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Dispositional Optimism and Incidence of Cognitive Impairment in Older Adults

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Abstract

Objective—Higher levels of optimism have been linked with positive health behaviors, biological processes, and health conditions that are potentially protective against cognitive impairment in older adults. However, the association between optimism and cognitive impairment has not been directly examined. We examined whether optimism is associated with incident cognitive impairment in older adults.

Methods—Data are from the Health and Retirement Study, a nationally representative sample of older U.S. adults. Using multiple logistic regression models, we prospectively assessed whether optimism was associated with incident cognitive impairment in 4,624 adults aged 65+ over a four-year period.

Results—Among the 4,624 participants, 497 respondents developed cognitive impairment over the four-year follow-up (306 women and 191 men). Higher optimism was associated with decreased risk of incident cognitive impairment. When controlling for sociodemographic factors, each standard deviation increase in optimism was associated with reduced odds (OR=0.72, 95% CI, 0.62–0.83) of becoming cognitively impaired. A dose-response relationship was observed.

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Compared to those with the lowest levels of optimism, people with moderate levels of optimism had somewhat reduced odds of cognitive impairment (OR=0.79, 95% CI, 0.59–1.03), while people with the highest levels of optimism had the lowest odds of cognitive impairment (OR=0.53, 95% CI, 0.35–0.78). These associations remained after adjusting for health behaviors, biological factors, and psychological covariates that could either confound the association of interest or serve on the pathway.

Conclusions—Optimism was prospectively associated with a reduced likelihood of becoming cognitively impaired. If these results are replicated, the data suggest that potentially modifiable aspects of positive psychological functioning such as optimism play an important role in maintaining cognitive functioning. Thus, these factors may prove worthy of additional clinical and scientific attention.

Keywords

optimism; cognitive impairment; aging; psychology; older adults; positive psychology

Given the rapidly increasing population of older adults in the United States, cognitive impairment is a growing concern (1). Cognitive impairment encompasses several conditions, with symptoms ranging from mild (e.g., mild cognitive impairment) to severe (e.g., Alzheimer's disease and other dementias) (2). Age is the primary risk factor for cognitive impairment, and the population of adults over the age of 65 is estimated to double by 2050 (2,3). Further, costs of health care, long-term care, and hospice for cognitively impaired people is predicted to rise from $214 billion today to $1.2 trillion by 2050 (1). Therefore, there is an increasingly urgent need to identify potentially modifiable risk factors, which may in turn open new avenues for innovative interventions.

Although many studies have investigated behavioral and biological risk factors for cognitive impairment, fewer studies have examined psychological factors—even though research shows that psychological factors such as depression or a sense of purpose in life impact a person's risk for a variety of health conditions (4,5). Past studies that examined psychological factors in relation to cognitive impairment mainly considered potential risk imposed by depression and anxiety (6,7). It is possible that some psychological factors may protect cognitive function, but far less is known about these factors and their possible effects. Aspects of positive psychological functioning such as optimism have been linked with a variety of positive health behaviors (e.g., less cigarette smoking, more exercise) and biological processes (e.g., reduced levels of inflammatory agents), and reduced likelihood of health conditions (e.g., cardiovascular disease and stroke) that are associated with risk of cognitive impairment, and therefore may warrant further investigation (4,8–14). Further, while optimism is about 25% heritable, several studies suggest that it may be learned (e.g., through classroom style instruction and activities, or brief paper and pencil exercises) and shaped by social influences (e.g., optimism is patterned by factors like education and income) (15–18). Therefore, optimism may provide a point of intervention for enhancing health prior to the development of health problems (19).

No studies to our knowledge have directly examined optimism's association with risk of becoming cognitively impaired. To address this knowledge gap, we examined this

association using data from the Health and Retirement Study (HRS), a prospective and nationally representative study of U.S. adults over the age of 50. We hypothesized that optimism would be associated with reduced likelihood of becoming cognitively impaired. We adjusted for potential confounder (e.g., sociodemographic) and pathway (e.g., behavior and biological) variables (8,11–13,20). Because prior research suggests women have higher lifetime risk of developing cognitive impairment than men, we tested a potential interaction between optimism and gender. Because they have been previously linked with cognitive impairment, we also adjusted for depression and anxiety symptoms to evaluate if the optimism-cognitive impairment association might be mainly driven by the absence of these forms of psychological distress (6,7).

