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# Self-Reported Vision Impairment and Psychological Distress in U.S. Adults

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## Abstract

**Purpose:** Examine the relationship between vision impairment and psychological distress in adults ≥18 years.

**Methods:** Using the 2016–2017 cross-sectional, U.S. National Health Interview Survey, we analyzed self-reported data (n=57,644) on: Kessler psychological distress scores; general vision impairment (GVI), defined as difficulty seeing even when wearing glasses or contacts; and visual function impairment (VFI), measured using six visual function questions. Multinomial logistic regression was used to estimate adjusted odds ratios (aOR) for mild/moderate and serious psychological distress, by GVI and VFI status, and identify predictors of psychological distress among those with GVI or VFI.

**Results:** Among adults, 10.6% (95% CI: 10.2, 11.0) had GVI; 11.6% (CI: 11.1, 12.0) had VFI. One in four adults with GVI had psychological distress (14.9% [CI: 13.8, 16.0] reported mild/moderate and 11.2% [CI: 10.2, 12.3] reported serious). Individuals with GVI, versus those without, had higher odds of mild/moderate (aOR=2.24; CI: 2.00, 2.52) and serious (aOR=3.41; CI: 2.96, 3.93) psychological distress; VFI had similar findings. Among adults with GVI, odds of serious psychological distress were higher for those aged 18–39 (aOR=4.46; CI: 2.89, 6.90) or 40–64 (aOR=6.09; CI: 4.33, 8.57) versus ≥65 years; smokers (aOR=2.45; CI: 1.88, 3.18) versus

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non-smokers; physically inactive (aOR=1.61; CI: 1.22, 2.11) versus active; and with arthritis (aOR=2.18; CI: 1.66, 2.87) or chronic obstructive pulmonary disease (aOR=1.65; CI: 1.15, 2.37) versus without.

**Conclusion:** Adults with self-reported vision impairment had higher odds of psychological distress. These findings may inform screening interventions to address psychological distress, particularly among younger working-age adults vision impairment.

### Keywords

vision impairment; blindness; psychological distress; depression; anxiety

## INTRODUCTION

Vision impairment (VI) affects more than 4 million people aged ≥40 years in the United States.[1] VI can have a profound deleterious impact on physical health, quality of life, and mental health. In adults, it is associated with an increased risk of falls, injuries, decreased functional capacity, premature mortality, and poor health-related quality of life.[2-7] It is also associated with adverse psychosocial outcomes like loneliness and social isolation.[8-10] Adults with VI have an increased risk of depression.[11-20] Fewer studies have examined the relationship between VI and anxiety, but a consistent, positive relationship has been found.[13, 15, 16, 19-21] In a prior investigation of adults aged ≥65 years, the prevalence of moderate to severe psychological distress was 24.4% in those who were blind and 21.2% in those with VI, and both groups had significantly increased odds of psychological distress compared to adults with no VI.[22] Mediators of the relationship between VI and adverse mental health outcomes may include: loss of functional capacity, greater activity limitations, reduced participation in pleasurable activities, financial strain, lower self-efficacy, and reduced social integration.[14, 17, 23-25]

Many studies examining this relationship were conducted in older adults,[13-20, 22, 26, 27] therefore, a primary aim of the present study is to examine this relationship across a wide range of adult ages. Furthermore, much of the research has focused on depression or depressive symptoms as mental health sequelae of VI,[11, 12, 14, 17, 18] whereas the present study explores whether VI is also associated with psychological distress. Additionally, less is known about correlates of depression, anxiety, and psychological distress among individuals with VI. Specifically, to our knowledge, the influence of other comorbidities on the risk of adverse mental health outcomes among individuals with VI is not well understood. Individuals with VI have an increased risk of chronic diseases such as hypertension, heart disease, arthritis, asthma, chronic obstructive pulmonary disease (COPD), and diabetes.[18] However, little is known about whether these chronic conditions are associated with poor mental health outcomes among those with VI. A better understanding of the relationship between VI and mental health is central to designing effective interventions to improve quality of life for these individuals.

Here, we examine the relationship between VI and psychological distress in a national sample of adults aged ≥18 years. The objective of this study was to describe this association

across a broad range of adult ages, and to identify demographic, socioeconomic, behavioral, and health characteristics that predict psychological distress among adults with VI.

## MATERIALS AND METHODS

We analyzed publicly available, de-identified data for US adults (≥18 years) from the sample adult core questionnaire and a supplement sponsored by the National Eye Institute in the 2016 and 2017 National Health Interview Surveys (NHIS). The NHIS is an annual, cross-sectional, in-person household interview survey of the US noninstitutionalized civilian population.[28, 29] This study adheres to the guidelines of the Declaration of Helsinki. All respondents provided oral consent before participation, and the survey was approved by the Research Ethics Review Board of the Centers for Disease Control and Prevention's National Center for Health Statistics and the U.S. Office of Management and Budget. The survey uses a multi-stage complex probability sampling strategy to select households and individuals. Weighted estimates represent the US adult civilian population. The sample adult core contained 33,028 respondents in 2016 and 26,742 respondents in 2017. Due to missing data for VI status (n=19) and psychological distress (n=2,114), the final analytic sample contained 57,644 adults. The sample adult component unconditional final response rates were 54.3% in 2016 and 53.0% in 2017.[28, 29]

### Outcome

Our outcome was the respondent's psychological distress score, measured using the Kessler Psychological Distress Scale (K6). The K6 is a widely used six-item scale that measures nonspecific psychological distress. It is used to screen for serious mental illness, depression, anxiety, and other mood disorders.[30, 31] It was originally developed for use in the NHIS but has been validated and used in other surveys and settings.[30-37] The six items are measured by asking, "during the past 30 days, how often did you feel: 1) so sad that nothing could cheer you up, 2) nervous, 3) restless or fidgety, 4) hopeless, 5) that everything was an effort, and 6) worthless?" Responses included: "none of the time" (0 points), "a little of the time" (1 point), "some of the time" (2 points), "most of the time" (3 points), and "all of the time" (4 points). Consistent with prior studies, points were summed across the six questions, resulting in K6 scores from 0–24, and psychological distress was categorized as: no/low (0–7 points), mild/moderate (8–12 points), and serious (13–24 points).[30, 33-35, 38-40]

### Exposure

Our exposure was self-reported VI defined as: general vision impairment (GVI) and visual function impairment (VFI). GVI was characterized as an affirmative response to the question: "Do you have trouble seeing, even when wearing glasses or contact lenses?". Six types of VFI were defined using questions that asked "Even when wearing glasses or contact lenses, because of your eyesight, how difficult is it for you to: 1) read ordinary print in newspapers; 2) do work or hobbies that require you to see well up close such as cooking, sewing, fixing things around the house or using hand tools; 3) go down steps, stairs, or curbs in dim light or at night; 4) drive during daytime in familiar places; 5) notice objects off to the side while you are walking along; 6) find something on a crowded shelf." Respondents who answered "somewhat difficult," "very difficult," and "can't do at

all because of eyesight" on a five-point Likert scale were categorized as having VFI for each of these functions. Respondents who reported difficulties for ≥1 of these functions were categorized, using a composite indicator, as having any visual function impairment (hereafter abbreviated as VFI). GVI and VFI are measures of vision impairment that provide complementary information for this analysis. The one question measuring GVI is an overall self-assessment of one's experience of disability due to vision impairment, whereas the six questions that measure VFI are more specific measures of an individual's experience with limitations in activities of daily living (i.e. reading, driving, or going down steps). These two ways of self-reporting one's experience of vision impairment could have different implications for a person's experience of psychological distress.

