Title

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Publication Date

2022

DOI

10.1016/j.ypmed.2021.106899

Peer reviewed

HHS Public Access

Author manuscript

Prev Med. Author manuscript; available in PMC 2023 January 01.

Published in final edited form as:

Prev Med. 2022 January ; 154: 106899. doi:10.1016/j.ypmed.2021.106899.

Optimism and risk of mortality among African-Americans: The Jackson Heart Study

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Abstract

Optimism is associated with reduced mortality risk among Whites, but evidence for this relationship is limited among African-Americans, whose life expectancy is shorter than Whites. This study examined the association between optimism and mortality rate in African-Americans. Data were from African-American women (n=2,652) and men (n=1,444) in the United States from the Jackson Heart Study. Optimism was measured using the Life Orientation Test-Revised at the baseline period (2000–2004), and mortality data were obtained until 2018. Using Cox proportional hazards models, we estimated hazard ratios (HRs) of mortality by optimism level, controlling for sociodemographic factors, depressive symptoms, health conditions, and health

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

behaviors. In secondary analyses, we evaluated potential effect modification by sex, age, income, and education. Higher optimism was related to lower mortality rates (HR=0.85, 95% confidence interval [CI]=0.74, 0.99), controlling for sociodemographic factors and depressive symptoms. After further adjusting for health conditions and health behaviors, associations were slightly attenuated (HR=0.89; 95%CI=0.77, 1.02). Stronger associations between optimism and mortality were observed in men, among those with higher income or education, and with age=55 (all p's for interaction terms < 0.06). In summary, optimism was associated with lower mortality rates among African-Americans in the Jackson Heart Study. Effect modification by sociodemographic factors should be further explored in additional research considering optimism and mortality in diverse populations. Positive factors, such as optimism, may provide important health assets that can complement ongoing public health efforts to reduce health disparities, which have traditionally focused primarily on risk factors.

Keywords

optimism; longevity; mortality; African-Americans; Jackson Heart Study

1. Introduction

African-Americans have higher rates of all-cause mortality than Whites in the US (Cunningham et al., 2017), a disparity likely due in part to differences in distributing risk factors and resources (Carnethon et al., 2017). Identifying modifiable factors that reduce mortality rates among African-Americans is thus critical to efforts aimed at improving public health and reducing racial disparities in health. While much existing research on modifiable factors for mortality has focused on the role of variables that increase risk, recent studies have increasingly suggested that optimism (and other positive psychosocial resources) may promote health (Kubzansky et al., 2020; Sims et al., 2019; Trudel-Fitzgerald et al., 2019).

Optimism is the generalized expectation that good things will happen. While optimism is 20–30% heritable (Mavioğlu et al., 2015; Plomin et al., 1992), randomized controlled trials indicate that optimism can be enhanced by accessible tools, such as cognitive-behavioral therapy or writing about the best possible future-self (Meevissen et al., 2011; Murphy et al., 2015; Peters et al., 2010). According to a recent systematic review (Rozanski et al., 2019), 9 studies have consistently reported strong associations of higher optimism with reduced mortality rates. Thus, optimism may be a relevant and novel target for preventive interventions. However, the majority of research has not included substantial samples of African-Americans (Rozanski et al., 2019; Trudel-Fitzgerald et al., 2019). The initial evidence in the Women's Health Initiative suggests that higher optimism is related to lower mortality in African-American women (Ma et al., 2012), although these are women generally of higher socioeconomic status (SES) than national averages.

Our objective was to prospectively examine the association between optimism levels at baseline and subsequent mortality rates in a socioeconomically diverse cohort of African-American men and women in the Jackson Heart Study (JHS). We hypothesized that higher

optimism would be associated with reduced mortality rates. We calculated multivariable-adjusted hazard ratios (HR) of mortality according to optimism levels and considered pertinent covariates from the literature, such as sociodemographic factors, health conditions, and health behaviors (Epel and Prather, 2018). Given prior research linking depression to both optimism and mortality (Achat et al., 2000; Cuijpers et al., 2014), we also evaluated depressive symptoms as a potential confounder. Further, we evaluated potential effect modification by sex, age, income, and education.

