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Longitudinal Associations of Self-reported Vision Impairment With Symptoms of Anxiety and Depression Among Older Adults in the United States

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IMPORTANCE Vision impairment (VI) and mental health conditions are highly prevalent among older adults and are major causes of morbidity and health care expenditures. However, there are few nationally representative data from the United States on the longitudinal association between VI and depressive symptoms, and no such data on anxiety symptoms.

OBJECTIVE To evaluate the longitudinal association and directionality of the association between self-reported VI and clinically significant symptoms of depression and anxiety in older US adults.

DESIGN, SETTING, AND PARTICIPANTS The National Health and Aging Trends Study, a nationally representative US survey administered annually from 2011 to 2016 to a cohort of Medicare beneficiaries 65 years and older. A total of 7584 participants with complete data on self-reported VI status at baseline were included. Data analysis was performed from February to October 2018.

MAIN OUTCOMES AND MEASURES Multivariable Cox proportional hazards regression models were used to evaluate the longitudinal associations between self-reported VI and depression and anxiety symptoms, adjusting for sociodemographics and medical comorbidities and accounting for the complex survey design.

RESULTS There were 7584 participants included in this study. At baseline, the survey-weighted proportion of participants who were women was 56.6%; 53.0% were aged 65 to 74 years, and 8.9% (95% CI, 8.1%-9.8%) had self-reported VI. Symptoms of depression were significantly more common in participants with self-reported VI than those without self-reported VI (31.2%; 95% CI, 27.0%-35.6% vs 12.9%; 95% CI, 11.9%-14.0%; $P < .001$), as were symptoms of anxiety (27.2%; 95% CI, 23.7%-30.9% vs 11.1%; 95% CI,10.2%-12.0%, $P < .001$). Baseline self-reported vision status was significantly associated with future report of depression (hazard ratio [HR], 1.33; 95% CI, 1.15-1.55) but not anxiety (HR, 1.06; 95% CI, 0.85-1.31) symptoms. Baseline depression (HR, 1.37; 95% CI, 1.08-1.75) and anxiety (HR, 1.55; 95% CI, 1.19-2.02) symptoms were both significantly associated with future reports of self-reported VI. In a sensitivity analysis excluding data provided by proxy respondents, statistical significance was unchanged and the effect size was similar for all statistical models.

CONCLUSIONS AND RELEVANCE Older US adults with self-reported VI were more likely to report symptoms of depression in the future, while those who had symptoms of either depression or anxiety were more likely to report VI in the future. This investigation suggests that there is a significant bidirectional and longitudinal association between self-reported VI and mental health symptoms. Furthermore, the study suggests the need for effective strategies to screen for and address depression and anxiety among older US adults with VI.

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Vision impairment (VI) and mental health conditions are 2 important drivers of the global burden of chronic disease in elderly persons.[1,2] Although these conditions are often treatable, they may also result in disability and decreased quality of life.[3,4] Prior studies have attempted to show an association between VI and mental health, and there is evidence that the prevalence of depression is higher in those with vision loss.[5]

Most prior studies on the association between VI and mental health conditions were cross-sectional,[6-9] focused on a narrow population,[10] or were conducted outside of the United States.[11-16] These studies have yielded mixed results. Two longitudinal studies examined the association between vision and depression among older adults in the United States.[9,16] However, these studies both reported the association of vision with changes in depression symptoms scores—an approach that may be less relevant to mental health and well-being than assessing the presence or absence of clinically significant symptoms.[17,18] In addition, a single study from France provided evidence for a bidirectional association between VI and depression.[13] Fewer studies have examined the association between vision loss and anxiety[14,15,19-22] and, to our knowledge, none has looked at this association longitudinally in a nationally representative sample of older US adults.

In the longitudinal study reported herein, we hypothesized that older adults with self-reported VI were more likely to develop clinically significant symptoms of depression and anxiety, and we also tested the reverse pathway leading from mental health symptoms to VI. A more complete understanding of the longitudinal associations between vision and mental health is important, as both conditions are projected to affect a growing number of older adults in the United States and globally. These data may help to shape public health approaches and the design of tailored interventions, such as innovative models of geriatrics care, to address co-occurring mental health and vision disorders in older US adults.