Methods

Participants

The Health and Retirement Study (HRS) is a nationally representative panel study of Americans over the age of 50. Since the study began in 1992, it has tracked over 37,000 Americans biannually. Starting in 2006, the HRS added a detailed module that gathered information about several psychological factors, including optimism. Because all relevant psychological and covariate data were collected in 2006, this data collection wave served as this study's baseline. Incident cognitive impairment was assessed during the follow-up waves (2008 and 2010). Exit interviews were completed by knowledgeable informants for respondents who died during follow-up. This study used de-identified, publicly available data, therefore the Institutional Review Board at the University of Michigan exempted it from review. The University of Michigan's Institute for Social Research conducts the study and provides extensive documentation about the protocol, instrumentation, sampling strategy, and statistical weighting procedures (http://hrsonline.isr.umich.edu/).

Procedure

In the 2006 wave, approximately half of the HRS respondents (n=9,568) were randomly selected for an enhanced face-to-face interview. At the end of each interview, interviewers left behind a questionnaire that included psychological measures, which respondents completed and returned by mail. Among those interviewed, the response rate for the leave-behind questionnaire was 90% (n=8,568). HRS sampling weights were used in all analyses to account for the complex multistage probability survey design, which includes individual non-response, sample clustering, stratification, and further post-stratification. While the HRS interviews all couples in a household regardless of age, the sampling weights apply only to people aged 51+, in order to ensure that the sample is nationally representative of adults aged 51+. The inclusion of these survey weights left us with 7,168 respondents who were initially eligible for this study. More detailed information about the survey weights used in this study can be found in an HRS documentation report (21).

We then excluded 2,424 participants younger than 65 because only an abbreviated version of the HRS cognitive test is administered to these younger respondents, and because cognitive impairment is rare in this age group. Of those affected by cognitive impairment in this age group, these people tend to have a higher burden of rare and inherited dementias than adults

who develop cognitive impairment later in life, and therefore the causes of cognitive impairment in these two groups may not be comparable (22). We also excluded 120 respondents who reported cognitive impairment at baseline (2006), resulting in a final sample of 4,624 respondents. To ensure that the exclusion of respondents < 65 years of age did not bias our results, we also conducted a sensitivity analysis that included cognitively normal, younger respondents in our analytic sample (n=6,999).

Measures

Cognitive Impairment Assessment—Cognitive functioning is assessed at each data collection wave in the HRS. Data from the 2008 and 2010 waves of the study were used to determine incidence of cognitive impairment. Among respondents 65 years of age and older, the HRS assesses cognitive functioning using a version of the modified Telephone Interview for Cognitive Status (TICS-M), which was derived from the Mini-Mental State Examination (23). The 35-point assessment included tests of memory, serial 7 subtractions, processing speed, naming, and orientation (24). This assessment tool has been shown to have high sensitivity and specificity for cognitive impairment in older adults (23,25). Approximately 10% of respondents were unable to participate in direct cognitive assessments. For these participants, a validated 16-item Informant Questionnaire on Cognitive Decline in Elderly (IQCODE) was completed by proxies (26).

The cut points for both the self-report and proxy scales for cognitive functioning were derived from previous research conducted on cognitive impairment in the HRS and the Aging, Demographics, and Memory Study—an extensive substudy of dementia conducted within the HRS (27,28). For self-respondents using the 35-point cognitive functioning scale, a score of 11 to 35 was defined as “normal cognitive functioning,” while a score of 0 to10 was defined as “cognitive impairment.” For proxy respondents, IQCODE scores greater than 3 were defined as “cognitive impairment.” More detailed information about the self-report and proxy measures of cognitive impairment can be found in an HRS documentation report (24). In order to test the influence of potential practice effects, we also conducted all analyses using an increased cut-off score for cognitive impairment at follow-up (12 versus 11, the baseline cut-off). We found that the estimates of association were virtually indistinguishable.