2. Methods

2.1. Study Participants and Procedures

The JHS recruited 5,306 African-American adults, ages 20 to 95 years, into the study at baseline in 2000–2004. After completing initial clinical visits (exam 1: 2000 to 2004), participants returned at two-time points for additional in-person examinations (exam 2: 2005–2008, and exam 3: 2009–2013), and follow-up questionnaires were also administered annually by telephone. Mortality follow-up was complete through 2018. Among the 5,306 participants, we excluded 561 participants who did not participate in the assessment wave when the LOT-R questionnaire was administered. Based on prior work, we also excluded 57 participants who did not answer at least 3 of the 6 items on optimism following prior work (Bell et al., 2016) (see Figure 1). This yielded a final analytic sample of 4,688 participants; those who were included vs. excluded from our analytic sample were similar across most sociodemographic, health conditions and behaviors such as age (55 vs. 57 years), body mass index (BMI; 32 vs. 31 kg/m^2), and proportion meeting recommended physical activity guidelines (17% vs. 19%) but differ in mortality rate (19% vs. 41%). The study was approved by the Institutional Review Boards at the University of Mississippi Medical Center, Jackson State University, and Tougaloo College. All participants provided written informed consent. The Institutional Review Board at Harvard University also approved the analysis.

2.2. Measures

2.2.1. Optimism.—Optimism was assessed at the baseline period (2000–2004) using the Life Orientation Test-Revised (LOT-R) (Scheier et al., 1994). Using a 4-point Likert scale, participants were asked how much they agreed with 6 statements such as, “In uncertain times, I usually expect the best.” We reverse-coded negatively worded items (e.g., *I hardly ever expect things to go my way*) and then summed all items to create a total score. In our sample, scores ranged 6–24 (mean [*M*] = 20.4, standard deviation [*SD*] = 3.2), with higher scores indicating higher optimism. For those missing values for 1–3 items, we imputed scores for each item using the individual’s average score on non-missing items. We used the 6-item composite measure in the main analyses because optimism appears to be best characterized by both endorsing positively-worded items and rejecting negatively worded items (Ryff and Singer, 2006). However, given prior studies presenting findings using a separate 3-item optimism subscale and 3-item pessimism subscale (Giltay et al., 2004), we created separate subscales for use in secondary analyses. The measure has good discriminant and convergent validity and good reliability (Scheier et al., 1994) and is also validated in African-American populations (Cadena et al., 2021). In the current analytic sample, internal

consistency reliability was moderate (Cronbach's alpha = 0.64). To facilitate comparability with other studies, we standardized optimism scores (*Mean* = 0, *Standard Deviation* =1). Since there are no established cut points for optimism, quantiles are commonly created. However, the raw LOT-R scores were highly negatively skewed in this cohort (Figure A, available as a supplement). For example, considering 4 is the lowest possible optimism score, the score in the analytic sample ranged from 6–24, with no JHS participants scoring 4 and 5. Further, scores 6–18 comprised the bottom quartile while scores in the top 3 quartiles ranged 19–24, with the upper quartile covering a tight range (scorings=23–24). Thus, to create greater contrast, we used a binary optimism score comparing the bottom quartile vs. the top 3 quartiles.

2.2.2. Mortality—Mortality was identified using the Mississippi Department of Health and the National Death Index. Death certificates were requested from the Mississippi State Department of Health as needed (Diaz et al., 2016). For the present analysis, data on mortality were available through May 31, 2018.

2.2.3. Assessment of Covariates—All covariates were obtained at baseline. Demographic measures were all obtained via self-report. Marital status was categorized as 1) married, 2) separated, divorced, widowed, or 3) never married. Based on income, family size, and inflation, annual household income was classified into 4 categories (Min et al., 2017): low (< poverty level), lower-middle (1–1.6 × poverty level), upper-middle (1.6–3.5 × poverty level), and affluent (at least 3.5 × poverty level). Education was categorized as years of education ≤ 16 and years of education > 16, consistent with prior social epidemiology studies (Jemal et al., 2013; Jemal et al., 2008; Mehta et al., 2011).