## Covariates and Predictor Variables

Demographic and socioeconomic variables included age in years (18–39, 40–64, ≥65), sex (male, female), race/ethnicity (white non-Hispanic, black non-Hispanic, Hispanic, other), education (<high school, high school/general education development [GED], >high school), marital status (married/domestic partnership, not married), employment status (employed, not employed), family income-to-poverty threshold ratio (<1, 1 to <2, ≥2), and health insurance status (public, private, both, none). Behavioral characteristics included: 1) current smoker, defined as smoking more than 100 cigarettes in their lifetime and now smoking every day or some days, and 2) physically inactive, defined as performing 0 minutes per week of light, moderate, or vigorous leisure-time physical activities. Self-reported health characteristics included: body mass index (BMI: weight [kg] / height [m]$^2$) categorized as underweight (BMI<18.5 kg/m$^2$), normal weight (BMI 18.5–24.9 kg/m$^2$), overweight (BMI 25.0–29.9 kg/m$^2$), and obesity (BMI≥30 kg/m$^2$), and the presence or absence of select chronic diseases (diabetes, hypertension, arthritis, coronary heart disease, COPD, myocardial infarction, and stroke).

## Statistical Analysis

Descriptive statistics are presented as weighted percentages and 95% confidence intervals (CI). We used multinomial logistic regression to estimate adjusted odds ratios (aOR) for mild/moderate and serious psychological distress (reference: no/low), with models run separately for GVI, each of the six forms of VFI, and the composite indicator of VFI. Each of these regressions were run using three models that controlled for different covariates: Model I (age, sex, race/ethnicity), Model II (Model I covariates plus education, marital status, employment, income-to-poverty ratio, and health insurance), and Model III (Model II covariates plus smoking, physical inactivity, BMI, and all seven chronic disease conditions). Additionally, we used multinomial logistic regression to identify demographic, socioeconomic, and health characteristics that are associated with increased odds for mild/moderate and serious psychological distress among adults with GVI and VFI. Using multiple imputation with chained equations, we imputed missing values for physical activity (2.4% of the data) and BMI (2.7%) and used the NHIS imputed income files for the income-to-poverty ratio (4.6%). Analyses were performed using STATA (version 16.0) and SUDAAN (version 9.4) and accounted for the complex survey design variables (strata, primary sampling units, and sampling weights).

## RESULTS

Overall, 10.6% (95% CI: 10.2, 11.0) of adults reported GVI (eTable 1). Prevalence of the six types of VFI ranged from 1.5% (CI: 1.4, 1.6) of adults reporting difficulty driving in daytime to 7.0% (CI: 6.7, 7.4) reporting difficulty reading newsprint; 11.6% (CI: 11.1, 12.0) had any VFI. Prevalence estimates for psychological distress were: 89.2% (CI: 88.8, 89.6) with no/low, 7.3% (CI: 7.0, 7.6) with mild/moderate, and 3.5% (CI: 3.3, 3.7) with serious psychological distress.

The crude prevalence of mild/moderate and serious psychological distress was 14.9% (CI: 13.8, 16.0) and 11.2% (CI: 10.2, 12.3), respectively, among individuals with GVI, compared to 6.4% (CI: 6.1, 6.7) and 2.5% (CI: 2.4, 2.7), respectively, among individuals without GVI (Table 1). The crude prevalence of mild/moderate and serious psychological distress was 14.6% (CI: 13.6, 15.7) and 10.7% (CI: 9.7, 11.7), respectively, among individuals with VFI, compared to 6.2% (CI: 5.9, 6.5) and 2.4% (CI: 2.2, 2.6), respectively, among individuals without VFI. Across the six types of VFI, the prevalence of psychological distress was lowest among those reporting difficulty reading newsprint (mild/moderate psychological distress: 13.7% [CI: 12.5, 15.1]; serious psychological distress: 11.9% [CI: 10.6, 13.2]) and highest among those reporting difficulty finding objects on a crowded shelf (mild/moderate psychological distress: 17.2% [CI: 14.9, 19.8]; serious psychological distress: 18.1% [CI: 15.6, 20.8]). Prevalence of serious psychological distress increased as the number of VFIs increased (Figure 1).

Table 2 presents the results for the separate multinomial logistic regression models used to estimate aOR for mild/moderate and serious psychological distress (reference: no/low) by GVI status, each of the six forms of VFI, and the composite indicator of VFI. In the fully-adjusted model, compared to those without GVI, individuals with GVI had increased odds of mild/moderate (aOR=2.24; 95% CI: 2.00, 2.52) and serious (aOR=3.41; 95% CI: 2.96, 3.93) psychological distress. Similarly, compared to those without VFI, individuals with VFI had increased odds of mild/moderate (aOR=2.37; 95% CI: 2.12, 2.65) and serious (aOR=3.18; 95% CI: 2.72, 3.72) psychological distress. Results of running the fully-adjusted models separately for each of the three age groups are shown in eTable 2.

In the model that examined sociodemographic correlates, among those with GVI, odds of serious psychological distress were higher among individuals who were: aged 18–39 years (aOR=4.46; CI: 2.89, 6.90) and 40–64 years (aOR=6.09; CI: 4.33, 8.57) versus ≥65 years; female (aOR=1.56; CI: 1.23, 1.99) versus male; non-Hispanic white (aOR=2.11; CI: 1.52, 2.93) or other race/ethnicities (aOR=2.00; CI: 1.21, 3.30) versus non-Hispanic black; educated at <high school level (aOR=1.44; CI: 1.04, 1.99) versus >high school level; unmarried (aOR=1.55; CI: 1.20, 2.01) versus married; unemployed (aOR=2.32; CI: 1.74, 3.09) versus employed; at an income-to-poverty threshold ratio <1 (aOR=1.97; CI: 1.41, 2.74) or 1 to <2 (aOR=1.53; CI: 1.13, 2.08) versus ≥2; and uninsured (aOR=1.56; CI: 1.02, 2.36), publicly insured (aOR=2.08; CI: 1.41, 3.06), or both publicly and privately insured (aOR=2.19; CI: 1.40, 3.43) versus privately insured (Table 3). In the model that examined health characteristics among adults with GVI, odds of serious psychological distress were higher among those who: were current smokers (aOR=2.45; CI: 1.88, 3.18)

versus not current smokers; were physically inactive (aOR=1.61; CI: 1.22, 2.11) versus physically active; and reported comorbid arthritis (aOR=2.18; CI: 1.66, 2.87) or COPD (aOR=1.65; CI: 1.15, 2.37) versus those without these comorbidities (Table 4). Many of these characteristics were also significant correlates of mild/moderate psychological distress and were significant in models that examined correlates among adults with VFI. Among those with VFI, comorbid hypertension and stroke were also significant predictors. In a sensitivity analysis, we compared results of the models using multiple imputed datasets (Tables 2-4) to results based on complete case analysis (eTables 3-5) and results were similar.