Optimism Measurement—The six-item Life Orientation Test-Revised (LOT-R) was used to assess optimism (29). The measure has good discriminant and convergent validity, and good reliability. Previous research has demonstrated that optimism assessed by the LOT-R is generally stable over time (8). In the HRS sample, correlation between optimism at baseline (2006) and at follow-up (2010) was 0.58. Respondents rated each item on a 6-point Likert scale, indicating the degree to which they endorsed items such as, “In uncertain times, I usually expect the best,” or “If something can go wrong for me, it will.” All three negatively worded items were reverse scored. All items were then averaged together, with higher scores indicating higher optimism (Cronbach’s α=0.79). Then, overall optimism scores were standardized (*M=0, SD=1*) to facilitate comparisons of effect size across optimism studies. In this study, odds ratios can be interpreted as the change in odds of becoming cognitively impaired as a function of a one standard deviation increase in optimism.

Sometimes researchers split the LOT-R into two subscales—one consisting of only negatively valenced items and one consisting of only positively valenced items (30,31). However, optimism is most accurately captured by a scale that combines negatively valenced items that are rejected and positively valenced items that are endorsed (30). Therefore, building upon theory and research in this area, we used the six-item composite rather than creating two 3-item subscales (14,31).

Covariates Measurement—Potential confounders or pathways linking optimism with risk of cognitive impairment included sociodemographic, behavioral, biological, and psychological factors that prior work suggests are relevant to cognitive impairment risk (6–8,11–13,20). All variables described below were collected via self-report at baseline in 2006. Building on relevant findings in the literature, we adjusted for a wide array of potential confounder (e.g., sociodemographic) and pathway (e.g., behavior and biological) variables. Given that prior research suggests women have higher lifetime risk of developing cognitive impairment than men, we tested a potential interaction between optimism and gender to assess possible gender differences in the association of interest (1). We also adjusted for depression and anxiety symptoms because they have been previously linked with cognitive impairment (6,7). Findings that the association between optimism and cognitive impairment is maintained even after adjusting for these factors would mitigate concerns that the association between optimism and cognitive impairment is mainly driven by the absence of these forms of psychological distress.

Potential confounders included: age, gender, race/ethnicity (Caucasian-American, African-American, Hispanic, Other), marital status (married/not married), educational attainment (no degree, GED or high school diploma, college degree or higher), and total wealth (based on tertiles of the score distribution in this sample).

Psychological factors (e.g., depression, anxiety) that might confound the primary associations of interest were assessed at baseline with widely used measures that have good reliability and validity. Depression symptoms were measured as a continuous variable using a short form version of the Center for Epidemiological Studies Depression Scale (CES-D) (in the HRS, M=1.72, SD=2.06, Cronbach α=0.89) and anxiety symptoms were measured as a continuous variable using a short form version of the Beck Anxiety Inventory (in the HRS, M=1.64, SD=0.62, Cronbach α=0.80) (32,33).

Potential behavioral and biological pathway covariates that link optimism with cognitive impairment were also considered. Behavioral covariates included cigarette smoking status (never, former, current), frequency of alcohol consumption (abstinent, less than 1 or 2 days per month, 1 to 2 days per week, and more than 3 days per week), and frequency of moderate (e.g., gardening, walking at a moderate pace) and vigorous exercise (e.g., running, swimming) reported as never, 1–4 times per month, more than once a week.

Biological covariates included self-reported weight in pounds, converted into kilograms, and height in inches, converted into meters (used to calculate body mass index [BMI] according to kg/m^2). Biological covariates also included heart disease, hypertension, and diabetes (each yes/no based on self-report of a doctor's diagnosis).

Statistical Analyses

We conducted multiple logistic regression analyses because we did not have exact dates for when cognitive impairment began, and onset may have occurred prior to our assessment dates. Therefore, timing of assessment cannot be equated with the timing of cognitive impairment. The impact of covariates on the association between optimism and cognitive impairment was estimated by adjusting for blocks of covariates. Model 1 adjusted for age and gender. Model 2, the core model, considered the impact of potential sociodemographic confounders and therefore included race/ethnicity, marital status, educational degree, and total wealth. Model 3 comprised the core model + health behaviors (smoking status, exercise, alcohol frequency). Model 4 comprised the core model + biological factors (heart disease, hypertension, diabetes, BMI). In these models, the degree of reduction in the association between optimism and cognitive impairment may be considered suggestive of the degree to which each block of variables is on the pathway linking optimism to cognitive impairment. We also created a Model 5, which included all covariates.

