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Original Contribution

Optimism and Healthy Aging in Women and Men

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Mounting evidence indicates that there are specific associations between higher levels of optimism and healthier behaviors, reduced risk of chronic diseases, and lower mortality. Yet, for public health purposes, it is critical to consider how optimism might be related to a full scope of health conditions in aging—from cognitive to physical health. Using prospective data from the Health and Retirement Study (n = 5,698), we examined whether higher baseline optimism was associated with subsequent increased likelihood of maintaining healthy aging over 6–8 years of follow-up. Optimism was assessed at study baseline (2006 or 2008), and components of healthy aging were assessed every 2 years, defined as: 1) remaining free of major chronic diseases; 2) having no cognitive impairment; and 3) good physical functioning. Hazard ratios were obtained using Cox proportional hazards models, and a range of relevant covariates were considered (sociodemographic factors, depressive symptoms, and health behaviors). After adjusting for sociodemographic factors and depression, the most (top quartile) versus least (bottom quartile) optimistic participants had a 24% increased likelihood of maintaining healthy aging (95% CI: 1.11, 1.38). Further adjustment for health behaviors did not meaningfully change the findings. Optimism, a potentially modifiable health asset, merits further research for its potential to improve likelihood of health in aging.

chronic disease; cognitive function; health psychology; healthy aging; optimism; physical function; psychological well-being; resilience

Abbreviations: CI, confidence interval; HRS, Health and Retirement Study.

As populations age, identifying factors that foster maintenance of healthy aging into late life is crucial for improving the health and well-being of older adults and containing health-care costs (1, 2). Although average life expectancy has increased, the number of years lost to disability has also increased (3, 4). Further, US health-care spending, which reached $3.2 trillion in 2015, is expected to increase at an average rate of 5.5% per year over the next decade, an increase that is attributable partly to the rising prevalence and burden of chronic diseases. Although most biomedical and public health efforts to foster health have focused on reducing risk factors, an emerging body of research suggests that there are modifiable health assets that might contribute to reduced risk of age-related chronic diseases (5, 6).

Dispositional optimism—the generalized expectation that good things will happen—is one promising health asset. Importantly, it appears as if the potential health benefits of optimism are independent of psychological distress (e.g., depression) (7). Although optimism is approximately 23%–32% heritable (8, 9) and is shaped by social, structural (e.g., socioeconomic status), and life-course factors (10, 11), randomized controlled trials suggest that it might be modified using a variety of methods that range from writing exercises (e.g., writing a list of items for which one is grateful) to classroom-based modules that focus on cognitive-behavioral strategies (12–14). Further, optimism has been associated with healthier behaviors (e.g., physical activity, healthy diet, not smoking, medication adherence) (15–19) and healthier biologic functioning (e.g., lower inflammation and higher antioxidants levels) (20–22), which in turn reduce risk of chronic conditions (23, 24). Finally, a previous study among 33,326 women from the Nurses' Health Study found that the most (top quartile) versus least (bottom quartile) optimistic women had 23% greater odds of healthy aging 8 years later, after adjusting for sociodemographic factors and depression (25). However, at that time, the Nurses'

Health Study comprised women only and was unable to exclude women who were not healthy agers at baseline because not all components of healthy aging were assessed then. Thus, the present study builds upon this work in 2 ways. First, we were able to examine risk of incident healthy aging, which helps reduce some potential bias. Second, we were able to test associations of optimism with healthy aging in men, as well as in women.

The present study uses data from the Health and Retirement Study (HRS) to examine the relationship of initial optimism levels to incident healthy aging over 6–8 years of follow-up, among men and women aged >50 years who were healthy in all aging domains at study baseline. Healthy aging was defined as having good cognitive and physical function with no major chronic diseases. We hypothesized that higher (versus lower) baseline optimism would be associated with higher likelihood of healthy aging over the follow-up period. We evaluated the role of known potential confounders, identified as relevant in prior research (e.g., demographic factors). We also considered current depression as a potential confounder to address the possibility that optimism might not have an independent effect and could merely mark the absence of psychological distress, which has previously been linked with negative health outcomes among older adults (26). Additionally, because some work suggests that the associations between optimism and health might vary according to sex, we evaluated whether associations were similar in women and men (27).

