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Adverse Outcomes and Correlates of Change in the Short Physical Performance Battery Over 36 Months in the African American Health Project

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Abstract

Background—The Short Physical Performance Battery (SPPB) is a well-established measure of lower body physical functioning in older persons but has not been adequately examined in African Americans or younger persons. Moreover, factors associated with changes in SPPB over time have not been reported.

Methods—A representative sample of 998 African Americans (49–65 years old at baseline) living in St. Louis, Missouri were followed for 36 months to examine the predictive validity of SPPB in this population and identify factors associated with changes in SPPB. SPPB was calibrated to this population, ranged from 0 (worst) to 12 (best), and required imputation for about 50% of scores. Adverse outcomes of baseline SPPB included death, nursing home placement, hospitalization, physician visits, incident basic and instrumental activity of daily living disabilities, and functional limitations. Changes in SPPB over 36 months were modeled.

Results—Adjusted for appropriate covariates, weighted appropriately, and using propensity scores to address potential selection bias, baseline SPPB scores were associated with all adverse outcomes except physician visits, and were marginally associated with hospitalization. Declines in

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D. K. M., T. K. M., and F. D. W. analyzed the data. All authors assisted in the study design, reviewed the results, and participated in the interpretation and presentation of the findings.

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SPPB scores were associated with low falls efficacy (b = −1.311), perceived income adequacy (−0.121), older age (−0.073 per year), poor vision (−0.754), diabetes mellitus (−0.565), refusal to report household income (1.48), ever had Medicaid insurance (−0.610), obesity (−0.437), hospitalization in the year prior (−0.521), and kidney disease (−.956).

Conclusions—The effect of baseline SPPB on adverse outcomes in this late middle-age African American population confirms reports involving older, primarily white participants. Alleviating deterioration in lower body physical functioning guided by the associated covariates may avoid or delay multiple age-associated adverse outcomes.

Keywords

Aging; Lower body physical functioning; Disability; African Americans; Mortality; Nursing home placement

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The Short Physical Performance Battery (SPPB) developed from the Established Populations for Epidemiological Study of the Elderly (EPESE) is based on standing balance, chair stands, and gait speed. In older adults, SPPB is a strong and consistent predictor of progressive disability, hospitalization, nursing home admission, and death (1–6). Easy to administer in both epidemiological (5,7) and clinical settings (8,9), SPPB has excellent test–retest reliability and sensitivity to change (7). Moreover, it has been suggested that SPPB may be used to identify seniors in a “preclinical” stage of disability who may be ideal candidates for interventions aimed at delaying or preventing age-associated disability (2).

This knowledge notwithstanding, the predictive validity of SPPB has not been investigated in persons younger than 65 years, nor has it not been evaluated specifically for the African American population. African Americans constitute an important, disadvantaged U.S. minority population with increased risk for disability (10); lower body dysfunction represents one of the most powerful predictors of falls, hip fractures, incident disability, nursing home placement, and mortality [e.g., (2,11–14)]; and African Americans compared to whites generally have different experiences related to lower body physical performance such as prevalence of deficits, types of falls, and performance-related life space mobility [e.g., (15–17)]. For these reasons, examination of the predictive validity of SPPB in this population is crucial. Moreover, factors associated with changes in SPPB over time have not been examined using multivariable methods in well-designed population-based studies. After being identified, factors associated with subsequent change in SPPB could inform interventions to prevent decline in lower body function and thus avoid or delay multiple age-associated adverse outcomes. Accordingly, we used data from the African American Health (AAH) project to address the predictive validity of SPPB in late middle-aged African Americans and to examine correlates in changes in SPPB over time. We hypothesized that SPPB would be associated with death, nursing home placement, hospitalization, physician visits, incident basic and instrumental activity of daily living (ADL) disabilities, and functional limitations. We anticipated that correlates of change in SPPB over time would include older age, female gender, disease status (e.g., diabetes, stroke), poor vision, poor self-rated health, underweight and obesity, cigarette smoking, physical inactivity, clinically relevant levels of depressive symptoms, adverse neighborhood conditions, and recent hospitalization.