Key Points

Question What is the longitudinal association between self-reported vision impairment and depression and anxiety symptoms in older US adults?

Findings In this 5-year, nationally representative cohort study of 7584 Medicare beneficiaries 65 years and older, participants with self-reported vision impairment at baseline had an increased hazard of reporting future symptoms of depression, and those with depression or anxiety symptoms at baseline had an increased hazard of reporting vision impairment in the future.

Meaning The findings suggest a longitudinal and bidirectional association between vision impairment and mental health symptoms in older US adults.

Methods

Study Sample

We used data from round 1 (2011) through round 6 (2016) of the National Health and Aging Trends Study (NHATS) public-use data sets.[23] Data analysis was conducted from February to October 2018. NHATS is a nationally representative panel study of Medicare beneficiaries 65 years and older. A total of 7609 community-dwelling older adults or their proxies completed in-person interviews in round 1. Annual follow-up interviews were conducted with these participants regardless of residential status. After excluding participants with missing data on VI status at baseline (n = 25), the final analytical sample consisted of 7584 Medicare beneficiaries 65 years or older. If a respondent was unable to answer for themselves, a proxy respondent, who was most often a close family member, was surveyed. The method used to account for the effect of proxy responses is described below. The University of Michigan Institutional Review Board deemed this study exempt because it consisted of secondary analyses of publicly available data.

Measures

Vision Impairment

Vision status was determined by self-report. A participant was defined as having VI if they reported that they were blind or could not see across the street and/or read newspaper print, even with glasses, in a given round of the survey.

Depressive and Anxiety Symptoms

The Patient Health Questionnaire for Depression and Anxiety (PHQ-4) was administered annually to participants and proxy respondents. The PHQ-4 is a brief screening tool for depression and anxiety symptoms that consists of 2 discrete factors[18] combining a 2-item measure of depression (PHQ-2)[17] and 2-item measure of generalized anxiety disorder (GAD-2).[24] The PHQ-4 scores range from 0 to 12, with increasing PHQ-4 scores strongly associated with functional impairment, disability days, and health care use.[18]

The depression subscale of PHQ-4 measures how often a person experienced "little interest or pleasure in doing things" and "feeling down, depressed, or hopeless" over the past month. Responses to each question were recorded on a 4-point Likert scale (scored 0-3) with total scores ranging from 0 to 6 and a higher score indicating more depressive symptoms. We created a dichotomous indicator of clinically significant depressive symptoms using a cutoff score of 3, which has a sensitivity of 0.87 and a specificity of 0.78 for major depressive disorder, and has a sensitivity of 0.79 and specificity of 0.86 for any type of depressive disorder.[17]

The anxiety subscale of PHQ-4 measures how often participants "felt nervous, anxious, or on edge" and were "unable to stop or control worrying" over the past month on a 4-point Likert scale (scored 0-3) with total scores ranging from 0 to 6 and a higher score indicating more anxiety symptoms. We created a dichotomous indicator of clinically significant anxiety symptoms using a cutoff score of 3, which has a sensitivity of 0.76 and specificity of 0.81 for generalized anxiety disorder,[25] and also has good operating characteristics for detecting panic disorder, social anxiety, and posttraumatic stress disorder.[24]

Covariates

Sociodemographic characteristics included age, sex, race/ethnicity, and highest educational level. A dichotomous indicator of Medicaid-Medicare dual eligibility was also included as an indicator of financial well-being. We used the validated NHATS 3-level dementia classification to account for cognitive impairment.[26] This classification system categorizes a respondent as having probable cognitive impairment (report of physician diagnosis of dementia or Alzheimer disease or scores ≤1.5 SDs below the mean on ≥2 cognitive tests of memory, orientation, and executive function), possible cognitive impairment (a score ≤1.5 SDs below the mean on 1 cognitive test), or no cognitive impairment. We also included a count of the number of self-reported chronic medical conditions, including hypertension, diabetes, heart disease or myocardial infarction, arthritis, osteoporosis, lung disease, cancer, and stroke. Survey design factors included a dichotomous indicator of proxy respondent.