METHODS

Study population

We used data from the Health and Retirement Study (HRS), an ongoing, nationally representative panel study of US adults aged >50 years that surveys participants every 2 years. Starting in 2006, study staff visited a randomly selected 50% of HRS study participants for an enhanced face-to-face (EFTF) interview. The remaining 50% of participants were assessed in 2008 (28). After the interview, respondents were given a self-administered psychosocial questionnaire (29), which they completed and returned by mail to the University of Michigan. The response rate for this psychosocial questionnaire was 88% in 2006 and 84% in 2008 (29). We combined data from both time points, and we considered both 2006 and 2008 as baselines for the present study. Healthy aging was assessed at baseline and every 2 years after that until the most recent wave of available HRS data in 2014. Thus, for the 2006 cohort, 4 follow-up measurements were available (i.e., 8 years), and for the 2008 cohort, 3 follow-up measurements were available (i.e., 6 years). Among those who completed the psychosocial questionnaire (n = 13,771), we excluded participants who did not have full information about the healthy-aging variables at baseline (n = 427), did not meet our definition of healthy aging at baseline (i.e., good cognitive and physical function, without major chronic diseases; n = 7,580), or did not complete the optimism measure (n = 66), resulting in a final analytical sample of 5,698 respondents. When considering the full HRS cohort with relevant information at baseline (n = 13,344), 80% had healthy cognitive function, 76% had healthy physical function, 60% had no chronic conditions, and 43% met all 3 healthy-aging criteria.

Measures

Optimism. Optimism was assessed at baseline (2006 or 2008) using the 6-item Life Orientation Test–Revised (LOT-R). This measure has good discriminant and convergent validity and good reliability (30). After reverse coding negatively worded items, all items were averaged together to create a composite score, with higher scores indicating greater optimism. Internal consistency reliability was high in the present sample at baseline (Cronbach $\alpha = 0.75$). To facilitate comparisons of effect size across studies, we standardized optimism scores (mean, $M = 0$, standard deviation, 1). Because optimism is best characterized by both endorsing positively worded items and rejecting negatively worded items (31), we followed recent recommendations to use the 6-item composite rather than 3-item subscales that are sometimes used whereby negatively oriented items are viewed as representing a pessimistic orientation and positively oriented items as representing an optimistic orientation (32).

Healthy aging. To obtain a multisystem view of healthy aging, we based our definition of healthy versus less-healthy aging on Rowe and Kahn's model of successful aging, which accounts for comorbidities and disabilities (33). Using a multidimensional definition of healthy aging has the benefit of summarizing the relationship of optimism to aging in a single measure, rather than separately quantifying how optimism relates to many distinct outcomes.

Each component of a multidimensional healthy-aging score (i.e., chronic conditions, physical function, cognitive function) was assessed every 2 years in HRS, and individuals were considered healthy versus usual agers if they met criteria for being healthy across all 3 components. Recognizing that varying cutpoints can be used for the domains below to determine healthy versus usual aging, several alternative cutpoints were previously tested; associations between known risk factors and healthy aging remained robust to variations in such cutpoints, indicating that results with this measure are likely robust to variations in healthy-aging definitions (34). Although healthy-aging definitions can include mental health, we did not include this domain because it can be strongly linked to optimism itself; however, to account for other aspects of mental health and reduce concerns about potential confounding by mental health we controlled for depression in our models. Below we describe the criteria for being categorized as healthy for each of the 3 domains.

Chronic disease domain. We considered chronic diseases that are primary causes of mortality in the United States; disease diagnosis was reported by participants on questionnaires every 2 years and included cancer or malignant tumor of any kind (excluding minor skin cancer), heart disease (including heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems), stroke, diabetes, and chronic lung disease (e.g., chronic bronchitis or emphysema but not including asthma). Participants also reported whether they were actively being treated or taking medication for a specific disease, thereby indicating whether the disease was active or severe. Participants were considered "healthy" in the chronic disease domain if they reported not having a disease or if they reported neither actively receiving treatment nor taking medication for the disease. Validity and reliability of self-reported chronic disease has previously been demonstrated in HRS (35).

Cognitive function domain. The HRS cognitive function assessment (36, 37) was adapted from the modified Telephone Interview for Cognitive Status (TICS-M). The assessment is a 27-point scale that includes an immediate and delayed 10-noun free-recall test, a serial-7 subtraction test, and a backward count-20 test. This assessment tool has been shown to have high sensitivity and specificity for cognitive impairment in older adults; the cutpoints were derived from previous research conducted on cognitive impairment in HRS (38, 39). Respondents scoring 0–11 on the 27-point scale were classified as "usual" in the cognitive domain, while those scoring ≥12 were classified as "healthy" in this domain. More detailed information about the cognitive assessments can be found in HRS reports (36, 37).