METHODS

Study Sample

The AAH project has been previously described (18,19). In brief, AAH is a population-based random sample study of 998 African Americans born in 1936 through 1950 from two diverse socioeconomic areas of St. Louis, Missouri (recruitment rate 76%). One area involved inner-city neighborhoods, and the other involved suburbs just northwest of St. Louis city with generally better socioeconomic circumstances. Additional inclusion criteria included self-reported black or African American race, ability and willingness to sign informed consent, and a Mini-Mental State Examination (MMSE) (20) score of 16 or greater (21). To recruit equal numbers of participants from both areas, unequal sampling proportions were used. When the original sample weight is used, the AAH cohort represents the noninstitutionalized African American population in the two areas as of the 2000 census. Baseline (wave 1) evaluations occurred in the participant's home between September 2000 and July 2001. Interviewers completed 26 hours of training on study-specific interviewing and performance testing. All procedures were approved by the Institutional Review Boards at the involved institutions, and all participants gave written informed consent.

Follow-Up Sample

In-home evaluations (wave 4) were again conducted 36 months after baseline. Eight hundred fifty-three participants were re-evaluated, with five of the evaluations relying on a proxy source previously identified by the participant. Because 51 participants had died between baseline and 36-month follow-up, the response rate for survivors was 90.1%. Attrition analysis (data available on request) indicated that dropout status was associated only with better vision and diagnoses of cancer and heart disease. Given the large number of factors included in the attrition analyses, it is likely that some of these three findings are due to chance. Furthermore, because the three associations were modest in size, the potential for meaningful attrition bias is minimal.

SPPB Measure

We constructed SPPB component and summary scores for the wave 1 and wave 4 evaluations based on the method described by Guralnik and colleagues (1,5) and Ostir and colleagues (7). The SPPB summary score is composed of three lower body physical performance measures: a hierarchical test of standing balance, five consecutive chair rises, and usual gait speed. Standardized assessment protocols were used, with interviewers demonstrating each task to participants before the evaluation. For each component score, participants who were deemed unable, unsafe, or in too much pain to attempt the task or were unable to complete the lowest performance level were given a task score of zero.

Standing balance was evaluated and scored using a hierarchical set of tasks based on side-by-side, semi-tandem, and tandem stances, as described by Guralnik and colleagues (1,5). For the chair stands evaluation, participants were asked to sit in a sturdy straight-back chair with the seat distance from the ground appropriate for the participants' height, to fold their arms across their chests, and to complete five chair rises as quickly as possible. Scores of 1 to 4 were based on quartiles of performance of AAH project participants who were able to complete the task, as follows: a score of 1 for >13.80 seconds; a score of 2 for 11.38–13.79 seconds; a score of 3 for 9.18–11.37 seconds; and a score of 4 for ≤9.17 seconds. For the habitual gait speed, a standardized 3- or 4-m course was demarcated in participants' homes, with participants instructed to walk at their usual pace, as if walking to the store. The average walking speed (m/s) for two trials was used to determine scores of 1–4 based on quartiles of performance for AAH participants who completed both walks. As gait speeds for 4 m were systematically faster than those for 3 m due to the effect of acceleration from the initial standing position, separate cut points were determined for the two distances, as follows: for 3 m (n = 244), a score of 1 for ≤0.60 m/s, a score of 2 for 0.61–0.72 m/s; a score of 3 for 0.73–0.86 m/s; and a score of 4 for ≥0.87 m/s. For 4 m (n = 241): a score of 1 for ≤0.70 m/s, a score of 2 for 0.71–0.81 m/s; a score of 3 for 0.82–0.97 m/s; and a score of 4 for ≥0.98 m/s. Due to safety concerns and challenges from cluttered, relatively small living spaces, gait speed participation was low during wave 1 but improved during wave 4 due to improved interviewer training and problem-solving during in-home interviewing.