Health conditions included blood pressure, total cholesterol, fasting glucose, history of cardiovascular disease, history of cancer, and depressive symptoms. Health behavior-related factors included smoking, physical activity, diet, alcohol, and BMI. Following prior work in JHS, health conditions and behaviors were characterized using Life's Simple 7 health metrics developed by the American Heart Association (Lloyd-Jones et al., 2010). According to this rubric, each health metric is categorized as poor, intermediate, or ideal according to whether individuals meet recommended guidelines. Although some information will be lost from categorization, biobehavioral factors as captured by the life's simple 7 metrics are widely used with strong clinical utility (detailed description in Appendix A, supplement). Depressive symptomatology was assessed at baseline using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D); following prior work, a score >16 was defined as depression (Vilagut et al., 2016). For missing covariates, multiple imputations (n=10) was conducted by chained equations using MICE package in R; results from each imputed dataset were combined by MITOOL packages (Zhang, 2016).

2.3. Statistical Analysis

We first examined the distribution of covariates across levels of optimism. To examine the optimism-mortality relationship, we used Cox proportional hazards models with 5 sets of models. The first model included age, and the second model further added sex, marital status, income, and education. The third model additionally controlled for

depressive symptoms as an important potential confounder, constituting the core model that accounts for key sociodemographic and psychological confounding factors. The fourth and fifth models further added health conditions and behaviors that could be confounders or intermediate variables. From the core model, the fourth model further added blood pressure, total cholesterol, fasting glucose, history of cardiovascular disease, and history of cancer. The fifth model further added health behaviors (smoking, physical activity, alcohol consumption, diet quality) and BMI, constituting the fully-adjusted model that considers potential pathway variables. Optimism was examined as binary and continuous (z-score) variables; we also created a 3-item subscale of optimism, and a separate 3-item subscale of pessimism. We examined the proportional hazards assumption of Cox models by Schoenfeld residuals, and the proportional hazard assumption for optimism was upheld in all 5 models ($p>0.05$).

We conducted several additional analyses. All analyses were conducted using the core model. To test potential effect modification by sex (men/women) and age, we included interaction terms for binary optimism × sex and binary optimism × age (median cut point: 55 years) in separate models. Due to large differences in income and education by optimism level (Table 1), we conducted 2 *post-hoc* analyses and considered income (binary; low & lower-middle vs. upper-middle and affluent) and education (years of education) as additional potential effect modifiers by adding interaction terms to separate models. We also conducted analyses stratified by sex, age (>55 years vs. ≤55 years), income (low & lower-middle vs. upper-middle & affluent), and education (>16 years vs. ≤16 years). Finally, we tested the 3-way interaction between binary optimism, sex, and binary income as well as binary optimism, age (median cut point: 55 years), and binary income.

We also performed sensitivity analyses to reduce concerns about reverse causality (i.e., recent changes in optimism due to pending death or underlying illness), using Cox models adjusted for the same sets of covariates in the full models. First, we excluded participants who died within 4 years of the study baseline. Second, we excluded individuals with major underlying illnesses (i.e., cardiovascular diseases and cancer) at baseline. All analyses were conducted in R Statistical Software (version 1.1456) (Zhang, 2016).

3. Results

At the study baseline, participants with higher vs. lower optimism were more likely to be married (56% vs. 48%), college-educated (75% vs. 53%), financially affluent (36% vs. 18%), and healthier (e.g., 46% vs. 35% had ideal fasting glucose level), and to have better health behaviors (e.g., 21% vs. 14% met physical activity guidelines) (Table 1).