Physical function domain. Physical function was assessed using items adapted from scales developed by Rosow and Breslau (40), Nagi (41), Katz et al. (42), and Lawton and Brody (43). We defined physical function limitations as ≥4 reported limitations of physical function (i.e., walking several blocks, climbing 1 flight of stairs, pushing or pulling large objects, lifting or carrying 10 pounds, getting up from a chair, reaching or extending arms up, stooping, kneeling, crouching, and sitting for 2 hours) or activities of daily living (i.e., walking across a room, dressing, eating, bathing, getting in/out bed, and using the toilet). Those reporting <4 limitations were considered "healthy" in the physical function domain. This criterion was determined by identifying the physical function score where 75% of participants could be considered to have healthy physical function at baseline.

Covariates. All covariates were self-reported at baseline (in 2006 or 2008) and included sociodemographic factors, depression, and health behaviors. Sociodemographic factors were age (continuous), sex, race/ethnicity (white, black, Hispanic, other), marital status (married, not married), educational attainment (did not complete high school, high-school diploma or General Education Development (GED) equivalent, college degree or higher), and total wealth (based on quintiles of the distribution). Based on past research, depression was defined as a score of ≥4 on the 8-item Center for Epidemiologic Studies Depression Scale (44, 45). Health behaviors were smoking status (never, former, current), frequency of physical activity (never, 1–3 times per month, >1 time per week, every day), frequency of alcohol consumption (abstinent, <1 day per week, 1–2 days per week, and ≥3 or more days per week), and body mass index (calculated from self-reported measurements as weight (kg)/height $(m)^2$; <25.0, 25.0–29.9, ≥30.0).

Statistical analysis

We used Cox proportional hazard models to calculate hazard ratios and 95% confidence intervals, and we estimated associations between baseline optimism and maintaining healthy aging over follow-up by taking the reciprocal of the exponentiated β estimates. Respondents were censored after 1) the first report of becoming a usual ager, 2) loss to follow-up, 3) death, or 4) the end of follow-up (2014). For all analyses, we evaluated 3 sets of models. The first adjusted for age only. The second model additionally adjusted for potential confounding factors, namely sociodemographic factors (i.e., sex, race, marital status, educational attainment, total wealth) and depression. The third model additionally adjusted for the following health behaviors, which are potential intermediates (and potential confounders): smoking, alcohol intake, physical activity, and body mass index. We considered optimism categorized as quartiles to assess the possibility of discontinuous effects and also as a continuous variable, where results can be interpreted as the likelihood of maintaining healthy aging as a function of a 1-standard-deviation increase in optimism.

Additional analyses

We conducted several additional analyses. To test possible residual confounding due to depression, we excluded people with depression at baseline. To evaluate the presence of effect modification by sex, we tested distinct models in men and women, as well as including an interaction term for sex × optimism, with optimism as a continuous variable. To evaluate the presence of effect modification by age group, we tested models separately in participants aged <65 and ≥65 years. We also included an interaction term for sex × age group, with optimism as a continuous variable. Some studies present findings with 3-item subscales; for comparability, we also considered these subscales in secondary analyses. Finally, we also tried using discrete-time survival analysis because survival analysis treats time as a continuous variable, yet time in our data was divided into discrete units (i.e., information was collected every 2 years instead of continuously). All analyses were performed using Stata, version 15.0 (StataCorp LLC, College Station, Texas).

RESULTS

At baseline, the distribution of sociodemographic and health characteristics was generally similar across optimism quartiles (Table 1). However, those in the highest versus lowest optimism quartile were more educated (e.g., 44% versus 25% with a college degree or more) and had a lower prevalence of smoking (e.g., 9% vs. 17% were current smokers) and depression (e.g., 2% versus 14%). Over the 6–8 years of follow-up, 49% of participants maintained healthy aging (2,774/5,698).

Optimism and likelihood of maintaining healthy aging over time

We observed that greater optimism was associated with the maintenance of healthy aging over time (Table 2). For example, after controlling for confounders (i.e., demographic factors and depression), we found a 24% increased likelihood of maintaining healthy aging over the follow-up period for those in the top versus bottom quartile of optimism (95% confidence interval (CI): 1.11, 1.38). Adding health behaviors resulted in little attenuation in the primary association. When considering optimism as a continuous variable, each standard-deviation increase in optimism was associated with a hazard ratio of 1.08 (95% CI: 1.04, 1.12) for maintaining healthy aging, after controlling for confounders (Table 2). This association remained after further adjusting for health behaviors.

Table 3 shows relationships of optimism and aging separately in women ($n = 3,492$) and men ($n = 2,206$). Average optimism scores at baseline were similar in women and men (mean optimism scores were 4.7 and 4.6 points, respectively).