A summary score was created by adding the component scores for standing balance, chair stands, and usual gait speed (range from 0 [worst] to 12 [best]). Using the approach employed by Ostir and colleagues (7), when one of the three measures was missing, the total score was calculated as the average of the other two scores times 3. When two of the three measures were missing, no total score was calculated. Adequate data were available to score the following at wave 1 and wave 4, respectively: 91.6% and 93.0% for standing balance, 89.2% and 87.5% for chair stands, 44.9% and 79.8% for gait speed, and 91.0% and 91.1% for the summary score. The physical performance tests were repeated about 2 weeks later (mean 18 days, standard deviation [*SD*] 6.9) on 28 participants, and the test–retest reliability using the intraclass correlation coefficient was 0.727.

Predictive Validity Measures

To examine the predictive validity of SPPB, we evaluated the relationship between the SPPB summary score at baseline and the following outcomes obtained during the wave 4 evaluation. Vital status was measured as alive versus dead and determined through the tracking efforts of the contracting survey organization (Survey Research Center at the University of Michigan). Nursing home placement for a long-term stay (i.e., short-term rehabilitation stays were not counted) was measured in a similar fashion, supplemented with specific questions during the wave 4 interview. Tracking was successful for all 998 of the original respondents. Hospitalization was based on respondent or (in five cases) proxy reports at the wave 4 interview of one or more hospitalizations in the year prior to the 36-month follow-up. Physician visits were based on respondent (or proxy) report of the number of non–emergency room physician visits in the year prior to the 36-month followup. Seven basic ADLs were taken from the Second Longitudinal Study on Aging (LSOA-II) (22) and included having any difficulty with bathing, dressing, eating, getting in and out of bed or chairs, walking across a room, getting outside, and using the toilet (0 = no difficulties to 7 = difficulties on all activities). Eight instrumental ADL items from LSOA-II and Lawton and Brody (23) included reporting any difficulty with preparing meals, shopping for groceries, managing money, making phone calls, doing light housework, doing heavy housework, getting to places outside of walking distance, and managing medications (0 = no difficulties to 8 = difficulties on all activities). Lower body functional limitations were measured as the sum of reported difficulty for five activities (walking one quarter mile, going up and down a flight of 10 steps, stooping–crouching–kneeling, lifting 10 pounds, and pushing large objects).

Measurement of Potential Correlates of Change in SPPB Measures

The following baseline covariates were used in multi-variable models to identify factors associated with change in the SPPB summary measures from wave 1 to wave 4. Demographic measures included age (continuous variable), gender, and marital status. Socioeconomic measures involved years of formal education, annual household income (< $20,000 vs ≥$20,000; 4.3% refused to report household income), perceived income adequacy (comfortable or not enough vs reference category of just enough to make ends meet), having Medicare now (yes vs no), ever having Medicaid, and stratum (inner city vs suburbs). Health conditions included self-rated health (24) and a five-level self-rated assessment of hearing ranging from excellent to poor (each dichotomized as fair or poor vs all others). A self-reported visual acuity scale (3 = excellent to 15 = poor) was coded as the lowest quintile versus all others. Severe underweight was defined as a body mass index (BMI) <20, obesity as a BMI of ≥30, with the reference category being 20 ≥BMI < 30 (BMI could not be determined in 1.6%). The presence of chronic disease was based on self-report of physician diagnosis for 11 diseases or conditions (hypertension, diabetes mellitus, stroke, heart attack, cancer other than a minor skin cancer, chronic obstructive pulmonary disease [COPD], heart failure, angina, asthma, kidney disease, and arthritis). Current and previous cigarette smokers were contrasted with the reference group of never smokers. Physical activity was measured with the frequency of walking one-quarter mile (1 to 6 times per week or 7 or more time per week vs < 1 time per week; 2.7% missing) and with the seasonally adjusted summary index from the Yale Physical Activity Scale (25). Chronic disease incidence over 36-month follow-up for the 11 conditions listed above was categorized as 1 incident condition or ≥2 incident conditions vs no incident conditions. Psychosocial measures involved the following: Depressive symptoms were measured using the 11-item Center for Epidemiological Studies Depression (CES-D) short form and coded as 1 if ≥9 points and 0 if <9 points (26,27). Cognitive function was measured using the MMSE and Animal Naming tests (28,29), with the lowest quintile contrasted with all others (5.8% missing Animal Naming). Fear of falling was measured using the Falls Efficacy Scale (30), contrasting the lowest quintile versus all others. The five-item social support scale was derived from the Medical Outcomes Study (5 = worst to 25 = best) (31) and coded as lowest quintile or missing (0.4%) versus all others. The religiosity scale (5 = highest to 33 = lowest) was based on five items from the Fetzer Institute/National Institute on Aging Working Group measures (32) and coded as the lowest quintile or missing (0.8%) versus all others. Race consciousness was measured by asking participants how often they thought about their race (33), with those responding never or only once a year (42.2%) contrasted with all others. Neighborhood desirability was assessed by a self-reported four-item scale, which was recoded to contrast living in the least desirable quintile versus all others. Home assessment was a five-item scale of the interviewer's ratings of the interior and exterior of the home (5 = excellent to 20 = poor), and the lowest quintile was contrasted to all others (3.0% missing). Neighborhood assessment was a five-item scale of the interviewer's ratings of block face conditions (5 = best to 20 = worst), and the lowest quintile was contrasted with all others. Health services use was measured by whether the respondent had been hospitalized in the year prior to the baseline interview, based on self-report. More details of the covariate measurements are available in previous publications (27,29,34).