3.1. Optimism and mortality rate

Over up to 18 years of follow-up, 18% of participants died (n=886). Unadjusted Kaplan-Meier curves are shown in Figure 2, and results from multivariable proportional hazards analyses are shown in Table 2. Overall, higher optimism was associated with a lower mortality rate (Table 2). For example, in the model that adjusted for sociodemographic factors and depressive symptoms (core model), higher versus lower optimism was associated with 15% lower mortality rates (HR=0.85; 95% CI=0.74, 0.99). After additionally adjusting

for health conditions and health behaviors, the optimism-mortality association was slightly attenuated (HR=0.89; 95% CI=0.77, 1.02). In analyses using a continuous standardized optimism score, results were consistent (Table A, supplement). When considering the optimism and pessimism subscales separately (Table B, supplement), associations for each subscale with mortality were largely similar to one another in terms of absolute magnitude of effects and with results obtained in the main models using continuous scores of optimism (Table A, supplement).

Results from the stratified analyses and interaction tests are presented in Figure B (see supplement). We found evidence of effect modification by sex (p-interaction=0.05), age (p-interaction=0.03), income (p-interaction=0.02), and education (p-interaction=0.007) in the core model. Relations between optimism and mortality were somewhat stronger in men, higher income (upper-middle & affluent vs. low & lower-middle), higher education (education year >16), and younger participants (age ≤55 yr). Post-hoc analyses demonstrated that lower income was observed in women ($p<0.001$, χ^2 test = 104.85, df=3; e.g., 40% of men were affluent vs. only 25% of women) and those aged >55 years ($p<0.001$, χ^2 test = 1077.5, df=3; e.g., 34% of peopled aged ≤55 were affluent vs. 28% aged >55 years). However, statistical significance was not observed when conducting 3-way interaction analyses, optimism × gender × income (p-interaction=0.42) and optimism × age × income (p-interaction=0.85).

3.2. Sensitivity analyses

In analyses excluding those who died within 4 years from baseline, associations remained similar to those of the primary analyses (Table C, supplement). For example, in the core model, the HR was 0.86 (95%CI=0.74, 1.00) vs. 0.85 (95%CI=0.74, 0.99) in the analogous primary analysis. In analyses excluding those with cardiovascular disease and cancer at baseline (Table D, supplement), findings were also similar to the initial ones.

4. Discussion

In a prospective, community-based cohort of socioeconomically diverse African-American men and women, higher optimism was related to 15% lower mortality rates over ~18 years of follow-up, controlling for core confounders including depressive symptoms. Further, when we adjusted for health conditions and health behaviors, findings were largely unchanged, suggesting these factors may not be strong intermediate variables on the pathway linking optimism to mortality. Interestingly, we found evidence of effect modification by several covariates; optimism-mortality associations were more clearly observed in men, younger participants (age ≤55 yr), and those with higher income and education.

Our findings generally converge with the body of evidence in predominantly White populations, suggesting that optimism is related to lower mortality rates and extends those findings to a large African-American cohort. A recent systematic review on optimism and mortality—in which associations between higher optimism levels and reduced mortality rate were reported from 9 studies—identified only one study with a substantial number of African-Americans and these were all women (Rozanski et al., 2019). Among 97,253

women (89,259 White, 7,994 Black) from the Women's Health Initiative (WHI) cohort, higher optimism was related to 33% lower mortality rates in African-American women adjusting for a broad range of covariates (Tindle et al., 2008). However, this study did not include African-American men, and the WHI comprises mostly higher educated and affluent women. Compared to WHI participants, JHS participants represent a broader spectrum of income and education levels.

The optimism-mortality associations were stronger in men and younger participants in the present study. Of note, in JHS, optimism levels were generally higher in younger participants. Though some studies have found optimism levels are higher among men than women (Bjuggren and Elert, 2019; Jacobsen et al., 2014; Puskar et al., 2010), others have found the reverse (Graham and Pinto, 2019), whereas still others found no differences (Boehm et al., 2015), which is consistent with findings in the present study. Our results regarding somewhat stronger associations in men versus women are comparable with prior studies including a 9.1-year follow-up study of 941 older adults ages 65–85 (466 men and 475 women) from the Netherlands (Giltay et al., 2004), and a nearly 45 year follow-up study of 4,442 U.S. adults (2,835 men and 1,607 women) from the Panel Study of Income Dynamics (O'Connor and Graham, 2019). However, several other studies of optimism and mortality that considered potential effect modification by sex among Whites did not find evidence of significant differences across various samples, including an 8-year follow-up of 367 men and 509 women in the Rancho Bernardo Study (Anthony et al., 2016), a 40-year follow-up of 5,750 men and 1,208 women students in the University of North Carolina Alumni Heart Study (Brummett et al., 2006), and a 16-year follow-up of 3,073 women and 1,460 men from Australian Twin Registry (Mosing et al., 2012).

