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Physical function trends and their association with mortality in postmenopausal women

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Abstract

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Objective: Research is limited regarding the predictive utility of the RAND-36 questionnaire and physical performance tests in relation to all-cause, cardiovascular disease (CVD), and total-cancer mortality in older women.

Methods: Data on the RAND-36 questionnaire, gait speed, and chair stand performance were assessed in 5,534 women aged ≥ 65 years at baseline. A subset (*n* = 298) had physical function assessments additionally at follow-up (years 1, 3, or 6). Multivariable Cox proportional hazards regression models estimated associations (HR) for a 1-standard deviation (SD) difference in baseline RAND-36 scores and performance tests (alone and combined) with mortality outcomes in the overall cohort and in models stratified by enrollment age (<70 and ≥70 y). The relative prognostic value of each physical function exposure was assessed using the Uno concordance statistic.

Results: A total of 1,186 deaths from any cause, 402 deaths from CVD, and 382 deaths from total-cancer were identified during a mean follow-up of 12.6 years. Overall, each 1-SD unit higher baseline RAND-36 score was associated with significantly lower all-cause mortality (HR = 0.90) and discriminatory capacity (Uno = 0.65) that was comparable to each performance exposure (HRs 0.88–0.91; Uno = 0.65). These findings were consistent in women aged <70 and ≥70 years. The associations of RAND-36 and performance measures with CVD mortality and total-cancer mortality were not significant in multivariable models nor in age-stratified models.

Conclusions: The RAND-36 questionnaire is a reasonable substitute for tracking physical functioning and estimating its association with all-cause mortality in older adults when clinical performance testing is not feasible.

Keywords

All-cause mortality; CVD mortality; Gait speed; Geriatric assessment; Physical functioning; RAND-36

Physical function is a critical metric of overall health status and a predictor of future health trajectory in older adults.[1–4] Declines in physical functioning based on both subjective (questionnaire) responses and objective clinical assessments are particularly disconcerting as they are associated with various adverse health outcomes, including clinical and subclinical disease,[5–8] healthcare utilization, and premature death.[4,6,9,10] Despite the increased acknowledgement regarding the importance of physical function assessments as a prognostic indicator of health and well-being of older adults,[11] assessing physical function levels in large epidemiologic cohort studies can be challenging.

Commonly used in-clinic measures include components of the Short Physical Performance Battery (SPPB) test: gait speed, chair rise capacity, and standing balance,[1,2,12] which evaluate lower-extremity physical functioning primarily, and have predicted adverse health outcomes significantly among older adults such as disability, falls risk, and mortality.[6,13–19] These are reliable tests with sensitivity to change and predictive validity well-established, and therefore, are considered as the gold-standard method for physical functioning.[1,3,20]

Although objective physical performance methods for the assessment of physical functioning have advantages, such in-person assessments are expensive and are often impractical for use in large epidemiological studies. Many studies, therefore, rely on subjective assessment of physical functioning, including the Short-Form Physical Function Index (SF-36 PFI) questionnaire,[21] or the RAND-modification of the SF-36 (RAND-36).[22] The RAND-36 is sensitive enough to detect health differences in the general population, including both positive and negative states of health, functional status, and well-being.[21,23–25] However, direct comparisons of the RAND-36 physical functioning scores to objective physical performance measures remain limited,[18,19] and the ability to assess change in physical functioning over time with the RAND-36 is unclear.

Data available in the Women's Health Initiative (WHI) provided the opportunity to conduct the present analysis to (1) compare physical function levels based on the RAND-36 questionnaire to objective physical performance tests (gait speed, chair stand, and a composite index of combined gait speed and chair stand performance) at baseline and during follow-up in in a small subset; and, (2) determine whether prospective associations between physical function and all-cause, cardiovascular disease (CVD), and total-cancer mortality differ when physical function is measured by the RAND-36 questionnaire or objective physical performance tests.

METHODS

Study population

The WHI study design, eligibility criteria, data collection, and outcomes ascertainment and adjudication have been published.[26,27] In brief, 161,808 postmenopausal women (aged 50–79 y, mean age 63 y) were recruited at 40 US clinical centers between 1993 and 1998 to enroll in one or more of three clinical trials (CT: menopausal hormone therapy, diet modification, and calcium/vitamin D supplementation; $n = 68,132$) or an observational study (OS, $n = 93,676$). The main study ended in 2005, after which participants were reconsented for continued follow-up in four Extension studies (2005–2025). All women provided informed consent. Protocols were approved by institutional review boards at participating institutions.