## DISCUSSION

We found that one in four adults aged ≥18 years with GVI or VFI reported mild/moderate or severe psychological distress; among those without GVI or VFI, this figure was less than one in ten. In models that adjusted for demographic, socioeconomic, and health characteristics, adults with GVI or VFI had significantly increased odds of psychological distress. An important finding was that among adults with GVI or VFI, those aged 18–39 years and 40–64 years had significantly higher odds of psychological distress compared to those ≥65 years. Younger individuals with VI, who are in their productive working years, may have not yet developed effective coping, adaptation, or self-management strategies to improve their functionality pertaining to activities of daily living. Our results are consistent with a previous investigation that showed adults with self-reported VI have increased psychological distress.[22] The present study builds on prior investigations by considering associations of GVI and VFI with psychological distress across a wider age range than many previous studies, and by reporting the independent associations of GVI and VFI and co-existing demographic, socioeconomic, and health factors with psychological distress.

Similar to the current study, several prior U.S. studies examining the relationship between VI and adverse mental health outcomes were cross-sectional,[11, 18, 22] making it difficult to establish causality and understand the direction of associations. However, other longitudinal, prospective studies outside the U.S. documented an increased incidence of depression and anxiety in older adults with VI.[14, 26, 27, 41] Authors have noted the possible bidirectional association that may lead to a downward spiral in which deterioration in one condition results in deterioration in another.[12, 26] A longitudinal study of a nationally-representative sample of US Medicare beneficiaries (aged ≥65 years) demonstrated a bidirectional association between self-reported VI and depression, whereby individuals with VI at baseline were more likely to report depression in the future, and vice versa.[13] Furthermore, it is important to note that the literature on the relationship between VI and mental health outcomes is based on a variety of methods of measuring VI, including self-reported VI, measured visual acuity, general vision impairment, and visual function impairment (which can be measured using many types of visual function). It is possible that the relationship between VI and mental health outcomes differs by the method used to measure VI. It is also possible that the relationship between VI and mental health outcomes differs by the severity of VI, as those living with blindness are likely to experience a higher level of psychological distress, due to greater functional limitations, than those with less severe forms of VI.
In the present study, sample size limitations for those who reported blindness in the two

survey years prevented us from stratifying the study results by those with blindness and those with general vision impairment who are not blind. However, a previous investigation of adults aged ≥65 years demonstrated a slightly higher prevalence of moderate to severe psychological distress among those who were blind (24.4%) compared to those with VI (21.2%).[22]

Various possible mechanisms exist through which VI may be associated with greater psychological distress. People with self-reported VI are more likely to have medical comorbidities,[19, 42] including hypertension, heart disease, stroke, arthritis, asthma, COPD, cancer, kidney disease, diabetes, and hearing impairment.[18] Those with self-reported VI have increased odds of numerous measures of poor health-related quality of life, including self-rated fair/poor health, life dissatisfaction, disability, and greater frequency of physically unhealthy days, mentally unhealthy days, and activity limitations days.[5, 42] Older adults with both self-reported VI and severe depressive symptoms are more likely to have poor health behaviors and outcomes such as smoking, having obesity, being physically inactive, and having difficulties with self-care.[43] In the absence of effective interventions, these health behaviors and outcomes can lead to further health declines and disablement.[43]

Greater stress among individuals with VI may also be the result of a diminished ability to care for oneself, feel a sense of self-efficacy, and engage in pleasurable or enriching activities. VI is associated with reduced functional capacity as measured by limitations in activities and instrumental activities of daily living.[3, 19, 20, 44] Individuals with VI also have a higher risk of cognitive decline-related functional limitations[44, 45] and lower levels of social integration.[17, 43] One study found that among adults with VI, defined using measured visual acuity, lower perceived adequacy of social support was associated with depressive symptoms.[46] Another study found that for older adults, of four possible mediating factors between self-reported VI and depression—activity limitations, financial strain, lower social integration and support, and reduced self-efficacy—the strongest mediating effect is reduced self-efficacy.[17]

An important contribution of the present study was its identification of correlates of psychological distress among adults with GVI and VFI. Demographic and socioeconomic factors that predicted serious psychological distress among individuals with GVI or VFI included being younger, female sex, non-Hispanic white race/ethnicity, unmarried, unemployed, and having <high school education, lower income, and no health insurance or public insurance. Health characteristics that predicted serious psychological distress included being a current smoker or physically inactive and having comorbid arthritis or COPD. Our findings were consistent with other studies which documented increased odds of depression among people with VI who are younger[47, 48] or have low levels of physical activity.[49] However, some of our findings differed from other investigations, such as a study in New Zealand that found depression among adults with VI was not related to age, sex, or race/ethnicity[49], and another study in the United Kingdom that found non-white ethnicity was a significant predictor of depression in this population.[47] Variation by country is not surprising, since social and health systems factors may shape these associations. Additionally, previous studies using the Kessler (K6) Psychological Distress Scale in the

general population have also documented a higher prevalence of mild/moderate and severe psychological distress among younger age groups compared to older age groups.[32, 33, 50]

Several studies demonstrated that poor self-reported health is associated with an increased risk of depression among people with VI.[46-49] An important finding of our study was that certain medical comorbidities were associated with higher odds of serious psychological distress among adults with GVI or VFI. Other studies have documented consistent findings related to comorbid chronic disease and physical functional limitations. One study found that compared to people without diabetes, individuals with diabetes have a 60% greater risk of experiencing a high level of psychological distress and that the highest risk was among people with both diabetes and physical functional limitations.[51] The authors concluded that a substantial proportion of the elevated risk of psychological distress among people with diabetes is attributable to their higher levels of disability or physical impairment.[51] A similar study in adults with diabetes found that those with dual sensory (vision and hearing) impairment or physical functioning limitations had increased odds of depression.[52]

Our study highlights the importance of clinical screening for psychological distress in individuals with VI and identifies important correlates of adverse mental health outcomes in this population. This may be addressed by providing training to eye care and other healthcare professionals to improve screening for and management of poor mental health in patients with VI; one study found that eye health and rehabilitation professionals reported that ‘low confidence in their ability to address depression’ is a barrier to identifying and responding to depression in patients with VI.[53] Additionally, clinical interventions could target health behaviors associated with adverse mental health outcomes among those with VI, for example, by promoting smoking cessation or increased physical activity. Lastly, interventions to improve mental health among individuals with VI should account for the increased risk of medical comorbidities in those with VI, and the potential for higher levels of psychological distress in those with comorbid conditions. Future research is important to determine the efficacy of integrated interventions designed to improve management of both VI and comorbid chronic disease.

This study had several limitations. First, all data were self-reported and may be prone to reporting biases. Importantly, the measures of general vision impairment and visual function impairment were all self-reported. Studies have noted that when compared to measured visual acuity, there is a slight over-identification of vision impairment using self-reported information[54], and the concordance of measured visual acuity and self-reported vision impairment varies by sociodemographic groups.[55] Second, causality cannot be established with cross-sectional data. Furthermore, several variables in the regression models had substantial missing data, and therefore, multiple imputation was used to preserve sample size for regression analyses. However, the sensitivity analysis showed similar findings when comparing results of the models using multiple imputed datasets to results based on complete case analysis. Lastly, while NHIS is nationally representative, it does not sample individuals living in nursing homes or other institutional settings where the rates of VI and chronic conditions are likely to be higher. Our study highlights the importance of considering mental health in those with VI. This may be particularly relevant to younger individuals with VI who had higher odds of psychological distress, and who

may benefit from interventions to improve productivity and quality of life during their working years. Our study further highlights the importance of screening for depression and anxiety in individuals with VI. Screening may facilitate early intervention and help prevent deterioration in quality of life. Interventions could include low vision rehabilitation to improve functional capabilities, problem-solving skills[56], and self-efficacy[23] as well as cognitive-behavioral therapy to address the symptoms of anxiety and depression.[57] Integrated courses may teach skills for self-management of vision loss and co-occurring chronic diseases.[58]