Statistical Analysis

Baseline sample characteristics were stratified by VI status and bivariate comparisons were performed using Pearson χ^2 tests for categorical variables and 2-tailed, unpaired *t* tests for continuous variables. Multivariable Cox proportional hazards regression models were used to estimate the longitudinal association between vision status and mental health. In a first set of models, baseline self-reported vision status was used to estimate the hazard of future clinically significant depression and anxiety symptoms. In a second set of models, baseline depression and anxiety symptoms were used to estimate the hazard of future self-reported VI. Respondents with the outcome of interest at baseline were classified as prevalent cases and were excluded from the corresponding analysis. Participants who never reported an event before the end of the study, loss to follow-up, or death were censored at the last round when they were interviewed. Models were adjusted for time-invariant covariates, including sex, race/ethnicity, and highest educational level, as well as time-varying covariates, including age, dementia status, number of chronic medical conditions, Medicaid eligibility, and proxy respondent. The proportional hazards assumption was evaluated for primary variables of interest. In addition, the Kaplan-Meier estimator[27] was used to estimate the unadjusted survival function for each outcome across survey rounds with respondents stratified by baseline predictor variable status.

We included data from proxy respondents because excluding these observations would have induced selection bias[28] and previous work has shown that statistical adjustment for respondent type can reduce the bias associated with proxy responses.[28,29] However, to evaluate fully whether there was any change in our models associated with data from proxies, we also reran each of the Cox proportional hazards regression models after pairwise deletion of all data provided by proxies.

Statistical analyses were conducted using Stata, version 15.1 (StataCorp). All models accounted for the complex design of NHATS using baseline survey weights and wave-specific weights based on the procedure described by Heeringa et al.[30] For all analyses, $P \leq .05$ was considered statistically significant.

Results

There were 7584 participants included in this study. At baseline, the survey-weighted proportion of participants who were women was 56.6%; 53.0% were aged 65 to 74 years, and 8.9% (95% CI, 8.1%-9.8%) had self-reported VI. Baseline characteristics of the study sample are presented in **Table 1**. Compared with those without self-reported VI at baseline, respondents with VI were more likely to be older, women, nonwhite, less educated, eligible for Medicaid, have dementia and more medical comorbidities, and require a proxy respondent ($P < .001$ for all comparisons).

The weighted prevalence of depression and anxiety symptoms was more than twice as high among participants with self-reported VI compared with those who did not report VI. Among those with self-reported VI, 31.2% (95% CI, 27.0%-35.6%) reported depressive symptoms compared with 12.9% (95% CI, 11.9%-14.0%) ($P < .001$) of those without self-reported VI. The weighted prevalence of anxiety symptoms was 27.2% (95% CI, 23.7%-30.9%) in participants with self-reported VI, compared with 11.1% (95% CI, 10.2%-12.0%) in those without self-reported VI ($P < .001$). When combined, more than 2 in 5 (41.3%; 95% CI, 36.8%-45.9%) participants with self-reported VI had either clinically significant depression or anxiety symptoms compared with less than 1 in 5 (18.6%; 95% CI, 17.3%-20.0%) participants without self-reported VI.

Figure 1 presents Kaplan-Meier curves illustrating the cumulative probability of not reporting psychiatric symptoms over the study period for participants with and without self-reported VI at baseline. The cumulative proportion that did not have depressive symptoms was 0.70 (95% CI, 0.69-0.72) for participants without self-reported VI and 0.50 (95% CI, 0.44-0.56) for those with self-reported VI. The cumulative proportion that did not have anxiety symptoms was 0.78 (95% CI, 0.76-0.79) for participants without self-reported VI and 0.66 (95% CI, 0.61-0.72) for those with self-reported VI. **Figure 2** presents Kaplan-Meier curves for the cumulative probability of not self-reporting VI during the study period for those with and without mental health symptoms at baseline. The cumulative proportion that did not have self-reported VI was 0.82 (95% CI, 0.81-0.83) for participants without depressive symptoms and 0.68 (95% CI, 0.64-0.72) for those with depressive symptoms. The cumulative proportion that did not have self-reported VI was 0.82 (95% CI, 0.81-0.83) for participants without anxiety symptoms and 0.69 (95% CI, 0.64-0.73) for those with anxiety symptoms. **Table 2** and **Table 3** contain the results of multivariable Cox proportional hazards regression models. Respondents who self-reported VI at baseline had a significantly increased hazard of future clinically significant symptoms of depression (adjusted hazard ratio [aHR], 1.33; 95% CI, 1.15-1.55) but not anxiety (aHR, 1.06; 95% CI, 0.85-1.31). Those who reported symptoms of depression (aHR, 1.37; 95% CI, 1.08-1.75) and anxiety (aHR, 1.55; 95% CI, 1.19-2.02) at baseline had a significantly increased hazard of reporting VI in the future.

