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Home Based Gait Speed Assessment: Normative Data and Racial/Ethnic Correlates Among Older Adults

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Abstract

Objectives.—To determine home-based gait speed performance and its associations with socio-demographic and health-related factors among older adults.

Design.—Cross-sectional analysis of nationally representative United States population sample.

Setting and Participants.—Homes of Health and Retirement Study (HRS) participants.

Methods.—Walk test data measured at home over 2.5 m were aggregated for 6983 individuals, aged ≥65 years (mean age 74.8±6.9, 54.2% women), from the 2006 and 2008 HRS waves. Means for gait speed at normal pace were determined for demographic and clinical groupings; gait speed associations with demographic, socioeconomic status, and health factors were examined. Four-year mortality was predicted from baseline slow gait status defined using demographic based cutscores as well as commonly recommended cutscores (100 or 60 cm/s).

Results.—Home-based gait speed (cm/s) means were lower for female than male (9.6% difference), older than younger (18.0% difference), African-American than Caucasian (20.5% difference), and Hispanic than Non-Hispanic (10.3% difference) participants. Differences by age group, race, and ethnicity remained significant within sexes (p<.001). Lower speed was associated with African-American race and all health problems; higher speed was associated with higher socioeconomic status and alcohol consumption. Four-year mortality was predicted by slow gait status. Predictive validity was, in general, higher for slow gait cutscores defined by demographic characteristics.

Conclusions and Implications.—Mean gait speed measured at home differs among older (aged 65+) U.S. resident population groups defined by sex, age, race, ethnicity, health status, and combinations of these factors, and predicts four-year mortality when substantially slower than group-based norms. These findings may assist researchers and clinicians in determining normal and abnormal gait performance in older adults in community settings.

Brief summary:

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Normative home based gait speed differs by socio-demographic groups for U.S. older adults and predicts four-year mortality when substantially slower than group-based norms.

Keywords

gait speed; demographics; socioeconomic status; race disparities; medical conditions; mortality

INTRODUCTION

Gait speed is increasingly recognized as an indicator of medical conditions and a predictor of future adverse health events in aging populations,[1-6] but establishing gait speed reference values has proven challenging given the heterogeneity in collection methods, protocols, and settings used.[7-10] Furthermore, normative gait speed data based in single racial/ethnic groups may have limited generalizability given the documented racial disparities in gait speed.[11-13]

Home-based assessments of older adults are becoming more popular in research and clinical settings,[6, 14, 15] lowering barriers to participation in research studies as well as enhancing access to clinical care. The timed walk test is a quick, inexpensive, and highly reliable measure of functional capacity that can be easily done in the home interview.[16, 17] Timed walk over a fixed distance at home settings either as a component of physical performance batteries[18-20] or as a stand-alone test is widely used.[14, 21] But there is limited data on the socio-demographic and health-related factors that might influence timed walk performance at home.

To address this knowledge gap, we analyzed home-based time walk using publicly available data from the Health and Retirement Study (HRS), a nationally representative survey of community-dwelling U.S. adults. We examined the association of gait speed with demographic, socioeconomic status, and health factors as well as the predictive ability of slow gait status in predicting four-year mortality.[22, 23] Establishing gait speed performance and its determinants in home settings will help guide assessments in this setting as well as others in which equipment and space are limited.

METHODS

Study Population

Study participants were selected from individuals enrolled in the HRS, a study sponsored by the National Institute on Aging (U01AG009740) and the Social Security Administration and conducted by the University of Michigan. Detailed information about its design and implementation is available on the HRS website (http://hrsonline.isr.umich.edu). The Einstein institutional review board approved this analysis.

The individuals selected for this analysis completed walk tests during HRS-administered, in-home interviews. These tests were part of a physical measures battery administered at home to a random half-sample in 2006 and to the complementary, remaining half-sample in 2008.

Data for all 2006 and 2008 participants were obtained from the HRS website.[24] Although they included person-level analysis weights designed to inflate each half sample to the entire target population, the half samples were aggregated for analysis because the estimated population parameters concerned measures of location (means) or association (correlations) rather than numbers of individuals. Participants with valid walk tests and available data for all socio-demographic and health-related factors under consideration were included in the gait speed analyses; those who had four-year mortality identified by HRS follow-up were included in the mortality analyses.