Statistical Analysis

Because a large number of participants were missing gait speed at wave 1, the propensity score method for addressing potential selection bias was used for all analyses except one of the sensitivity analyses. In brief, a multivariable logistic regression of whether gait speed was obtained on the participant at wave 1 was run using the variables described in the Methods section as potential predictor variables, and the predicted probability of inclusion in the gait speed group was determined for each participant in the study sample. The predicted probabilities were divided into quintiles, and the average participation rate within each quintile was calculated. Then the inverse (1 − participation rate) was used to weight the data so that participants with gait speeds who were most like those participants without gait speeds were given proportionally greater influence on the results (35,36). (Factors associated with lack of participation in wave 1 gait speed in the propensity-score model are available on request.)

Baseline characteristics were compared across tertiles of the SPPB using analysis of variance for continuous variables and the chi-square test for categorical variables. The relationship of the baseline SPPB summary scores with subsequent vital status, nursing home placement, and hospitalization was examined using logistic regression. The vital status model was adjusted for baseline age, gender, education, and self-rated health, and the model for the other two outcomes was adjusted for these variables plus incident conditions. The association of the baseline SPPB summary scores with the subsequent number of physician visits, basic and instrumental ADL disabilities, and lower body functional limitations was examined using residual change score linear regression, adjusting for the baseline level of the outcome as well as age, gender, education, self-rated health, and incident conditions. Factors associated with changes in the SPPB summary score over time were also identified using residual change score regression. In these analyses, the covariates were sequentially entered in the following block sequence: baseline SPPB summary score, demographic factors, socioeconomic measures, health conditions, psychosocial measures, and health services use (37). Dummy variables were used to represent missing data (when >1%) for each covariate. Variables independently associated with changes in the SPPB summary measure within their block were retained for the next step, and all variables retained in this process were included in final forced-entry regression analyses (unweighted *n* of participants included = 687).

In sensitivity analyses, robustness of the results was evaluated first using two alternative methods for scoring the SPPB summary measure. In one method, participants who had missing data for a single component task (e.g., chair stands) were given a 0 for that task to maximize the number of participants in the analysis. In the other method, summary SPPB scores were computed only when data were available for all three component tasks, which minimized the number of participants available (to 474 for the outcome assessments and to

346 for evaluating changes in SPPB over time). These analyses used propensity-score weighting. Then a third sensitivity analysis was conducted, which used the original scoring method but used the original sample weight rather the propensity-score weight.