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Data availability:

The data used in this analysis are publicly available at: https://www.cdc.gov/nchs/nhis/index.htm

## References

1. Varma R, Vajaranant TS, Burkemper B, et al. Visual Impairment and Blindness in Adults in the United States: Demographic and Geographic Variations From 2015 to 2050. JAMA Ophthalmol. 2016;134(7):802–9. [PubMed: 27197072]
2. McCarty CA, Nanjan MB, Taylor HR. Vision impairment predicts 5 year mortality. Br J Ophthalmol. 2001;85(3):322–6. [PubMed: 11222339]
3. Christ SL, Zheng D, Swenor BK, et al. Longitudinal relationships among visual acuity, daily functional status, and mortality: the Salisbury Eye Evaluation Study. JAMA Ophthalmol 2014;132(12):1400–6. [PubMed: 25144579]
4. Patino CM, McKean-Cowdin R, Azen SP, Allison JC, Choudhury F, Varma R. Central and peripheral visual impairment and the risk of falls and falls with injury. Ophthalmology. 2010;117(2):199–206. [PubMed: 20031225]
5. Crews JE, Chou CF, Zhang X, Zack MM, Saaddine JB. Health-related quality of life among people aged ≥65 years with self-reported visual impairment: findings from the 2006-2010 behavioral risk factor surveillance system. Ophthalmic Epidemiol. 2014;21(5):287–96. [PubMed: 24955821]
6. McKean-Cowdin R, Varma R, Wu J, Hays RD, Azen SP. Severity of visual field loss and health-related quality of life. Am J Ophthalmol. 2007;143(6):1013–23. [PubMed: 17399676]
7. Ehrlich JR, Hassan SE, Stagg BC. Prevalence of Falls and Fall-Related Outcomes in Older Adults With Self-Reported Vision Impairment J Am Geriatr Soc. 2019;67(2):239–245. [PubMed: 30421796]
8. Brunes A, Hansen MB, Heir T. Loneliness among adults with visual impairment: prevalence, associated factors, and relationship to life satisfaction. Health Qual Life Outcomes. 2019;17(1):24. [PubMed: 30709406]
9. Mick P, Parfyonov M, Wittich W, Phillips N, Pichora-Fuller K. Associations between sensory loss and social networks, participation, support, and loneliness: Analysis of the Canadian Longitudinal Study on Aging. Can Fam Physician. 2018;64(1):e33–e41. [PubMed: 29358266]
10. Shah K, Frank CR, Ehrlich JR. The Association Between Vision Impairment and Social Participation in Community-Dwelling Adults: A Systematic Review. Eye (Lond). 2020;34(2):290–298. [PubMed: 31896798]
11. Zhang X, Bullard KM, Cotch MF, et al. Association between depression and functional vision loss in persons 20 years of age or older in the United States, NHANES 2005-2008. JAMA Ophthalmol. 2013;131(5):573–81. [PubMed: 23471505]

12. Khoo K, Man REK, Rees G, Gupta P, Lamoureux EL, Fenwick EK. The relationship between diabetic retinopathy and psychosocial functioning: a systematic review. Qual Life Res. 2019;doi:10.1007/s11136-019-02165-1 [Epub ahead of print]
13. Frank CR, Xiang X, Stagg BC, Ehrlich JR. Longitudinal Associations of Self-reported Vision Impairment With Symptoms of Anxiety and Depression Among Older Adults in the United States. JAMA Ophthalmol. 2019;doi:10.1001/jamaophthalmol.2019.1085. [Epub ahead of print]
14. Cosh S, Carriere I, Nael V, Tzourio C, Delcourt C, Helmer C. The association of vision loss and dimensions of depression over 12 years in older adults: Findings from the Three City study. J Affect Disord. 2019;243:477–484. [PubMed: 30273886]
15. Court H, McLean G, Guthrie B, Mercer SW, Smith DJ. Visual impairment is associated with physical and mental comorbidities in older adults: a cross-sectional study. BMC Med 2014;12(181)
16. van der Aa HPA, Comijs HC, Penninx BWJH, van Rens GHMB, van Nispen RMA. Major depressive and anxiety disorders in visually impaired older adults. Invest Ophthalmol Vis Sci. 2015;56(2):849–54. [PubMed: 25604690]
17. Brown RL, Barrett AE. Visual Impairment and Quality of Life Among Older Adults: An Examination of Explanations for the Relationship. J Gerontol B Psychol Sci Soc Sci. 2011;66(3):364–73. [PubMed: 21402645]
18. Crews JE, Chou C-F, Sekar S, Saaddine JB. The Prevalence of Chronic Conditions and Poor Health Among People With and Without Vision Impairment, Aged >65 Years, 2010–2014. Am J Ophthalmol. 2017;182:18–30. [PubMed: 28734819]
19. Simning A, Fox ML, Barnett SL, Sorensen S, Conwell Y. Depressive and Anxiety Symptoms in Older Adults With Auditory, Vision, and Dual Sensory Impairment. J Aging Health. 2019;31(8):1353–1375. [PubMed: 29896982]
20. Kempen GIJM, Ballemans J, Ranchor AV, van Rens GHMB, Zijlstra GAR. The impact of low vision on activities of daily living, symptoms of depression, feelings of anxiety and social support in community living older adults seeking vision rehabilitation services. Qual Life Res. 2012;21(8):1405–11. [PubMed: 22090173]
21. Loprinzi PD, Codey K. Influence of visual acuity on anxiety, panic and depression disorders among young and middle age adults in the United States. J Affect Disord 2014;167:8–11. [PubMed: 25082107]
22. Jones GC, Crews JE, Danielson ML. Health Risk Profile for Older Adults with Blindness: An Application of the International Classification of Functioning, Disability, and Health Framework. Ophthalmic Epidemiol. 2010;17(6):400–10. [PubMed: 21090913]
23. Cimarolli VR, Casten RJ, Rovner BW, Heyl V, Sörensen S, Horowitz A. Anxiety and depression in patients with advanced macular degeneration: current perspectives. Clin Ophthalmol. 2015;10:55–63. [PubMed: 26766899]
24. Evans JR, Fletcher AE, Wormald RPL. Depression and Anxiety in Visually Impaired Older People *Ophthalmology*. 2007;114(2):283–8. [PubMed: 17270678]
25. Williamson GM, Shaffer DR. The Activity Restriction Model of Depressed Affect. Physical Illness and Depression in Older Adults. Springer; 2002. *The Plenum Series in Social/Clinical Psychology*.
26. Carrière I, Delcourt C, Daien V, et al. A prospective study of the bi-directional association between vision loss and depression in the elderly. J Affect Disord. 2013;151(1):164–70. [PubMed: 23787409]
27. Heesterbeek TJ, van der Aa HPA, van Rens GHMB, Twisk JWR, van Nispen RMA. The incidence and predictors of depressive and anxiety symptoms in older adults with vision impairment: a longitudinal prospective cohort study. Ophthalmic Physiol Opt. 2017;37(4):385–398. [PubMed: 28516509]
28. National Center for Health Statistics. Survey Description, National Health Interview Survey, 2016. Hyattsville, Maryland. 2017.
29. National Center for Health Statistics. Survey Description, National Health Interview Survey, 2017. Hyattsville, Maryland. 2018.
30. Kessler RC, Barker PR, Colpe LJ, et al. Screening for Serious Mental Illness in the General Population. Arch Gen Psychiatry. 2003;60(2):184–9. [PubMed: 12578436]