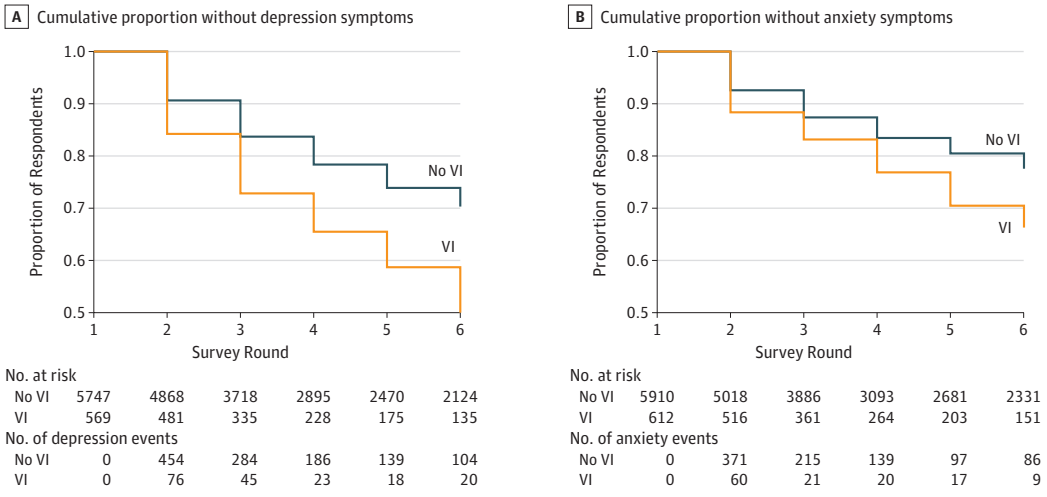
We reestimated each of the Cox proportional hazards regression models after excluding all data provided by proxy respondents. In these models, the hazard of future depression

Table 1. Weighted Sample Characteristics by Self-reported Vision Impairment Status at Baseline

Characteristic	No Self-reported VI (95% CI)	Self-reported VI (95% CI)	*P* Value
No.	6744	840	
Age groups, %, y			
65-69	28.7 (27.7-29.8)	20.7 (17.6-24.1)	<.001
70-74	26.0 (25.1-26.9)	14.6 (11.3-18.7)	
75-79	19.3 (18.5-20.1)	17.0 (14.0-20.5)	
80-84	14.4 (13.7-15.2)	16.8 (14.1-19.9)	
85-89	8.3 (7.6-8.9)	18.0 (15.4-20.9)	
≥90	3.3 (2.9-3.8)	13.0 (11.1-15.2)	
Sex, %			
Men	44.3 (42.8-45.9)	34.5 (30.1-38.2)	<.001
Women	55.7 (54.1-57.2)	65.5 (61.8-69.1)	
Race/ethnicity, %			
White, non-Hispanic	81.3 (79.6-82.9)	72.1 (67.2-76.5)	<.001
Black, non-Hispanic	7.9 (7.1-8.7)	10.9 (9.3-12.7)	
Hispanic	6.2 (5.3-7.3)	12.2 (8.5-17.1)	
Other	4.6 (3.7-5.8)	4.9 (3.3-7.4)	
Educational level, %			
No degree	20.2 (18.5-21.9)	38.5 (33.9-43.2)	<.001
High school	27.6 (26.2-29.0)	27.4 (24.0-30.1)	
Some college	21.8 (20.5-23.1)	18.1 (14.6-22.2)	
College degree	30.5 (28.2-33.0)	16.1 (13.0-19.8)	
Dementia status, %			
None	81.7 (80.0-83.2)	53.6 (48.7-58.5)	<.001
Possible	10.58 (9.4-11.9)	14.7 (11.9-18.0)	
Probable	7.8 (7.0-8.6)	31.7 (27.9-35.7)	
Medicare-Medicaid enrollees, %	10.7 (9.5-12.0)	25.0 (21.0-29.3)	<.001
Chronic disease count, mean	2.32 (2.28-2.36)	3.03 (2.88-3.17)	<.001
Proxy respondent, %	4.0 (3.5-4.7)	22.3 (18.7-26.3)	<.001