The present study sample included 6,025 CT participants (25% subsample of enrolled CT participants) aged 65 and older, who were randomly selected at WHI enrollment to complete objective physical performance tests. Among this subsample, 5,582 had complete data at baseline on gait speed, chair stand test, and RAND-36; of them, 48 were excluded for implausible data on gait speed (ie, >4 m/s), leaving 5,534 participants for the main analysis. A subanalysis was conducted among 298 participants for whom follow-up data on RAND-36, gait speed, and chair stand tests were available.

Figure 1 illustrates the flow of participants into these analytic groups. To be included in the longitudinal analysis comparing physical functioning measures over time, participants were required to have complete RAND-36 and physical performance data at baseline, year 1 and either at year 3 or year 6 follow-up visits.

Physical function assessment

Physical performance tests—Standard performance-based measures of physical functioning were assessed at baseline and at years 1, 3, and 6 by trained research staff and included gait speed and chair stand tests. The reliability, sensitivity to change, and predictive validity of these performance measures have been previously published.[7,12] Gait speed was assessed by measuring the time in seconds that it took to complete a 6-m walk at usual pace without stopping using ambulatory aids as needed. The test was repeated, and the faster of the two measured times was included in this analysis. Chair stand performance was recorded if the participant was able to stand at least once, without using hands or arms, from a straight-backed, non-padded, flat-seated, armless chair. The number of chair stands performed in 15 seconds was measured to assess lower extremity muscle strength and balance. Two 15-second trials of repeated chair stands were performed with arms folded across the chest, with 1–2 minutes of rest between trials, and the trial with the greater number of chair stands was included in this analysis.

A composite index of physical function was computed using Guralnik's original SPPB scoring algorithm.[2] Similar to the original SPPB, in which three performance tests (gait speed, repeated chair stand, standing balance) are assigned a score of 0–4, and summed for an overall score of 0–12 over three tests, we scored the two tests available using the published SPPB scoring cut points for each and computed a performance index score of 0–8. This modification to the SPPB score has previously been used in WHI.[28]

RAND-36 score—The RAND modification[22] of the SF-36 instrument was used to assess self-rated physical functioning, resulting in a score of 0–100 with higher scores reflecting better function. The RAND SF-36 scale has demonstrated high internal reliability and sound test–retest reliability.[29,30]

Mortality ascertainment

Three mortality endpoints were examined in this study: all-cause mortality, CVD mortality, and total cancer mortality. Deaths, including cause of death, were ascertained through annual follow-up and classified by physician adjudicators following review of medical records, death certificates, and autopsy reports, in addition National Death Index searches were conducted.[31] For the present analysis, ascertainment of mortality outcomes was complete through September 17, 2010.

Other covariate assessment

Information on baseline demographic characteristics, lifestyle factors, medical history, self-reported general health, falls history, and depression was collected in standard self-administered questionnaire assessments. Anthropometrics were measured at each clinic visit. Data collection methods and reporting for these variables are described elsewhere.[32] Dietary intake was evaluated using the WHI food frequency questionnaire[33] and diet quality was summarized by the Healthy Eating Index 2015, scored on the basis of the intake of 13 foods and nutrients predictive of chronic disease risk.[34] Neighborhood socioeconomic status (nSES) was assessed by using data from the 2000 US Census at the census tract level, as described previously.[35] The nSES index was scaled to range from 0 to 100 with higher scores indicating more affluent census tracts.

Statistical analysis

Demographic and health characteristics were described for the whole cohort and compared across categories of mean enrollment age (<70, ≥70 y). In the repeated assessment subset of women ($n = 298$), physical performance (gait speed, chair stands, and composite performance index) and RAND-36 are described by means and standard deviations (SD) at each visit and changes between visits (overall and by age categories). Correlations between the RAND-36 physical functioning score and the performance tests are quantified with Spearman's rho. RAND-36 trajectories are presented in time course graphs stratified by tertiles of physical performance measures.