31. Kessler R, Andrews G, Colpe L, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med. 2002;32(6):959–76. [PubMed: 12214795]
32. Prochaska JJ, Sung H-Y, Max W, Shi Y, Ong M. Validity Study of the K6 Scale as a Measure of Moderate Mental Distress based on Mental Health Treatment Need and Utilization. Int J Methods Psychiatr Res. 2012;21(2):88–97. [PubMed: 22351472]
33. Okoro CA, Strine TW, Balluz LS, et al. Serious psychological distress among adults with and without disabilities. Int J Public Health. 2009;54(Suppl 1):52–60. [PubMed: 19363587]
34. Okoro CA, Dhingra SS, Li C. A triple play: psychological distress, physical comorbidities, and access and use of health services among U.S. adults with disabilities. J Health Care Poor Underserved. 2014;25(2):814–36. [PubMed: 24858888]
35. Okoro CA, Dhingra SS. Severity of Psychological Distress among Adults with and without Disabilities. Soc Work Public Health. 2014;29(7):671–85. [PubMed: 25350897]
36. Tomitaka S, Kawasaki Y, Ide K, et al. Characteristic distribution of the total and individual item scores on the Kessler Screening Scale for Psychological Distress (K6) in US adults. BMC Psychiatry. 2017;17(1):290. [PubMed: 28784101]
37. Taylor HO, Taylor RJ, Nguyen AW, Chatters L. Social Isolation, Depression, and Psychological Distress Among Older Adults. J Aging Health. 2018;30(2):229–246. [PubMed: 28553785]
38. Dhingra SS, Zack MM, Strine TW, Druss BG, Berry JT, Balluz LS. Psychological Distress Severity of Adults Reporting Receipt of Treatment for Mental Health Problems in the BRFSS. Psychiatr Serv. 2011;62(4):396–403. [PubMed: 21459991]
39. Dhingra SS, Zack M, Strine T, Pearson WS, Balluz L. Determining Prevalence and Correlates of Psychiatric Treatment With Andersen's Behavioral Model of Health Services Use. Psychiatr Serv. 2010;61(5):524–8. [PubMed: 20439377]
40. Wang PS, Gruber MJ, Powers RE, et al. Mental health service use among hurricane Katrina survivors in the eight months after the disaster. Psychiatr Serv. 2007;58(11):1403–11. [PubMed: 17978249]
41. Choi HG, Lee MJ, Lee S-M. Visual Impairment and Risk of Depression: A Longitudinal Follow-Up Study Using a National Sample Cohort. Sci Rep. 2018;8(1):2083. [PubMed: 29391510]
42. Lam BL, Christ SL, Lee DJ, Zheng DD, Arheart KL. Reported visual impairment and risk of suicide: the 1986-1996 national health interview surveys. Arch Ophthalmol. 2008;126(7):975–80. [PubMed: 18625946]
43. Jones GC, Rovner BW, Crews JE, Danielson ML. Effects of Depressive Symptoms on Health Behavior Practices Among Older Adults With Vision Loss. Rehabil Psychol. 2009;54(2):164–72. [PubMed: 19469606]
44. Patel N, Stagg BC, Swenor BK, Zhou Y, Talwar N, Ehrlich JR. Association of Co-occurring Dementia and Self-reported Visual Impairment With Activity Limitations in Older Adults. JAMA Ophthalmol. 2020:e201562 [Epub online ahead of print].
45. Saydah S, Gerzoff RB, Taylor CA, Ehrlich JR, Saaddine J. Vision Impairment and Subjective Cognitive Decline–Related Functional Limitations — United States, 2015–2017. MMWR Morb Mortal Wkly Rep. 2019;68(20):453–457.
46. Rees G, Xie J, Holloway EE, et al. Identifying Distinct Risk Factors for Vision-Specific Distress and Depressive Symptoms in People With Vision Impairment Invest Ophthalmol Vis Sci. 2013;54(12):7431–8. [PubMed: 24150757]
47. Nollett C, Ryan B, Bray N, et al. Depressive Symptoms in People With Vision Impairment: A Cross-Sectional Study to Identify Who Is Most at Risk BMJ Open. 2019;9(1):e026163.
48. Rees G, Tee HW, Marella M, Fenwick E, Dirani M, Lamoureux EL. Vision-Specific Distress and Depressive Symptoms in People with Vision Impairment. Invest Ophthalmol Vis Sci. 2010;51(6):2891–6. [PubMed: 20164466]
49. Hayman KJ, Kerse NM, Grow SJL, Wouldes T, Robertson MC, Campbell AJ. Depression in Older People: Visual Impairment and Subjective Ratings of Health. Optom Vis Sci. 2007 84(11):1024–30. [PubMed: 18043421]

50. Pirraglia PA, Hampton JM, Rosen AB, Witt WP. Psychological Distress and Trends in Healthcare Expenditures and Outpatient Healthcare. Am J Manag Care. 2011;17(5):319–28. [PubMed: 21718079]

51. Elmira E, Banks E, Joshy G. To what extent is the elevated risk of psychological distress in people with diabetes accounted for by physical disability? Findings from a large population-based study. BMJ Open. 2018;8(8):e022767.

52. Loprinzi PD, Smit E, Pariser G. Association Among Depression, Physical Functioning, and Hearing and Vision Impairment in Adults With Diabetes. Diabetes Spectr. 2013;26(1):6–15.

53. Rees G, Fenwick EK, Keeffe JE, Mellor D, Lamoureux EL. Detection of Depression in Patients With Low Vision. Optom Vis Sci 2009;86(12):1328–36. [PubMed: 19844188]

54. Whillans J, Nazroo J. Assessment of visual impairment: The relationship between self-reported vision and 'gold-standard' measured visual acuity. British Journal of Visual Impairment. 2014;32(3)

55. El-Gasim M, Munoz B, West SK, Scott AW. Discrepancies in the concordance of self-reported vision status and visual acuity in the Salisbury Eye Evaluation Study. Ophthalmology. 2012;119(1):106–11. [PubMed: 21962256]

56. Nollett CL, Bray N, Bunce C, et al. Depression in Visual Impairment Trial (DEPVIT): A Randomized Clinical Trial of Depression Treatments in People With Low Vision. Invest Ophthalmol Vis Sci. 2016;57(10):4247–54. [PubMed: 27548898]

57. Senra H, Macedo AF, Nunes N, Balaskas K, Aslam T, Costa E. Psychological and Psychosocial Interventions for Depression and Anxiety in Patients With Age-Related Macular Degeneration: A Systematic Review. Am J Geriatr Psychiatry. 2019;27(8):755–773. [PubMed: 31005495]

58. Cate Y, Sikes Baker S, Gilbert MP. Occupational therapy and the person with diabetes and vision impairment. Am J Occup Ther. 1995;49(9):905–11. [PubMed: 8572050]