Abbreviation: VI, vision impairment.

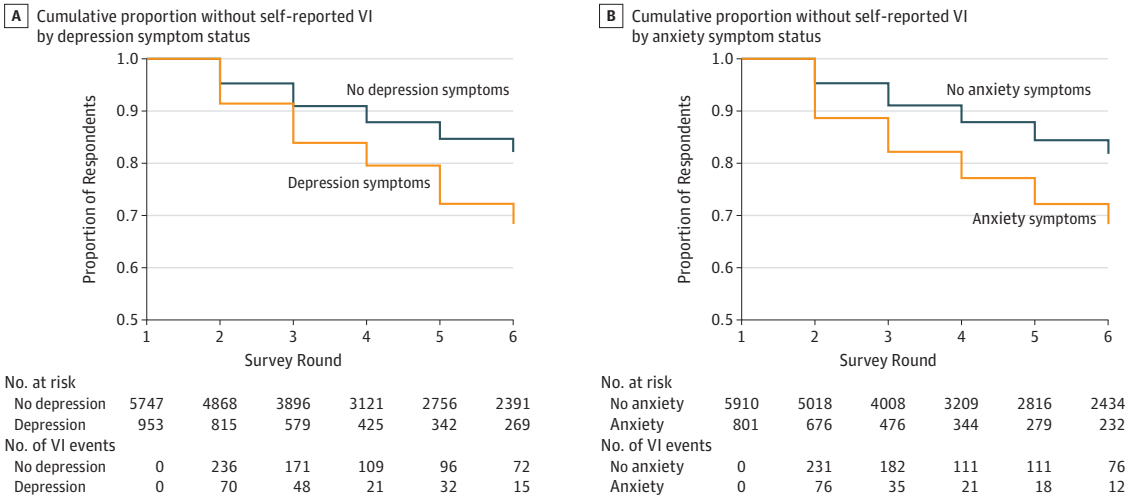
Figure 1. Cumulative Probability of Not Reporting Mental Health Symptoms During the Follow-up Period



The cumulative probability of not reporting clinically significant depression (A) and anxiety (B) symptoms during 5 years of follow-up among participants with and without self-reported vision impairment (VI) at baseline. Respondents with the outcome of interest at baseline are excluded.

(HR, 1.40; 95% CI, 1.18-1.66) and anxiety (HR, 1.15; 95% CI, 0.89-1.49) symptoms in participants with baseline self-reported VI, and the hazard of future self-reported VI in those with baseline depression (HR, 1.48; 95% CI, 1.12-1.96) and anxiety (HR, 1.67; 95% CI, 1.23-2.28) symptoms was similar to the models that included proxy data.

Figure 2. Cumulative Probability of Not Reporting Vision Impairment (VI) During the Follow-up Period



No. at risk						
No depression	5747	4868	3896	3121	2756	2391
Depression	953	815	579	425	342	269
No. of VI events						
No depression	0	236	171	109	96	72
Depression	0	70	48	21	32	15

No. at risk						
No anxiety	5910	5018	4008	3209	2816	2434
Anxiety	801	676	476	344	279	232
No. of VI events						
No anxiety	0	231	182	111	111	76
Anxiety	0	76	35	21	18	12

The cumulative probability of not self-reporting VI during 5 years of follow-up among participants with and without clinically significant symptoms of depression (A) and anxiety (B) at baseline. Respondents with self-reported VI at baseline are excluded.

