Title: Optimism, Lifestyle, and Longevity in a Racially Diverse Cohort of Women

Short running title: Optimism, Lifestyle, and Longevity

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Key Points:

- Among a racially diverse cohort of women, higher levels of optimism were associated with increased lifespan and greater likelihood of achieving exceptional longevity over up to 26 years of follow-up.
- This relationship was generally evident across racial and ethnic groups, suggesting the association of optimism with longevity extends to diverse populations.
- Lifestyle factors mediated 24% of the optimism-lifespan association.

Why does this matter?

Optimism may be an important asset to consider for promoting health and longevity in diverse populations.

Abstract

Background: Research has suggested optimism is associated with healthy aging and exceptional longevity, but most studies were conducted among non-Hispanic White populations. We examined associations of optimism to longevity across racial and ethnic groups and assessed healthy lifestyle as a possible mediating pathway.

Methods: Participants from the Women's Health Initiative (N=159,255) completed a validated measure of optimism and provided other demographic and health data at baseline. We evaluated associations of optimism with increments in lifespan using accelerated failure time models, and with likelihood of exceptional longevity (survival to age ≥90) using Poisson regression models. Causal mediation analysis explored whether lifestyle-related factors mediated optimism-lifespan associations.

Results: After covariate adjustment, the highest versus lowest optimism quartile was associated with 5.4% (95% confidence interval [CI]=4.5, 6.4%) longer lifespan. Within racial and ethnic subgroups, these estimates were 5.1% (95%CI=4.0, 6.1%) in non-Hispanic White, 7.6% (95%CI=3.6, 11.7%) in Black, 5.4% (95%CI=-0.1, 11.2%) in Hispanic/Latina, and 1.5% (95% CI=-5.0, 8.5) in Asian women. A high proportion (53%) of the women achieved exceptional longevity. Participants in the highest versus lowest optimism quartile had greater likelihood of achieving exceptional longevity (e.g., full sample risk ratio=1.1, 95%CI=1.1, 1.1). Lifestyle mediated 24% of the optimism-lifespan association in the full sample, 25% in non-Hispanic White, 10% in Black, 24% in Hispanic/Latina, and 43% in Asian women.

Conclusions: Higher optimism was associated with longer lifespan and a greater likelihood of achieving exceptional longevity overall and across racial and ethnic groups. The contribution of lifestyle to these associations was modest. Optimism may promote health and longevity in

diverse racial and ethnic groups. Future research should investigate these associations in less long-lived populations.

Key words: Optimism, psychological well-being, longevity, aging, race/ethnicity

Introduction

Growing evidence suggests positive psychological factors are associated with lower risk of morbidity and mortality, above and beyond simply signaling the absence of depression or other markers of poor psychological functioning.[1] In particular, optimism —the generalized expectation of positive future outcomes[2]— has been consistently associated with improved health outcomes, including exceptional longevity[3] — surviving well past the average age of death (in 2018, this was 81.2 years for women and 76.2 years for men in the US).[4] While optimism is partly heritable (23-32%),[5] experimental research has demonstrated that optimism is modifiable with accessible methods that actively target optimism such as writing exercises and cognitive-behavioral strategies.[6] This work, in conjunction with findings linking optimism to a range of outcomes including physical health[1] suggest optimism may be a novel target for intervention to improve health. Moreover, studies looking into the racial and ethnic differences in the association between optimism and health suggest that optimism may provide benefits to health across racial and ethnic groups,[7] however evidence that these effects generalize remains limited.

Prior work has suggested more versus less optimistic individuals take more proactive approaches to promoting their health and they are more likely to engage in healthy behaviors such as increased physical activity, healthier diet, and not smoking.[8] This evidence suggests such behaviors may mediate the relationship between optimism and longevity. However, the association between optimism and health behaviors appears to be bidirectional and although plausible, conclusive evidence to support that optimism precedes and leads to healthy behaviors is not yet available. Moreover, whether and how much these behaviors mediate the association between optimism and health is understudied. Further, if optimism provides benefits to health

similarly across racial and ethnic groups, the mediating pathways involved might also work similarly across diverse groups.

