JAMA Psychiatry | Original Investigation

Longitudinal Associations Between Optimism and Objective Measures of Physical Functioning in Women

Hayami K. Koga, MD, PhD; Francine Grodstein, ScD; David R. Williams, PhD; JoAnn E. Manson, MD, DrPH; Hilary A. Tindle, MD, MPH; Aladdin H. Shadyab, PhD; Yvonne L. Michael, ScD; Nazmus Saquib, PhD; Michelle J. Naughton, PhD; Anne-Josee Guimond, PhD; Laura D. Kubzansky, PhD

IMPORTANCE Identifying factors contributing to sustained physical functioning is critical for the health and well-being of the aging population, especially as physical functioning may precede and predict subsequent health outcomes. Prior work suggests optimism may protect health, but less is known about the association between optimism and objective physical functioning measures as individuals age.

OBJECTIVE To evaluate the longitudinal association between optimism and 3 physical functioning measures.

DESIGN, SETTING, AND PARTICIPANTS This was a prospective cohort study using data from the Women's Health Initiative (WHI) with participants recruited from 1993 to 1998 and followed up over 6 years. Data analysis was conducted from January 2022 to July 2022. Participants included postmenopausal women older than 65 years recruited from 40 clinical centers in the US.

EXPOSURE Optimism was assessed at baseline using the Life Orientation Test–Revised.

MAIN OUTCOMES AND MEASURES Physical functioning was measured at 4 time points across 6 years by study staff evaluating performance in grip strength, timed walk, and chair stands.

RESULTS The final analytic sample included 5930 women (mean [SD] age, 70 [4] years). Linear mixed-effects models controlling for demographics, depression, health status, and health behaviors showed that higher optimism was associated with higher grip strength (β = 0.36; 95% CI, 0.21-0.50) and number of chair stands (β = 0.05; 95% CI, 0.01-0.10) but not timed walk at baseline. Higher optimism was also associated with slower rates of decline in timed walk (β = −0.09; 95% CI, −0.13 to −0.04) and number of chair stands (β = 0.01; 95% CI, 0-0.03) but not grip strength over time. Cox proportional hazards models showed that higher optimism was associated with lower hazards of reaching clinically defined thresholds of impairment for all 3 outcomes over 6 years of follow-up. For example, in fully adjusted models, for a 1-SD increase in optimism, hazard ratios for reaching impairment thresholds were 0.86 (95% CI, 0.80-0.92) for grip strength, 0.94 (95% CI, 0.88-1.01) for timed walk, and 0.91 (95% CI, 0.85-0.98) for chair stands.

CONCLUSION AND RELEVANCE In this cohort study of postmenopausal women, at baseline, higher optimism was associated with higher grip strength and number of chair stands but not with the time it took to walk 6 m. Higher optimism at baseline was also associated with maintaining healthier functioning on 2 of the 3 performance measures over time, including less decline in walking speed and in number of chair stands women could perform over 6 years of follow-up. Given experimental studies suggesting that optimism is modifiable, it may be a promising target for interventions to slow age-related declines in physical functioning. Future work should explore associations of optimism with maintenance of physical functioning in diverse populations.

Supplemental content

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Hayami K. Koga, MD, PhD, Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, 677 Huntington Ave, Boston, MA 02215 (hkoga@g.harvard.edu).

JAMA Psychiatry. doi:10.1001/jamapsychiatry.2023.5068
Published online March 20, 2024.

Along with rising global life expectancy, years living with disability have increased.[1] In 2016, 25.7% of noninstitutionalized US adults reported a disability, with mobility issues being the most common.[2] Although women live longer and have fewer chronic conditions than men, they consistently report more functional limitations with age.[3] Declines in physical functioning are prominent barriers to healthy aging, causing significant deterioration in quality of life, and are linked to worse physical health and increased medical expenditures.[4-6] Physical functioning may also precede and predict subsequent health outcomes.[7] Therefore, identifying factors contributing to sustained physical functioning is critical for improving the health and well-being of the aging population, especially women.

Recent research has investigated modifiable positive social and psychological factors that could be leveraged to enhance physical activity and performance. Evidence indicates that optimism—the generalized tendency to expect good outcomes—may be one such factor.[8] Optimism is associated with improved subsequent health outcomes including reduced risk of cardiovascular diseases and greater longevity.[9,10] Prior work suggests that optimism may be associated with healthier trajectories of physical functioning with age, but direct tests of the hypothesis are limited. For example, a study of older women linked optimism with healthier aging according to a composite measure that included self-reported measures of physical functioning.[11] Prior work assessing functional status has used both self-report and performance-based measures of physical functioning. Although self-reported measures provide important insight, performance-based measures provide higher validity and reproducibility and more strongly predict major health outcomes, including mortality and hospitalizations.[12,13] Furthermore, performance-based measures can differentiate gradients in physical functioning even among individuals who report no specific limitations when using self-reported measures.[12,14,15] However, few studies of optimism and physical functioning have used performance-based measures, often using cross-sectional designs with mixed findings.[16,17]

Prior research on optimism and physical functioning has been conducted in relatively homogeneous populations, and whether this association is similar across racial and ethnic groups is unknown.[16,17] Of note, racial and ethnic disparities are evident in age-related decline in physical functioning, with minority groups experiencing higher levels of functional limitations with age.[18,19] Some studies suggest optimism levels are also patterned by race and ethnic groups.[20] However, recent research examining optimism in relation to other health outcomes has found associations are often (but not always) similar across racial and ethnic groups, despite varying distributions of both optimism and health.[10,21]

Using a sample of postmenopausal women from the Women's Health Initiative (WHI), we investigated the longitudinal association between optimism and 3 performance-based measures of physical functioning: grip strength, timed walk, and chair stands. We tested whether higher optimism levels would be associated with better baseline performance as well as a slower rate of decline in these 3 measures over 6 years.

Key Points

Question Is optimism associated with age-related changes in performance-based measures of physical functioning?

Findings In this cohort study that included 5930 postmenopausal women, at baseline, higher optimism was associated with higher grip strength and number of chair stands but not with the time it took to walk 6 m. Higher optimism at baseline was also associated with maintaining healthier functioning on 2 of the 3 performance measures over time, including less decline in walking speed and in number of chair stands women could perform over 6 years of follow-up.

Meaning Optimism may be a promising target for interventions to slow age-related decline in physical functioning.

To evaluate whether optimism would be associated with better performance across the full spectrum of physical functioning, we considered associations with continuous measures of functioning. We further evaluated if optimism would be associated with a more clinically relevant outcome, impairment levels that predict other adverse health outcomes, using previously identified thresholds.[22-28] We considered potential confounders, including baseline physical health and depression, as they have been associated with optimism and physical functioning.[29-31] We also examined whether associations were similar across racial and ethnic groups.