Table 1. Distribution of Participant Characteristics at Baseline According to Quartiles of Optimism (n = 5,698), Health and Retirement Study, United States, 2006 or 2008[a,b]

Characteristic	Quartile[c]			
	1 (n = 1,322)	2 (n = 1,522)	3 (n = 1,333)	4 (n = 1,521)
Mean age, years[d]	66 (9)	68 (9)	66 (9)	66 (8)
Sex				
Female	56	59	61	68
Male	44	41	39	32
Marital status				
Married	67	68	71	70
Race/ethnicity				
White	81	81	86	87
Black	7	10	8	8
Hispanic	9	7	4	3
Other	3	2	2	1
Education				
Less than high school	15	10	6	5
High school or equivalent	59	59	56	51
At least college	25	30	38	44
Depressed	14	7	4	2
Smoking status				
Never	44	47	48	48
Former smoker	39	40	42	43
Current smoker	17	12	10	9
Physical activity frequency, no.				
0	12	10	7	6
1–3 per month	9	8	8	6
1 per week	15	14	12	13
>1 per week	50	55	59	61
>1 per day	14	14	14	14
Alcohol frequency, days per week				
0	43	40	37	34
<1	18	21	19	18
1–2	19	18	21	22
≥3	20	21	23	26
Body mass index[e]				
Normal (<25.0)	33	31	32	37
Overweight (25.0–29.9)	38	41	43	40
Obese (≥30.0)	28	28	25	22

[a] Optimism was measured using the Life Orientation Test–Revised (30).
[b] Some values of categorical variables do not sum to 100% due to rounding or because of missing data.
[c] Quartile 1 (mean = 3.4; range, 1.0–3.9); quartile 2 (mean = 4.3; range, 4.0–4.7); quartile 3 (mean = 5.1; range, 4.75–5.4); quartile 4 (mean = 5.8; range, 5.4–6.0).
[d] Values are expressed as mean (standard deviation).
[e] Weight (kg)/height (m)^2.

We observed strong associations between greater optimism and increased likelihood of maintaining healthy aging over the follow-up period for both sexes (Table 3). Among women, after controlling for confounders, we found a 18% increased likelihood of maintain healthy aging for those in the top versus bottom quartile of optimism (95% CI: 1.02, 1.35); adding potential intermediates to the model slightly attenuated this finding. Findings were similar among men; we found a 41%

Table 2. Hazard Ratios for the Association Between Optimism and Likelihood of Maintaining Healthy Aging (n = 5,698), Health and Retirement Study, United States, 2006–2014

Model	Optimism Score									
	Continuous[a]		Quartile 1 (n = 1,322) (n = 553 Cases[b])		Quartile 2 (n = 1,522) (n = 593 Cases[b])		Quartile 3 (n = 1,333) (n = 689 Cases[b])		Quartile 4 (n = 1,521) (n = 839 Cases[b])	
	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
1[c]	1.14	1.10, 1.18	1.00	Referent	1.15	1.05, 1.27	1.33	1.19, 1.47	1.44	1.30, 1.59
2[d]	1.08	1.04, 1.12	1.00	Referent	1.10	1.00, 1.22	1.19	1.07, 1.33	1.24	1.11, 1.38
3[e]	1.07	1.03, 1.11	1.00	Referent	1.10	1.00, 1.22	1.17	1.05, 1.30	1.21	1.09, 1.35

Abbreviations: CI, confidence interval; HR, hazard ratio.
[a] Per 1-standard-deviation increase in Life Orientation Test–Revised (30) score.
[b] Cases are defined as those who experienced healthy aging.
[c] Model 1 adjusted for age.
[d] Model 2 added potential confounding factors to model 1: age, sex, race/ethnicity, marital status, education, total wealth, and depression.
[e] Model 3 added possible intermediates (also potential confounders) to model 2: smoking status, alcohol intake, physical activity, and body mass index.

increased likelihood of maintaining healthy aging for those in the top versus bottom quartile of optimism (95% CI: 1.18, 1.69), and the relationship remained after controlling for health behaviors. Using the continuous optimism score revealed analogous results for each sex (Table 3). Although these sex-stratified analyses suggested that the associations were stronger in men, there was no interaction between sex and optimism (P for interaction = 0.33).

Additional analyses

In secondary analyses, the association between each standard-deviation increase in optimism and healthy aging remained significant when restricting analyses to people without depression at baseline. For example, in models adjusting for sociodemographic factors, each standard-deviation increase in optimism was associated with an 8% increased likelihood of maintaining healthy aging (95% CI: 1.04, 1.12). When considering optimism as quartiles, participants in the highest versus lowest quartile had a greater likelihood of maintaining healthy aging (hazard ratio = 1.22, 95% CI: 1.09, 1.37) after adjusting for sociodemographic factors.