Thus, we used data from the WHI, a longitudinal study of racial and ethnically diverse women to evaluate the association of optimism with lifespan and exceptional longevity. In prior WHI research (N=97,253), higher optimism was associated with reduced mortality risk in both non-Hispanic White and Black women;[7] however, the authors did not further consider Hispanic/Latina or Asian women, nor did the study examine the potential mediating effect of health behaviors.

We tested two hypotheses: (1) higher optimism would be associated with longer lifespan and exceptional longevity across racial and ethnic categories, (2) lifestyle factors would mediate this association across racial and ethnic groups. We considered a range of relevant covariates based on prior work, including baseline health status and depression, which has been linked with both optimism and mortality.[3]

Methods

Study population

The WHI is a study of 161,808 U.S. postmenopausal women aged 50-79 at enrollment (1993-1998) that included a set of randomized clinical trials (N=68,132) and an observational study (N=93,676) that enrolled women who were ineligible or unwilling to be randomized. Participants were recruited from 40 clinical centers with representation of diverse racial and ethnic groups. Detailed information on the WHI recruitment has been described elsewhere.[9]

Following prior work in the WHI, the current study included all women with data on optimism and survival from both the observational and clinical trial arms.[7] As shown in Supplemental Figure S1, women were excluded from the current analysis if they died within the

first two years of follow-up (N=1,095) to mitigate concerns that health status affected report/experience of optimism levels. Participants were also excluded if they completed <3 of the 6 items on the optimism measure (N=881), or were missing data on ≥2 of the 5 lifestyle components (N=762). All participants provided informed consent using materials approved by institutional review boards at each center.

Measures

Optimism. Optimism was assessed at baseline with the 6-item Life Orientation Test Revised (LOT-R), which has good discriminant and convergent validity, and reliability (see Supplemental Material).[10] The measure had high internal consistency reliability in the current sample (overall score Cronbach's α=0.75). Participants reported the degree to which they agreed with each item on a scale ranging from 1="strongly disagree" to 5="strongly agree". Optimism can be represented by endorsing the positively worded items and rejecting the negatively worded items.[11] Following prior work and recommendations, we focused analyses on the 6-item composite of the LOT-R.[11,12] Negatively framed items were reverse-coded, and items were summed to create a score ranging from 6 to 30, where higher scores indicated higher optimism levels. For those missing ≤3 items (N=3,296; 2.0%), missing values were replaced using mean imputation.[13] We considered optimism as a standardized continuous measure (z-scores), and also created quartiles of optimism based on the score distribution in our sample to assess potential discontinuous or threshold effects.

In secondary analyses, we also created 3-item subscales for optimism and pessimism and conducted analyses of these separately.[14] For the optimism subscale we summed the three positively worded items; for the pessimism subscale we summed the three negatively worded items with higher scores indicating higher optimism or pessimism levels, respectively. Each

subscale score ranged 3 to 15 with Cronbach's α=0.68 for the positively framed and 0.75 for the negatively framed items.

Longevity. Following prior work,[3] we used average difference in lifespan and likelihood of exceptional longevity as two approaches to examine longevity. Since there is no standard definition of the age threshold for exceptional longevity, we followed recent literature and defined exceptional longevity as survival to age 90 or older.[15] To identify and confirm deaths, participants lost to follow-up or known to be dead were matched to the National Death Index,[16] with March 1st, 2019 being the end of the mortality follow-up period.