Discussion

We found a significant longitudinal association between VI and symptoms of depression and anxiety. This association builds on findings from previous studies that were cross-sectional,[5-8] focused on a narrower population,[9] or were conducted outside of the United States.[10-15,22] Specifically, this study demonstrated that the association between self-reported VI and depression symptoms is bidirectional, and that anxiety symptoms may precede self-reported VI but that the reverse is not true. To our knowledge, this study is the first to investigate a longitudinal association between VI and anxiety symptoms in older US adults, and one of few to do so for depressive symptoms.[9,16] Accordingly, this study contributes to the understanding of the association between VI and mental health among older adults.

Previous investigations from other settings have yielded mixed results on the association between VI and anxiety. Studies from the United Kingdom, France, and Norway did not find evidence of an association between VI and anxiety.[19,22,31] However, each of these studies measured visual acuity and it is possible that self-reported VI may be a better indicator of the likelihood of mental health symptoms. In fact, Zhang et al[5] reported that severe depressive symptoms were significantly associated with self-reported VI, but not with visual acuity. Similarly, Yip et al[32] found that self-reported VI was more strongly associated than visual acuity with the likelihood of falls in older adults. These studies suggest that self-reported vision status may represent a unique and valuable construct for identifying individuals at risk for certain consequences of VI.

In a recent analysis using data from the 2011 round of NHATS,[8] researchers demonstrated a cross-sectional association between self-reported VI and mental health symptoms. They also showed that older adults with self-reported VI at baseline were more likely to have both persistent and new onset depression and anxiety symptoms at the 1-year follow-up interview, though they did not assess participants over more than 1 year and did not adjust for confounders in this analysis. The magnitude of the cross-sectional associations in their investigation (depressive symptoms: odds ratio, 1.52; anxiety symptoms: odds ratio, 1.51) were greater than the effect sizes in the present study for self-reported VI as a predictor but were similar to the effect sizes for the reverse pathway. Our research builds on previous studies like this one by estimating the hazard of future mental health symptoms over 5 years as a function of a respondent's vision status at baseline. We found a significant bidirectional association between self-reported VI and depression symptoms; although anxiety symptoms preceded self-reported VI, the reverse was not true. Future research should be done to confirm these findings in other large cohorts of older adults in the United States, as well as to analyze the longitudinal association between mental health and objective measures of visual function.

Carrière et al[13] found evidence for a bidirectional association between VI and depression in a French cohort, but no association with anxiety symptoms was identified in the same cohort.[22] To our knowledge, only 2 other large cohort studies have examined the longitudinal association between VI and depressive symptoms in a US population. Sloan et al[16] conducted a study using nationally representative panel survey data from adults 72 years and older. They found that there was a small but significant longitudinal association between decline in self-reported vision status and depressive symptoms. However, this study modeled depression symptom scores as a linear function rather than examining the presence or absence of clinically significant symptoms, and the investigators did not examine the reverse association of depressive symptoms with VI. In another investigation, Zheng et al[9] used data from the Salisbury Eye Evaluation study to determine the association between best-corrected visual acuity and

Table 2. Cox Proportional Hazards Regression Results Modeling the Development of Depression and Anxiety Symptoms Over 5 Years as a Function of Baseline Self-reported Vision Status[a]