Sensitivity analyses were performed. First, we used multiple linear regression models to examine the association between optimism and continuous cognitive scores at follow-up. Second, we examined the impact of including older adults aged 51 to < 65 years of age (n=6,999) on the association between optimism and cognitive impairment. Since the HRS gives an abbreviated cognitive test to these younger participants (27 total points versus 35 total points), cognitive scores of less than 8 points at follow-up were defined as cognitive impairment for this group, per previous research (34). Third, we examined if optimism-cognitive impairment associations were maintained after adjusting for depression and anxiety symptoms. Since depression may cause short-term concentration problems that could translate into lower cognitive scores, we also adjusted for depression symptoms at follow-up in 2010. Fourth, we evaluated a potential threshold effect by considering tertiles of optimism. Fifth, to assess if associations might be due to reverse causality (i.e., having undiagnosed cognitive impairment may lead to lower optimism), we re-examined the primary association after excluding all cases of cognitive impairment that developed within two years of baseline. Sixth, we re-examined associations after excluding people with borderline cognitive impairment at baseline (i.e., scored within one standard deviation of the cutoff— score= 11 to 15). Seventh, we re-examined the primary association of interest while simultaneously excluding both people who developed cognitive impairment within two years of baseline and people who were on the borderline of cognitive impairment. Eighth, we tested for a potential interaction between type of cognitive assessment (TICS-M or IQCODE) and optimism and for a potential interaction between optimism and gender. Finally, we conducted a sensitivity analysis re-examining the primary association of interest while controlling for baseline cognitive scores. Glymour et al. 2005 cautions that controlling for baseline cognitive scores may inflate the association with the independent variable (35). Therefore, we did not control for baseline cognitive scores in our main models. Logits were converted into odds ratios (ORs) for ease of interpretation. All analyses were conducted using Stata version 13 (StataCorp).

Missing Data Analyses

For all study variables, the overall item non-response rate was only 2.58%. However, missing data were distributed across variables, resulting in a 29.80% loss of respondents with complete-case analyses. To examine the impact of missing data and to obtain less biased estimates, a multivariate normal multiple imputation procedure was used to impute all missing data. Because results were largely the same between the original and imputed datasets, we used the dataset with multiple imputation for all reported analyses as this provides a more accurate estimate of association than other methods of handling missing data (36).

Results

Descriptive Analyses

At baseline, the average age of respondents was 75.00 years (SD=10.88). Respondents identified as being European-American (86%), African-American (8%), Hispanic (5%), or "Other" (1%). Respondents were primarily female (57%) and married (58%), and also reported having a high school degree (56%) or having attended some college (23%). At baseline, 120 people were cognitively impaired and therefore removed from analyses. There were 232 participants that developed cognitive impairment at the two-year follow-up. There were 559 total cases of cognitive impairment observed over the four-year course of this study. Of the 559 total cases of cognitive impairment, 62 (26.72%) went from being impaired at year two of follow-up to unimpaired at year four of follow-up. Therefore, because of the 62 people who went from impaired at year two of follow-up to not impaired at year four of follow-up, the total number of people impaired at year four of follow-up is 497 (306 women and 191 men). These numbers are in keeping with previous research on incidence rates of cognitive impairment in the HRS (37). Of the 4,624 participants in this study, 4,065 of them remained cognitively unimpaired throughout the entirety of the study. The Spearman rank correlation between optimism scores at baseline and change in continuous 35-item cognitive function scores over four-year follow-up was 0.07 (p<.001). Optimism scores at baseline were also correlated (Spearman rank correlation coefficient) with 35-item cognitive function scores at baseline (r_s= 0.24, p<.001). The 35-item cognitive function scores at baseline were correlated with cognitive scores at four-year follow-up (r_s=0.66, p<.001). Table 1 describes the distribution of covariates across optimism tertiles.