In the present study, associations of optimism with mortality were also stronger among individuals with higher versus lower income and education. Any single asset, such as optimism by itself, may not be adequate to counter multiple psychosocial disadvantages, which are typically clustered in those with lower SES (Hobfoll, 2001; Thurston and Kubzansky, 2007). Such co-occurrence of psychosocial factors can have additive effects on health outcomes (Thurston and Kubzansky, 2007). For example, a prior JHS study shows that high income was associated with a lower prevalence of stress across three stress measures (i.e., Global Perceived Stress Scale, Weekly Stress Inventory, and Major Life Events scale), covering various domains of stressors such as legal problems, experiences of racism and discrimination, the neighborhood, and meeting basic needs (Gebreab et al., 2012). Similarly, some mechanisms by which optimism might lead to better health are less available to individuals with fewer resources. Given behavior-related factors did not appear to attenuate associations substantially, other factors may also be at play. Individuals with higher optimism tend to maintain good health and to track their health more closely (Radcliffe and Klein, 2002) as well as having stronger social networks (Segerstrom, 2007). However, those in more socially disadvantaged environments may have less ability to act on health-related knowledge, have more difficulty developing strong social ties and obtaining subsequent health benefits due to lower trust and more chaotic circumstances (Settels, 2020); also, due to more stress in the network they may have social ties that yield less positive support than more advantaged persons' networks (Lin, 1999, 2000; McDonald et al., 2009).

In our sample, men and younger participants (age<55 years) had higher income, which may partly explain the stronger associations found in these groups. In prior research with a younger population, a bidirectional relationship between income and optimism was observed (De Neve and Oswald, 2012). However, despite some differences in the magnitude of associations, optimism was associated with mortality controlling for income across age groups in the present study, which may be because JHS participants are mostly middle-aged adults. Generally, more insights might be gained about the intricate relation between psychological factors linked with optimism, income, sex, and race/ethnicity from studies that can directly compare associations across groups (Graham and Pinto, 2019; O'Conner and Graham, 2019).

Various potential mechanisms could explain the role of optimism in the mortality rate. While a prior cross-sectional study from JHS shows that higher optimism was related to a higher composite score of healthier behaviors (Sims et al., 2019), we did not detect strong evidence that health behavior-related factors were likely to serve as a primary pathway linking optimism to reduced mortality risk. Notably, biobehavioral factors and optimism were measured at a similar period (i.e., baseline) in JHS, providing limited capacity to assess temporality in the associations between optimism, biobehavioral factors and mortality in the present study; also, health behaviors not measured in the present study may mediate the relationship (e.g., sleep). Alternatively, non-behavioral mechanisms may mediate the potential impact of optimism on health, such as healthier immune responsiveness (Segerstrom and Sephton, 2010), healthier lipid profiles (Boehm et al., 2013b), and higher levels of plasma antioxidants (Boehm et al., 2013a), although not with markers of accelerated aging like telomeres or epigenetic age (Kim et al., 2019; Kim et al., 2020). Some studies also suggest that associations of optimism with health outcomes may differ between African-Americans and Whites. In a cross-sectional study of 950 adolescents (529 Whites and 421 Blacks), higher optimism was associated with higher high-density lipoprotein among Blacks but not Whites (Oreskovic and Goodman, 2013). Glucose and total cholesterol, which were related to optimism level among Whites (Hernandez et al., 2015), was not associated with optimism level among the JHS participants (Sims et al., 2019) Research examining both biological and behavioral mechanisms of optimism warrants future investigation, particularly in diverse racial groups.