When evaluating potential effect modification by age group, we observed that associations between greater optimism and increased likelihood of maintaining healthy aging over the follow-up period were similar for older and younger participants. Among those aged <65 years, after controlling for confounders, we found a 31% increased likelihood of maintaining

Table 3. Hazard Ratios for the Association Between Optimism and Likelihood of Maintaining Healthy Aging According to Sex, Health and Retirement Study, United States, 2006–2014

Sex and Model	Optimism Score													
	Continuous[a]		Quartile 2[b]				Quartile 3[b]				Quartile 4[b]			
	HR	95% CI	No. of Participants	No. of Cases[c]	HR	95% CI	No. of Participants	No. of Cases[c]	HR	95% CI	No. of Participants	No. of Cases[c]	HR	95% CI
Women			900	443			877	455			802	443		
1[d]	1.12	1.07, 1.17			1.18	1.04, 1.34			1.22	1.07, 1.39			1.36	1.19, 1.56
2[e]	1.06	1.00, 1.11			1.12	0.98, 1.27			1.09	0.96, 1.24			1.18	1.02, 1.35
3[f]	1.05	1.00, 1.10			1.12	0.98, 1.27			1.08	0.94, 1.23			1.16	1.00, 1.33
Men			617	259			524	266			489	279		
1[d]	1.17	1.10, 1.23			1.13	0.97, 1.31			1.40	1.19, 1.64			1.59	1.34, 1.89
2[e]	1.11	1.05, 1.18			1.09	0.94, 1.27			1.26	1.07, 1.49			1.41	1.18, 1.69
3[f]	1.10	1.04, 1.17			1.09	0.94, 1.27			1.24	1.05, 1.47			1.39	1.16, 1.66

Abbreviations: CI, confidence interval; HR, hazard ratio.
[a] Per 1-standard-deviation increase in Life Orientation Test–Revised (30) score.
[b] Quartile 1 is the reference category (women: n = 913 participants, 402 cases; men: n = 576 participants, 227 cases).
[c] Cases are defined as those who experienced healthy aging.
[d] Model 1 adjusted for age.
[e] Model 2 added potential confounding factors to model 1: age, sex, race/ethnicity, marital status, education, total wealth, and depression.
[f] Model 3 added possible intermediates (also potential confounders) to model 2: smoking status, alcohol intake, physical activity, and body mass index.

healthy aging for those in the top versus bottom quartile of optimism (95% CI: 1.08, 1.59). Findings were similar among participants aged ≥65 years (top vs. bottom optimism quartile, OR = 1.17, 95% CI: 1.03, 1.34). Adding further potential intermediates to models in either age group only slightly attenuated these finding. There was no statistical interaction between age group and optimism (*P* for interaction = 0.1).

When considering the 3-item subscales separately, the association with healthy aging was stronger for the negatively worded subscale. For example, in models adjusting for sociodemographic factors, each standard-deviation increase in the optimism subscale was associated with a 3% increased likelihood of maintaining healthy aging (95% CI: 0.99, 1.06) while each standard-deviation increase in the pessimism subscale was associated with a 10% reduced likelihood of maintaining healthy aging (95% CI: 0.87, 0.93).

Finally, results from discrete-time survival analyses were similar to results from the standard survival analyses. For example, after controlling for confounders, we found a 27% increased likelihood of maintaining healthy aging for people in the top versus bottom optimism quartile (95% CI: 1.13, 1.41).

DISCUSSION

In a prospective study using a nationally representative sample of older US adults who were free of chronic disease as well as cognitive and physical impairment at baseline, we found that higher baseline optimism was associated with an increased likelihood of maintaining healthy aging over the 6–8 years of follow-up. In addition to the existing literature suggesting that optimism is associated with reduced risk of mortality (23, 46–48), our findings further indicate that this prolonged longevity might also be accompanied by better overall health and functioning. Our results were maintained after careful control for potential confounders, such as sociodemographic factors. They were also robust to further adjustment for depression; this suggests that optimism is not primarily a marker of the absence of depression but might independently increase the likelihood of healthy aging.

Our findings converge with past research, in which associations between higher optimism levels and reduced risk of individual age-related conditions (e.g., heart disease, stroke, cognitive impairment) have been reported, as well as reduced risk of mortality from age-related diseases (e.g., heart disease, stroke, respiratory disease, total cancer) (23, 46–49). However, in the present study, we gain a multisystem view of healthy aging by simultaneously considering chronic diseases, cognitive health, and physical function, which has the public health benefit of summarizing the relationship of optimism to aging within an integrated, composite measure.