Methods

Study Population

The WHI is a study of postmenopausal women aged 50 to 79 years at enrollment and includes a set of randomized clinical trials and an observational study. WHI is among the largest US studies probing the link between psychological traits and physical health, offering a unique opportunity to assess these associations using a prospective design and accounting for a rich array of covariates. Participants were recruited from 40 clinical centers across the US between 1993 and 1998 and followed up annually (details have been previously described).[32] Performance-based physical functioning tests were administered during clinic visits from 1993 through 2005 to a subsample of women older than 65 years randomly selected from the dietary modification and hormonal trials.[33] Women missing more than 3 of the 6 items on the optimism measure or the baseline outcome measure were excluded from analyses. Participants provided written informed consent using materials approved by institutional review boards at each center. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines.

Measures

Optimism

Baseline optimism was assessed via the Life Orientation Test-Revised (LOT-R), which has good discriminant and convergent validity and reliability[34] and predicts various health outcomes in older women.[11,35] Participants reported the degree

to which they agreed with each of the 6 items on a 5-point Likert scale via written surveys. Three negatively framed items were reverse coded, and all 6 items were summed to create a score from 6 to 30; higher scores indicate greater optimism. For those missing 3 or fewer items, we conducted person-mean substitution.[36] Internal consistency reliability in the current sample was α = .74.

Physical Functioning

Standard measures of physical functioning, grip strength, timed walk, and chair stands, were assessed at baseline and at follow-up years 1, 3, and 6. Prior work demonstrates that these measures are reliable and sensitive to changes in older women.[26-28,37-39] During clinic visits, trained staff following standardized protocols assessed each of the measures twice. The mean of 2 assessments at any given time period was used.[40]

Grip strength was measured in the dominant hand using a hydraulic handgrip dynamometer. Participants were instructed to squeeze the handle of a dynamometer as hard as possible. For observations missing due to safety or health reasons or attempted but not completed, the minimum value of 0 kg was imputed for consistency with prior studies.[40]

Timed walk was assessed by measuring the time in seconds taken to complete a 6-m walk, performed at usual pace, using ambulatory aids as needed. For observations missing due to safety or health reasons or attempted but not able to complete, the maximum value of 60 seconds was imputed.[40] Following recommendations,[41] observations with less than 2 seconds for both measurements were considered missing.

Chair stand performance was assessed in participants who were able to stand at least once without using their hands or arms from a straight-backed, nonpadded, flat-seated, armless chair. The number of chair rises performed in 15 seconds was recorded. Two, 15-second trials of repeated chair stands were performed with arms folded across the chest, with a 1- to 2-minute rest between trials. For observations missing due to safety or health reasons or attempted but not able to complete, the minimum value of 0 was imputed.[40]

Consistent with other cohorts and likely due to the difference in complexities of these tasks, more observations were missing for timed walk and chair stands than grip strength.[42] For analyses using impairment thresholds, thresholds were defined as reaching less than 16 kg for grip strength, greater than 7.5 seconds for a 6-m timed walk, and fewer than 5 times in 15 seconds for chair stands.[22-25]

Covariates

At baseline, participants self-reported their demographic and health information. Demographics included age (years), marital status (married or marriagelike relationship, divorced or single, widowed), education (<high school, some high school, some college or associate degree, college graduate or more), income (<$20 000, $20 000-$49 999, $50 000-$74 999, $75 000 or more), and occupation (managerial/professional, technical/sales/admin, service/labor, homemaker only). Race and ethnicity were self-identified according to options defined by investigators (American Indian or Alaska Native, Asian or Pacific Islander, Black, Hispanic/Latina, White, or other, which included races or ethnicities not specifically listed). Trained study staff assessed baseline body mass index (BMI; calculated as weight in kilograms divided by height in meters squared). We assessed baseline health conditions using a modified version of the Charlson Comorbidity Index (eAppendix 1 in Supplement 1).[43] Depressive symptoms were assessed using the validated Burnam Screening Algorithm questionnaire, and a cutoff value of 0.06 identified women experiencing depression (eAppendix 2 in Supplement 1).[29] Relevant health behaviors including smoking, diet quality, alcohol consumption, and physical activity were also considered (eAppendix 3 in Supplement 1). All covariates except age, BMI, health conditions, physical activity, and diet quality were operationalized as categorical variables. Dummy variables for missingness were included for missing categorical covariates.[44,45] Individuals with missing continuous covariates were excluded from analyses using this information.

Statistical Analysis

We first examined covariate distribution by optimism levels. To evaluate whether higher optimism was associated with baseline and sustained physical functioning over time, we used linear mixed-effects models with random intercepts and random slopes, using residual maximum likelihood estimators and compound symmetry covariance structures.[46] Model 1 adjusted for age. Model 2 adjusted for baseline demographics as potential confounders, as prior studies have found demographic differences in both optimism and physical functioning.[18,20,47] Model 3 added baseline health conditions, depression, and BMI as potential confounders. Model 4 further added potential confounders including baseline smoking, diet quality, alcohol consumption, and physical activity. We assessed models that included time × optimism interaction terms (assessing rate of change) and main effect models that did not include these interaction terms (assessing pooled effects across time). As we did not have postbaseline health behavior data, we could not rigorously examine potential mediating effects. Each model included optimism as a standardized continuous measure (*z* score). To assess potential nonlinear associations between optimism and physical functioning, we categorized optimism into quartiles based on the score distribution in our sample and tested for discontinuous effects. We also tested for interaction between optimism (continuous), time, and each category of race and ethnicity by adding appropriate dummy-coded interaction terms. We combined women identifying as American Indian and Alaska Native with those identifying as other race and ethnicity due to limited sample sizes in these categories.

Next, we used Cox proportional hazards models to assess differences in time to reach thresholds of impairment in physical functioning by baseline optimism levels. For each outcome, we incorporated the same sets of covariates in increasingly adjusted models, as described previously. We examined the proportional hazards assumption by Schoenfeld residuals.

Further, we applied inverse probability weights (IPW) for censoring to account for potential bias that may arise if those who died or were lost to follow-up were systematically different from those remaining in the sample (eAppendix 4 in

Supplement 1). To assess whether associations of optimism with physical functioning varied by age, we tested for interaction between optimism and age group (age 65-72 years vs 73-81 years) and also stratified analyses by age group. To assess potential bias induced from imputing optimism using person-mean substitution, we conducted analyses excluding women missing any data on optimism. We also conducted analyses excluding observations with missing data on physical functioning. Lastly, we assessed associations adjusting for trial arm (hormone therapy, dietary modification, and the calcium and vitamin D trials). The nlme and survival packages in R, version 4.1.2 (R Project for Statistical Computing) were used. Two-sided *P* values < .05 were considered significant. Data analysis was conducted from January 2022 to July 2022.