Our study has limitations. There can be measurement error in the mediators, and unmeasured confounding remains possible. For example, those with higher social support, less interpersonal conflict, and more fulfilling work tend to live longer and may also have higher optimism. However, we controlled for a wide range of potential confounders, including depressive symptoms which often track with these factors. Thus, it seems unlikely that the strong relations we found of optimism to mortality would be eliminated with additional covariate control. Reverse causality is possible, whereby less healthy or already-ill individuals are less optimistic at the study baseline, and therefore, more likely to die during the study period. However, we had a long follow-up period, and in the sensitivity analyses where we excluded those who died early in the follow-up or with chronic diseases at baseline, findings remained consistent. Moreover, prior work suggests that optimism is stable even in the face of declining health (Schou et al., 2005; Stiegelis et al., 2003). Our study has several important strengths, such as the ability to examine optimism-mortality

relationships in a large and socioeconomically heterogeneous sample of African-American men and women.

5. Conclusion

Optimism was associated with a lower mortality rate among African-American adults. The associations between optimism and mortality rate appeared to be modified by sex, age, and SES, such that optimism is related to lower mortality in African-American men, younger adults (age <55 years), and those with relatively higher SES. Positive factors—such as optimism and other dimensions of psychological well-being that have also been linked with reduced risk of mortality (Trudel-Fitzgerald et al., 2020; Trudel-Fitzgerald et al., 2019) (e.g., purpose in life, life satisfaction)—may provide important health assets that can complement ongoing public health efforts to reduce health disparities, which have traditionally focused primarily on risk factors.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This work was supported by the National Institutes of Health (R01AG053273). **JHS acknowledgement.** The Jackson Heart Study (JHS) is supported and conducted in collaboration with Jackson State University (HHSN268201800013I), Tougaloo College (HHSN268201800014I), the Mississippi State Department of Health (HHSN268201800015I/HHSN26800001) and the University of Mississippi Medical Center (HHSN268201800010I, HHSN268201800011I and HHSN268201800012I) contracts from the National Heart, Lung, and Blood Institute (NHLBI) and the National Institute for Minority Health and Health Disparities (NIMHD). The authors also wish to thank the staffs and participants of the JHS. **JHS disclaimer.** The views expressed in this manuscript are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute; the National Institutes of Health; or the U.S. Department of Health and Human Services

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Highlights

- We examined the association between optimism and mortality rate in African Americans from the Jackson Heart Study.
- Compared to prior studies, we examined socioeconomically diverse African Americans.
- Optimism was associated with lower mortality rates.
- Stronger optimism-mortality associations were observed in men, among those with higher income or education, and with age≤55.