Covariates. At baseline, participants reported demographics and medical history through questionnaires. Demographics included age (years), education (less than high school, some high school, some college or associate degree, college graduate or more), partner's education (same categorization as education), marital status (married or marriage-like relationship, divorced or single, widowed), total annual family income before taxes (less than $20,000, $20,000 to $49,999, $50,000 to $74,999, $75,000 or more), occupation (managerial/professional, technical/sales/admin, service/labor, homemaker only), health insurance (private, Medicare/Veterans Administration/military, Medicaid, other insurance, no insurance), and region (Northeast, South, Midwest, West). Self-identified race and ethnicity (American Indian or Alaskan Native, Asian or Pacific Islander, Black or African-American, Hispanic/Latina, White (not of Hispanic origin) and Other) was assessed at baseline. In 2003-2004, an additional question on race and ethnicity was administered which provided more nuanced information. Due to limited sample size in some of the categories, we relied on the baseline categorization for this study. Following prior work, we assessed baseline chronic health conditions using a modified version of the Charlson Index (see Supplemental Material).[17] Depression was assessed with the

validated Burnam Screening Algorithm questionnaire that includes 6 items from the Center for Epidemiologic Studies Depression Scale and two items from the Diagnostic Interview Scale.[19,20] A total score ≥0.06 (possible range=0-1) indicated depression (see Supplemental Material).[19] Dummy variables for missingness were included for missing covariates.

Lifestyle. Health behaviors tend to cluster,[21] and most work identifies similar associations between optimism and multiple behavior-related factors.[8,22] We created a composite measure of healthy lifestyle, which has been linked with better health and higher optimism.[22,23] Components of the composite score were diet quality, physical activity, body mass index (BMI), smoking status, and alcohol consumption (see Supplemental Material). These were assessed at baseline and categorized according to whether participants met pre-defined cut-points for having healthy levels (yes=1/no=0). Scores on each component were then summed to create a composite lifestyle score ranging from 0 "least healthy" to 5 "most healthy." For those with missing data on one component, scores were made comparable by weighting by the number of questions answered. For mediation analysis, the lifestyle components were assessed 3 years after baseline assessments of optimism to ensure temporal ordering of the exposure and mediator.

Statistical analysis

First, we examined the distribution of covariates across optimism levels. Next, to evaluate if higher optimism levels were associated with extended lifespan, we used an accelerated failure time (AFT) model. The estimated regression coefficient β was transformed by $100\left(e^{\beta}-1\right)$ to represent the percent difference in the expected survival time for each standard deviation (SD) increment in optimism.[3,24] Further, to evaluate the likelihood of achieving exceptional longevity (i.e., ≥90 years), which was common in our sample, we used Poisson regression with robust error variance estimates.[25] This analysis was conducted in the subset of women who were old enough

at baseline to reach age 90 within the follow-up period (N=55,855). Given how common surviving past age 90 was, we also conducted a sensitivity analysis to investigate the likelihood of surviving past age 95 in the subset of women who were old enough to reach this age within the follow-up period (N= 26,418).

We used three sets of models for both the AFT and Poisson regression analyses. Model 1 adjusted for baseline demographics (i.e., age, race and ethnicity, education, partner's education, marital status, family income, occupation, health insurance and region). Model 2 additionally adjusted for presence of prevalent chronic conditions (via the Charlson Index) and depression at baseline. Model 3 further added the lifestyle score to account for potential confounding or mediation by lifestyle factors. To evaluate potential effect modification by race and ethnicity, we included relevant interaction terms of optimism (continuous) with each racial and ethnic group, and also conducted analyses stratified by race and ethnicity except for American Indian or Alaskan Native (N=713) and women who self-identified as "Other" (N=1,849) due to the limited sample size in these categories. As a secondary analysis, we constructed separate models for the optimism and pessimism subscales of the LOT-R, with the same sets of models described above. As sensitivity analysis, we also excluded those who died within the first 4 years of follow-up (N=3,030).