Optimism and Risk of Becoming Cognitively Impaired

Inverse associations between optimism and likelihood of becoming cognitively impaired were evident across all five models. In the core model (Model 2), each standard deviation increase in optimism was associated with a multivariate-adjusted OR of 0.72 for cognitive impairment (95% CI, 0.62–0.83), whereby people with higher optimism were at lower risk for becoming cognitively impaired over the follow-up period. When considering each set of potential pathway covariates (e.g., behavioral, biological pathways), associations between optimism and cognitive impairment were somewhat attenuated but remained significant in all models (Table 2, Models 3–5).

Controlling for Depression and Anxiety Symptoms

Adding depression or anxiety symptoms as continuous variables sequentially to the base model resulted in only a modest decrease in the strength of the association between optimism and cognitive impairment. For example, with anxiety symptoms the multivariate-adjusted OR for optimism was 0.77 (95% CI, 0.67–0.89). When including depression symptoms, the multivariate-adjusted OR for optimism was 0.77 (95% CI, 0.66–0.89). When including both forms of distress simultaneously, the association between optimism and cognitive impairment was maintained (OR=0.79, 95% CI, 0.69–0.92). Finally, we controlled for depression symptoms at follow-up (2010) (Table S1 in Supplemental Digital Content 1) and found that the association between optimism and cognitive impairment was maintained in all models.

Additional Analyses

When examining tertiles of optimism, the results suggested a dose-response relationship (Table 3). For example, in the core model (Table 3, Model 2) compared to those with the lowest optimism, people with moderate optimism had a somewhat reduced risk (OR=0.79, 95% CI, 0.59–1.03), while those with the highest optimism had the lowest risk of cognitive impairment (OR=0.53, 95% CI, 0.356–0.78). This pattern was maintained in all models (Table 3, Models 1–5). After excluding any cases of cognitive impairment that developed within 2 years of baseline (n=4,407), the association between optimism and cognitive impairment risk was maintained in all models (Table 4, Models 1–5), and the magnitude of reduction in risk was virtually unchanged (OR=0.69, 95% CI, 0.59–0.80; Table 4, Model 2). Similarly, after excluding people with borderline cognitive impairment scores at baseline (n=4,075), the primary association was maintained in all models (Table 5, Models 1–5), with little change in the magnitude of the odds ratios and confidence intervals (OR=0.68, 95% CI, 0.56–0.83; Table 5, Model 2). We also re-ran analyses excluding both people who developed cognitive impairment within two years of baseline and people who were on the borderline of cognitive impairment but not cognitively impaired (n=3,972). Again, the estimates of association (OR=0.68, 95% CI, 0.56–0.82) were mostly indistinguishable from the original findings (Table S2 in Supplemental Digital Content 1, Models 1–5). Further, the association between optimism and cognitive impairment was maintained when controlling for baseline cognitive scores (Table S3 in Supplemental Digital Content 1, Models 1–5), though the strength of the association was attenuated (OR=0.784, 95% CI, 0.67–0.91; Table S3 in Supplemental Digital Content 1, Model 2). When examining the association between optimism and continuous cognitive scores at follow-up, for each standard deviation increase in optimism, cognitive scores increased by approximately 0.80 points after adjusting for sociodemographic factors (Table S4 in Supplemental Digital Content 1, Model 2). The inclusion of adults aged 51 to < 65 years old who were given the abbreviated cognitive test had little impact on the magnitude of reduction in risk (OR=0.74, 95% CI, 0.67–0.83; Table S5 in Supplemental Digital Content 1, Model 2). In addition, we found no evidence of an interaction between the type of cognitive assessment (TICS-M or IQCODE) and optimism (p=0.36). We also found no evidence of an association between gender and optimism (p=0.66).

Discussion

We examined a nationally representative sample of older U.S. adults with normal cognitive function at baseline, and found that each standard deviation increase in optimism was associated with substantially reduced odds of becoming cognitively impaired over a four-year period (OR=0.72, 95% CI, 0.62–0.83). We also observed a dose-response relationship, whereby as optimism increased, risk of cognitive impairment decreased monotonically. The association between optimism and cognitive impairment was maintained after taking into account sociodemographic, health behavior, and biological factors, as well as the presence of depression and anxiety symptoms. The association was somewhat attenuated after adjusting for demographics, which may be due in part to the strong association of optimism with education, and given that educational attainment has been strongly linked with cognitive decline (38). That said, the association between optimism and cognitive decline remained robust even after accounting for education and other sociodemographic variables. Prior work has found that optimism is strongly patterned by both education and income, and it may be one mechanism by which social disparities in health occur (39). Future work might directly test if optimism mediates the effects of educational attainment on cognitive decline. Moreover, our results are consistent with past studies which show that optimism's association with health outcomes is only partially explained by behavioral and disease-related risk factors, suggesting that these potentially mediating factors account for a small proportion of variance (4). Our findings are also consistent with work suggesting that associations between optimism and positive health outcomes are not merely due to the absence of depression or anxiety symptoms (4,14). Therefore, optimism may work through other mechanisms to reduce risk of cognitive impairment.