Multivariable Cox proportional hazards regression models were used to estimate associations (hazard ratios, 95% CI) for a 1-SD difference in baseline physical functioning exposure (RAND-36 score, physical performance scores) with, separately, all-cause mortality, CVD death, and cancer death. Time to event was computed from WHI enrollment to censoring at their last follow-up visit, the end of Extension I (2010), or death, whichever came first. Follow-up time was restricted to end of Extension I (2010) to optimize the validity of the association of physical functioning exposures with mortality outcomes and to minimize the potential for bias in the analyses. Covariates included age, race and ethnicity, education, nSES, living alone, BMI, smoking status, alcohol intake, self-rated health, recreational physical activity, myocardial infarction, stroke, congestive heart failure, cancer, treated diabetes, hip fracture, depressive symptoms, emphysema, falls, treatment for hypertension, and rheumatoid arthritis. Additional Cox proportional hazard models were re-run, stratified by age at enrollment (<70 and ≥70 y), which was decided a priori, based on prior epidemiological findings that decline in physical performance[36–38] and SF36 scores[37,39] accelerate in late-life. Briefly, it was hypothesized that the RAND-36 and performance-based measures will perform similarly across the two age groups. Confirmation of the proportional hazards assumption preceded model building and hypothesis testing. Missing categorical covariate data were given a separate missing category; no imputation was performed. The discriminatory power and predictive accuracy of the RAND-36 scores and each physical performance test to predict mortality outcomes was assessed using the Uno concordance statistic, a measure of the probability that a person with higher risk dies sooner than a person with lower risk.[40] Statistical analyses were conducted using SAS software (v 9.4, Cary, NC).

RESULTS

Baseline characteristics of the analytic cohort of 5,534 women are presented in Supplemental Table 1, http://links.lww.com/MENO/A941. Mean (SD) age of participants was 69.8 (3.7) years. The majority of women were White of Non-Hispanic origin and had more than a high-school education. Participants were from middle or higher socioeconomic strata (mean nSES, 75.4), and on average were overweight (mean BMI, 28.4 kg/m^2). Most participants self-rated their health to be very good (41.6%) or good (35.5%) and the prevalence of current smoking (5.5%), diabetes mellitus (5.4%), cancer (5.1%), myocardial infarction (3.0%), stroke (1.6%), heart failure (1.4%), emphysema (4.1%), and rheumatoid arthritis (5.0%) was relatively low. Nearly a third of the cohort reported receiving treatment for hypertension, and 17% reported treatment for hyperlipidemia. Women aged ≥70 were generally less healthy than women aged <70.

Participants overall had moderately high physical functioning as indicated by a mean RAND-36 score of 78.0, and mean gait speed and chair stands of 1.2 m/s and 6.9, respectively. Compared to women <70 years of age, those ≥70, on average, demonstrated poorer physical functioning (RAND-36: mean 74.9 vs 79.9), gait speed (mean 1.1 vs 1.2 m/s), and chair stands (mean 6.7 vs 7.0).

Baseline characteristics of the repeated assessment subset of women (*n* = 298) are described in Supplemental Table 2, http://links.lww.com/MENO/A941. Participant characteristics were overall similar to those of the primary analytic cohort.

Significant correlations were observed between all four of physical functioning exposures at baseline and at each post-baseline visit (Supplemental Table 3, http://links.lww.com/MENO/A941). At baseline, there were moderate correlations between the RAND-36 questionnaire and gait speed (Spearman's ρ=0.38), chair stand capacity (ρ = 0.31), and the composite of these performance measures (r = 0.41). The correlation between gait speed and chair stand performance was ρ=0.37, similar in magnitude as the correlations for the RAND-36 with each performance measure. Correlations between the RAND-36 and individual and composite performance measures remained robust, and statistically significant at postbaseline visit 1 (RAND-36-gait speed, ρ = 0.33; RAND-36-chair stand, ρ = 0.38; RAND-36-composite measure, ρ = 0.47), visit 3 (RAND-36-gait speed, ρ = 0.36; RAND-36-chair stand, ρ = 0.31; RAND-36-composite measure, ρ = 0.38), and visit 6 (RAND-36-gait speed, ρ = 0.43; RAND-36-chair stand, ρ = 0.46; RAND-36-composite measure, ρ = 0.53).

Physical functioning declined over time according to the RAND-36 and the physical performance measures (Table 1). The decline in physical functioning by each assessment across the three time points was more pronounced in women ≥70 years compared to those <70 years.

Figure 2 describes the longitudinal trajectory of RAND-36 scores across assessment time points grouped according to tertiles of baseline gait speed, chair stand performance, or the composite performance index. A declining trajectory of physical function measured by the RAND-36 was observed across tertiles of each objective physical performance test. There was a general consistency in the pattern of decline in RAND-36 scores over time within each physical performance group. Those with better physical performance at baseline and over time also had higher RAND-36 scores at baseline and over time. RAND-36 scores at baseline and over time were also higher in women in the middle compared to the lowest tertile of physical performance tests. Similarly, a graded pattern of decline in RAND-36 score by baseline comorbidity status at baseline and overtime was observed. Women with no comorbidity maintained higher RAND-36 scores over time compared to those with one or more comorbidity, and those with one comorbidity had higher scores than those with two or more comorbidities over time (Supplemental Figure 1, http://links.lww.com/MENO/A941).