Home-based Gait Speed Assessment

Interviewees aged ≥65 years were assessed in their homes. A clear, preferably non-carpeted area, approximately 3.7 m in length was needed to set up the walking course. Participants were asked to walk at their "normal pace", unassisted, on a 2.5 m course with start and stop points marked on the floor. The distance was chosen based on considerations of limited unobstructed space available in homes.[16] The interviewer placed a strip of masking tape, approximately 20 cm long, on the floor to mark the starting and ending points of the course. Participants were instructed to place their toes at the start of the course. The interviewer said, “Ready, begin” to signal to the respondent to begin walking at their normal pace just past the end of the course. The interviewer started the stop watch once the respondent’s foot was across the starting line and fully touching the floor, and stopped the stop watch as soon as the respondent’s foot was completely past the masking tape marking the finish line and fully touched the floor. Participants were instructed to wear appropriate footwear (low or no heel). The interviewer walked just to the side and slightly behind the respondent so as to clearly see the respondent’s feet as they crossed the line, but also to gently support the respondent if they lost their balance or started to fall. This measure could be completed with a walking aid, such as a cane or a walker, if a respondent normally used an aid to walk. Transit time on two trials was measured, and gait speed was computed separately for each trial as the course distance in centimeters divided by the transit time in seconds. Trial speeds <2.5 cm/s or >250 cm/s were deemed implausible and excluded from analysis. Overall gait speed (cm/s) for each participant was defined as the average of available trial speeds.

Gait Speed Correlates

Individual attributes likely to be associated with gait speed variation were identified in accordance with previous research.[11, 25, 26] Basic demographics included sex, age, race (African-American/Caucasian), Hispanic ethnicity, and urbanicity (1=urban, 2=suburban, 3=exurban). Socioeconomic status was indexed by education years (0-17) and a composite wealth score (1-10) derived by averaging decile rankings from two HRS summary measures, household income and household assets (including secondary residence).

Health-related factors included medical conditions and health behaviors previously shown[26] to predict incident slow gait (defined as gait speed at least a standard deviation (SD) below a group's mean) in HRS participants. Presence of hypertension, diabetes, strokes, heart conditions (angina, myocardial infarction, or cardiac failure), lung conditions (chronic bronchitis or emphysema, but not asthma), and arthritis were ascertained by participants' responses to interview questions about physician-diagnosed diseases.

Alcohol consumption, pain, and falls were defined by participants' affirmative answers, respectively, to the questions, *Do you ever drink any alcoholic beverages such as beer, wine, or liquor? Are you often troubled with pain?* and *Have you fallen down in the last two years?* Low vision was identified by legally blind status or self-ratings of overall, near, or far vision as *fair* or *poor*. Poor sleep quality was indicated by responses of *sometimes*, *rarely*, or *never* to the question, *How often do you feel really rested when you wake up in the morning?* Physical inactivity was indicated by self-reported engagement of less than once per week in *sports or activities that are vigorous*. Use of prescription medications was identified by affirmative answers to the question, *Do you regularly take prescription medications?*

Body mass index (BMI) was calculated from height and weight, and obesity was identified for values ≥30. Grip strength (kg) was calculated by averaging readings obtained with a Smedley spring-type hand dynamometer over four trials (two per hand), and muscle weakness was identified for values 1 SD or more below the mean for groupings by sex and age (65-74 vs. ≥75 years). Cognition was assessed by the Telephone Interview for Cognitive Status (range: 0-35), and cognitive impairment was identified for scores 1 SD or more below the mean in accordance with procedures used to define pre-dementia syndromes.[27] Depressive symptoms were assessed with the 8-item Center for Epidemiologic Studies Depression Scale, and depression was defined as a score ≥4.[28]

A measure of illness burden was defined as the count of health problems (health-related factors excluding alcohol consumption; 0-16). Participants were classified by scores into illness levels labeled Low (0-5), Medium (6-10), and High (11-16).