A growing body of research suggests that optimism promotes positive health through both indirect and direct pathways. Health behavior is one indirect pathway. Optimism is associated with better health behaviors in older adults, including being more physically active and abstaining from smoking (40). Although we controlled for relevant health behaviors, it is possible we did not include all behaviors that affect risk of cognitive impairment. There may be other pathways we were unable to measure in the current study. For example, people with higher optimism tend to eat healthier diets and manage stress more effectively (8,40). Research also indicates that more optimistic people may have better capacity to self-regulate and experience higher levels of positive emotions; more optimistic individuals tend to approach difficult life circumstances with more confidence about the future, and engage in more effortful problem solving, but are also more willing to adjust goals when they become unattainable (41–44). More optimistic people are also more likely to seek social support, a key environmental factor that protects against cognitive decline (43,45,46).

In addition to indirect pathways, researchers hypothesize that optimism may have direct biological effects that promote positive health outcomes. High levels of inflammatory cytokines such as interleukin-6 (IL-6) and C-reactive protein are associated with increased risk of cognitive impairment (13). Prior research has found that higher levels of optimism are associated with lower levels of inflammation (9,10). Other research suggests that optimism is also associated with high levels of high-density lipoprotein cholesterol, an anti-

inflammatory lipoprotein hypothesized to protect cognitive function (47,48). Finally, numerous health conditions have been identified as risk factors for cognitive impairment, including stroke, diabetes, heart failure, and hypertension (12,13). Accumulating evidence suggests higher optimism leads to lower risk of developing these conditions (4,8,14). Further investigations are needed to clarify the biological mechanisms underlying the observed protective effect of optimism on cognitive impairment.

This study has several limitations. The assessment of cognitive impairment available in the HRS did not differentiate subtypes of cognitive impairment (e.g. mixed/vascular dementia, amnestic/non-amnestic mild cognitive impairment), and effects of optimism might vary depending on type of cognitive impairment. It is also worth noting that the cognitive assessment used does not definitively establish clinical diagnosis of dementia, so it is possible that some cases of cognitive impairment may be due to other causes such as head injury, meningitis, or thyroid dysfunction. However, the cut-off scores used in this study have shown high concordance with clinical dementia in prior research (49). It is also possible that optimism itself may influence self-report of health behaviors and health information. One study found that people with higher optimism were more likely to underestimate their weight compared to people with higher pessimism (50). Given the nature of observational data and shorter follow-up periods, we cannot fully rule out concerns about unmeasured confounders or reverse causality. However, we ran several sensitivity analyses to mitigate concerns about reverse causality. In all of these analyses, we found that the association between optimism and cognitive impairment was maintained. Although further research is needed, our findings suggest that optimism precedes the development of cognitive impairment. Finally, it is possible that a shared genetic predisposition to both low optimism and cognitive impairment may underlie the association observed in this study. To date optimism genes have not been identified, and candidate genes remain debated (51). However, previous research has demonstrated that optimism is partially heritable, and therefore future studies may seek to exclude possible genetic confounding by studying the association between optimism and cognitive impairment in twins or other related individuals.

This study also has several strengths, including a large and nationally representative sample, a prospective study design, and capacity to adjust for a wide array of potential confounders. Further, many large-scale longitudinal studies do not include proxy measures of cognitive impairment. The inclusion of proxy assessments in this study makes underestimation of the prevalence of cognitive impairment less likely (27,52).