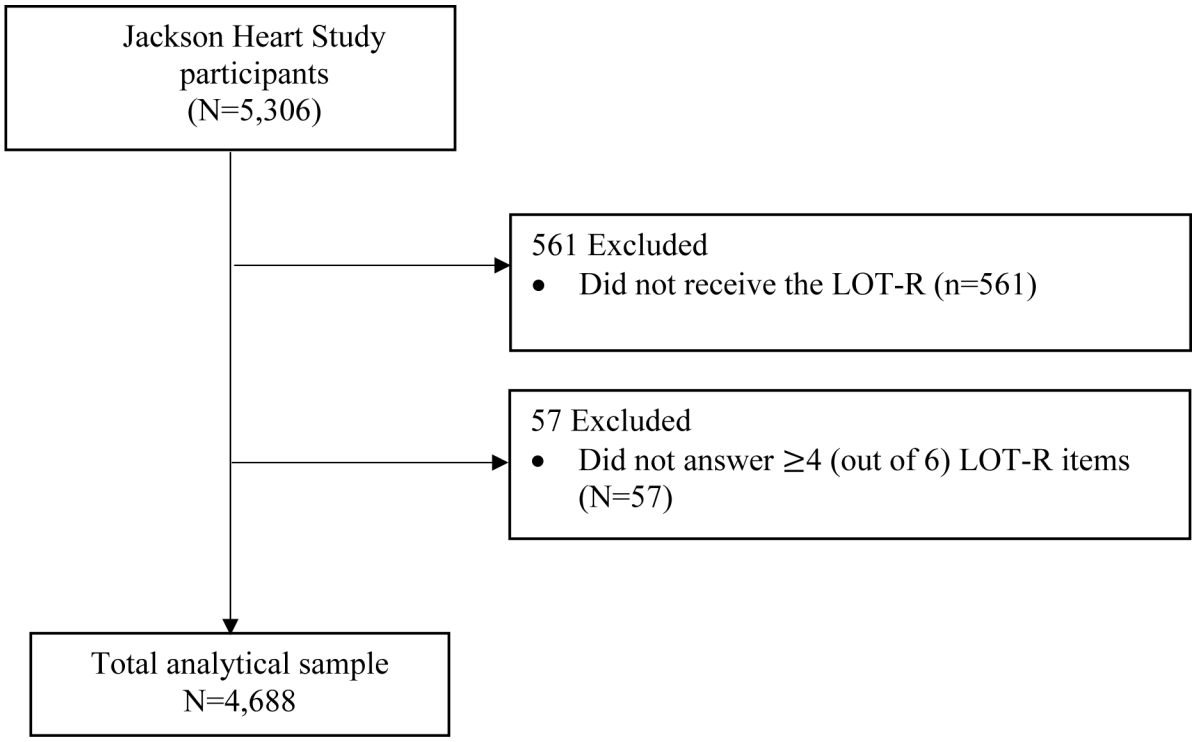

Figure 1.
Flowchart of Sample Inclusion

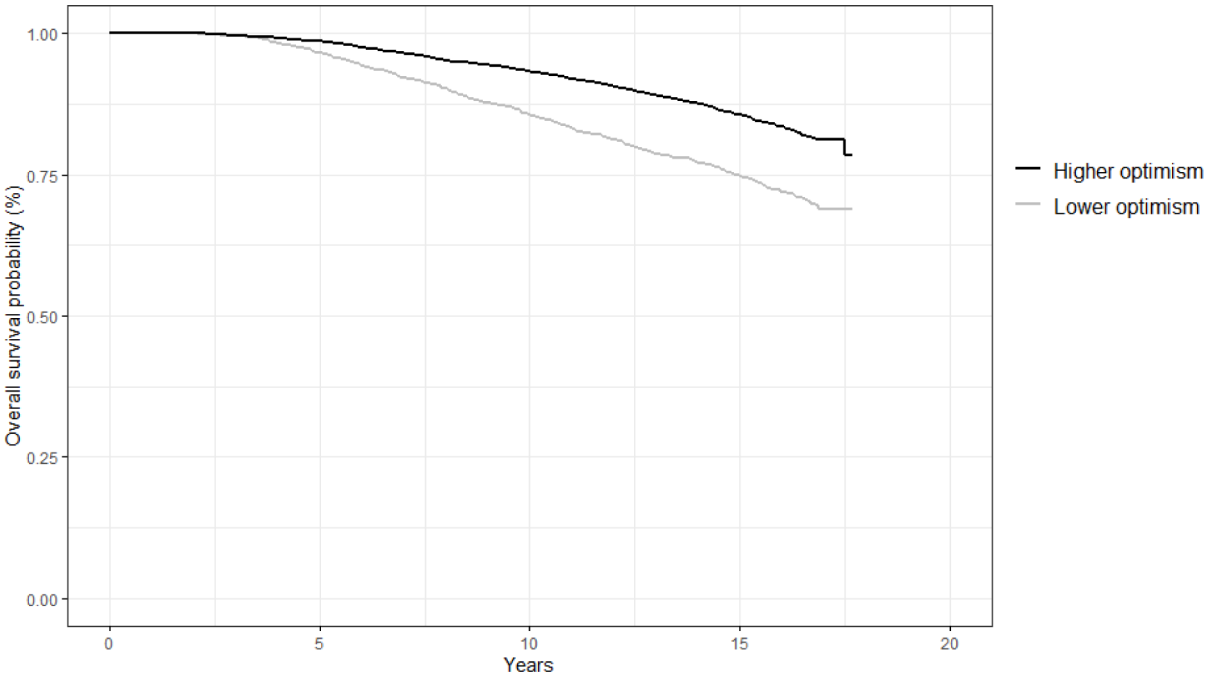

Figure 2.