RESULTS

Descriptive Data

Baseline characteristics are noted in Table 1, along with their association with tertiles of the wave 1 SPPB summary score. By the 36-month follow-up, of the 853 assessed participants, 6.0% had died, 2.5% had been admitted to a nursing home for what was considered a permanent stay, 20.2% had experienced one or more hospitalizations in the prior year, and the mean number of physician visits in the prior year, basic and instrumental ADL disabilities, and lower body functional limitations were 6.32 (*SD* 10.32), 0.88 (*SD* 1.74), 1.16 (*SD* 1.83), and 1.50 (*SD* 1.53), respectively. Average SPPB summary scores were 7.65 (*SD* 3.54) at baseline and 8.06 (*SD* 2.95) at 36-month follow-up. At baseline, 49% scored <9, and at 36-month follow-up 47% scored <9. Thirty-six-month SPPB change scores averaged 0.16 (*SD* 2.71), inter-quartile range −1.5 to 2.0, with negative scores indicating a decline in SPPB. A decline of one point or more SPPB points was experienced by 39% of participants, 38% improved ≥1 points, and 23% stayed the same.

Predictive Validity

After appropriate adjustments, each 1-point increase in the baseline SPPB score was independently associated with a 12% relative decrease in the risk of death, a 21% decrease in the risk of nursing home placement, and a 5% decrease in the risk of hospitalization, although this last result only reached borderline statistical significance (Table 2). The baseline SPPB summary score was also an independent predictor of changes in basic and instrumental ADL disabilities and lower body functional limitations over the 36-month period (Table 3). On average, for each additional 1 point on the baseline SPPB summary score (6), the net increase in the number of disabilities and limitations was reduced by about 0.1 on each of the basic ADL, instrumental ADL, and lower body functional limitations scales. Although the crude association of the baseline SPPB score was significantly associated with change in the number of physician visits, this relationship was not significant in the multivariable model.

Correlates of Change in the SPPB Summary Score

The results of the multivariable change score regression analysis of the SPPB summary score are shown in Table 4. As expected, the largest association involved the baseline SPPB summary score. Changes in the SPPB summary score over time were associated, from highest to lowest relative magnitude (using the standardized regression coefficient), with low falls efficacy, comfortable perceived income, age, poor vision, diabetes mellitus, refusal to report income, ever having Medicaid, BMI ≥30, hospitalization in the year prior to baseline, and kidney disease. With the exception of refusal to report income, the presence of each risk factor was associated with a decline in the SPPB summary score over the 36-month period.

Sensitivity Analysis

As indicated above, all of the models were replicated using three different approaches to scoring the SPPB and analyzing the data. In these analyses, the results of both the predictive validity and correlates of change in the SPPB summary score over time were materially similar to those using the original method. Most of the differences involved fewer statistically significant results when the more restrictive inclusion criterion resulted in fewer participants in the analytic sample, although the point estimates obtained were similar (data available from authors).

DISCUSSION

Previous research has shown that lower body function is crucial for avoiding or delaying health problems that often accompany older age, such as falls, progressive disability, institutionalization, and mortality. Our study extends previous research regarding the association of SPPB with adverse outcomes in samples of mixed or primarily white race (1–6) to mortality, nursing home placement, and progressive basic ADL, instrumental ADL, and lower body functional difficulties in a probability-based sample of urban-dwelling African Americans. Moreover, our findings demonstrate that these relationships are important for persons in late middle age as well as for older adults, when SPPB is calibrated for the younger group.

Of probably greater importance is the identification of factors independently associated with changes in SPPB summary scores over the 36-month period in this population. There are two reasons why these results are so important. First, factors associated with declines in SPPB summary scores over time can be used as an early warning system to identify persons at greater risk for subsequent declines in essential lower body functioning. The substantial independent association of low falls efficacy with declines in SPPB summary scores is of particular interest and appears similar to the well-known ability of a self-reported general health question to independently predict mortality (e.g., 38). Although it is unclear from these data whether low falls efficacy taps information that predicts a natural decline in lower body physical functioning or whether it acts like a self-fulfilling prophecy, low falls efficacy remains a strong predictor of decline in lower body function.