Table 2 displays overall and age-stratified associations between baseline RAND-36 scores and physical performance tests with mortality outcomes. A total of 1,186 deaths from any cause, 402 deaths due to CVD, and 382 deaths due to total cancer were identified during a mean follow-up of 12.6 years. Women ≥70 years had higher mortality rates per 1,000 person-years due to all-causes (25.1 vs. 12.3), CVD (9.6 vs. 3.6), and cancer deaths (6.6 vs. 4.8) compared with women <70 years.

Overall, each 1-SD unit higher baseline value of RAND-36 score and each physical performance test was associated with a lower risk of all-cause mortality, of similar magnitudes, in both the age-adjusted (HRs 0.77–0.82) and fully adjusted models (HRs 0.88–0.91). In the overall cohort and among women <70 years of age, associations with all-cause mortality remained statistically significant in the multivariable-adjusted models (HRs 0.81–0.88), whereas among women ≥70 years, only the RAND-36 (HR 0.91) and gait speed (HR 0.87) were significant in the multivariable model (Table 2). CVD mortality was significantly inversely associated with RAND-36 score (HR 0.76) and physical performance tests (HRs 0.78–0.84) in age-adjusted models for the overall cohort but associations were attenuated (HRs 0.91–0.95) and no longer statistically significant following multivariable adjustment. Associations with cancer mortality followed a similar pattern as above for CVD mortality. Among age groups, there was not a clear pattern of association between physical functioning and cancer mortality.

Table 3 gives results for Uno concordance statistics comparing the prognostic value of RAND-36 scores and physical performance tests for all-cause mortality on a base model containing only age and then separate models with age and each exposure variable. Compared with age alone (Uno = 0.64), models with age and additionally RAND-36 (Uno = 0.65), gait speed (Uno = 0.65), chair stand (Uno = 0.65), or a composite performance index (Uno = 0.65) had similar abilities to discriminate risk of all-cause mortality (difference from age only, $P > 0.05$, all).

DISCUSSION

In the present study, we evaluated the longitudinal trends in physical functioning measured using the self-assessed RAND-36 questionnaire as compared with physical performance tests (gait speed, chair stand, and a composite index of gait speed and chair stand performance) in older women aged 50–79 years at enrollment into the WHI. Mean physical functioning declined across three longitudinal assessments in a similar pattern for the RAND-36 and the physical performance measures, suggesting that the RAND-36 is reasonably sensitive to monitor physical functioning in a large epidemiologic study where completing physical functioning measures on all participants might not be feasible. We further showed that baseline physical functioning assessed with the RAND-36 questionnaire is a significant independent predictor of all-cause mortality in older women, with multivariable HR (0.90) and discriminatory capacity (Uno c-statistic 0.65) that is comparable to the objective physical performance measures (HRs 0.88–0.91; Uno c-statistic

0.65). Consistent with previous literature,[6] the combination of gait speed and chair stand performance tests did not provide any additional predictive or discriminatory value for all-cause mortality compared with that for each individual test. For CVD mortality and total-cancer mortality outcomes, we found significant inverse associations with the RAND-36 questionnaire and each performance exposure in age-adjusted models; associations with either mortality outcome were no longer significant after adjustment for important confounders. Collectively, these findings suggest that physical functioning assessed with the RAND-36 questionnaire is useful for predicting mortality risk in older women, with similar discriminatory capacity as single or combined objective physical performance tests. These findings have important implications in research and clinical practice where feasibility constraints might preclude use of objective performance testing.

Physical functioning is regarded as a powerful vital sign of general health, aging resiliency, and disease risks and events in older adults.[3,6,21,41,42] The relationship between poor physical performance, assessed singly (eg, gait speed, chair stand performance, balance tests)[3,6,20,43] or by a combination of tests (eg, SPPB),[2,16] and increased mortality risk is well established. Global self-rated health or physical constructs of the SF-36 have also been reported to predict mortality in older adults.[4,9,44–47] The findings of our study extend this existing literature by showing that higher baseline RAND-36 scores are significantly associated with lower all-cause mortality risk, with similar predictive value as gait speed, chair stand capacity, or the composite performance index. Significant associations for the RAND-36 and performance exposures with all-cause mortality remained consistent across the two age subgroups. Our results align with previous evidence directly comparing the prognostic value of self-reported and objective performance measures of physical functioning on subsequent morality risk in older adults.[4,48] For example, in the ilSIRENTE study, Cesari et al[4] reported that self-rated health and the SPPB were strong predictors of mortality in very old community dwelling adults (mean age 85.4 y); the chair stand test demonstrated the strongest association with all-cause mortality compared with the self-rated health questionnaire and other SPPB tests. Comparatively, in our study, there were no meaningful differences in the prediction and discrimination of mortality based on RAND-36 scores or on single (or combined) physical performance tests. The use of a single-item self-rated health measure, older age of participants (mean age 85.6 y) including men, and smaller sample size of the ilSIRENTE study may partly explain inconsistencies between findings reported by Cesari et al[4] and those of the present study.