To explore the extent to which healthy lifestyle may mediate the association of optimism with lifespan, the total effect of optimism on extended lifespan was decomposed into direct and indirect effects (via lifestyle), following the causal mediation approach by VanderWeele et al.[26] This approach uses a counterfactual framework that accounts for potential exposure-mediator interaction. As we found evidence of an interaction between optimism and lifestyle in relation to lifespan for the full sample, all analyses accounted for this interaction by allowing for exposure-

mediator interaction.[27] Next, we examined the proportion of the effect of optimism mediated by the lifestyle composite, which represents the combined effect of these behavior-related factors (see Supplemental Material). We also evaluated mediation separately in each racial and ethnic group via stratified analyses. These analyses were conducted in the observational study sample only (N=81,963) due to data availability for the lifestyle components measured 3 years post-baseline. All analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

As shown in Table 1, the final analytic sample (N=159,255) consisted of 131,666 non-Hispanic White (84%), 14,261 Black (9%), 6,287 Hispanic/Latina (4%), 4,144 Asian (3%), 693 American Indian or Alaskan native women (0.4%) and 1,810 women who self-identified as "Other" for racial or ethnic group (1%). At baseline, the mean age was 63.2 years (SD=7.2). The mean optimism score was 17.3 for the overall sample, 17.4 for non-Hispanic White, 17.1 for Black, 16.0 for Hispanic/Latina, 16.2 for Asian, 16.5 for American Indian or Alaskan native women, and 16.6 for women who self-identified as "Other" for race or ethnic group (see Figure 1A). The distribution of baseline covariates by quartiles of optimism levels is shown in Table 1. Women with higher optimism levels were more frequently non-Hispanic White, had higher education levels, were less likely to report prevalent health conditions including depression, and had somewhat healthier lifestyle, but did not differ meaningfully with regard to age and marital status.

Optimism, lifespan, and exceptional longevity

Overall, 64,301 women (40.3%) died over up to 26 years of follow-up. In all models using the full sample, higher optimism levels at baseline were associated with longer lifespan (Table 2

and Figure 2). For instance, after adjusting for demographics, chronic conditions, and depression (Model 2), women in the highest versus lowest quartile of optimism had 5.4% (95% confidence interval [CI]=4.5, 6.4%) longer lifespan. The association was somewhat attenuated after adding lifestyle to the model. Findings were consistent when optimism was measured continuously (per 1-SD increase: 2.0%; 95%CI=1.7, 2.3% in Model 2). Secondary analysis separating the optimism measure into optimism and pessimism subscales showed that optimism was associated with extended lifespan and pessimism was associated with shortened lifespan, with the magnitude of the association slightly larger for the pessimism subscale. For example, in Model 2, women in the highest versus lowest quartile of optimism had 2.5% (95% CI=1.6, 3.4%) longer lifespan whereas women in the highest versus lowest quartile of pessimism had 5.2% (95%CI=4.3, 6.1%) shorter lifespan (Supplemental Table S1). Sensitivity analysis excluding those who died within the first four years of follow up did not meaningfully change the results.

Of the 55,885 women eligible for exceptional longevity analyses, 29,703 (53%) survived to age ≥90. As shown in Table 3, higher optimism levels were consistently associated with greater likelihood of exceptional longevity in the overall sample. After adjusting for demographics, chronic conditions, and depression, women in the highest versus lowest optimism quartiles had 10% (relative risk [RR]=1.1, 95%CI=1.1, 1.1) greater likelihood of achieving exceptional longevity. Findings were consistent when optimism was modeled as a continuous variable (per 1-SD increase RR=1.05; 95% CI=1.04, 1.06 in Model 2). Findings were also similar when increasing the cut point for exceptional longevity to age ≥95 (e.g., highest versus lowest optimism quartile RR=1.2, 95% CI=1.1, 1.3 in Model 2, see Supplemental Table S2).