Ascertainment of mortality was obtained from the vital status variable, which was reported by the decedent's spouse, family member, or friend during a core or exit interview biannually between 2006 and 2014. The Tracker File is updated following each wave. The Tracker File (2014 V1.0) was used for this analysis and only deaths reported up to wave 2012 and 2014 for participants from the 2006 and 2008 wave, respectively, were included in the analysis.

Data Analyses

Analyses served three major objectives. The first was to define home-based gait speed performance for subpopulations defined by participant sex, age, race, Hispanic ethnicity, urbanicity, and illness level, as well as combinations of these factors.

The second objective was to elucidate associations of home-based gait speed with sociodemographic and health-related factors more generally. Of particular interest was replication and extension of previous research[11-13] showing race-related differences in gait speed that persisted after adjustment for numerous covariates. Accordingly, we developed linear regression models predicting gait speed from individual attributes.

The third objective was to examine the utility of slow gait in predicting future mortality, in accordance with previous longitudinal research showing the relationship between gait speed decline and adverse outcomes in older adults.[1-6] We estimated four-year mortality risk for slow-gait status defined as the mean minus the SD reported in Table 2 for categories of age, sex, race and ethnicity. We compared the odds ratio, specificity and positive predictive value of these slow gait cutscores with two slow gait cutscores (100 cm/s and 60 cm/s) that are widely reported in the literature.[29, 30] A gait speed of less than 100 cm/s is associated with sarcopenia, which in turn increases risk of disability in older adults.[30] The risk of disability and other poor health outcomes increases rapidly with lower gait speed such as 60 cm/s, which is uncommon among individuals younger than 65 years.[31]

Analyses were performed with SAS 9.4 (SAS Institute Inc., Cary, NC) statistical software, employing procedures that accommodate complex survey design features (e.g., weighting, stratification) and using the Taylor series linearization method for error variance estimation. To preserve accurate error estimation while excluding observations with missing or problematic data from analyses, we entered all observations into each analytical procedure but treated those to be included versus excluded as constituents of distinct subpopulations, retaining results for only the former.[32] When conducting multiple hypothesis tests within a given analysis, we applied the Benjamini and Hochberg[33] procedure to obtain a false discovery rate (FDR) of .05. This procedure affords greater statistical power than the Bonferroni procedure by controlling the overall rather than the familywise rate of false positive findings.

RESULTS

Study population

Among 13,589 participants for whom physical measures data were available, 8995 (66.2%) were aged 65 or more and 7977 (88.7%) of these individuals completed home-based walk tests. The reasons most frequently provided for missing walk tests were lack of space at home (n=401), participant health problems (n=339), and participant (n=310) and interviewer (n=273) concerns about safety.

Among participants with home-based walk tests, 6983 (87.5%) met all criteria for sample inclusion in determining gait speed norms and concurrent correlates. The reasons for exclusion were missing demographics (n=11), race other than African-American or Caucasian (n=230), use of walking aids (n=348), effort deficiencies (n=19), implausible velocities (n=13), and (among those meeting all demographic and walk test criteria) missing education (n=1) and health (n=402) data. Mortality analyses were conducted on the 6973 participants for whom vital status information was available up to wave 2014.

Descriptive statistics for the sample characteristics, divided by race, are presented in Table 1. Compared with Caucasians (88.7% of participants), African-Americans were more likely to be female and to have low vision, poor sleep, physical inactivity, diabetes, hypertension, obesity, depression, and cognitive impairment. Fewer of them were of Hispanic ethnicity, consumed alcohol, and had falls, lung conditions, and heart conditions. They also had lower gait speed, age, wealth, and cognitive scores, and fewer years of education; lived in more urban areas; and had higher BMI and more depressive symptoms.

Gait performance

Distributions of home-based gait speed at normal pace for the full sample and defined subpopulations were essentially normal. Means and SDs are presented with their respective standard errors in Table 2. Subpopulation comparisons for these statistics yielded numerous significant differences (FDR threshold=.041, df≈13,500).