Results

A subsample of 5962 women (25%) older than 65 years was randomly selected from the dietary modification and hormonal trials.[33] Women missing 3 or more of the 6 items on the optimism measure (n = 30) or the baseline outcome measure (grip strength, n = 65; timed walk, n = 120; chair stands, n = 153) were excluded from analyses. The final analytic sample included 5930 women (mean [SD] age, 70 [4] years). Women self-identified with the following race and ethnicity categories: 12 American Indian or Alaska Native (0.2%), 133 Asian or Pacific Islander (2.2%), 469 Black (7.9%), 154 Hispanic/Latina (2.6%), 5093 White (85.9%), and 57 other (1.0%). Although participants included vs excluded in the study were largely similar, some differences were observed. For example, included participants more often held managerial/professional or technical/sales/admin jobs and had less missing data for depression, smoking, and alcohol consumption (eTable 1 in Supplement 1). The number of participants with follow-up measurements from 4, 3, 2, and 1 time points was 3844, 1252, 553, and 281 for grip strength; 3753, 1284, 561, and 277 for timed walk; and 3619, 1311, 597, and 295 for chair stands, respectively. At baseline, the mean (SD) optimism score was 23 (3.0). Mean (SD) optimism scores for women by race and ethnic category were 22.1 (3.1) for American Indian or Alaska Native, 21.9 (2.9) for Asian or Pacific Islander, 23.0 (3.2) for Black, 22.1 (3.6) for Hispanic/Latina, 23.4 (3.3) for White, and 22.9 (3.1) for those who identified as other. **Table 1** shows the distributions of baseline covariates and outcomes by optimism quartiles. Baseline physical functioning measures for grip strength and timed walk were comparable with mean values from other samples (no comparable data for chair stands found). Intercorrelations between measures of physical function were modest (grip strength and timed walk, $r = -0.05$; grip strength and chair stands, $r = 0.15$; timed walk and chair stands, $r = -0.18$).

Optimism and Physical Function at Baseline and Over Time

Optimism and Grip Strength

On average, grip strength declined at a rate of 0.57 kg per year over follow-up. In all models, higher optimism was associated with stronger grip strength at baseline. For example, in the fully adjusted model (model 4), a 1-SD increase in optimism was associated with a 0.36 kg (95% CI, 0.21-0.50) stronger grip strength (**Table 2**). However, rate of decline in grip strength was not associated with optimism (time × optimism β = 0; 95% CI = −0.03 to 0.03) (Table 2). In the main effect model, a 1-SD increase in optimism was associated with a 0.37-kg (95% CI, 0.23-0.50; model 4) stronger grip strength (**Table 3**).

Optimism and Timed Walk

On average, time to walk 6 m increased at a rate of 0.20 seconds per year over follow-up. Higher optimism was not associated with timed walk at baseline (optimism β = −0.10; 95% CI = −0.05 to 0.25; model 4) (Table 2) but was associated with a slower rate of decline in timed walk over follow-up. In model 4, a 1-SD increase in baseline optimism was associated with a 43% slower rate of decline in walking time each year (time × optimism β = −0.09; 95% CI = −0.13 to −0.04) (Table 2). Higher optimism was not associated with timed walk in any of the main effect models (eg, optimism β = −0.06; 95% CI, −0.18 to 0.07; model 4) (Table 3).

Optimism and Chair Stands

On average, the number of chair stands completed in 15 seconds declined at a rate of 0.11 stands per year over follow-up. In all models, higher optimism was associated with performing more chair stands at baseline. In model 4, a 1-SD increase in baseline optimism was associated with 0.05 (95% CI, 0.01-0.10) more chair stands (Table 2). Higher optimism was also associated with a slower rate of decline in the number of chair stands performed over time. In model 4, a 1-SD increase in baseline optimism was associated with a 9% slower rate of decline in the average number of chair stands performed (time × optimism β = 0.01; 95% CI, = 0-0.03) (Table 2). In the main effect model, a 1-SD increase in optimism was associated with 0.07 (95% CI, 0.03-0.12; model 4) more chair stands (Table 3).

Across all outcomes, we found no evidence of a threshold effect in optimism levels categorized into quartiles. We also found no evidence of interaction between optimism, time, and categories of race and ethnicity (eTable 2 in Supplement 1).

Optimism and Developing Impaired Physical Functioning

Over follow-up, participants reached predefined thresholds for impairment in grip strength (850 [15.5%]), timed walk (869 [16.4%]), and chair stands (876 [17.2%]). We report results for Cox proportional hazards models without interaction terms for time in **Table 4**, as the main effects for optimism were unchanged after including them. Higher optimism was associated with lower hazards of reaching levels for impairment in all outcomes. For example, in model 4, for a 1-SD increase in optimism, the hazard ratio for becoming impaired was 0.86 (95% CI, 0.80-0.92) for grip strength, 0.94 (95% CI, 0.88-1.01) for timed walk, and 0.91 (95% CI, 0.85-0.98) for chair stands.

Additional Analysis

Findings were similar after incorporating the IPWs for censoring (eTable 3 in Supplement 1). We found no evidence of a statistically significant interaction between optimism and age. Results for stratified analysis by age group are shown in eTable 4

Table 1. Baseline Characteristics by Quartiles of Optimism in the Women's Health Initiative[a,b]