Some of our findings appear to vary from those of other investigations examining the relationship between physical functioning and the covariates that we studied. For example, in cross-sectional studies, Malmstrom and colleagues (29) identified associations between cognitive and physical functioning, and Brach and colleagues (39) found that participants who reported being physically active had better physical performance than did inactive participants. In a longitudinal study, Mendes de Leon and colleagues (40) showed that social relationships were important in the disability process, with similar findings in blacks and whites. Differences in design probably explain these discrepancies.

Second, these findings suggest treatment approaches for patients most in need of assistance in midlife to prevent subsequent declines in lower body functioning. For example, interventions are available to increase falls efficacy (41,42), to improve the physical and social impacts of low vision (43), and to improve outcomes in persons recently discharged from the hospital (44,45).

The primary limitation of this study is the restricted number of participants with gait speed assessments at baseline. However, we used the best available method for addressing the potential selection bias related to gait speed acquisition to obtain our results. Furthermore, two different methods for dealing with missing gait speeds and one method using a different approach to weighting the data produced equivalent results in both the predictive validity analyses and the analyses of changes in SPPB summary scores over the 36-month period. Together, these increase our confidence that the results shown in Tables 2–4 are robust. Other, less important limitations of this study relate to the single race-ethnic group, the single metropolitan area, and the limited age range. Although these are distinct advantages of the internal validity of our study, they do constrain its generalizability. This is critical for the identification of factors associated with declines in SPPB over time, and further studies to replicate these analyses are essential.

Summary

This study has confirmed the predictive validity of SPPB for adverse health outcomes in a population-based cohort of late middle-aged, urban-dwelling African Americans, when SPPB is calibrated for that population. Moreover, the factors associated with changes in SPPB over 36 months suggest avenues that may be useful to both researchers and clinicians for preventing declines in important lower body functioning in late middle age that may avoid or delay multiple age-associated adverse outcomes. Additional studies replicating these analyses in other middle-aged populations are needed.

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Table 1

Baseline Characteristics of African American Health Project Participants and Relationship to Tertiles of SPPB Distribution at Baseline

Characteristics	Prevalence at Baseline (%, Unless Noted)	SPPB: Tertiles Lowest (worst)	Middle	Highest (best)	p Value* (for Differences Across the Tertiles)
Demographics					
Age, mean (SD)	56.7 (4.4)	57.7 (9.4)	56.8 (7.0)	55.5 (7.6)	<.0001[a,b,c]
Gender, women vs men	58.3	58.2	58.6	59.0	.9181
Marital status					<.0001
Married	49.1	44.1	47.6	55.7	
Divorced/separated	28.6	27.5	29.2	28.7	
Widowed	13.0	14.6	13.0	10.6	
Single	9.3	13.8	17.7	5.1	
Socioeconomics					
Education, mean (*SD*)	12.4 (2.9)	11.7 (7.8)	12.4 (5.2)	12.8 (5.9)	<.0001
Household income <$20,000	31.2	51.6	30.7	14.3	<.0001
Perceived income adequacy					<.0001
Not enough to get by	17.9	27.4	20.5	13.1	
Just enough to get by	39.4	42.6	38.6	34.6	
Comfortable income	42.7	30.0	40.9	52.3	
Medicare coverage, current vs previous/no	19.8	38.5	16.3	5.6	<.0001
Medicaid coverage, current/previous	21.5	30.2	19.2	11.3	<.0001
Stratum, inner city	25.4	26.9	29.9	17.7	<.0001
Health conditions					
Self-rated health ¼ fair/poor vs other	43.4	67.1	39.1	18.9	<.0001
Visual acuity scale, lowest quintile	21.7	34.1	16.3	9.5	<.0001
Body mass index					<.0001
<20.0	3.0	1.3	5.3	3.3	
20.0 – <30.0	54.8	43.0	56.6	58.0	
≥30.0	42.3	55.7	38.1	38.8	
Hypertension	65.3	76.7	62.4	52.8	<.0001
Diabetes mellitus	27.6	36.3	19.8	13.7	<.0001