Gait speed means were lower for female than male (75.6 vs. 83.2, p<.001), older than younger (71.2 vs. 85.3, p<.001), African-American than Caucasian (65.2 vs. 80.1, p<.001), and Hispanic than Non-Hispanic (71.6 vs. 79.4, p<.001) participants. Differences by age group, race, and ethnicity remained significant when nested within sex, with lower means for older than younger females (68.3 vs. 82.0, p<.001) and males (75.0 vs. 88.8, p<.001), for African-American than Caucasian females (63.1 vs. 76.6, p<.001) and males (68.3 vs. 84.1, p<.001), and for Hispanic than Non-Hispanic females (67.3 vs. 75.9, p<.001) and males (76.8 vs. 83.5, p<.004). Means declined successively (p<.001) among the illness groups labeled Low (85.6), Medium (72.2), and High (57.9).

Gait Speed Correlates

Univariable linear regressions of gait speed on sociodemographic and health-related factors are presented in Table 3. Lower speed was associated with African-American race, female sex, increasing age, and Hispanic ethnicity. Lower speed was furthermore associated with all physical health problems, physical inactivity, depression, cognitive impairment, and prescription medication use, whereas higher speed was associated with alcohol consumption and increasing education and wealth.

A multiple linear regression of gait speed on the same predictors is also presented in Table 3. Sex, age, education, and wealth, along with alcohol consumption, pain, low vision, physical inactivity, stroke, lung and heart conditions, diabetes, obesity, muscle weakness, and cognitive impairment, retained statistical significance and direction of effect. The difference between races, although attenuated (B=−9.6, p<.001 vs. B=−14.9, p<.001), remained significant despite adjustment for risk factors (female sex, low vision, poor sleep, physical inactivity, diabetes, hypertension, obesity, depression, and cognitive impairment) more prevalent among African-Americans. While other effects lost significance, an association of lower gait speed with urbanicity acquired significance, apparently in consequence of this predictor's relative independence from others (tolerance=.93) and reduced error variance in the multivariable model. Replacing individual health problems with the illness burden measure yielded a strong effect (B=−2.3, p<.001) for this measure, modestly altered the coefficients of other predictors, and negligibly reduced explained variance (R^2=.25).

Gait speed cuts and mortality

We examined the utility of different slow gait cuts in predicting four-year mortality. Cuts were defined by a universal cut point of 60 cm/s and 100 cm/s as well as by 1 SD below the mean age, sex, race, and ethnicity gait speeds as shown in Table 2. The odds ratio for predicting four-year morality was the strongest for slow gait cuts defined by sex and ethnicity and the weakest for those defined by age cuts. The specificity and positive predictive values for mortality were the highest for gait cuts defined by race and ethnicity and the lowest for standard cuts of 60 cm/s and 100 cm/s.

DISCUSSION

This study used walking test, socio-demographic, and health-related information from the 2006 and 2008 waves of HRS to determine home-based gait speed norms and correlates for community-dwelling U.S. adults aged ≥65. In addition, these norms were used to define demographic group-specific slow gait cuts to predict four-year mortality.

These gait speed performance characteristics are comparable to other large, population-representative samples assessed by home-based methods in the U.S.[34, 35] The Established Populations for the Epidemiologic Study of the Elderly (EPESE) and National Health and Aging Trends Study, which are predominantly Caucasian U.S. based cohort studies, have reported overall mean gait speeds of 83 cm/s[31] and 79 cm/s[36] respectively for participants aged ≥65, similar to our finding for Caucasian participants in HRS. By contrast, Studenski et al.[31] reported a speed of 56 cm/s for the Hispanic-EPESE sample, a U.S. cohort study of predominantly Hispanic participants, which is substantially lower than our value of 71.6 cm/s for Hispanic participants in HRS. These differences may reflect differences in sample composition between the studies, cultural factors, distances of timed walk protocols, or use of a formula in the case of the EPESE studies that adjusted course results for compatibility across studies. Our results suggest that gait speed assessment method and setting needs to be considered when assessing walking.[17, 27, 37, 38]