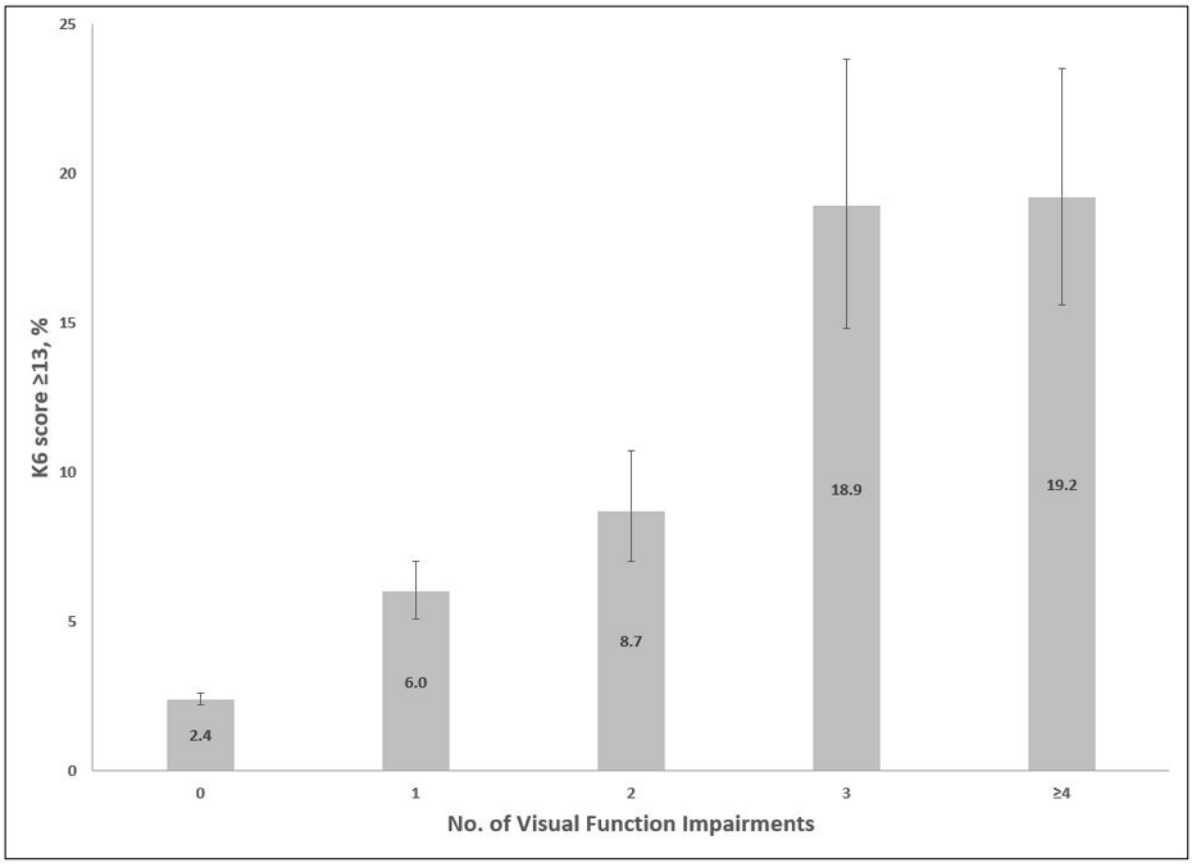


**Figure 1.**

Crude Prevalence of Serious Psychological Distress (Kessler K6 Score ≥13) by Number of Visual Function Impairments Among Adults ≥18 Years in the United States in 2016–2017.

**Table 1.**

Crude Prevalence of Psychological Distress by Vision Status Among Adults ≥18 Years in the United States in 2016–2017

| | Prevalence of Psychological Distress, Weighted % (95% CI) | |
|---|---|---|
| **Status** | **Mild/moderate (K6 score: 8–12)** | **Serious (K6 score: 13–24)** |
| General vision impairment status (n=57,644) | | |
| No vision impairment | 6.4 (6.1, 6.7) | 2.5 (2.4, 2.7) |
| Vision impairment[a] | 14.9 (13.8, 16.0) | 11.2 (10.2, 12.3) |
| Visual Function Impairment[b] | | |
| Difficulty reading ordinary newsprint (n=57,057) | | |
| No | 6.8 (6.5, 7.1) | 2.8 (2.6, 3.0) |
| Yes | 13.7 (12.5, 15.1) | 11.9 (10.6, 13.2) |
| Difficulty seeing up close when doing work or hobbies (n=56,889) | | |
| No | 6.9 (6.6, 7.2) | 2.9 (2.7, 3.1) |
| Yes | 14.7 (13.2, 16.4) | 12.5 (11.0, 14.2) |
| Difficulty going down steps, stairs, or curbs in dim light (n=56,419) | | |
| No | 6.8 (6.5, 7.1) | 2.8 (2.6, 3.0) |
| Yes | 17.0 (15.3, 18.9) | 15.9 (14.1, 17.8) |
| Difficulty driving in daytime in a familiar place (n=53,864) | | |
| No | 6.9 (6.6, 7.2) | 3.0 (2.8, 3.2) |
| Yes | 15.0 (12.5, 18.0) | 12.9 (10.4, 15.9) |
| Difficulty noticing objects off to the side (n=56,981) | | |
| No | 7.1 (6.8, 7.4) | 3.1 (2.9, 3.3) |
| Yes | 17.1 (14.8, 19.5) | 16.5 (14.1, 19.2) |
| Difficulty finding object on a crowded shelf (n=57,119) | | |
| No | 7.1 (6.8, 7.4) | 3.1 (2.9, 3.3) |
| Yes | 17.2 (14.9, 19.8) | 18.1 (15.6, 20.8) |
| ≥1 visual function impairment[c] (n=54,535) | | |
| No | 6.2 (5.9, 6.5) | 2.4 (2.2, 2.6) |
| Yes | 14.6 (13.6, 15.7) | 10.7 (9.7, 11.7) |

Abbreviations: CI (confidence interval), K6 (Kessler 6-item Psychological Distress Scale).

[a] Defined as an affirmative response to the question: “Do you have trouble seeing, even when wearing glasses or contact lenses?”.

[b] Visual function impairment was measured using six questions that asked: “Even when wearing glasses or contact lenses, because of your eyesight, how difficult is it for you to [perform each of these six listed tasks].” Difficulty is defined as reporting that the task is somewhat difficult, very difficult, or the person is unable to do the task at all because of his/her eyesight.

[c] Defined as having difficulty with any of these six functional tasks: 1) reading ordinary newsprint, 2) seeing up close when doing work or hobbies, 3) going down steps, stairs, or curbs in dim light, 4) driving in daytime in a familiar place, 5) noticing objects off to the side, or 6) finding object on a crowded shelf.

**Table 2.**

Adjusted Odds Ratios for Psychological Distress by Vision Status Among Adults ≥18 Years in the United States in 2016–2017