Associations of optimism with lifespan and longevity by race and ethnicity

We found no interaction between optimism and any categories of race and ethnicity (all p-values for interactions >0.05) in any model for lifespan, and when optimism was measured either continuously or in quartiles. Further, when we stratified by race and ethnicity (Table 2) after adjusting for demographics, chronic conditions, and depression, participants in the highest versus lowest optimism quartiles had longer lifespan by 5.1% (95%CI=4.0, 6.1%) within Non-Hispanic White, 7.6% (95%CI=3.6, 11.7%) within Black, and 5.4% (95%CI=-0.1, 11.2%) within Hispanic/Latina women. Among Asian women, optimism was associated with 1.5% longer lifespan, but confidence intervals around the effect estimate were wide (95%CI=-5.0, 8.5%) perhaps because this was the smallest sub-sample. Similar patterns were noted when optimism was measured continuously (e.g., in Model 2, per 1-SD increase: non-Hispanic White women=1.9%, 95%CI=1.5, 2.2%; Black women=2.7%, 95%CI=1.5, 4.0%; Hispanic/Latina women=2.2%, 95%CI=0.2, 4.3%; Asian women=-0.1%, 95%CI=-2.4, 2.3%).

We also found no interaction between optimism and any category of race and ethnicity in all models for exceptional longevity (all p-values for interactions >0.05). When considering stratified associations (Table 3) the risk ratio of exceptional longevity comparing women in the highest vs lowest quartile of optimism was 1.10 (95%CI=1.08, 1.13) for non-Hispanic White, 1.17 (95%CI=1.06, 1.28) for Black, 1.02 (95%CI=0.89, 1.18) for Hispanic/Latina and 0.94 (95%CI=0.84, 1.06) for Asian women in Model 2.

The role of lifestyle in associations of optimism with lifespan

The mean lifestyle score was 2.4 for the overall sample, 2.5 for non-Hispanic White, 1.8 for Black, 2.0 for Hispanic/Latina, and 2.7 for Asian women (Figure 1B). Causal mediation models adjusting for demographics, chronic conditions, and depression suggested lifestyle mediated 24% of the relation of optimism with lifespan in the full sample. When stratified by race and ethnicity,

lifestyle mediated the following proportions of the relationship; 25% in non-Hispanic White, 10% in Black, 24% in Hispanic/Latina, and 43% in Asian women. See Supplemental Table S3 for detailed results.

Discussion

In this large longitudinal, racially and ethnically diverse cohort of women, higher optimism levels were associated with longer lifespan and greater likelihood of achieving exceptional longevity, with no interaction by categories of race and ethnicity. Importantly, associations found in the present study were maintained after adjustment for multiple potential confounders and across various racial and ethnic groups. Moreover, the finding that associations were independent of depression suggests optimism may confer benefits for longevity beyond simply signaling the absence of depression. Associations were also present in the various secondary and sensitivity analyses conducted, considering optimism and pessimism as separate subscales or excluding women who died within four years of baseline; these findings further support the robustness of the primary associations observed. We also found modest evidence that lifestyle may partly mediate these associations.

Our findings are consistent with previous work. A study conducted in mostly White women in the US found optimism was associated with 15% longer lifespan and 50% greater odds of achieving exceptional longevity over 10 years of follow up.[3] The current study utilized data from a large racially and ethnically diverse cohort of women, and followed them for up to 26 years. Using life expectancy of US women in 2018 (81.2 years),[4] our main finding that optimism is associated with a 5.4% increase in lifespan can be extrapolated as adding 4.4 years of life on average. Of note, exercise has been widely recognized as an important factor for health and studies have shown that regular exercise adds 0.4 to 4.2 years of life when adjusting for

256 confounding risk factors.[28] Thus, our findings suggest the impact of optimism may be
257 comparable to that of exercise.