Characteristic	Overall (n = 5930)	Optimism (Q1 = least optimistic) Q1 (n = 1589)	Q2 (n = 1460)	Q3 (n = 1424)	Q4 (n = 1457)
Optimism, mean (SD)[c]	23 (3)	19 (2)	23 (1)	24 (0)	27 (1)
Demographics					
Age, mean (SD), y	70 (4)	70 (4)	70 (4)	70 (4)	70 (4)
Race and ethnicity, No. (%)					
American Indian or Alaska Native	12 (0)	<10	<10	<10	<10
Asian or Pacific Islander	133 (2)	60 (4)	32 (2)	29 (2)	12 (1)
Black	469 (8)	159 (10)	103 (7)	99 (7)	108 (7)
Hispanic/Latina	154 (3)	74 (5)	26 (2)	30 (2)	24 (2)
White	5093 (86)	1272 (80)	1278 (88)	1242 (87)	1301 (89)
Other[d]	57 (1)	13 (1)	14 (1)	21 (2)	<10
Married/marriagelike relationship, No. (%)	3324 (56)	826 (52)	851 (58)	783 (55)	864 (59)
Education, No. (%)					
<High school graduate	1086 (18)	404 (25)	280 (19)	237 (17)	165 (11)
High school graduate	1152 (19)	371 (23)	310 (21)	249 (18)	222 (15)
Some college or associate degree	1685 (28)	418 (26)	423 (29)	431 (30)	413 (28)
College or more	1968 (33)	379 (24)	442 (30)	497 (35)	650 (45)
Income, No. (%)					
<$20 000	1321 (22)	488 (31)	328 (23)	280 (20)	225 (15)
$20 000 to $49 000	2888 (49)	728 (46)	741 (51)	724 (51)	695 (48)
$50 000 to $74 999	818 (14)	151 (10)	190 (13)	223 (16)	254 (17)
≥$75 000	512 (9)	100 (6)	116 (8)	112 (8)	184 (13)
Occupation, No. (%)					
Managerial/professional	2138 (36)	420 (26)	521 (36)	547 (38)	650 (45)
Technical/sales/administrative	1833 (31)	542 (34)	468 (32)	431 (30)	392 (27)
Service/labor	1115 (19)	383 (24)	254 (17)	244 (17)	234 (16)
Homemaker only	682 (12)	181 (11)	178 (12)	170 (12)	153 (11)
Health conditions					
Depressed, No. (%)	457 (8)	246 (16)	108 (7)	62 (4)	41 (3)
Charlson Comorbidity Index, mean (SD)	0.97 (1)	1.07 (1)	0.93 (1)	0.97 (1)	0.89 (1)
BMI, mean (SD)[e]	29 (6)	29 (6)	29 (6)	29 (5)	28 (6)
Health behaviors					
Smoking, No. (%)					
Never smoked	3192 (54)	851 (54)	762 (52)	773 (54)	806 (55)
Past smoker	2331 (40)	611 (39)	604 (41)	556 (39)	560 (38)
Current smoker	321 (5)	104 (7)	72 (5)	71 (5)	74 (5)
Physical activity, mean (SD), METs/week	11 (13)	10 (12)	11 (13)	11 (13)	13 (14)
Alcohol, No. (%)					
Nondrinker	723 (12)	219 (14)	165 (11)	161 (11)	178 (12)
Past drinker	1164 (20)	355 (22)	296 (20)	270 (19)	243 (17)
Current drinker					
<1 Drink per month	752 (13)	224 (14)	182 (13)	182 (13)	164 (11)
<1 Drink per week	1257 (21)	346 (22)	327 (22)	290 (20)	294 (20)
1 to <7 Drinks per week	1369 (23)	301 (19)	330 (23)	352 (25)	386 (27)
7+ Drinks per week	624 (11)	132 (8)	150 (10)	157 (11)	185 (13)
AHEI, mean (SD)	47 (9)	46 (9)	47 (9)	47 (9)	48 (9)
Baseline physical functioning					
Grip, mean (SD), kg[f]	23.4 (6)	22.7 (6)	23.3 (6)	23.6 (6)	24.0 (6)
Timed walk, mean (SD), s[g]	6.6 (7)	6.8 (6)	6.6 (7)	6.6 (7)	6.6 (7)
Chair stands, mean (SD), times[h]	6.4 (2)	6.2 (2)	6.4 (2)	6.4 (2)	6.6 (2)

Abbreviations: AHEI, Alternate Healthy Eating Index; BMI, body mass index; MET, metabolic equivalent of task; Q, quartile.

[a] Percentages may not add up to 100% due to rounding.

[b] Sample sizes less than 10 are noted as <10 to protect the identifiability of individuals.

[c] Optimism was categorized into quartile ranges ($6 \leq Q1 \leq 21$; $21 < Q2 \leq 23$; $23 < Q3 \leq 25$; $25 < Q4 \leq 30$).

[d] Other includes races or ethnicities not specifically listed.

[e] Calculated as weight in kilograms divided by height in meters squared.

[f] The range of measures for grip strength was 0 to 61 kg.

[g] The range for timed walk was 2.45 to 60 seconds.

[h] The range for chair stands was 0 to 16.5 times.

Table 2. Associations Between Baseline Optimism and Grip Strength, Timed Walk, and Chair Stands Over Follow-Up Using Linear Mixed-Effects Models With Interaction Between Optimism and Time[a]

	β (95% CI)			
Test	Model 1[b]	Model 2[c]	Model 3[d]	Model 4[e]
Grip strength, kg[f]				
Optimism	0.51 (0.37 to 0.65)[g]	0.43 (0.28 to 0.57)[g]	0.37 (0.22 to 0.51)[g]	0.36 (0.21 to 0.50)[g]
Time, y	−0.57 (−0.60 to −0.54)[g]	−0.57 (−0.60 to −0.54)[g]	−0.57 (−0.60 to −0.54)[g]	−0.57 (−0.60 to −0.54)[g]
Time × optimism	0.00 (−0.03 to 0.03)	0.00 (−0.03 to 0.03)	0.00 (−0.03 to 0.03)	0.00 (−0.03 to 0.03)
Timed walk, s[h]				
Optimism	−0.03 (−0.18 to 0.11)	0.02 (−0.12 to 0.17)	0.09 (−0.06 to 0.24)	0.10 (−0.05 to 0.25)
Time, y	0.20 (0.15 to 0.25)[g]	0.20 (0.16 to 0.25)[g]	0.21 (0.16 to 0.25)[g]	0.21 (0.16 to 0.25)[g]
Time × optimism	−0.08 (−0.13 to −0.04)[g]	−0.08 (−0.13 to −0.04)[g]	−0.08 (−0.13 to −0.04)[g]	−0.09 (−0.13 to −0.04)[g]
Chair stands, times[i]				
Optimism	0.15 (0.10 to 0.20)[g]	0.10 (0.05 to 0.15)[g]	0.07 (0.02 to 0.12)[g]	0.05 (0.01 to 0.10)[j]
Time, y	−0.11 (−0.12 to −0.10)[g]	−0.11 (−0.12 to −0.10)[g]	−0.11 (−0.12 to −0.10)[g]	−0.11 (−0.12 to −0.10)[g]
Time × optimism	0.01 (0.00 to 0.02)[j]	0.01 (0.00 to 0.02)[j]	0.01 (0.00 to 0.02)[j]	0.01 (0.00 to 0.03)[j]

[a] Higher numbers for grip strength and chair stands and lower numbers for timed walk indicate better physical function.

[b] Model 1 adjusted for baseline age.