Although mechanisms that explain the potential health benefits of optimism have not yet been clearly defined, optimism might operate through health behaviors, altered biologic functioning, or potentially other factors. For example, individuals with higher optimism appear to be more proactive in taking care of their health and engaging in favorable behaviors (e.g., healthier diets, less smoking, and more physical activity) (15–19, 50). That said, associations between optimism and healthy aging were only modestly attenuated after adjusting for important health behaviors in our sample. Thus, the range of health behaviors considered might need to be broadened, the measurement instruments used to capture such behaviors might require more precision, or at this point in the life course other mechanisms might be stronger. Other work evaluating potential biological pathways shows that those with higher optimism display healthier regulation of physiological systems including healthier immune responsiveness, healthier lipid profiles, and higher levels of plasma antioxidants (20–22). Thus, the association of optimism with healthy aging might be explained in part by a direct effect on biological function. These direct mechanisms merit additional research. Other factors that are influenced by optimism and might be relevant to health include developing enhanced social networks and the ability to mobilize support, having greater confidence in the future, and having a better capacity to problem solve and self-regulate (49, 51–55).

Our study has several limitations. Unmeasured confounding is always possible in observational studies. For example, a genetic predisposition to good health could lead to higher optimism. While we cannot completely rule out this possibility, we did control for a range of potential confounders, including depression. Also, worth noting is that strong genetic variants associated with optimism have not yet been found. Reverse causation is possible if underlying physical, functional, or cognitive health conditions influenced optimism at baseline. We used several measures to mitigate concern about this issue. For example, we excluded participants who were not aging with good health in any of these domains at baseline. Moreover, prior work has indicated that optimism tends to be stable in the face of declining health (56, 57).

Our study also has several strengths. We drew from a large, diverse, and nationally representative sample of older US adults followed prospectively over 6–8 years. In addition, the study population is richly characterized, and as a result we were able to take account of a broad array of potential confounders and had limited attrition.

In conclusion, as the number of older adults in our society rapidly rises, we will need a comprehensive and multidisciplinary effort to meet the unique demands of this growing demographic. Specifically, we will need a range of interventions that can be deployed at the population level to improve health as well as functioning. Our findings suggest that optimism might be a promising intervention target for future research. Early randomized trials suggest that optimism can be altered with a variety of interventions, ranging from intense classroom-style instruction and activities that have larger effects (13, 14) to brief paper-and-pencil exercises that elicit smaller effects (12). Although most interventions have been tested primarily in younger samples, and durability of effects are unknown, our study suggests the importance of further developing approaches that foster optimism among older adults, with the goal of enhancing the health trajectory of our increasingly aging population.