Predictor	Mental Health Outcomes, aHR (95% CI)	
	Depression Symptoms[b]	Anxiety Symptoms[c]
No vision impairment	1 [Reference]	1 [Reference]
Vision impairment	1.33 (1.15-1.55)	1.06 (0.85-1.31)
Age, y		
65-69	1 [Reference]	1 [Reference]
70-74	0.98 (0.75-1.29)	1.16 (0.80-1.70)
75-79	1.19 (0.93-1.52)	1.25 (0.86-1.83)
80-84	1.29 (1.00-1.67)	1.18 (0.83-1.67)
85-89	1.18 (0.90-1.54)	1.41 (0.98-2.04)
≥90	1.30 (0.97-1.73)	1.26 (0.87-1.80)
Sex		
Men	1.09 (0.96-1.24)	0.75 (0.63-0.90)
Women	1 [Reference]	1 [Reference]
Race/ethnicity		
White	1 [Reference]	1 [Reference]
Black	1.30 (1.12-1.52)	1.06 (0.88-1.31)
Hispanic	1.24 (0.96-1.60)	1.46 (1.04-2.04)
Other	1.34 (1.01-1.78)	1.00 (0.67-1.48)
Educational level		
No degree	1 [Reference]	1 [Reference]
High school degree	0.89 (0.73-1.08)	0.90 (0.75-1.08)
Some college	0.75 (0.61-0.91)	0.85 (0.69-1.05)
College degree	0.58 (0.47-0.71)	0.61 (0.49-0.77)
Medicare-Medicaid enrollees	1.59 (1.32-1.92)	1.43 (1.16-1.77)
Dementia status		
None	1 [Reference]	1 [Reference]
Possible	1.34 (1.14-1.59)	1.51 (1.18-1.94)
Probable	1.80 (1.54-2.10)	2.25 (1.82-2.79)
Chronic disease count	1.24 (1.18-1.29)	1.21 (1.14-1.28)
Proxy respondent	1.78 (1.48-2.15)	1.39 (1.09-1.77)

Abbreviation: aHR, adjusted hazard ratio.

[a] Adjusted for age, sex, race/ethnicity, highest educational level, dementia status, number of chronic medical conditions, dual Medicaid-Medicare eligibility, and proxy respondent.

[b] Respondents with prevalent depression symptoms at baseline were excluded.

[c] Respondents with prevalent anxiety symptoms at baseline were excluded.

Table 3. Cox Proportional Hazards Regression Results Modeling the Development of Self-reported Vision Impairment Over 5 Years as a Function of Baseline Mental Health Symptoms[a]

Predictor	Vision Impairment Outcomes, aHR (95% CI)[b]	
	Depression Symptoms Model	Anxiety Symptoms Model
Mental health symptoms		
No symptoms	1 [Reference]	1 [Reference]
Symptoms	1.37 (1.08-1.75)	1.55 (1.19-2.02)
Age, y		
65-69	1 [Reference]	1 [Reference]
70-74	1.13 (0.72-1.78)	1.12 (0.71-1.77)
75-79	1.40 (0.94-2.10)	1.38 (0.93-2.06)
80-84	1.73 (1.18-2.52)	1.71 (1.17-2.51)
85-89	1.98 (1.38-2.84)	1.99 (1.41-2.79)
≥90	2.32 (1.59-3.37)	2.26 (1.55-3.28)
Sex		
Men	0.96 (0.83-1.12)	0.96 (0.82-1.12)
Women	1 [Reference]	1 [Reference]
Race/ethnicity		
White	1 [Reference]	1 [Reference]
Black	1.38 (1.18-1.62)	1.41 (1.19-1.66)
Hispanic	2.00 (1.56-2.54)	1.99 (1.56-2.54)
Other	1.72 (1.12-2.62)	1.77 (1.16-2.68)
Educational level		
No degree	1 [Reference]	1 [Reference]
High school degree	0.76 (0.59-0.97)	0.77 (0.60-0.98)
Some college	0.88 (0.70-1.10)	0.89 (0.71-1.11)
College degree	0.66 (0.52-0.85)	0.67 (0.52-0.85)
Medicare-Medicaid enrollees	1.17 (0.96-1.43)	1.15 (0.94-1.41)
Dementia status		
None	1 [Reference]	1 [Reference]
Possible	1.27 (1.02-1.59)	1.29 (1.02-1.63)
Probable	1.97 (1.61-2.42)	1.92 (1.54-2.39)
Chronic disease count	1.13 (1.08-1.18)	1.12 (1.07-1.17)
Proxy respondent	2.55 (2.05-3.18)	2.65 (2.15-3.27)

Abbreviation: aHR, adjusted hazard ratio.

[a] Adjusted for age, sex, race/ethnicity, highest educational level, dementia status, number of chronic medical conditions, dual Medicaid-Medicare eligibility, and proxy respondent.