Our analyses included thorough examination of race and ethnicity as gait speed correlates. Building on previous research findings linking mobility to race,[11-13] we compared African-Americans with Caucasians on multiple covariates and found numerous significant differences. Adjusting for these factors via multiple regression analysis, we found that the difference in mean gait speeds between African-Americans and Caucasians attenuated substantially (−14.9 cm/s vs. −9.6 cm/s); this result replicated a similar effect attenuation (−8.87 cm/s vs. −7.79 cm/s) reported in a Bronx-based cohort.[11]

Similar to the results by Studenski et al.,[31] we found a strong association with slow gait and survival, providing further evidence of the predictive importance of slow gait for both ongoing health problems as well as future adverse outcomes. In general, demographic based slow gait cutscores showed greater specificity and positive predictive value than single cutscores applied uniformly across all ages, sexes and races. Our results underscore the importance of examining gait using cutscores based by sex, age, race and ethnicity rather than using a universal cut point, which may lead to more false positive results for female, African-American, and Hispanic individuals.

Health status itself evinced substantial power in explaining gait speed variability. Each health problem accounted on average for a 2.3 cm/s decrease in gait speed after adjustment for all other factors. This finding implies that gait speed may index a cumulative burden imposed by multiple health problems.

We acknowledge several limitations. Numerous risk factors were identified by self-report; future studies including medical chart review or laboratory investigations may help identify undetected or milder forms of disease. Second, while we examined a number of risk factors based on previous studies to understand why gait speed differs by race/ethnicity, the list is not exhaustive and other yet unidentified risk factors could explain residual differences. Our choice of risk factors in this retrospective analysis was also limited by those available in the HRS. Third, while longer distances are more reliable in assessing gait,[9] practical considerations such as limited availability of unobstructed space restricts the distance that can be used in home-based walking tests.

CONCLUSIONS AND IMPLICATIONS

Our findings of strong, concurrent associations between home-based gait speed and numerous health-related factors, in community-resident older adults, extend a growing body of evidence that gait speed and its correlates warrant close attention in geriatric populations. Understanding the relationship between these risk factors, and particularly that these relationships differ by race, is essential for the development of future interventions that may be tailored to benefit various ethnic and racial groups and those with particular health and behavioral risk factors. Our home-based gait speed performance statistics can be used by clinicians and researchers to provide reference values, determine cut points that distinguish normal from abnormal performance, and help predict adverse outcomes.

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Table 1

Characteristics of the 2006/2008 Health and Retirement Study Walking Trial Subjects

Characteristic	African American (N=791)	Caucasian (N=6192)	*t*	*p*
Gait speed, median (IQR), cm/s	63.5 (48.7, 81.2)	79.2 (63.3, 95.6)	−12.8	.000*
Female, %	59.8	53.8	2.8	.005*
Age, median (IQR), y	72.4 (68.2, 77.4)	73.7 (69.0, 79.8)	−4.9	.000*
Hispanic, %	1.5	4.3	−2.7	.006*
Urbanicity score, median (IQR)	2.2 (1.3, 2.6)	1.8 (1.0, 2.4)	8.0	.000*
Education, median (IQR), y	11.3 (9.0, 12.9)	11.8 (11.1, 14.5)	−11.4	.000*
Wealth score, median (IQR)	3.1 (1.8, 5.0)	5.6 (3.7, 7.4)	−17.6	.000*
Alcohol consumption, %	32.3	53.8	−10.1	.000*
Pain, %	17.9	20.9	−1.6	.100
Falls, %	27.2	34.2	−3.4	.001*
Low vision, %	39.4	26.2	6.8	.000*
Poor sleep quality, %	41.5	33.6	3.9	.000*
Physical inactivity, %	74.0	68.6	2.7	.007*
Arthritis, %	68.6	67.5	0.6	.564
Stroke, %	6.9	6.8	0.1	.924
Lung condition, %	8.5	11.7	−2.4	.019*
Heart condition, %	26.6	31.2	−2.2	.026*
Diabetes, %	30.8	19.5	6.5	.000*
Hypertension, %	76.7	61.1	7.4	.000*
Prescription meds, %	88.5	88.3	0.2	.877
Obesity, %	39.2	24.7	7.6	.000*
Depression, %	15.5	10.6	3.3	.001*
Muscle weakness, %	14.2	15.1	−0.6	.562
Cognitive impairment, %	36.8	13.2	14.2	.000*
Body mass index, median (IQR)	28.3 (25.1, 32.6)	26.6 (23.7, 30.0)	8.2	.000*
CESD score, median (IQR)	0.4 (0.0, 1.8)	0.0 (0.0, 1.2)	4.6	.000*
Grip strength, median (IQR), kg	26.0 (21.3, 32.6)	25.2 (19.5, 34.5)	0.5	.606
Cognition score, median (IQR)	18.6 (15.0, 21.9)	22.6 (19.3, 25.1)	−15.2	.000*