Expectedly, we found in our aging cohort of postmenopausal women that physical functioning declined over repeated assessments. RAND-36 scores declined over time in a similar pattern and with a similar magnitude of difference as declines in objectively measured gait speed, chair stand performance, or the combination of these two performance measures. Further, women with low RAND-36 scores at baseline almost uniformly scored in the lowest tertile of gait speed, chair stand, or the composite performance index, which may provide insight on why higher RAND-36 scores or performance tests of lower-extremity function[6] appear to provide similar prognostic information. These findings raise the possibility that in initially well-functioning older women, self-awareness of declining function, as indicated by the self-assessed RAND-36 physical function score, and its influence on perceived general health status, may occur in tandem with measurable declines in physical performance during aging.[48]

Overall, the association of RAND-36 scores and physical performance tests with mortality from CVD and cancer were not significant after adjusting for other factors including comorbidities. Fewer cause-specific events that likely contributed to the wider confidence intervals for hazard ratios observed for cause-specific versus all-cause mortality analyses may partly explain these findings. Nonetheless, these results contrasts with previously reported results assessing the association of physical functioning measures by self-report or performance tests with cardiovascular mortality.[15,17,45,46,49] Nonetheless, our findings align with studies that have demonstrated no association with cancer mortality outcomes.[17,45] The lack of association observed for the RAND-36 or physical performance exposures with CVD and cancer-related mortality in the present study may be due to the influence that a subclinical disease has on an individual’s physical or perceived functional health, which is likely dependent on symptom duration or level of restriction on an individual’s day-to-day functional abilities.[44,45]

Strengths of this study include a large cohort of older postmenopausal women, long follow-up for mortality, systematic adjudication of mortality outcomes, information on many potential confounders for analysis, and a subset of women with repeated assessments on physical functioning to support comparisons of RAND-36 and physical performance trends over time. Further, the prospective study design allowed for a reasonable follow-up time to assess overall and age group differences in all-cause and cause-specific mortality. Additionally, we used data from the validated RAND-36 questionnaire[23,25] and multiple clinic measures of physical performance, allowing for a comprehensive comparison of the long-term predictive ability of self-reported and objective physical functioning assessments commonly used in research and clinical settings.

Several limitations of our study methodology warrant comment. First, the generalizability of the present study is limited since the WHI is comprised of older women. Whether similar results would be found in men or younger women remains unknown. Likewise, the higher baseline functional status of this cohort may lead to an underestimation of the incidence of events such as cause-specific death. Although, in prior literature, it has been shown the relation between baseline exposure and incidence of disease during follow-up is not biased.[50] Second, despite adjustment for chronic conditions and other relevant factors at baseline, we cannot rule out the possibility of reverse causation bias or residual confounding having influenced our results. Accordingly, the present findings of an inverse association between physical function and mortality should be carefully interpreted as they do not indicate a causal relationship. Finally, the reduced sample size for women with repeated longitudinal assessments further limited extending our analyses to examine the association between functional changes and future mortality in this cohort. Future studies aim to define actionable cut-point scores for the RAND-36 that are predictive of mortality and are more conducive for future intervention trials or for enabling increased surveillance in the clinic settings.

Clinical implications

These results may have considerable implications for the use of the RAND-36 questionnaire in clinical practice. First, our findings suggest that a single measure of the RAND-36 provides similar predictive value as performance-related movement measures for future risk of all-cause mortality in older well-functioning women. Additionally, our results highlight the relationship between RAND-36 scores and objective performance measurements at baseline and at subsequent post-baseline visits, supporting the value and clinical basis for the RAND-36 as an adequate and more practical substitute of performance-based measures (eg, gait speed, chair stand) to progressively evaluate and identify physical functioning status and impending long-term risk of mortality. Importantly, feedback (scores) of the RAND-36 may be used to help guide high-risk patients to appropriate rehabilitation interventions aimed at improving physical functional health and reducing risk of adverse health outcomes. Finally, the RAND-36 questionnaire is easy to implement, does not necessitate additional costs (staff time), training or space, and can be delivered using telehealth approaches or prior to scheduled office visits, without imposing significant burden on the patient or provider.