Unadjusted Kaplan-Meier survival curves for participants in the Jackson Heart Study 2001–2018, stratified by level of optimism at baseline

Table 1.

Characteristics of Participants at Baseline (2000–2004) by Levels of Optimism, Jackson Heart Study

Characteristics	Optimism Levels		p-value
	Lower Optimism (n=1,232)	Higher Optimism (n=3,456)	
Sociodemographic Factors			
Mean age, years (SD)	58 (13)	53 (12)	<0.001
Female, %	67	64	0.025
Marital status, %			<0.001
Married	48	56	
Never married	11	11	
Separated, Divorced, or Widowed	41	32	
Educational Level, %			<0.001
Years of education ≤ 16	75	53	
Years of education > 16	25	47	
Income, %			<0.001
Low (<poverty level)	23	12	
Lower-middle (1–1.6 times poverty level)	33	22	
Upper-middle (1.6–3.5 times poverty level)	26	31	
Affluent (at least 3.5 times poverty level)	18	36	
Mental Health			
Depressive symptoms, %	39	19	<0.001
Baseline Health			
Total cholesterol, %			<0.001
Poor	17	15	
Intermediate	42	40	
Ideal	41	46	
Blood pressure, %			<0.001
Poor	23	19	
Intermediate	62	59	
Ideal	14	22	
Fasting glucose, %			<0.001
Poor	22	17	
Intermediate	43	38	
Ideal	35	46	
CVD History, %	13	8	<0.001
Cancer History, %	5	4	0.210
Health Behavior-Related Factors			
Smoking status, %			<0.001
Current smoker	16	11	
Former smoker	22	18	
Never smoked	62	71	
Physical activity level, %			<0.001

Characteristics	Optimism Levels		p-value
	Lower Optimism (n=1,232)	Higher Optimism (n=3,456)	
Poor (0 min)	57	45	
Intermediate (0–150)	29	34	
Ideal (>150)	14	21	
Diet, %			0.002
Poor	61	56	
Intermediate	38	43	
Ideal	1	1	
Alcohol, %			<0.001
Poor (excessive drinking)	4	3	
Intermediate (no drinking)	62	53	
Ideal (moderate drinking)	34	43	
Body mass index, %			0.099
Poor (BMI ≥ 30)	57	54	
Intermediate (25 ≤ BMI < 30)	29	33	
Ideal (BMI < 25)	14	13	

Percentage may not add up to 100% due to missing values. See Supplement for details on how each variables was measured and scored.

Table 2.

Hazard Ratios for the Associations of Optimism with All-Cause Mortality, Jackson Heart Study, 2000–2018

Covariate Models	Lower Optimism (n=1,232) (n=345 deaths; 17,573 person-years)		Higher Optimism (n=3,456) (n=541 deaths, 50,812 person years)	
	HR	95% CI	HR	95% CI
Model 1: Age	1.00	Referent	0.76	0.67–0.88
Model 2: Model 1 + Sociodemographic factors[a]	1.00	Referent	0.85	0.74–0.97
Model 3: Model 2 + Depressive symptoms[b]	1.00	Referent	0.85	0.74–0.99
Model 4: Model 3 + Health conditions[c]	1.00	Referent	0.87	0.76–1.01
Model 5: Model 4 + Health behavior-related factors[d]	1.00	Referent	0.89	0.77–1.02

HR = hazard ratio; CI = confidence interval

[a] Sociodemographic factors: sex, marital status, educational status, income

[b] Depressive symptoms were measured by CES-D

[c] Health conditions: cholesterol, blood pressure, glucose level, history of cancer, history of cardiovascular disease

[d] Health behaviors-related factors: smoking, physical activity, diet, body mass index, alcohol