The rapidly growing population of older adults in the United States is projected to result in an increasing number of people who develop cognitive impairment. Our findings indicate that higher optimism is associated with reduced risk of developing cognitive impairment, and several studies suggest that optimism is potentially modifiable (15,16). Further research should examine whether optimism induced by interventions is associated with the same health benefits as naturally occurring optimism. If future research supports findings from this study, supplementing current cognitive impairment prevention measures with interventions that have been shown to dependably enhance facets of positive psychological functioning, such as optimism, may be warranted (15,16,19).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

HRS	Health and Retirement Study
BMI	body mass index
TICS-M	modified Telephone Interview for Cognitive Status
IQCODE	Informant Questionnaire on Cognitive Decline in Elderly
CES-D	Center for Epidemiological Studies Depression Scale
LOT-R	Life Orientation Test-Revised

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Table 1

Distribution of respondent characteristics by level of optimism

	Optimism		
Characteristic	**Low 1.00–3.83 *In* = 1483)**	**Moderate 3.83–4.94 *In* = 1551)**	**High 4.95–6.00 *In* = 1590)**
Age, M (SD), y	75.26 (9.24)	75.43 (9.85)	74.30 (8.37)
Female	830 (55.96)	883 (56.91)	941 (59.20)
Married status	778 (52.46)	901 (58.10)	1025 (64.45)
Race/Ethnicity			
White	1213 (81.81)	1342 (86.51)	1418 (89.16)
African American	134 (9.04)	116 (7.51)	101 (6.33)
Hispanic	118 (7.92)	69 (4.46)	59 (3.74)
Other	18 (1.23)	24 (1.52)	12 (0.77)
Education			
<High school	470 (31.65)	319 (20.57)	183 (11.48)
High school	801 (54.03)	882 (56.85)	888 (55.88)
College	212 (14.32)	350 (22.58)	519 (32.64)
Total wealth			
1st tertile-lowest	654 (44.08)	420 (27.08)	338 (21.29)
2nd tertile	466 (31.40)	575 (37.06)	497 (31.25)
3rd tertile-highest	363 (24.52)	556 (35.86)	755 (47.46)
Smoking status			
Never	602 (40.60)	664 (42.80)	743 (46.74)
Former smoker	710 (47.87)	739 (47.62)	749 (47.10)
Current smoker	171 (11.52)	148 (9.58)	98 (6.16)
Exercise			
Never	1108 (74.74)	1070 (69.00)	925 (58.18)
1–4 times per month	148 (9.98)	159 (10.24)	208 (13.11)
More than 1 x per week	227 (15.28)	322 (20.80)	457 (28.71)
BMI, M (SD), kg/m’	27.87 (6.16)	27.38 (6.30)	27.04 (6.38)
Alcohol frequency			
Never	842 (56.81)	761 (49.05)	735 (46.22)

	Optimism		
Characteristic	**Low 1.00–3.83 *In* = 1483)**	**Moderate 3.83–4.94 *In* = 1551)**	**High 4.95–6.00 *In* = 1590)**
<1 per week	248 (16.71)	289 (18.65)	280 (17.63)
1–2 per week	176 (11.85)	217 (14.02)	224 (14.06)
3+ per week	217 (14.62)	284 (18.29)	351 (22.09)
Heart disease	497 (33.48)	477 (30.74)	403 (25.33)
Hypertension	924 (62.28)	931 (60.00)	919 (57.78)
Diabetes	370 (24.96)	325 (20.93)	234 (14.73)
Depression symptoms, M (SD)	2.14 (3.08)	1.37 (1.96)	0.81 (1.28)
Anxiety symptoms, M (SD)	1.81 (0.65)	1.58 (0.63)	1.35 (0.56)
Cognitive change score, M (SD)	-3.13 (10.40)	-2.45 (7.48)	-2.03 (6.38)
Baseline continuous cognitive score, M (SD)	21.24 (9.24)	22.22 (6.70)	23.57 (6.78)

M = mean; SD = standard deviation; BMI = body mass index.

[a]Unless otherwise noted, values am number of participants (percentage).

Table 2

Adjusted logistic regression parameter estimates for the association between optimism and cognitive impairment

Model	Covariates	Adjusted Logistic Regression (95% CI)	
1	Age + sex	0.64 (0.56–0.73)	<.001
2	Demographic’	0.70(0.61–0.81)	<.001
3	Demographic’ + health behaviors[b]	0.72 (0.62–0.83)	<.001
4	Demographic’ + biological factors’	0.71 (0.61–0.82)	<.001
5	All covariates[d]	0.73 (0.63–0.84)	<.001

CI = confidence interval; BMI = body mass index.