CONCLUSIONS

In conclusion, our findings demonstrate that in community-dwelling older women, the RAND-36 can be used to monitor physical functioning over time with identified patterns of decline comparable to those based on objective physical performance measures. Our results further highlight the prognostic value of the RAND-36 questionnaire, which examines multiple dimensions of physical health, including physical limitation. Therefore, the RAND-36 likely captures additional information germane to physical functioning status, complementary to information imparted by physical performance tests such as gait speed or chair stand tests. The RAND-36 questionnaire assessment of physical functioning may be a practical approach to adopt in large epidemiological settings, as well as in clinic settings, to monitor physical functioning status and evaluate its relevance to aging health outcomes, when physical performance testing is not feasible.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Availability of data and materials:

The Women's Health Initiative Study data supporting the conclusions of this article are available via the BioLINCC website of the National Heart, Lung, and Blood Institute at https://biolincc.nhlbi.nih.gov/home/.

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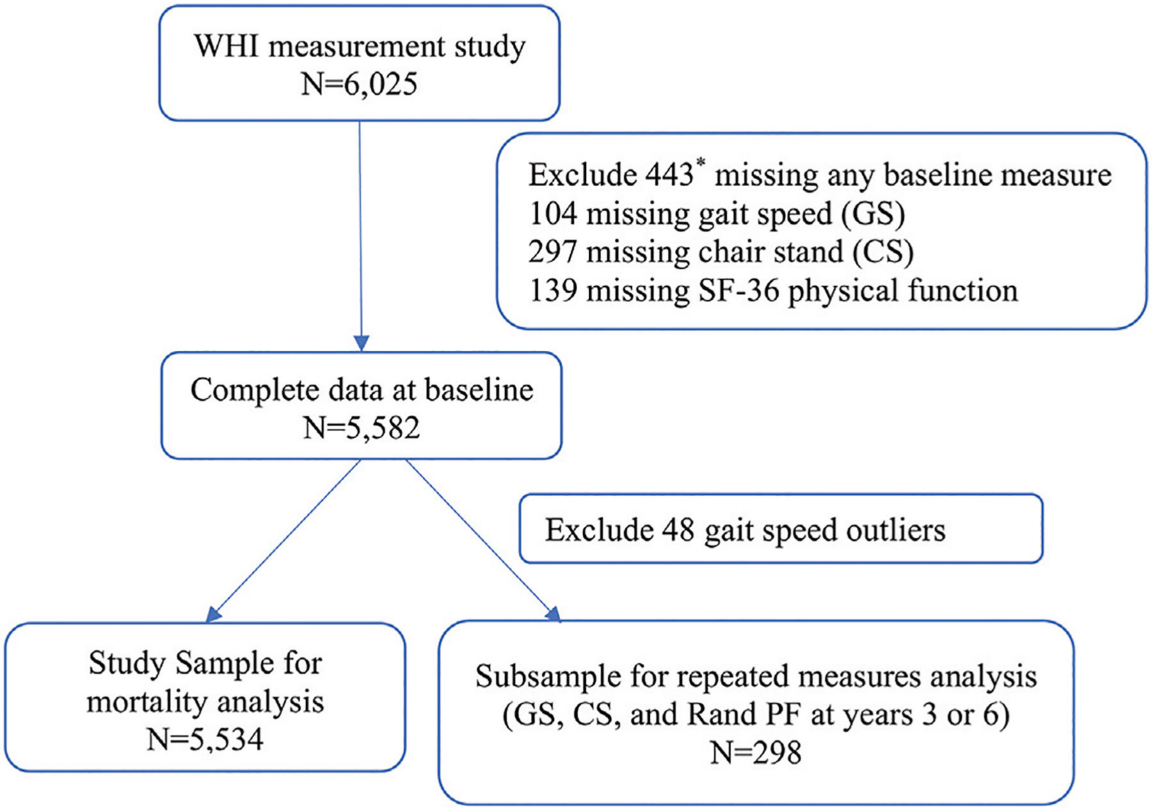

FIG. 1.

Baseline, year 1 and year 3 or 6—RAND-36 data drops off at extended follow-up. *The numbers do not add up to the total because women can be missing more than 1 of the listed measurements.