258 Causal mediation analyses further suggested at least some mechanistic role of lifestyle in the
259 optimism-lifespan associations, which would operate similarly across racial and ethnic groups.
260 These findings are consistent with other work examining related questions and with conceptual
261 frameworks suggesting such behavior-related factors are likely to serve as underlying
262 mechanisms for the observed associations.[8,29,30] Although we saw evidence of mediation across
263 racial and ethnic groups, the proportion mediated seemed to somewhat differ according to which
264 race or ethnic category we considered. Such differences could be due to variation in the extent to
265 which individuals from these different groups have opportunities to engage in healthy behaviors;
266 for example, not all have equal access to healthy food or safe environments for exercise.
267 However, these results should be interpreted cautiously given the small effect sizes and the wide
268 confidence intervals evident in the groups with smaller sample sizes. More exploration of these
269 differences is needed. Nonetheless, the proportion mediated was modest in magnitude, implying
270 other possible pathways likely also mediate the association of optimism to lifespan. Other
271 possible pathways include neurobiological processes[31,32] and psychosocial resources that
272 promote health or buffer the harmful health impact of stressful experiences.[33,34] For example,
273 studies have investigated how psychological stress and distress can trigger a host of
274 physiological changes (including autonomic nervous system activation, immune system
275 activation, neuroendocrine changes, platelet hypercoagulability, and oxidative stress) and
276 positive psychological factors may buffer psychological stress as well as the physiologic
277 reactions to this sense of stress.[33,35] In addition, optimists appear to have greater social support,[36]

use problem-solving and planning strategies to minimize health risks,[37] and are better able to regulate emotions and behavior.[38]

This study has several limitations. First, the samples of Hispanic/Latina and Asian women may be less representative than the samples of non-Hispanic White and Black women. Nevertheless, the directionality of the associations found in Hispanic/Latina and Asian women were similar to that in the other groups. The WHI emphasized inclusion of women of racial and ethnic minorities in the US and actively recruited participants from clinical centers with access to these minority groups,[9] and 6,287 Hispanic/Latina and 4,144 Asian women are sizeable numbers of participants compared to other epidemiologic cohorts in the US. Second, participants in this study on average had higher education levels than the average US population and although we used a widely accepted definition to define exceptional longevity, a high proportion (53%) of the women in this study were able to achieve it, suggesting these women were also healthier than the average US population. Caution is needed in generalizing these findings to the general population and future research should investigate the association in less long-lived populations. Third, due to the limited sample size in some of the racial and ethnic categories, we did not use more detailed categorizations of race and ethnicity. For example, we did not separate Hispanic Black women from non-Hispanic Black women. Future studies could take a more detailed look into these differences. Fourth, although we considered a broad range of potential confounders, unmeasured confounding by factors including heritability,[5] childhood environment like parental warmth and financial stability[39,40] may be possible. However, this study also has important strengths including data from a large racially and ethnically diverse cohort of women, a longitudinal design with up to 26 years of follow-up, and ability to consider a broad range of potential confounders.

In conclusion, we found that higher levels of optimism were associated with longer lifespan and greater likelihood of achieving exceptional longevity across racial and ethnic groups, suggesting the health benefits of optimism may hold across these groups. Thus, while some evidence suggests optimism itself is patterned by some social structural factors,[41] meaningful associations between optimism and health remain even after robust adjustment for these factors and when examined separately across race and ethnic groups. The contribution of lifestyle to these associations was evident albeit modest. As prior work has demonstrated that optimism is modifiable,[6] it may be a novel target for interventions that aim to extend lifespan across diverse racial and ethnic groups.

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Conflict of interest

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Author contributions

L.D.K., F.G., and H.K.K. developed the study concept. All authors contributed to the study design. H.K.K. analyzed data; H.K.K., L.D.K., F.G. drafted the manuscript; all authors provided critical revisions. All authors approve the final version of the manuscript for submission. The authors confirm that these findings have not been presented elsewhere.

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Tables

Table 1. Baseline characteristics by quartiles of optimism (score range 6 to 30) in the Women's Health Initiative (N=159,255)