Note. Differences between races in the frequency or level of each characteristic were tested via logistic regression of race group membership on the characteristic.

*Significant at α=.05 by false discovery rate (threshold=.040).

CESD: Center for Epidemiologic Studies Depression Scale

IQR: Interquartile range

Table 2

Gait Speed Norms for the 2006/2008 Health and Retirement Study Walking Trial Subjects

		N	Mean (SE), cm/s	SD (SE), cm/s
Total				
All		6,983	79.1 (0.3)	25.5 (0.3)
Sex				
Male		3,132	83.2 (0.5)[a]	25.6 (0.4)
Female		3,851	75.6 (0.4) [b]	24.8 (0.4)
Age				
65-74		4,060	85.3 (0.4) [a]	25.5 (0.4)
≥ 75		2,923	71.2 (0.5) [b]	23.2 (0.4)
Race				
African American		791	65.2 (1.0) [a]	24.0 (1.2)
Caucasian		6,192	80.1 (0.4) [b]	25.3 (0.3)
Ethnicity				
Hispanic		417	71.6 (1.5) [a]	25.3 (1.4)
Non-Hispanic		6,566	79.4 (0.3) [b]	25.4 (0.3)
Urbanicity				
Urban		3,198	78.8 (0.5) [a]	26.7 (0.4)
Suburban		1,511	79.0 (0.7) [a]	24.0 (0.7)
Ex-urban		2,274	79.5 (0.6) [a]	24.6 (0.4)
Sex x Age				
Male	65-74	1,831	88.8 (0.7) [a]	25.4 (0.5)
	≥ 75	1,301	75.0 (0.7) [b]	23.7 (0.6)
Female	65-74	2,229	82.0 (0.6) [a]	25.1 (0.4)
	≥ 75	1,622	68.3 (0.6) [b]	22.4 (0.6)
Sex x Race				
Male	African-American	308	68.3 (1.6) [a]	24.8 (2.5)
	Caucasian	2,824	84.1 (0.5) [b]	25.4 (0.4)
Female	African-American	483	63.1 (1.2)[a]	23.2 (0.8)
	Caucasian	3,368	76.6 (0.5) [b]	24.7 (0.4)
Sex x Ethnicity				
Male	Hispanic	189	76.8 (2.2) [a]	25.1 (2.3)
	Non-Hispanic	2,943	83.5 (0.5)[b]	25.6 (0.4)
Female	Hispanic	228	67.3 (1.9) [a]	24.7 (1.5)
	Non-Hispanic	3,623	75.9 (0.5) [b]	24.7 (0.4)
Illness Burden				
Low		3,752	85.6 (0.5) [a]	25.0 (0.4)
Medium		3,061	72.2 (0.5) [b]	23.7 (0.4)
High		170	57.9 (2.1) [c]	22.9 (1.9)

Note. Differing superscript letters at the lowest level of each demographic breakdown (e.g., age within sex) indicate significant differences between means at α=.05 by false discovery rate (threshold=.041).