[c] Model 2 adjusted for baseline age, race and ethnicity, education, income, occupation, and marital status.

[d] Model 3 further adjusted for baseline health conditions, depression, and body mass index.

[e] Model 4 additionally included smoking status, diet quality, alcohol consumption, and physical activity.

[f] Sample size for analysis of grip strength ranged from 5865 to 5930 depending on the model.

[g] $P < .01$.

[h] Sample size for analysis of timed walk ranged from 5811 to 5875 depending on the model.

[i] Sample size for analysis of chair stands ranged from 5778 to 5824 depending on the model.

[j] $P < .05$.

in Supplement 1. After excluding women missing any data on optimism, the patterning of findings was similar (eTable 5 in Supplement 1). Findings were also similar when excluding observations missing data on physical functioning (eTable 6 in Supplement 1) and when adjusting for trial arm (eTable 7 in Supplement 1).

Discussion

In a diverse sample of postmenopausal women in the US, higher optimism was generally associated with better functional status across 3 performance measures over time. However, findings varied somewhat by measure. Baseline optimism was associated with stronger grip strength and increased number of chair stands at baseline and when considering associations pooled across time. In contrast, baseline optimism was associated with slower rates of decline in timed walk and chair stands. However, higher optimism was associated with lower hazards of becoming impaired for all performance measures. Together, these findings suggest that women with higher optimism have better physical functioning in older age and experience slower decline, resulting in extended time with healthy physical functioning. Notably, these associations were observed after adjusting for a broad range of potential confounders. Further, we found no evidence to suggest that benefits of optimism in relation to physical functioning differ across racial and ethnic groups. However, these findings should be interpreted with caution, as sample sizes were limited for certain racial and ethnic categories.

Our results confirm and extend previous studies examining longitudinal associations of other facets of psychological well-being with performance-based physical functioning measures, which also reported somewhat varying associations. For example, a study in the Health and Retirement Study found a higher sense of purpose in life was associated with lower likelihood of developing slow walking speed but not weak grip strength.[48] Such variations may be explained by prior studies indicating that age-related changes are more pronounced in lower body measures compared with upper body measures.[38] Notably, prior studies have shown that changes in grip strength occur at a slower rate than in timed walk and chair stands.[38] Muscle mass and strength also appear to be more affected by aging in the lower compared with the upper body.[49,50]

Several pathways may underlie observed associations between optimism and physical functioning. Although the association between optimism and health behaviors appears to be bidirectional,[51] evidence suggests higher optimism levels precede and predict healthier behaviors, including increased physical activity, healthier diet, and not smoking.[44] As health behaviors have also been linked to physical functioning, they may plausibly mediate associations observed in this study. However, because our findings were observed even after adjusting for health behaviors, other pathways likely also contribute. Social connections and activities in which more optimistic individuals regularly engage (eg, religious gatherings and volunteering) may support healthier physical functioning.[52] Neurobiological pathways, including healthier immune or autonomic functioning or neuroendocrine changes, are also possible.[9,53]

Table 3. Associations Between Baseline Optimism and Grip Strength, Timed Walk, and Chair Stands Pooled Across Time (Main Effect Models)[a]

	β (95% CI)			
Test	Model 1[b]	Model 2[c]	Model 3[d]	Model 4[e]
Grip strength, kg[f]				
Optimism	0.52 (0.39 to 0.65)[g]	0.43 (0.30 to 0.56)[g]	0.38 (0.24 to 0.51)[g]	0.37 (0.23 to 0.50)[g]
Time, y	−0.57(−0.60 to −0.54)[g]	−0.57 (−0.60 to −0.54)[g]	−0.57 (−0.60 to −0.54)[g]	−0.57 (−0.60 to −0.54)[g]
Timed walk, s[h]				
Optimism	−0.18 (−0.30 to −0.06)[g]	−0.12 (−0.24 to −0.00)[i]	−0.06 (−0.18 to 0.06)	−0.06 (−0.18 to 0.07)
Time, y	0.20 (0.15 to 0.24)[g]	0.20 (0.15 to 0.25)[g]	0.20 (0.16 to 0.25)[g]	0.20 (0.16 to 0.25)[g]
Chair stands, times[j]				
Optimism	0.17 (0.12 to 0.21)[g]	0.12 (0.07 to 0.17)[g]	0.09 (0.04 to 0.13)[g]	0.07 (0.03 to 0.12)[g]
Time, y	−0.11 (−0.12 to −0.10)[g]	−0.11 (−0.12 to −0.10)[g]	−0.11 (−0.12 to −0.10)[g]	−0.11 (−0.12 to −0.10)[g]

[a] Higher numbers for grip strength and chair stands and lower numbers for timed walk indicate better physical function.

[b] Model 1 adjusted for baseline age.

[c] Model 2 adjusted for baseline age, race and ethnicity, education, income, occupation, and marital status.

[d] Model 3 further adjusted for baseline health conditions, depression, and body mass index.

[e] Model 4 additionally included smoking status, diet quality, alcohol consumption, and physical activity.

[f] Sample size for analysis of grip strength ranged from 5865 to 5930 depending on the model.

[g] $P < .01$.

[h] Sample size for analysis of timed walk ranged from 5811 to 5875 depending on the model.

[i] $P < .05$.

[j] Sample size for analysis of chair stands ranged from 5778 to 5824 depending on the model.

Table 4. Hazard Ratios for the Association Between Baseline Optimism (*z* Score) and Reaching Impaired Levels of Grip Strength, Timed Walk, and Chair Stands, Using Cox Proportional Hazards Models

	HR (95% CI)			
Test	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
Grip strength, kg[e]	0.84 (0.79 to 0.90)[f]	0.85 (0.79 to 0.91)[f]	0.86 (0.80 to 0.92)[f]	0.86 (0.80 to 0.92)[f]
Timed walk, s[g]	0.88 (0.82 to 0.94)[f]	0.90 (0.84 to 0.96)[f]	0.93 (0.87 to 1.00)[h]	0.94 (0.88 to 1.01)
Chair stands, times[i]	0.87 (0.81 to 0.93)[f]	0.89 (0.83 to 0.95)[f]	0.91 (0.85 to 0.97)[f]	0.91 (0.85 to 0.98)[f]

[a] Model 1 adjusted for baseline age.

[b] Model 2 adjusted for baseline age, race and ethnicity, education, income, occupation, and marital status.

[c] Model 3 further adjusted for baseline health conditions, depression, and body mass index.

[d] Model 4 additionally included smoking status, diet quality, alcohol consumption, and physical activity.

[e] Sample size for analysis of grip strength ranged from 5155 to 5210 depending on the model.

[f] $P < .01$.