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REFERENCES

1. Oppers ES, Chikada K, Eich F, et al. The financial impact of longevity risk. International Monetary Fund. https://www.imf.org/~/media/Websites/IMF/imported-flagship-issues/external/pubs/ft/GFSR/2012/01/pdf/_c4pdf.ashx. Published April 2012. Accessed June 15, 2018.
2. Suzman R, Beard JR, Boerma T, et al. Health in an ageing world—what do we know? *Lancet*. 2015;385(9967):484–486.
3. 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.
4. King DE, Matheson E, Chirina S, et al. The status of baby boomers' health in the United States: the healthiest generation? *JAMA Intern Med*. 2013;173(5):385–386.
5. Labarthe DR, Kubzansky LD, Boehm JK, et al. Positive cardiovascular health: a timely convergence. *J Am Coll Cardiol*. 2016;68(8):860–867.
6. Seligman MEP. Positive health. *Appl Psychol Int Rev*. 2008;57:3–18.
7. Boehm JK, Kim ES, Kubzansky LD. Positive psychological wellbeing. In: Kivimäki M, Batty GD, Kawachi I, et al., eds. *The Routledge International Handbook of Psychosocial Epidemiology*. London, UK: Routledge; 2017:156–170.
8. Plomin R, Scheier MF, Bergeman CS, et al. Optimism, pessimism and mental health: a twin/adoption analysis. *Pers Individ Dif*. 1992;13(8):921–930.
9. Mosing MA, Pedersen NL, Martin NG, et al. Sex differences in the genetic architecture of optimism and health and their interrelation: a study of Australian and Swedish twins. *Twin Res Hum Genet*. 2010;13(4):322–329.
10. Boehm JK, Chen Y, Williams DR, et al. Unequally distributed psychological assets: are there social disparities in optimism, life satisfaction, and positive affect? *PLoS One*. 2015;10(2):e0118066.
11. Jackson LM, Pratt MW, Hunsberger B, et al. Optimism as a mediator of the relation between perceived parental authoritativeness and adjustment among adolescents: finding the sunny side of the street. *Soc Dev*. 2005;14(2):273–304.
12. Malouff JM, Schutte NS. Can psychological interventions increase optimism? A meta-analysis. *J Posit Psychol*. 2017;12(6):594–604.
13. Mohammadi N, Aghayousefi A, Nikrahan GR, et al. A randomized trial of an optimism training intervention in patients with heart disease. *Gen Hosp Psychiatry*. 2018;51:46–53.
14. Celano CM, Albanese AM, Millstein RA, et al. Optimizing a positive psychology intervention to promote health behaviors following an acute coronary syndrome: the Positive Emotions after Acute Coronary Events-III (PEACE-III) randomized factorial trial. *Psychosom Med*. 2018:80(6):526–534.
15. 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.
16. Steptoe A, Wright C, Kunz-Ebrecht SR, et al. Dispositional optimism and health behaviour in community-dwelling older people: associations with healthy ageing. *Br J Health Psychol*. 2006;11(1):71–84.
17. Huffman JC, Beale EE, Celano CM, et al. Effects of optimism and gratitude on physical activity, biomarkers, and readmissions after an acute coronary syndrome: the Gratitude Research in Acute Coronary Events (GRACE) Study. *Circ Cardiovasc Qual Outcomes*. 2016;9(1):55–63.
18. Progovac AM, Donohue JM, Matthews KA, et al. Optimism predicts sustained vigorous physical activity in postmenopausal women. *Prev Med Rep*. 2017;8:286–293.
19. Boehm JK, Chen Y, Koga H, et al. Is optimism associated with healthier cardiovascular-related behavior? Meta-analyses of 3 health behaviors. *Circ Res*. 2018;122(8):1119–1134.
20. Boehm JK, Williams DR, Rimm EB, et al. Relation between optimism and lipids in midlife. *Am J Cardiol*. 2013;111(10):1425–1431.
21. Segerstrom SC, Sephton SE. Optimistic expectancies and cell-mediated immunity: the role of positive affect. *Psychol Sci*. 2010;21(3):448–455.
22. Boehm JK, Williams DR, Rimm EB, et al. Association between optimism and serum antioxidants in the midlife in the United States study. *Psychosom Med*. 2013;75(1):2–10.
23. 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.
24. Gawronski KA, Kim ES, Langa KM, et al. Dispositional optimism and incidence of cognitive impairment in older adults. *Psychosom Med*. 2016;78(7):819–828.
25. James P, Kim ES, Kubzansky LD, et al. Optimism and healthy aging in women. *Am J Prev Med*. 2019;56(1):116–124.
26. Gan Y, Gong Y, Tong X, et al. Depression and the risk of coronary heart disease: a meta-analysis of prospective cohort studies. *BMC Psychiatry*. 2014;14:371.
27. Elliot AJ, Chapman BP. Socioeconomic status, psychological resources, and inflammatory markers: results from the MIDUS study. *Health Psychol*. 2016;35(11):1205–1213.
28. Sonnega A, Faul JD, Ofstedal MB, et al. Cohort profile: the Health and Retirement Study (HRS). *Int J Epidemiol*. 2014;43(2):576–585.
29. Smith J, Fisher G, Ryan L, et al. Psychosocial and lifestyle questionnaire. Ann Arbor, MI: Survey Research Center University of Michigan. https://hrs.isr.umich.edu/publications/