SD: standard deviation, SE: Standard error

Table 3

Linear Regressions of Gait Speed for the 2006/2008 Health and Retirement Study Walking Trial Subjects

	Univariable			Multivariable		
Characteristic	***B***	***t***	***p***	***B***	***t***	***p***
African American	−14.9	−14.1	.000 *	−9.6	−9.4	.000 *
Female	−7.6	−11.3	.000 *	−4.4	−7.0	.000 *
Age, y	−1.2	−25.9	.000 *	−0.9	−20.1	.000 *
Hispanic	−7.7	−5.1	.000 *	−2.0	−1.5	.145
Urbanicity score	−0.4	−1.0	.338	−1.0	−2.9	.004 *
Education, y	2.0	17.7	.000 *	0.6	4.9	.000 *
Wealth score	3.2	24.0	.000 *	1.1	7.6	.000 *
Alcohol consumption	9.3	13.8	.000 *	2.5	4.1	.000 *
Pain	−8.6	−10.8	.000 *	−3.7	−5.1	.000 *
Falls	−5.1	−7.0	.000 *	−1.0	−1.5	.137
Low vision	−10.1	−13.6	.000 *	−2.7	−4.0	.000 *
Poor sleep quality	−5.2	−7.2	.000 *	−1.2	−1.8	.066
Physical inactivity	−11.0	−15.0	.000 *	−3.0	−4.3	.000 *
Arthritis	−6.3	−8.6	.000 *	−1.0	−1.5	.137
Stroke	−10.0	−7.7	.000 *	−4.2	−3.6	.000 *
Lung condition	−6.4	−6.6	.000 *	−2.1	−2.4	.016 *
Heart condition	−6.5	−9.1	.000 *	−2.1	−3.3	.001 *
Diabetes	−5.9	−7.1	.000 *	−1.7	−2.3	.023 *
Hypertension	−5.7	−7.9	.000 *	−0.8	−1.2	.244
Prescription meds	−8.6	−7.7	.000 *	−2.0	−1.9	.065
Obesity	−4.4	−5.9	.000 *	−4.8	−7.0	.000 *
Depression	−9.4	−8.5	.000 *	−0.9	−0.9	.380
Muscle weakness	−11.1	−11.6	.000 *	−6.0	−7.3	.000 *
Cognitive impairment	−16.0	−18.5	.000 *	−5.2	−6.3	.000 *

Note. For the multiple regression, R^2=0.25, F(22,13533)=84.8, p<.001.

*Significant at α=.05 by false discovery rate (threshold for univariable/multivariable analyses=.048/.035).

Table 4

Prediction of four-year mortality from slow gait status.

Grouping Basis for Slow Gait Cut Points	OR (95% CI)	PPV (95% CI)	Specificity (95% CI)
Standard cut (speed ≤100 cm/s)	3.08 (2.34-4.05)	0.15 (0.14-0.16)	0.21 (0.20-0.22)
Standard cut (speed <60 cm/s)	3.03 (2.58-3.56)	0.25 (0.23-0.28)	0.81 (0.80-0.82)
Sex	3.34 (2.80-3.97)	0.29 (0.26-0.32)	0.88 (0.87-0.89)
Age	2.70 (2.25-3.23)	0.26 (0.23-0.29)	0.88 (0.87-0.88)
Race	3.05 (2.45-3.79)	0.30 (0.26-0.34)	0.94 (0.93-0.94)
Ethnicity	3.28 (2.69-4.01)	0.30 (0.27-0.34)	0.92 (0.91-0.93)

OR: odds ratio, PPV: positive predictive value (PPV), CI: confidence interval.

Table 5

Gait Speed Cut Points by Age and Sex Categories for the 2006/2008 Health and Retirement Study

Sex x Age		N	Mean (SE) cm/s	SD (SE) cm/s	Mean minus 1 SD (SE) cm/s	Mean minus 2 SDs (SE) cm/s
Male	65-74	1,831	88.8 (0.7)	25.4 (0.5)	63.4 (0.8)	38.0 (1.3)
	75-84	1,063	76.6 (0.8)	24.5 (0.7)	52.1 (1.0)	27.6 (1.5)
	≥ 85	238	68.7 (1.3)	19.2 (1.0)	49.5 (1.7)	30.3 (2.5)
Female	65-74	2,229	82.0 (0.6)	25.1 (0.4)	57.0 (0.7)	31.9 (1.1)
	75-84	1,239	70.7 (0.7)	22.5 (0.7)	48.2 (1.0)	25.7 (1.6)
	≥ 85	383	60.7 (1.1)	20.1 (0.8)	40.6 (1.4)	20.5 (2.0)

SD: standard deviation, SE: Standard error