[g] Sample size for analysis of timed walk ranged from 5003 to 5057 depending on the model.

[h] $P < .05$.

[i] Sample size for analysis of chair stands ranged from 5023 to 5081 depending on the model.

Our findings suggest that psychological resources like optimism may play an important role in maintaining healthy physical functioning as individuals age. Randomized clinical trials have demonstrated that optimism can be enhanced through various interventions, from brief writing tasks to more intensive cognitive-behavioral therapy-based approaches.[54,55] A key question is if intervening on optimism leads to greater ability to sustain healthy physical functioning with age. If so, optimism may be a valuable target for interventions to promote healthy aging. Moreover, given deterioration in physical functioning with age is patterned by sex and other social structural factors, optimism may be an intervention target that could also help reduce disparities in healthy aging.

Limitations

This study has several limitations. First, generalizability may be limited as WHI participants were postmenopausal women with higher income and educational levels than the general population[56,57]; women in our subsample were willing and eligible to participate in the clinical trial component of the study, and data were gathered over 19 years ago. Investigating whether these associations hold across different populations and generations using more recent data is important. However, data within this sample suggest that optimism levels remain stable over time, as evidenced by the similar distribution of optimism at study closeout (average 8.6 years postbaseline). Second, we had limited power to detect interactions by race and ethnic categories. Third, 6 years of follow-up may be insufficient to observe meaningful changes in physical functioning especially in grip strength. Fourth, we were able to assess only if health behaviors might confound the association of optimism with physical functioning rather than evaluate their role as mediators. Fifth, bias may arise due to censoring for death and loss of follow-up. However, we conducted analysis using IPW for censoring to mitigate this concern and found associations were unchanged.

Conclusions

In conclusion, in this cohort study, we found that higher optimism was generally associated with better performance on measures of physical functioning over a 6-year follow-up. These findings highlight the importance of considering optimism as a potential resource for individual and population health. In clinical settings, practitioners may consider assessing optimism levels when evaluating risks for less healthy aging.[58] Governments and institutions aiming to mitigate declines in physical functioning among older adults may consider whether strategies to improve optimism also have downstream effects on physical health. Future work should further explore this association in diverse populations.

ARTICLE INFORMATION

Accepted for Publication: November 7, 2023.

Published Online: March 20, 2024. doi:10.1001/jamapsychiatry.2023.5068

Author Affiliations: Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, Massachusetts (Koga, Williams, Guimond, Kubzansky); Harvard Center for Population and Development Studies, Cambridge, Massachusetts (Koga); Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, Illinois (Grodstein); Department of African and African American Studies, Department of Sociology, Harvard University, Cambridge, Massachusetts (Williams); Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts (Manson); Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, Massachusetts (Manson); Division of Internal Medicine, Vanderbilt University Medical Center, Nashville, Tennessee (Tindle); Geriatric Research Education and Clinical Centers, Veterans Affairs Tennessee Valley Healthcare System, Nashville (Tindle); Herbert Wertheim School of Public Health and Human Longevity Science, University of California, San Diego, La Jolla (Shadyab); Division of Geriatrics, Gerontology, and Palliative Care, Department of Medicine, University of California, San Diego, La Jolla (Shadyab); Urban Health Collaborative, Drexel Dornsife School of Public Health, Philadelphia, Pennsylvania (Michael); Department of Epidemiology and Biostatistics, Drexel Dornsife School of Public Health, Philadelphia, Pennsylvania (Michael); College of Medicine, Sulaiman Al Rajhi University, Bukairyah, Al-Qassim, Saudi Arabia (Saquib); Division of Cancer Prevention and Control, Department of Internal Medicine, The Ohio State University, Columbus (Naughton).

Author Contributions: Dr Koga had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: Koga, Grodstein, Manson, Kubzansky.
Acquisition, analysis, or interpretation of data: Koga, Williams, Manson, Tindle, Shadyab, Michael, Saquib, Naughton, Guimond, Kubzansky.
Drafting of the manuscript: Koga.
Critical review of the manuscript for important intellectual content: All authors.
Statistical analysis: Koga, Grodstein, Saquib, Guimond, Kubzansky.
Obtained funding: Koga.
Administrative, technical, or material support: Koga, Manson, Kubzansky.
Supervision: Grodstein, Williams, Manson, Kubzansky.

Conflict of Interest Disclosures: Dr Manson reported receiving grants from the National Institutes of Health and Mars Edge outside the submitted work. Dr Naughton reported receiving grants from the National Institute of Aging (NIA) and the National Cancer Institute (NCI) to The Ohio State University during the conduct of the study. No other disclosures were reported.

Funding/Support: This study was supported in part by the Lee Kum Sheung Center for Health and Happiness Dissertation Research Award. The Women's Health Initiative is funded by the National Heart, Lung, and Blood Institute of the National Institutes of Health and the Department of Health and Human Services.

Role of the Funder/Sponsor: The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Data Sharing Statement: See Supplement 2.

REFERENCES

1. Salomon JA, Wang H, Freeman MK, et al. Healthy life expectancy for 187 countries, 1990-2010: a systematic analysis for the Global Burden Disease Study 2010. *Lancet*. 2012;380(9859):2144-2162. doi:10.1016/S0140-6736(12)61690-0

2. Okoro CA, Hollis ND, Cyrus AC, Griffin-Blake S. Prevalence of disabilities and health care access by disability status and type among adults—US, 2016. *MMWR Morb Mortal Wkly Rep*. 2018;67(32):882-887. doi:10.15585/mmwr.mm6732a3

3. Murtagh KN, Hubert HB. Gender differences in physical disability among an elderly cohort. *Am J Public Health*. 2004;94(8):1406-1411. doi:10.2105/AJPH.94.8.1406

4. Hardy SE, Kang Y, Studenski SA, Degenholtz HB. Ability to walk 1/4 mile predicts subsequent disability, mortality, and health care costs. *J Gen Intern Med*. 2011;26(2):130-135. doi:10.1007/s11606-010-1543-2

5. Musich S, Wang SS, Ruiz J, Hawkins K, Wicker E. The impact of mobility limitations on health outcomes among older adults. *Geriatr Nurs*. 2018;39(2):162-169. doi:10.1016/j.gerinurse.2017.08.002

6. Landré B, Fayosse A, Ben Hassen C, et al. Terminal decline in objective and self-reported measures of motor function before death: 10-year follow-up of Whitehall II cohort study. *BMJ*. 2021;374:n1743. doi:10.1136/bmj.n1743

7. De Buyser SL, Petrovic M, Taes YE, Toye KRC, Kaufman JM, Goemaere S. Physical function measurements predict mortality in ambulatory older men. *Eur J Clin Invest*. 2013;43(4):379-386. doi:10.1111/eci.12056