Characteristics	Prevalence at Baseline (%, Unless Noted)	SPPB: Tertiles			p Value* (for Differences Across the Tertiles)
		Lowest (worst)	Middle	Highest (best)	
Stroke	10.3	19.2	4.1	2.2	<.0001
Heart attack	10.3	14.1	9.6	4.4	.0003
Cancer	7.2	7.7	10.5	2.8	.0005
COPD	5.4	12.4	6.4	2.8	<.0001
Heart failure	6.0	10.3	3.8	1.9	<.0001
Angina	8.3	11.6	7.9	3.4	<.0001
Asthma	10.4	16.7	8.8	8.7	.0035
Kidney disease	6.2	10.7	2.9	3.1	<.0001
Arthritis	49.0	66.2	47.1	32.9	<.0001
Incident diseases over 3 y					<.0001
0	15.8	4.9	16.1	28.1	
1	25.3	15.1	27.0	35.3	
2–11	58.0	80.0	56.9	36.1	
Smoking status					.0003
Current smoker	30.8	30.1	35.5	27.2	
Former smoker	36.2	36.8	31.8	40.9	
Never smoked	33.0	33.1	32.8	31.9	
Frequency walking one-quarter mile					<.0001
<1 time/wk	48.2	73.3	40.0	26.2	
1–6 times/wk	30.5	16.9	36.9	39.5	
≥7 times/wk	21.3	9.8	23.2	34.2	
Physical activity, mean (SD), YPAS	33.8 (20.7)	27.1 (41.9)	34.8 (31.6)	41.5 (37.1)	<.0001[a,b,c]
Psychosocial					
CES-D ≥9	24.0	41.0	22.5	12.0	<.0001
MMSE, lowest quintile	24.6	34.5	21.3	13.5	<.0001
Animal naming, lowest quintile	19.3	26.6	17.0	9.7	<.0001
Falls efficacy scale, lowest quintile	22.4	44.1	13.7	2.7	<.0001
Social support, lowest quintile	14.4	21.1	12.0	8.5	<.0001
Religiosity scale, lowest quintile	20.6	21.5	21.6	18.4	.1374
Race consciousness, 1 time/y vs more often	41.2	34.8	46.6	44.6	<.0001

Characteristics	Prevalence at Baseline (%, Unless Noted)	SPPB: Tertiles			*p* Value* (for Differences Across the Tertiles)
		Lowest (worst)	Middle	Highest (best)	
Neighborhood desirability scale, lowest quintile	18.9	19.5	16.8	20.7	.093
Home assessment scale, lowest quintile	20.3	27.5	18.3	14.2	<.0001
Health services					
Hospitalized in past year	20.8	28.3	18.6	10.2	<.0001
Functional status					
Activities of daily living, mean (SD)	0.9 (1.6)	1.7 (4.4)	0.4 (1.8)	0.2 (1.1)	<.0001[a,b,c]
Instrumental activities of daily living, mean (SD)	1.0 (1.7)	2.0 (4.6)	0.6 (2.0)	0.1 (0.8)	<.0001[a,b,c]
Lower body functional limitations, mean (SD)	1.5 (1.5)	2.7 (3.1)	1.0 (2.0)	0.5 (1.4)	<.0001[a,b,c]

Notes: Analysis of variance with Tukey's post hoc test was used for continuous variables, and the chi-square test was used for categorical variables.

* a = $p < .05$ for lowest vs middle tertile; b = $p < .05$ for lowest vs highest tertile; c = $p < .05$ for middle vs highest tertile.

SPPB = Short Physical Performance Battery; *SD* = standard deviation; YPAS = Yale Physical Activity Scale Seasonally-adjusted Summary Index; COPD = chronic obstructive pulmonary disease; MMSE = Mini-Mental State Examination; CES-D = Center for Epidemiological Studies Depression Scale.