	Optimism (Q1= least optimistic)			
	Q1 (N=43,211)	Q2 (N=39,260)	Q3 (N=48,227)	Q4 (N=28,557)
Median (SD) optimism	20 (2.2)	23 (0.5)	25 (0.8)	28 (1.1)
Demographics:				
Mean (SD) age	63.2 (7.4)	63.5 (7.2)	63.3 (7.1)	62.7 (7.1)
Race and Ethnicity				
Non-Hispanic White (%)	77	84	85	86
Black (%)	10	8	9	9
Hispanic/Latina (%)	6	4	3	3
Asian (%)	4	3	2	1
American Indian/Alaskan Native (%)	1	0	0	0
Women who self-identified as "Other" (%)	2	1	1	1
Education				
Less than high school graduate (%)	22	16	13	9
High school graduate (%)	22	18	15	11
Some college or associate degree (%)	26	28	28	28
College graduate or more (%)	30	37	43	51
Partner's Education				
Less than high school graduate (%)	13	11	9	8
Some high school graduate (%)	10	10	8	7
High school graduate (%)	11	12	13	12
College graduate or more (%)	22	29	33	37
Married/marriage-like relationship (%)	57	63	64	64
Family Income				
Less than $20,000 (%)	23	15	12	10
$20,000 to $49,000 (%)	43	43	42	38
$50,000 to $74,999 (%)	15	19	20	22
$75,000 or more (%)	11	16	20	25
Occupation				
Managerial/professional (%)	29	37	42	50
Technical/sales/admin (%)	30	29	26	23
Service/labor (%)	21	16	14	13
Homemaker only (%)	11	10	9	8
Health Insurance				
Private (%)	77	82	84	85
Medicare/Veterans Administration/Military (%)	9	8	8	7
Medicaid (%)	2	1	1	0
Other (%)	5	4	4	3

	Optimism (Q1= least optimistic)			
	Q1 (N=43,211)	Q2 (N=39,260)	Q3 (N=48,227)	Q4 (N=28,557)
No insurance (%)	6	4	4	4
Region				
Northeast (%)	26	24	22	19
South (%)	26	25	26	26
Midwest (%)	21	23	22	22
West (%)	27	28	30	32
Health conditions:				
Depression (%)	22	9	6	4
Mean (SD) Charlson Index (chronic conditions)	0.6 (0.9)	0.5 (0.8)	0.5 (0.8)	0.4 (0.8)
Mean (SD) lifestyle score	2.2 (1.1)	2.4 (1.2)	2.5 (1.2)	2.6 (1.2)

Notes: means (SD) or percentages are presented. Values of polytomous variables may not add up to 100% due to rounding. Q=quartile. The range of optimism scores (LOT-R) for quartiles of optimism are: $6 \leq Q1 \leq 21$, $21 < Q2 \leq 23$, $23 < Q3 \leq 26$, and $26 < Q4 \leq 30$.

Table 2. Percent differences in lifespan associated with optimism for the full sample and by racial and ethnic groups.

		Optimism (Q1= least optimistic)						
		Q1	Q2		Q3		Q4	
	N		%	95% CI	%	95%CI	%	95%CI
Model 1								
Full sample	159,255	Ref	3.51	2.69, 4.34	4.89	4.08, 5.13	7.27	6.27, 8.27
N-H White	131,666	Ref	3.71	2.82, 4.60	4.72	3.85, 5.60	7.20	6.14, 8.26
Black	14,261	Ref	0.70	-2.29, 3.78	7.06	3.94, 10.27	10.27	6.25, 14.45
Hispanic/Latina	6,287	Ref	2.20	-2.88, 7.55	4.08	-1.27, 9.72	8.21	2.61, 14.12
Asian	4,144	Ref	0.24	-5.29, 6.08	1.13	-4.85, 7.47	2.29	-4.30, 9.32
Model 2								
Full sample	159,225	Ref	2.41	1.58, 3.23	3.43	2.62, 4.25	5.43	4.45, 6.43
N-H White	131,666	Ref	2.50	1.62, 3.39	3.06	2.19, 3.93	5.05	4.01, 6.11
Black	14,261	Ref	0.04	-2.92, 3.11	5.63	2.53, 8.82	7.58	3.62, 11.69
Hispanic/Latina	6,287	Ref	2.08	-2.98, 7.42	2.17	-3.11, 7.73	5.40	-0.10, 11.22
Asian	4,144	Ref	-0.01	-5.50, 5.80	0.82	-5.11, 7.11	1.52	-4.99, 8.49
Model 3								
Full sample	159,225	Ref	2.08	1.27, 2.90	2.87	2.07, 3.68	4.59	3.61, 5.58
N-H White	131,666	Ref	2.16	1.28, 3.05	2.54	1.68, 3.41	4.31	3.27, 5.36
Black	14,261	Ref	-0.06	-3.02, 2.99	5.16	2.07, 8.33	6.39	2.47, 10.45
Hispanic/Latina	6,287	Ref	1.71	-3.32, 7.03	1.81	-3.44, 7.34	4.48	-0.99, 10.23
Asian	4,144	Ref	-0.16	-5.64, 5.64	0.56	-5.34, 6.83	1.04	-5.46, 7.97

