The Women's Health and Aging Study. *Ann Epidemiol.* 1999; 9:498–507.
25. Simonsick EM, Maffero CE, Rogers SK, et al. Methodology and feasibility of home-based examinations in disabled older women: The Women's Health and Aging Study. *J Gerontol Med Sci.* 1997;52A: M264–M274.
26. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State": a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res.* 1975;12:189–198.
27. Fried LP, Kasper JD, Williamson JD, et al. Appendix E: disease ascertainment algorithms. In: Guralnik JM, Fried LP, Simonsick EM, et al., eds. *The Women's Health and Aging Study: Health and Social Char-*

*acteristics*. Bethesda, MD: National Institute on Aging; 1995:E1–E22. NIH Publication 95-4009.
28. Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res.* 1983;17:37–49.
29. Verbrugge LM, Jette A. The disablement process. *Soc Sci Med.* 1994; 38:1–14.
30. Guralnik JM, Ferrucci L, Simonsick EM, Salive ME, Wallace RB. Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability. *N Engl J Med.* 1995;332:556–561.
31. Hoeymans N, Feskens EJM, van der Bos GAM, Kromhout D. Measuring functional status: cross-sectional and longitudinal associations between performance and self-reports (Zutphen Elderly Study 1990–1993). *J Clin Epidemiol.* 1996;49:1103–1110.
32. Guralnik JM, Branch LG, Cummings SR, Curb JD. Physical performance measures in aging research. *J Gerontol Med Sci.* 1989;44:M141–M146.
33. Jylhä M, Jokela J, Heikkinen E. Health-related quality of life in the elderly in 1979 and 1989. A birth cohort comparison in Tampere, Finland. In: Ferrucci L, Heikkinen E, Waters E, Baroni A, eds. *Health and Quality of Life in Older Europeans*. Copenhagen: INRCA and WHO; 1995:67–103.
34. Jylhä M, Guralnik JM, Ferrucci L, Jokela J, Heikkinen E. Is self-rated health comparable across cultures and genders? *J Gerontol Soc Sci.* 1998;53B:S144–S152.
35. Shetterly SM, Baxter J, Mason LD, Hamman RE. Self-rated health among Hispanic vs non-Hispanic white adults: the San Luis Valley Health and Aging Study. *Am J Public Health.* 1996;86:1798–1801.

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