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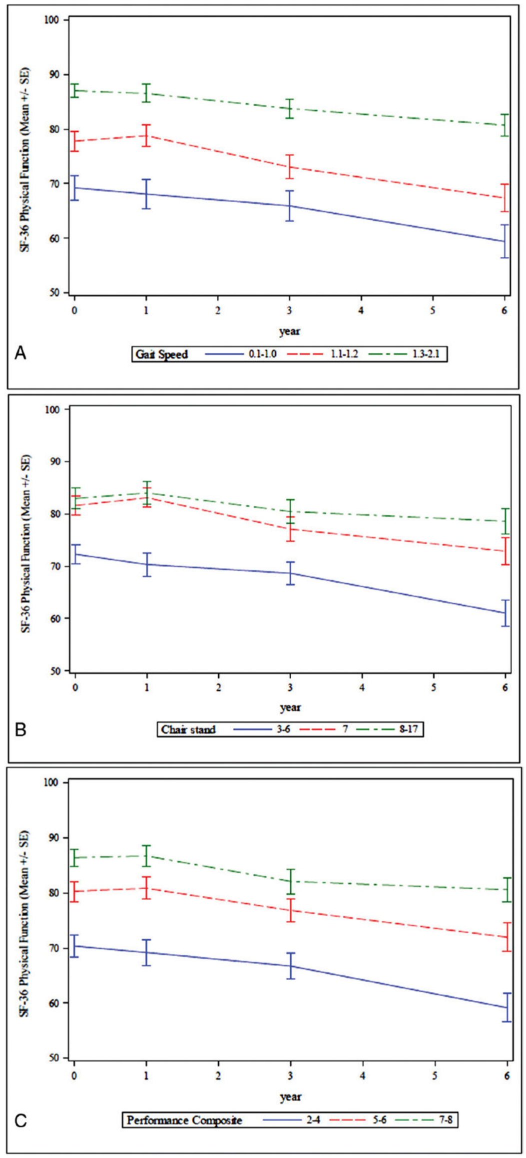

FIG. 2.

RAND-36 physical function across time by baseline tertiles of (**A**) gait speed, (**B**) chair stand performance, and (**C**) the composite performance index.

TABLE 1.

Physical function and performance measures at each visit and change between visits[a]

	Overall		<70		≥70	
	N	**Mean (SD)**	***N***	**Mean (SD)**	***N***	**Mean (SD)**
RAND-36						
Baseline	298	77.9 (19.6)	197	78.8 (19.8)	101	76.1 (19.2)
Year 1	283	77.9 (21.9)	188	79.9 (21.1)	95	74.0 (23.1)
Year 3	279	74.3 (22.7)	183	76.1 (22.2)	96	70.7 (23.2)
Year 6	268	69.2 (25.4)	181	72.2 (24.7)	87	62.9 (25.9)
Change						
Baseline to year 1	283	−0.27 (14.67)	188	0.82 (12.65)	95	−2.42 (17.88)
Year 1 to 3	264	−3.41 (16.42)	174	−3.91 (15.74)	90	−2.44 (17.71)
Year 3 to 6	249	−5.26 (18.00)	167	−3.80 (16.22)	82	−8.23 (20.96)
Gait speed (m/s)						
Baseline	298	1.16 (0.28)	197	1.18 (0.29)	101	1.11 (0.27)
Year 1	274	1.10 (0.31)	181	1.10 (0.30)	93	1.10 (0.34)
Year 3	275	1.06 (0.27)	182	1.09 (0.25)	93	1.01 (0.28)
Year 6	248	1.02 (0.26)	170	1.06 (0.25)	78	0.94 (0.27)
Change						
Baseline to year 1	274	−0.06 (0.34)	181	−0.09 (0.32)	93	−0.01 (0.39)
Year 1 to 3	254	−0.03 (0.32)	168	−0.00 (0.30)	86	−0.09 (0.35)
Year 3 to 6	225	−0.05 (0.24)	155	−0.04 (0.25)	70	−0.07 (0.23)
Chair stand (n)						
Baseline	298	6.8 (1.8)	197	6.9 (1.9)	101	6.7 (1.5)
Year 1	268	6.9 (1.9)	180	7.0 (1.9)	88	6.9 (1.8)
Year 3	274	6.7 (1.8)	183	6.7 (1.9)	91	6.8 (1.6)
Year 6	242	6.6 (2.1)	167	6.7 (2.3)	75	6.5 (1.7)
Change						
Baseline to year 1	268	0.01 (1.57)	180	−0.01 (1.57)	88	0.06 (1.58)
Year 1 to 3	250	−0.20 (1.71)	168	−0.27 (1.77)	82	−0.05 (1.58)
Year 3 to 6	224	−0.15 (1.79)	153	−0.01 (1.90)	71	−0.46 (1.47)