8. Scheier MF, Carver CS. Dispositional optimism and physical health: a long look back, a quick look forward. *Am Psychol*. 2018;73(9):1082-1094. doi:10.1037/amp0000384

9. Kubzansky LD, Huffman JC, Boehm JK, et al. Positive psychological well-being and cardiovascular disease: JACC health promotion series. *J Am Coll Cardiol*. 2018;72(12):1382-1396. doi:10.1016/j.jacc.2018.07.042

10. Koga HK, Trudel-Fitzgerald C, Lee LO, et al. Optimism, lifestyle, and longevity in a racially diverse cohort of women. *J Am Geriatr Soc*. 2022;70(10):2793-2804. doi:10.1111/jgs.17897

11. James P, Kim ES, Kubzansky LD, Zevon ES, Trudel-Fitzgerald C, Grodstein F. Optimism and healthy aging in women. *Am J Prev Med*. 2019;56(1):116-124. doi:10.1016/j.amepre.2018.07.037

12. Guralnik JM, Simonsick EM, Ferrucci L, et al. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. *J Gerontol*. 1994;49(2):M85-M94. doi:10.1093/geronj/49.2.M85

13. Kuriansky JB, Gurland BJ, Fleiss JL, Cowan D. The assessment of self-care capacity in geriatric psychiatric patients by objective and subjective methods. *J Clin Psychol*. 1976;32(1):95-102. doi:10.1002/1097-4679(197601)32:1<95::AID-JCLP2270320129>3.0.CO;2-J

14. Seeman TE, Charpentier PA, Berkman LF, et al. Predicting changes in physical performance in a high-functioning elderly cohort: MacArthur studies of successful aging. *J Gerontol*. 1994;49(3):M97-M108. doi:10.1093/geronj/49.3.M97

15. Guralnik JM, Seeman TE, Tinetti ME, Nevitt MC, Berkman LF. Validation and use of performance measures of functioning in a nondisabled older population: MacArthur studies of successful aging. *Aging (Milano)*. 1994;6(6):410-419. doi:10.1007/BF03324272

16. Brenes GA, Rapp SR, Rejeski WJ, Miller ME. Do optimism and pessimism predict physical functioning? *J Behav Med*. 2002;25(3):219-231. doi:10.1023/a:1015376510466

17. Umstattd MR, McAuley E, Motl RW, Rosengren KS. Pessimism and physical functioning in older women: influence of self-efficacy. *J Behav Med*. 2007;30(2):107-114. doi:10.1007/s10865-006-9089-9

18. Melvin J, Hummer R, Elo I, Mehta N. Age patterns of racial/ethnic/nativity differences in disability and physical functioning in the US. *Demogr Res*. 2014;31:497-510. doi:10.4054/DemRes.2014.31.17

19. Williams ED, Cox A, Cooper R. Ethnic differences in functional limitations by age across the adult life course. *J Gerontol A Biol Sci Med Sci*. 2020;75(5):914-921. doi:10.1093/gerona/glz264

20. Boehm JK, Chen Y, Williams DR, Ryff C, Kubzansky LD. Unequally distributed psychological assets: are there social disparities in optimism, life satisfaction, and positive affect? *PLoS One*. 2015;10(2):e0118066. doi:10.1371/journal.pone.0118066

21. Tindle HA, Chang YF, Kuller LH, et al. Optimism, cynical hostility, and incident coronary heart disease and mortality in the Women's Health Initiative. *Circulation*. 2009;120(8):656-662. doi:10.1161/CIRCULATIONAHA.108.827642

22. Alley DE, Shardell MD, Peters KW, et al. Grip strength cut points for the identification of clinically relevant weakness. *J Gerontol A Biol Sci Med Sci*. 2014;69(5):559-566. doi:10.1093/gerona/glu011

23. Pinheiro PA, Carneiro JA, Coqueiro RS, Pereira R, Fernandes MH. "Chair stand test" as simple tool for sarcopenia screening in elderly women. *J Nutr Health Aging*. 2016;20(1):56-59. doi:10.1007/s12603-016-0676-3

24. Abellan van Kan G, Rolland Y, Andrieu S, et al. Gait speed at usual pace as a predictor of adverse outcomes in community-dwelling older people an International Academy on Nutrition and Aging (IANA) Task Force. *J Nutr Health Aging*. 2009;13(10):881-889. doi:10.1007/s12603-009-0246-z

25. Studenski S, Perera S, Patel K, et al. Gait speed and survival in older adults. *JAMA*. 2011;305(1):50-58. doi:10.1001/jama.2010.1923

26. Atkinson HH, Rapp SR, Williamson JD, et al. The relationship between cognitive function and physical performance in older women: results from the women's health initiative memory study. *J Gerontol A Biol Sci Med Sci*. 2010;65(3):300-306. doi:10.1093/gerona/glp149

27. Peel NM, Kuys SS, Klein K. Gait speed as a measure in geriatric assessment in clinical settings: a systematic review. *J Gerontol A Biol Sci Med Sci*. 2013;68(1):39-46. doi:10.1093/gerona/gls174

28. McGinn AP, Kaplan RC, Verghese J, et al. Walking speed and risk of incident ischemic stroke among postmenopausal women. *Stroke*. 2008;39(4):1233-1239. doi:10.1161/STROKEAHA.107.500850

29. Tindle H, Belnap BH, Houck PR, et al. Optimism, response to treatment of depression, and rehospitalization after coronary artery bypass graft surgery. *Psychosom Med*. 2012;74(2):200-207. doi:10.1097/PSY.0b013e318244903f

30. Lever-van Milligen BA, Lamers F, Smit JH, Penninx BWJH. Six-year trajectory of objective physical function in persons with depressive and anxiety disorders. *Depress Anxiety*. 2017;34(2):188-197. doi:10.1002/da.22557

31. Lever-van Milligen BA, Lamers F, Smit JH, Penninx BWJH. Physiological stress markers, mental health, and objective physical function. *J Psychosom Res*. 2020;133:109996. doi:10.1016/j.jpsychores.2020.109996

32. Hays J, Hunt JR, Hubbell FA, et al. The Women's Health Initiative recruitment methods and results. *Ann Epidemiol*. 2003;13(9)(suppl):S18-S77. doi:10.1016/S1047-2797(03)00042-5

33. The Women's Health Initiative Study Group. Design of the Women's Health Initiative clinical trial and observational study. *Control Clin Trials*. 1998;19(1):61-109. doi:10.1016/S0197-2456(97)00078-0

34. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *J Pers Soc Psychol*. 1994;67(6):1063-1078. doi:10.1037/0022-3514.67.6.1063

35. Lee LO, James P, Zevon ES, et al. Optimism is associated with exceptional longevity in 2 epidemiologic cohorts of men and women. *Proc Natl Acad Sci U S A*. 2019;116(37):18357-18362. doi:10.1073/pnas.1900712116

36. Bell ML, Fairclough DL, Fiero MH, Butow PN. Handling missing items in the Hospital Anxiety and Depression Scale (HADS): a simulation study. *BMC Res Notes*. 2016;9(1):479. doi:10.1186/s13104-016-2284-z

37. Ostir GV, Volpato S, Fried LP, Chaves P, Guralnik JM; Women's Health and Aging Study. Reliability and sensitivity to change assessed for a summary measure of lower body function: results from the Women's Health and Aging Study. *J Clin Epidemiol*. 2002;55(9):916-921. doi:10.1016/s0895-4356(02)00436-5

38. Onder G, Penninx BWJH, Lapuerta P, et al. Change in physical performance over time in older women: the Women's Health and Aging Study. *J Gerontol A Biol Sci Med Sci*. 2002;57(5):M289-M293. doi:10.1093/gerona/57.5.M289

39. Mijnarends DM, Meijers JMM, Halfens RJG, et al. Validity and reliability of tools to measure muscle mass, strength, and physical performance in community-dwelling older people: a systematic review. *J Am Med Dir Assoc*. 2013;14(3):170-178. doi:10.1016/j.jamda.2012.10.009

40. Rosso AL, Lee BK, Stefanick ML, et al. Caregiving frequency and physical function: the Women's Health Initiative. *J Gerontol A Biol Sci Med Sci*. 2015;70(2):210-215. doi:10.1093/gerona/glu104

41. Clinical Measurements WHI Manuals. Clinical measurements. Accessed March 31, 2022. https://www-whi-org.s3.us-west-2.amazonaws.com/wp-content/uploads/Vol-2-09-Clinical-Measurements.pdf

42. Bodilsen AC, Juul-Larsen HG, Petersen J, Beyer N, Andersen O, Bandholm T. Feasibility and interrater reliability of physical performance measures in acutely admitted older medical patients. *PLoS One*. 2015;10(2):e0118248. doi:10.1371/journal.pone.0118248

43. Gold R, Michael YL, Whitlock EP, et al. Race/ethnicity, socioeconomic status, and lifetime morbidity burden in the women's health initiative: a cross-sectional analysis. *J Womens Health (Larchmt)*. 2006;15(10):1161-1173. doi:10.1089/jwh.2006.15.1161

44. Boehm JK, Chen Y, Koga H, Mathur MB, Vie LL, Kubzansky LD. Is Optimism associated with healthier cardiovascular-related behavior: meta-analyses of 3 health behaviors. *Circ Res*. 2018;122(8):1119-1134. doi:10.1161/CIRCRESAHA.117.310828

45. Hingle MD, Wertheim BC, Tindle HA, et al. Optimism and diet quality in the Women's Health Initiative. *J Acad Nutr Diet*. 2014;114(7):1036-1045. doi:10.1016/j.jand.2013.12.018

46. Twisk J, de Boer M, de Vente W, Heymans M. Multiple imputation of missing values was not necessary before performing a longitudinal mixed-model analysis. *J Clin Epidemiol*. 2013;66(9):1022-1028. doi:10.1016/j.jclinepi.2013.03.017

47. Mendes de Leon CF, Barnes LL, Bienias JL, Skarupski KA, Evans DA. Racial disparities in disability: recent evidence from self-reported and performance-based disability measures in a population-based study of older adults. *J Gerontol B Psychol Sci Soc Sci*. 2005;60(5):S263-S271. doi:10.1093/geronb/60.5.S263

48. Kim ES, Kawachi I, Chen Y, Kubzansky LD. Association between purpose in life and objective measures of physical function in older adults. *JAMA Psychiatry*. 2017;74(10):1039-1045. doi:10.1001/jamapsychiatry.2017.2145

49. Yee XS, Ng YS, Allen JC, et al. Performance on sit-to-stand tests in relation to measures of functional fitness and sarcopenia diagnosis in community-dwelling older adults. *Eur Rev Aging Phys Act*. 2021;18(1):1. doi:10.1186/s11556-020-00255-5

50. Candow DG, Chilibeck PD. Differences in size, strength, and power of upper and lower body muscle groups in young and older men. *J Gerontol A Biol Sci Med Sci*. 2005;60(2):148-156. doi:10.1093/gerona/60.2.148

51. Trudel-Fitzgerald C, James P, Kim ES, Zevon ES, Grodstein F, Kubzansky LD. Prospective associations of happiness and optimism with lifestyle over up to 2 decades. *Prev Med*. 2019;126:105754. doi:10.1016/j.ypmed.2019.105754

52. Carver CS, Scheier MF. Dispositional optimism. *Trends Cogn Sci*. 2014;18(6):293-299. doi:10.1016/j.tics.2014.02.003

53. Boehm JK, Kubzansky LD. The heart's content: the association between positive psychological well-being and cardiovascular health. *Psychol Bull*. 2012;138(4):655-691. doi:10.1037/a0027448

54. Boehm JK, Kim ES, Kubzansky LD. Positive psychological well-being. In: Kivimäki M, Batty D, Kawachi I, Steptoe A, eds. *The Routledge International Handbook of Psychosocial Epidemiology*. Routledge; 2017. doi:10.4324/9781315673097-7

55. Malouff JM, Schutte NS. Can psychological interventions increase optimism: a meta-analysis. *J Posit Psychol*. 2017;12(6):594-604. doi:10.1080/17439760.2016.1221122

56. Ritenbaugh C, Patterson RE, Chlebowski RT, et al. The Women's Health Initiative Dietary Modification trial: overview and baseline characteristics of participants. *Ann Epidemiol*. 2003;13(9)(suppl):S87-S97. doi:10.1016/S1047-2797(03)00044-9

57. Stefanick ML, Cochrane BB, Hsia J, Barad DH, Liu JH, Johnson SR. The Women's Health Initiative postmenopausal hormone trials: overview and baseline characteristics of participants. *Ann Epidemiol*. 2003;13(9)(suppl):S78-S86. doi:10.1016/S1047-2797(03)00045-0

58. Levine GN, Cohen BE, Commodore-Mensah Y, et al. Psychological health, well-being, and the mind-heart-body connection: a scientific statement from the American Heart Association. *Circulation*. 2021;143(10):e763-e783. doi:10.1161/CIR.0000000000000947