| | Adjusted Odds Ratio (95% Confidence Interval) for Psychological Distress[a] | | | | | |
|---|---|---|---|---|---|---|
| | Model I[b] | | Model II[c] | | Model III[d] | |
| Status | Mild/moderate (K6 score: 8–12) | Serious (K6 score: 13–24) | Mild/moderate (K6 score: 8–12) | Serious (K6 score: 13–24) | Mild/moderate (K6 score: 8–12) | Serious (K6 score: 13–24) |
| General vision impairment status | | | | | | |
| No vision impairment | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Vision impairment[e] | 2.99 (2.70, 3.31) | 5.47 (4.84, 6.19) | 2.59 (2.32, 2.88) | 4.09 (3.58, 4.67) | 2.24 (2.00, 2.52) | 3.41 (2.96, 3.93) |
| Visual Function Impairment[f] | | | | | | |
| No difficulty | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Difficulty reading ordinary newsprint | 2.73 (2.42, 3.08) | 5.29 (4.58, 6.12) | 2.36 (2.09, 2.67) | 3.90 (3.32, 4.57) | 2.03 (1.77, 2.31) | 3.15 (2.66, 3.73) |
| Difficulty seeing up close when doing work or hobbies | 3.01 (2.62, 3.45) | 5.55 (4.71, 6.53) | 2.60 (2.26, 2.99) | 3.99 (3.35, 4.75) | 2.19 (1.89, 2.54) | 3.11 (2.58, 3.75) |
| Difficulty going down steps, stairs, or curbs in dim light | 3.86 (3.36, 4.44) | 8.50 (7.27, 9.95) | 3.09 (2.67, 3.57) | 5.44 (4.57, 6.47) | 2.45 (2.11, 2.86) | 4.02 (3.35, 4.83) |
| Difficulty driving in daytime in a familiar place | 3.05 (2.42, 3.83) | 5.95 (4.60, 7.70) | 2.49 (1.96, 3.17) | 3.69 (2.77, 4.92) | 2.11 (1.64, 2.72) | 2.99 (2.20, 4.05) |
| Difficulty noticing objects off to the side | 3.64 (3.05, 4.33) | 7.93 (6.44, 9.76) | 2.91 (2.42, 3.49) | 4.87 (3.87, 6.13) | 2.46 (2.03, 2.99) | 3.89 (3.04, 4.97) |
| Difficulty finding object on a crowded shelf | 3.82 (3.18, 4.59) | 9.13 (7.51, 11.10) | 3.13 (2.59, 3.77) | 5.83 (4.65, 7.31) | 2.62 (2.16, 3.17) | 4.59 (3.62, 5.82) |
| ≥1 visual function impairment[g] | 3.36 (3.04, 3.72) | 5.94 (5.16, 6.84) | 2.80 (2.52, 3.11) | 4.05 (3.49, 4.70) | 2.37 (2.12, 2.65) | 3.18 (2.72, 3.72) |

Abbreviations: K6 (Kessler 6-item Psychological Distress Scale).

[a] Multinomial logistic regression was used to calculate adjusted odds ratios for mild/moderate and serious psychological distress (reference: no/low psychological distress which is a K6 score of 0–7). Each type of vision impairment was modeled separately. Sample sizes for each model were: 1) general vision impairment: Model I (n=57,644), Model II (n=57,163), Model III (n=56,501); 2) difficulty reading ordinary newsprint: Model I (n=57,057), Model II (n=56,587), Model III (n=55,942); 3) difficulty seeing up close when doing work or hobbies: Model I (n=56,889), Model II (n=56,425), Model III (n=55,789); 4) difficulty going down steps, stairs, or curbs in dim light: Model I (n=56,419), Model II (n=55,954), Model III (n=55,337); 5) difficulty driving in daytime in a familiar place: Model I (n=53,864), Model II (n=53,439), Model III (n=52,901); 6) difficulty noticing objects off to the side: Model I (n=56,981), Model II (n=56,511), Model III (n=55,865); 7) difficulty finding object on a crowded shelf: Model I (n=57,119), Model II (n=56,650), Model III (n=56,001); 8) ≥1 visual function impairment: Model I (n=54,535), Model II (n=54,100), Model III (n=53,532).

[b] Controlling for age, sex, and race/ethnicity.

[c] Model I plus education level, marital status, employment status, income-to-poverty ratio, and health insurance status. Multiple imputation was used to impute missing data for income-to-poverty ratio.

[d] Model II plus smoking status, physical activity, body mass index, diabetes, hypertension, arthritis, coronary heart disease, chronic obstructive pulmonary disease, myocardial infarction, and stroke. Multiple imputation was used to impute missing data for physical activity and body mass index.

[e] Defined as an affirmative response to the question: “Do you have trouble seeing, even when wearing glasses or contact lenses?”.

[f] Visual function impairment was measured using six questions that asked: "Even when wearing glasses or contact lenses, because of your eyesight, how difficult is it for you to [perform each of these six listed tasks]." Difficulty is defined as reporting that the task is somewhat difficult, very difficult, or the person is unable to do the task at all because of his/her eyesight.

[g] Defined as having difficulty with any of these six functional tasks: 1) reading ordinary newsprint, 2) seeing up close when doing work or hobbies, 3) going down steps, stairs, or curbs in dim light, 4) driving in daytime in a familiar place, 5) noticing objects off to the side, or 6) finding object on a crowded shelf.

**Table 3.**

Sociodemographic Characteristics Associated with Psychological Distress Among Adults ≥18 Years with General Vision Impairment or ≥1 Visual Function Impairment in the United States in 2016–2017

| | Psychological Distress Adjusted Odds Ratio (95% Confidence Interval)[a] | | | |
|---|---|---|---|---|
| | General Vision Impairment[b] | | ≥1 Visual Function Impairment[c] | |
| **Sociodemographic characteristics** | **Mild/moderate (K6 score: 8–12)** | **Serious (K6 score: 13–24)** | **Mild/moderate (K6 score: 8–12)** | **Serious (K6 score: 13–24)** |
| Age, years | | | | |
| 18–39 | **2.48 (1.83, 3.38)** | **4.46 (2.89, 6.90)** | **3.50 (2.45, 5.00)** | **5.14 (3.34, 7.93)** |
| 40–64 | **2.78 (2.13, 3.64)** | **6.09 (4.33, 8.57)** | **2.67 (2.04, 3.48)** | **6.20 (4.63, 8.29)** |
| ≥65 | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Sex | | | | |
| Male | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Female | **1.30 (1.08, 1.58)** | **1.56 (1.23, 1.99)** | **1.51 (1.25, 1.82)** | **1.57 (1.26, 1.95)** |
| Race/ethnicity | | | | |
| White, non-Hispanic | 1.25 (0.93, 1.67) | **2.11 (1.52, 2.93)** | **1.51 (1.12, 2.03)** | **1.40 (1.03, 1.91)** |
| Black, non-Hispanic | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Hispanic | 1.13 (0.79, 1.61) | 1.38 (0.86, 2.22) | **1.48 (1.02, 2.16)** | 1.26 (0.82, 1.92) |
| Other | 0.86 (0.55, 1.34) | **2.00 (1.21, 3.30)** | 1.47 (0.93, 2.31) | 1.40 (0.79, 2.50) |
| Education level | | | | |
| <High school | **1.32 (1.02, 1.71)** | **1.44 (1.04, 1.99)** | **1.32 (1.03, 1.70)** | **1.42 (1.06, 1.90)** |
| High school/GED | 1.01 (0.80, 1.27) | 1.18 (0.92, 1.51) | 1.15 (0.93, 1.42) | **1.38 (1.08, 1.77)** |
| >High school | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Marital status | | | | |
| Married/domestic partnership | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Not married[d] | 1.16 (0.94, 1.43) | **1.55 (1.20, 2.01)** | 1.14 (0.93, 1.39) | **1.43 (1.10, 1.85)** |
| Employment status | | | | |
| Working at a job/business for pay | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Not working at a job/business for pay | **1.36 (1.08, 1.71)** | **2.32 (1.74, 3.09)** | **1.31 (1.02, 1.68)** | **2.80 (2.15, 3.66)** |
| Income/poverty ratio[e] | | | | |

| Sociodemographic characteristics | Psychological Distress Adjusted Odds Ratio (95% Confidence Interval)[a] | | | |
|---|---|---|---|---|
| | General Vision Impairment[b] | | ≥1 Visual Function Impairment[c] | |
| | Mild/moderate (K6 score: 8–12) | Serious (K6 score: 13–24) | Mild/moderate (K6 score: 8–12) | Serious (K6 score: 13–24) |
| <1 | **1.60 (1.21, 2.11)** | **1.97 (1.41, 2.74)** | **1.45 (1.10, 1.92)** | **2.31 (1.69, 3.16)** |
| 1 to <2 | **1.30 (1.02, 1.67)** | **1.53 (1.13, 2.08)** | **1.54 (1.20, 1.98)** | **2.11 (1.58, 2.83)** |
| ≥2 | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Insurance status | | | | |
| Public | 1.18 (0.90, 1.54) | **2.08 (1.41, 3.06)** | **1.79 (1.33, 2.41)** | **2.61 (1.80, 3.80)** |
| Private | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Both | 1.34 (0.92, 1.96) | **2.19 (1.40, 3.43)** | **1.76 (1.22, 2.54)** | **2.63 (1.68, 4.11)** |
| None | 0.87 (0.60, 1.25) | **1.56 (1.02, 2.36)** | 1.13 (0.78, 1.65) | **1.79 (1.13, 2.85**) |

Abbreviations: GED (General Educational Development), K6 (Kessler 6-item Psychological Distress Scale).