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Table 2

Baseline Short Physical Performance Battery (SPPB) Summary Scores by Vital Status, Nursing Home Placement, and Hospitalization Over the 36-Month Follow-Up, and Adjusted Odds Ratios (OR) Obtained Using Multivariable Logistic Regression*

		Logistic Regression		
Variables	**Mean SPPB (*SD*)**	**Adjusted OR**	**95% CI**	***p* Value**
Vital status†		0.88	0.81–0.95	.002
Dead (1)	5.59 (3.87)			
Alive (0)	7.78 (3.49)			
Nursing home placement‡		0.79	0.65–0.96	.02
Yes (1)	3.91 (5.04)			
No (0)	7.89 (3.42)			
Hospitalization‡		0.95	0.90–1.00	.08
≥1 (1)	7.13 (3.86)			
None (0)	8.01 (3.35)			

Notes:

*Separate logistic regression computed for each variable, using propensity-score weighted data.

†Adjusted for baseline age, gender, years of education, and self-rated health (fair/poor vs excellent/very good/good).

‡Adjusted for baseline age, gender, years of education, self-rated health (fair/poor vs excellent/very good/good), and incident conditions (1 or 2 or more vs none).

SD = standard deviation; CI = confidence interval.

Table 3

Residual Change Score Linear Regression Analysis Results for Baseline Short Physical Performance Battery (SPPB) Summary Scores on Physician Visits, ADL Disabilities, IADL Disabilities, and Functional Limitations at the 36-Month Follow-Up

	Residual Change Score Multiple Linear Regression		
Variables	**B**	**Standardized Beta**	***p* Value**
Physician visits*	−0.124	−0.040	.31
ADL disabilities†	−0.123	−0.259	<.001
IADL disabilities‡	−0.121	−0.245	<.001
Lower body functional limitations§	−0.084	−0.192	<.001

Notes: Separate ordinary least squares regression computed for each variable, using weighted data.

* Adjusted for baseline physician visits, age, gender, education, self-rated health (fair/poor vs excellent/very good/good), and incident conditions (1 or 2 or more vs none).

† Adjusted for baseline ADL disabilities, age, gender, education, self-rated health (fair/poor vs excellent/very good/good), and incident conditions (1 or 2 or more vs none).

‡ Adjusted for baseline IADL disabilities, age, gender, education, self-rated health (fair/poor vs excellent/very good/good), and incident conditions (1 or 2 or more vs none).

§ Adjusted for baseline lower body functional limitations, age, gender, education, self-rated health (fair/poor vs excellent/very good/good), and incident conditions (1 or 2 or more vs none).

ADL = activities of daily living; IADL = instrumental ADL.

Table 4

Baseline Factors Associated With 36-Month Changes in the Short Physical Performance Battery (SPPB) Summary Scores Obtained From Residual Change Score Multiple Linear Regression Analyses

Factors	B	Standardized Beta	*p* Value
Baseline SPPB summary score	0.347	0.404	<.001
Age	−0.073 (per y)	−0.113	<.001
Education	.036	.037	.22
Household income			
<$20,000 vs ≥$20,000	−.317	−.052	−.13
Refusal to report vs ≥$20,000	1.48	.084	.002
Perceived income adequacy			
Comfortable income vs Just enough to get by	−0.680	−0.121	<.001
Not enough make to ends meet vs Just enough to get by	−0.266	−0.036	.25
Medicare coverage (current vs previous/no)	−0.282	−0.036	.24
Medicaid coverage (current/previous vs never)	−0.610	−0.082	.007
Poor vision (worst quintile)	−0.754	−0.102	<.001
Body mass index			
<20.0 vs 20.0 – <30.0	0.144	0.009	.75
≥30.0 vs 20.0 – <30.0	−0.437	−0.077	.007
Unknown vs 20.0 – <30.0	−0.062	0.003	.92
Diabetes mellitus	−0.565	−0.086	.003
Chronic lung condition	−0.628	−0.051	.06
Kidney disease	−0.956	−0.058	.04
Low efficacy quintile) falls (worst	−1.311	−0.171	<.001
Hospitalized in past tear	−0.521	−0.066	.03
Model *N* (unweighted)	687		
Model R^2	.527		