biblio/8515. Published February 2013. Accessed June 15, 2018.
30. 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.
31. Ryff CD, Singer B. What to do about positive and negative items in studies of psychological well-being and ill-being? *Psychother Psychosom*. 2007;76(1):61–62.
32. Segerstrom SC, Evans DR, Eisenlohr-Moul TA. Optimism and pessimism dimensions in the Life Orientation Test-Revised: method and meaning. *J Res Pers*. 2011;45(1):126–129.
33. Rowe JW, Kahn RL. Successful aging. *Gerontologist*. 1997; 37(4):433–440.
34. Samieri C, Sun Q, Townsend MK, et al. The relation of midlife diet to healthy aging: a cohort study. *Ann Intern Med*. 2013; 159(9):584–591.
35. Fisher GG, Faul JD, Weir DR, et al. Documentation of Chronic Disease Measures in the Heath and Retirement Study (HRS/ AHEAD). Ann Arbor, MI: Survey Research Center University of Michigan. http://hrsonline.isr.umich.edu/sitedocs/userg/dr-009.pdf. Published February 10, 2005. Accessed June 10, 2018.
36. Fisher GG, Halimah H, Faul JD, et al. Health and Retirement Study Imputation of Cognitive Functioning Measures: 1992 – 2014. Ann Arbor, MI: Survey Research Center University of Michigan. http://hrsonline.isr.umich.edu/modules/meta/xyear/cogimp/desc/COGIMPdd.pdf. Published January 13, 2017. Accessed June 10, 2018.
37. Ofstedal MB, Fisher GG, Herzog AR. Documentation of Cognitive Functioning Measures in the Health and Retirement Study. Ann Arbor, MI: Survey Research Center University of Michigan. http://hrsonline.isr.umich.edu/sitedocs/userg/dr-006.pdf. Published March 2015. Accessed June 10, 2018.
38. Crimmins EM, Kim JK, Langa KM, et al. Assessment of cognition using surveys and neuropsychological assessment: the Health and Retirement Study and the Aging, Demographics, and Memory Study. *J Gerontol B Psychol Sci Soc Sci*. 2011;66(suppl 1):i162–i171.
39. Langa KM, Plassman BL, Wallace RB, et al. The Aging, Demographics, and Memory Study: study design and methods. *Neuroepidemiology*. 2005;25(4):181–191.
40. Rosow I, Breslau N. A Guttman health scale for the aged. *J Gerontol*. 1966;21(4):556–559.
41. Nagi SZ. An epidemiology of disability among adults in the United States. *Milbank Mem Fund Q Health Soc*. 1976;54(4):439–467.
42. Katz S, Ford AB, Moskowitz RW, et al. Studies of illness in the aged, the index of ADL: a standardized measure of biological and psychosocial function. *JAMA*. 1963;185(12):914–919.
43. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*. 1969;9(3):179–186.
44. Wallace RB, Herzog AR, Ofstedal MB, et al. HRS/AHEAD Documentation Report. Documentation of affective functioning measures in the Health and Retirement Study. Ann Arbor, MI: Survey Research Center. http://hrsonline.isr.umich.edu/sitedocs/userg/dr-005.pdf. Published 2000. Accessed June 12, 2018.
45. Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. *Appl Psychol Meas*. 1977;1:385–401.
46. Giltay EJ, Kamphuis MH, Kalmijn S, et al. Dispositional optimism and the risk of cardiovascular death: the Zutphen Elderly Study. *Arch Intern Med*. 2006;166(4):431–436.
47. Giltay EJ, Geleijnse JM, Zitman FG, et al. Dispositional optimism and all-cause and cardiovascular mortality in a prospective cohort of elderly Dutch men and women. *Arch Gen Psychiatry*. 2004;61(11):1126–1135.
48. Kim ES, Hagan KA, Grodstein F, et al. Optimism and cause-specific mortality: a prospective cohort study. *Am J Epidemiol*. 2017;185(1):21–29.
49. Carver CS, Scheier MF. Dispositional optimism. *Trends Cogn Sci*. 2014;18(6):293–299.
50. Lemola S, Räikkönen K, Gomez V, et al. Optimism and self-esteem are related to sleep. Results from a large community-based sample. *Int J Behav Med*. 2013;20(4):567–571.
51. Brissette I, Scheier MF, Carver CS. The role of optimism in social network development, coping, and psychological adjustment during a life transition. *J Pers Soc Psychol*. 2002; 82(1):102–111.
52. Nes LS, Segerstrom SC. Dispositional optimism and coping: a meta-analytic review. *Pers Soc Psychol Rev*. 2006;10(3): 235–251.
53. Karademas EC. Self-efficacy, social support and well-being: the mediating role of optimism. *Pers Individ Dif*. 2006;40(6): 1281–1290.
54. John OP, Gross JJ. Healthy and unhealthy emotion regulation: personality processes, individual differences, and life span development. *J Pers*. 2004;72(6):1301–1333.
55. Carver CS, Scheier MF, Segerstrom SC. Optimism. *Clin Psychol Rev*. 2010;30(7):879–889.
56. Schou I, Ekeberg Ø, Sandvik L, et al. Stability in optimism-pessimism in relation to bad news: a study of women with breast cancer. *J Pers Assess*. 2005;84(2):148–154.
57. Stiegelis HE, Hagedoorn M, Sanderman R, et al. Cognitive adaptation: a comparison of cancer patients and healthy references. *Br J Health Psychol*. 2003;8(Pt 3):303–318.