Notes: Q=quartile, CI=confidence interval, Ref=reference group (Q1 is the reference group), N-H= Non-Hispanic

Model 1 adjusted for baseline age, race and ethnicity, education, partner's education, marital status, family income, occupation, health insurance, and region.

Model 2 further adjusted for baseline chronic health conditions and depression.

Model 3 further added the lifestyle score to Model 2.

Table 3. Risk ratios for the association between optimism and likelihood of achieving exceptional longevity (reaching 90 years old) for the full analytic sample and by racial and ethnic groups

		Optimism (Q1= least optimistic)							
		Q1		Q2		Q3		Q4	
	Cases/ total N	RR	--	RR	95% CI	RR	95%CI	RR	95%CI
Model 1									
Full sample	29,703/55,855	1.00	Ref	1.07	1.05, 1.10	1.11	1.09, 1.14	1.14	1.11, 1.16
N-H White	25,977/48,904		Ref	1.08	1.05, 1.10	1.11	1.08, 1.14	1.14	1.11, 1.17
Black	1,728/3,530		Ref	1.08	0.99, 1.19	1.21	1.10, 1.32	1.20	1.09, 1.32
Hispanic/Latina	601/1109		Ref	1.09	0.94, 1.26	1.03	0.88, 1.21	1.07	0.93, 1.23
Asian	853/1,347		Ref	0.96	0.86, 1.07	1.03	0.90, 1.17	0.96	0.86, 1.07
Model 2									
Full sample	29,703/55,855	1.00	Ref	1.06	1.03, 1.08	1.09	1.06, 1.11	1.10	1.08, 1.13
N-H White	25,977/48,904		Ref	1.06	1.04, 1.09	1.08	1.06, 1.11	1.11	1.08, 1.13
Black	1,728/3,530		Ref	1.07	0.98, 1.18	1.19	1.08, 1.30	1.17	1.06, 1.28
Hispanic/Latina	601/1109		Ref	1.07	0.93, 1.24	0.99	0.84, 1.15	1.02	0.89, 1.18
Asian	853/1,347		Ref	0.95	0.86, 1.06	1.02	0.90, 1.16	0.94	0.84, 1.06
Model 3									
Full sample	29,703/55,855	1.00	Ref	1.05	1.03, 1.08	1.08	1.06, 1.10	1.09	1.07, 1.12
N-H White	25,977/48,904		Ref	1.06	1.03, 1.08	1.08	1.05, 1.10	1.10	1.07, 1.12
Black	1,728/3,530		Ref	1.07	0.98, 1.18	1.18	1.08, 1.29	1.15	1.05, 1.27
Hispanic/Latina	601/1109		Ref	1.06	0.91, 1.22	0.98	0.84, 1.15	1.00	0.87, 1.15
Asian	853/1,347		Ref	0.94	0.85, 1.04	1.02	0.89, 1.16	0.92	0.82, 1.03

Notes: Q=quartile, RR=risk ratio, CI=confidence interval, Ref=reference group (Q1 is the reference group), N-H=Non-Hispanic
Model 1 adjusted for baseline age, race and ethnicity, education, partner's education, marital status, family income, occupation, health insurance, and region.
Model 2 further adjusted for baseline chronic health conditions and depression.
Model 3 further added the lifestyle score to Model 2.