[a]Multinomial logistic regression was used to calculate adjusted odds ratios for mild/moderate and serious psychological distress (reference: no/low psychological distress which is a K6 score of 0–7). Each type of vision impairment was modeled separately, and the models included all of the sociodemographic characteristics. Multiple imputation was used to impute missing data for income-to-poverty ratio. Sample sizes for each model were: general vision impairment (n=6,702) and ≥1 visual function impairment (n=7,183). Bold indicates statistical significance (95% confidence interval does not contain 1.0).

[b]Defined as an affirmative response to the question: “Do you have trouble seeing, even when wearing glasses or contact lenses?”.

[c]Defined as having difficulty (the task is somewhat difficult, very difficult, or the person is unable to do the task at all because of his/her eyesight) with any of these six functional tasks: 1) reading ordinary newsprint, 2) seeing up close when doing work or hobbies, 3) going down steps, stairs, or curbs in dim light, 4) driving in daytime in a familiar place, 5) noticing objects off to the side, or 6) finding object on a crowded shelf.

[d]Widowed, divorced, separated, or never married.

[e]Ratio of the family income to the poverty threshold, based on the U.S. Census Bureau federal poverty thresholds given the family’s size and number of children (https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html).

**Table 4.**

Chronic Disease Risk Factors and Comorbidities Associated with Psychological Distress Among Adults ≥18 Years with General Vision Impairment or ≥1 Visual Function Impairment in the United States in 2016–2017

| | Psychological Distress Adjusted Odds Ratio (95% Confidence Interval)[a] | | | |
|---|---|---|---|---|
| | General Vision Impairment[b] | | ≥1 Visual Function Impairment[c] | |
| **Risk factors and comorbidities** | **Mild/moderate (K6 score: 8–12)** | **Serious (K6 score: 13–24)** | **Mild/moderate (K6 score: 8–12)** | **Serious (K6 score: 13–24)** |
| Smoking status[d] | | | | |
| Not current smoker | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Current smoker | **1.48 (1.20, 1.82)** | **2.45 (1.88, 3.18)** | 1.23 (0.99, 1.52) | **1.96 (1.55, 2.49)** |
| Physical activity[e] | | | | |
| Some physical activity | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Physically inactive | 1.22 (1.00, 1.48) | **1.61 (1.22, 2.11)** | **1.26 (1.03, 1.53)** | **1.44 (1.13, 1.83)** |
| Body mass index (kg/m$^2$)[f] | | | | |
| Underweight | 0.98 (0.45, 2.12) | 1.64 (0.74, 3.66) | 1.14 (0.54, 2.43) | **2.97 (1.45, 6.08)** |
| Normal weight | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] | 1.00 [Reference] |
| Overweight | 0.94 (0.72, 1.23) | 0.94 (0.67, 1.31) | 1.01 (0.80, 1.28) | 0.99 (0.73, 1.34) |
| Obesity | 1.08 (0.84, 1.38) | 1.17 (0.86, 1.58) | 1.15 (0.88, 1.49) | 1.19 (0.88, 1.60) |
| Health conditions[g] | | | | |
| Diabetes | 0.98 (0.77, 1.24) | 0.92 (0.71, 1.19) | 0.90 (0.71, 1.15) | 1.08 (0.82, 1.43) |
| Hypertension | **1.39 (1.11, 1.74)** | 1.29 (1.00, 1.66) | 1.23 (0.99, 1.53) | **1.46 (1.14, 1.87)** |
| Arthritis | **1.50 (1.23, 1.83)** | **2.18 (1.66, 2.87)** | **1.60 (1.33, 1.93)** | **1.76 (1.39, 2.23)** |
| Coronary heart disease | 1.03 (0.70, 1.51) | 1.31 (0.82, 2.08) | 1.21 (0.86, 1.69) | 1.30 (0.89, 1.90) |
| COPD | **1.66 (1.23, 2.25)** | **1.65 (1.15, 2.37)** | **1.70 (1.27, 2.28)** | **1.68 (1.24, 2.28)** |
| Myocardial infarction | 1.11 (0.74, 1.67) | 1.25 (0.79, 1.99) | 1.07 (0.75, 1.55) | 1.39 (0.91, 2.13) |
| Stroke | **1.70 (1.26, 2.31)** | 1.44 (0.99, 2.09) | **1.60 (1.18, 2.16)** | **1.51 (1.07, 2.14)** |

Abbreviations: COPD (chronic obstructive pulmonary disease), K6 (Kessler 6-item Psychological Distress Scale).

[a]Multinomial logistic regression was used to calculate adjusted odds ratios for mild/moderate and serious psychological distress (reference: no/low psychological distress which is a K6 score of 0–7). Each type of vision impairment was modeled separately, and the models included all of the chronic disease risk factors and comorbidities and all of the sociodemographic characteristics (age, sex, race/ethnicity, education level, marital status, employment status, income-to-poverty ratio, and health insurance status). Multiple imputation was used to impute missing data for physical activity, body mass index, and

income-to-poverty ratio. Sample sizes for each model were: general vision impairment (n=6,596) and ≥1 visual function impairment (n=7,057). Bold indicates statistical significance (95% confidence interval does not contain 1.0).

[b] Defined as an affirmative response to the question: "Do you have trouble seeing, even when wearing glasses or contact lenses?".

[c] Defined as having difficulty (the task is somewhat difficult, very difficult, or the person is unable to do the task at all because of his/her eyesight) with any of these six functional tasks: 1) reading ordinary newsprint, 2) seeing up close when doing work or hobbies, 3) going down steps, stairs, or curbs in dim light, 4) driving in daytime in a familiar place, 5) noticing objects off to the side, or 6) finding object on a crowded shelf.

[d] Current smoker was defined as those who had smoked more than 100 cigarettes in their lifetime and now smoke every day or some days.

[e] Physically inactive was defined as performing 0 minutes per week of light, moderate, or vigorous leisure-time physical activities.

[f] Body mass index was calculated, using self-reported data, as weight (kilograms) divided by height (meters) squared. Body mass index was classified as: underweight (BMI<18.5 $kg/m^2$), normal weight (BMI 18.5–24.9 $kg/m^2$), overweight (BMI 25.0–29.9 $kg/m^2$), and obesity (BMI≥30 $kg/m^2$).

[g] Self-reported health conditions ascertained by asking whether respondent has ever been told by a doctor or other health professional that they had this condition.