[°]Demographic factors: age, sex, race/ethnicity, marital status, education level, total wealth.

Health behaviors: smoking, exercise, alcohol frequency.

Biological factory heart disease, hypertension, diabetes, BMI.

All covariates: age, sex, race/ethnicity, marital status, education level, total wealth, smoking, exercise, alcohol frequency, heart disease, hypertension, diabetes, BMI.

Table 3

Adjusted logistic regression parameter estimates for the association between optimism and cognitive impairment by tertiles of optimism

Model	Level of Optimism	Adjusted Logistic Regression (95% CI)	
	Low (reference group)	1.00	
	Moderate	0.67 (0.52–0.88)	.005
	High	0.42 (0.30–0.58)	<.001
	Low (reference group)	1.00	
	Moderate	0.78 (0.59–1.03)	.080
	High	0.52 (0.36–0.74)	.001
3a,b	Low (reference group)	1.00	
	Moderate	0.79 (0.60–1.05)	.107
	High	0.55 (0.39–0.79)	.002
4[5′]	Low (reference group)	1.00	
	Moderate	0.77 (0.58–1.03)	.073
	High	0.53 (0.37–0.75)	.001
5[d]	Low (reference group)	1.00	
	Moderate	0.79 (0.59–1.05)	.097
	High	0.56 (0.39–0.79)	.002

Cl = confidence interval; BMI = body mass index.

[°]Demographic factors: age, sex, race/ethnicity, marital status, education level, total wealth.

*6*Health behaviors: smoking, exercise, alcohol frequency.

Biological factors: heart disease, hypertension, diabetes, BMI.

[°]All covariates: age, sex, race/ethnicity, marital status, education level, total wealth, smoking, exercise, alcohol frequency, heart disease, hypertension, diabetes, BMI.

Table 4

Adjusted logistic regression parameter estimates for the association between optimism and cognitive impairment (excluding people with cognitive impairment in the first 2 years of follow-up; n = 4,407)

Model	Covariates	Adjusted Logistic Regression (95% CI)	
1	Age + sex	0.64 (0.55–0.73)	<.001
2	Demographic’	0.69 (0.59–0.79)	<.001
3	Demographic’ + health behaviors[b]	0.70(0.61–0.81)	<.001
4	Demographic’ + biological factors’	0.69 (0.60–0.80)	<.001
5	All covariates[d]	0.70 (0.61–0.81)	<.001

CI = confidence interval; BMI = body mass index.

n= 4407.

[°]Demographic factors: age, sex, race/ethnicity, marital status, education level, total wealth.

Health behaviors: smoking, exercise, alcohol frequency.

Biological facto’s: heart disease, hypertension, diabetes, BMI.

[a]All covariates: age, sex, race/ethnicity, marital status, education level, total wealth, smoking, exercise, alcohol frequency, heart disease, hypertension, diabetes, BMI.

Table 5

Adjusted logistic regression parameter estimates for the association between optimism and cognitive impairment (excluding people who were within one standard deviation of the cognitive impairment cutoff score; n = 4,075)

Model	Covariates	Adjusted Logistic Regression (95% CI)	
1	Age + sex	0.63 (0.53–0.73)	<.001
2	Demographic’	0.67 (0.57–0.78)	<.001
3	Demographic[s] + health behaviors[b]	0.69 (0.58–0.81)	<.001
4	Demographic’ + biological factors’	0.68 (0.58–0.80)	<.001
5	All covariates[5]	0.69 (0.59–0.82)	<.001

CI = confidence interval; BMI = body mass index.

n= 4075.

[°]Demographic factors; age, sex, race/ethnicity, marital status, education level, total wealth.

Health behaviors: smoking, exercise, alcohol frequency.

Biological factors: heart disease, hypertension, diabetes, BMI.

[a]All covariates: age, sex, race/ethnicity, marital status, education level, total wealth, smoking, exercise, alcohol frequency, heart disease, hypertension, diabetes, BMI.