	Overall		<70		≥70	
	N	**Mean (SD)**	***N***	**Mean (SD)**	***N***	**Mean (SD)**
Performance composite						
Baseline	298	5.1 (1.8)	197	5.3 (1.8)	101	4.8 (1.7)
Year 1	275	4.9 (1.9)	180	4.9 (1.8)	95	4.7 (2.0)
Year 3	280	4.7 (1.8)	186	4.7 (1.8)	94	4.6 (1.9)
Year 6	253	4.4 (2.0)	171	4.6 (2.0)	82	3.9 (2.0)
Change						
Baseline to year 1	275	−0.30 (1.59)	180	−0.39 (1.62)	95	−0.12 (1.54)
Year 1 to 3	260	−0.18 (1.73)	171	−0.19 (1.71)	89	−0.15 (1.78)
Year 3 to 6	237	−0.33 (1.60)	160	−0.14 (1.45)	77	−0.71 (1.81)

[a]Negative changes indicate a decrease in scores (change = later – earlier).

TABLE 2.

HR and 95% CI for all-cause mortality through extension 1 (2010) (N = 5,534)

		Rand-36 Score	Gait speed	Chair stand	Performance composite
Event	**Deaths (rate)[a]**	**HR[b] (95% CI)**	**HR[b] (95% CI)**	**HR[b] (95% CI)**	**HR[b] (95% CI)**
All-cause					
Age adjusted	1,186 (17.0)	0.77 (0.73–0.81)	0.81 (0.77–0.86)	0.82 (0.77–0.87)	0.77 (0.73–0.82)
Multivariable[c]		0.90 (0.85–0.97)	0.89 (0.84–0.95)	0.91 (0.86–0.97)	0.88 (0.83–0.94)
Stratified by age[c]					
< 70	546 (12.3)	0.84 (0.76–0.92)	0.88 (0.81–0.96)	0.84 (0.77–0.93)	0.81 (0.74–0.89)
≥ 70	640 (25.1)	0.91 (0.83–0.99)	0.87 (0.79–0.95)	0.96 (0.88–1.05)	0.92 (0.84–1.00)
CVD death[d]	402 (5.8)				
Age adjusted		0.76 (0.70–0.83)	0.80 (0.73–0.89)	0.84 (0.76–0.94)	0.78 (0.71–0.87)
Multivariable[c]		0.93 (0.83–1.04)	0.91 (0.81–1.01)	0.95 (0.85–1.06)	0.91 (0.82–1.02)
Stratified by age[c]					
< 70	158 (3.6)	0.89 (0.73–1.08)	0.83 (0.70–0.98)	0.92 (0.77–1.09)	0.81 (0.68–0.97)
≥ 70	244 (9.6)	0.90 (0.78–1.03)	0.92 (0.79–1.06)	0.95 (0.82–1.10)	0.94 (0.81–1.08)
Cancer death[d]	382 (5.5)				
Age adjusted		0.90 (0.81–0.99)	0.85 (0.77–0.95)	0.90 (0.81–0.99)	0.84 (0.76–0.93)
Multivariable[c]		1.09 (0.96–1.23)	0.92 (0.83–1.03)	0.99 (0.89–1.11)	0.96 (0.86–1.08)
Stratified by age[c]					
< 70	214 (4.8)	1.08 (0.91–1.29)	0.97 (0.84–1.12)	0.93 (0.80–1.08)	0.91 (0.79–1.06)
≥ 70	168 (6.6)	1.08 (0.90–1.30)	0.86 (0.72–1.04)	1.07 (0.92–1.26)	1.03 (0.87–1.23)[c]

BMI, body mass index; CHF, congestive heart failure; CVD, cardiovascular disease; HTN, hypertension; MI, myocardial infarction; nSES, neighborhood socioeconomic status.

[a] Morality rate per 1,000 person-years.

[b] HR per standard deviation.

[c] Multivariable adjusted for age, race/ethnicity, education, nSES, living along, BMI, smoking status, alcohol intake, Self-rated Health, physical activity, MI, Stroke, CHF, cancer, treated diabetes, hip fracture, depressive symptoms, emphysema, falls, treated HTN, and rheumatoid arthritis ($N = 5{,}534$).

[d]Six women are excluded from cause-specific (CVD and Cancer) analysis because cause of death is unknown.

TABLE 3.

Uno concordance statistic for all-cause mortality

Variables	Estimate	SE	Diff from Age only	*P* value	Diff from Age ± RAND-36	*P* value
Age	0.641	0.017				
Age ± GS	0.647	0.014	−0.006	0.359	0.006	0.410
Age ± CS	0.650	0.016	−0.009	0.093	0.003	0.723
Age ± PC	0.649	0.010	−0.008	0.542	0.004	0.581
Age ± RAND-36	0.653	0.013	−0.012	0.194		

CS, chair stand; GS, gait speed; PC, performance composite.