[b] Respondents with prevalent self-reported vision impairment at baseline were excluded.

severe depression symptom scores.[9] In their study, higher severe depression symptoms scores at baseline were associated with worsening visual acuity over time, but the reverse was not true. Variations in study design could account for the different results between this study and ours. The study by Zheng et al[9] used data collected from 1993 to 2003 in a Maryland-based cohort, assessed objective visual acuity, and examined changes in ordinal severe depression symptom scores. In contrast, our study used nationally representative data collected from 2011 to 2016, relied on self-report of VI, and assessed the presence or absence of clinically significant depression and anxiety symptoms. We believe that our approach to modeling mental health symptoms may be more relevant to well-being and mental health because we used a validated threshold to determine the presence or absence of symptoms that have a high sensitivity and specificity for clinical disorders.[17]

Despite research on the topic, it is still not fully clear why individuals with self-reported VI appear to be more likely to have emotional and behavioral symptoms or why emotional and behavioral symptoms are associated with increases in the risk of self-reported VI. Some have hypothesized that the effect of VI on mental health is due to difficulty adapting to changes in daily activities and future goals, although there is also evidence that this effect may be mitigated by strong social support.[3] Individuals with mental health symptoms at baseline could be at higher risk for developing vision problems if they are less likely to seek eye care or are more likely

to have other risk factors for VI (eg, poor diet, medical comorbidities).[33] In addition, some individuals may be aware that they have strong risk factors for vision loss (eg, diabetes, family history) or have been diagnosed with a progressive ocular condition (eg, age-related macular degeneration, glaucoma), which in either case may cause baseline depression or anxiety symptoms before causing VI years later. It is also important to recognize that some individuals with mental health conditions will become visually impaired independent of their mental health, and vice versa.

In a prior study, researchers found that the association between poor vision and depressive symptoms could be attenuated through an integrated vision rehabilitation and mental health program.[34] This finding suggests that the association between these conditions may be modifiable.[35] Consequently, eye care clinicians should be aware of the associations between vision and mental health and provide referrals to address the mental health needs of their patients when appropriate. Future studies are needed to clarify more fully the nature of any causal association between VI, depression, and anxiety. However, the present study, with its longitudinal perspective, contributes to this effort.

Strengths and Limitations

There were a number of strengths to this study. We used data from a nationally representative panel study that provided annual measures of self-reported VI and mental health symptoms in older adults. Our predictors and outcomes were measured using the same testing protocol each year, which provided internal measurement consistency. The measures of mental health symptoms in NHATS have been validated and are clinically relevant, with a high sensitivity and specificity for detecting clinical depression and anxiety disorders.[17,18] In addition, this study provides what we believe to be novel data on the longitudinal association between self-reported VI and anxiety in older US adults.

Our study also had several limitations. Data were based on self-report, which can be subject to recall and social desirability biases. Although self-reported vision status has been widely used in previous population-based studies,[36-39] there could be a confounding effect of personality type on the association between self-reported VI and depression.[40] Therefore, future work should investigate the associations between mental health, self-reported VI, and objectively measured visual function (eg, visual acuity, visual fields, contrast sensitivity) in this population. In addition, the questions used to assess VI in NHATS relate to central vision and therefore do not account for the effect of peripheral field loss; this limitation could have resulted in misclassification that would have likely biased results toward the null hypothesis. Although the PHQ-2 and GAD-2 are validated screening tools, they do not provide a clinical diagnosis; therefore, we were not able to determine the association between self-reported VI and actual depression and anxiety disorders. In addition, the groups with and without VI were significantly different at baseline with respect to demographic, socioeconomic, and clinical factors; this finding was anticipated based on existing literature[41-43] and we adjusted for these factors in our statistical models.

Conclusions

This study provides evidence for a longitudinal association between VI and clinically significant symptoms of mental illness. Additional investigations are needed to confirm this finding and establish whether a causal association exists. Given the results of this nationally representative study, eye care clinicians may consider incorporating mental health screening into their assessment of older patients with vision loss, while primary care clinicians could consider emphasizing vision screening for patients with mental health symptoms. Moreover, clinicians and researchers should continue developing and testing strategies, including innovative models of geriatrics care, to identify and treat the substantial burden of comorbid VI and mental health symptoms in older adults.

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