

Association Between Myopia and Mental Health in United States Adults: A population-based analysis of 2023 National Health Interview Survey Data

Thuvaraha Jeyakumaran

t.jeyaku@uwo.ca

Lawson Research Institute

Devina Ramesh

Queen's University

Chris Zajner

Western University

Ryan Huang

University of Toronto

Peter J. Kertes

University of Toronto

Rajeev H. Muni

University of Toronto

Radha P. Kohly

University of Toronto

Marko M. Popovic

University of Toronto

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Abstract

Purpose

Myopia is highly prevalent worldwide and its relationship with mental health is increasingly being studied. However, existing studies in adults remain inconsistent and often lack comprehensive evaluation of treatment-related variables and sociodemographic factors. To examine the association between myopia and mental health conditions, treatment-related variables, and sociodemographic factors in a nationally representative sample of United States adults.

Methods

This cross-sectional study used 2023 National Health Interview Survey (NHIS) data from adults aged ≥ 18 years. Self-reported myopia was the outcome. Mental health variables included anxiety and depression diagnoses, symptom frequency, severity, medication use, and therapy status. Univariable and multivariable logistic regression analyses were performed, with separate models adjusting for relevant covariates.

Results

Anxiety (OR = 1.48 [95% CI: 1.36–1.60]; $p < 0.001$) and depression (OR = 1.43 [95% CI: 1.31–1.55]; $p < 0.001$) were associated with higher odds of self-reported myopia. Treatment-related variables, including anxiety medication (OR = 1.43 [95% CI: 1.32–1.55]; $p < 0.001$), depression medication (OR = 1.39 [95% CI: 1.27–1.52]; $p < 0.001$) and lack of therapy engagement (OR = 1.33 [95% CI: 1.21–1.46]; $p < 0.001$) were also associated. Symptom frequency demonstrated a graded association, while severity was not consistently associated. Higher odds were observed among females and Asian participants, and lower odds among non-citizens and uninsured individuals.

Conclusion

Mental health conditions, treatment-related variables, and sociodemographic factors were associated with myopia. These findings highlight the role of structural and access-related factors and support the need for integrated, equity-oriented approaches to care.

Introduction

Myopia is the most prevalent ocular condition worldwide and a recognized major public health concern [1, 2]. The prevalence of myopia is growing, and by 2050, it is predicted that 49.8% of people will have myopia globally [3]. In 2015, the global estimated productivity loss associated with the burden of myopia was determined to be \$244 billion United States dollars [4]. Beyond its economic impact, a high burden

of myopia increases the risk of associated ocular conditions that can cause irreversible vision loss including retinal detachment, glaucoma, and myopic macular degeneration [5]. Previous studies have also demonstrated that the quality of life of patients with high myopia can be significantly lower compared to those with moderate or no myopia [6].

The increasing prevalence of mental health conditions, particularly anxiety and depressive disorders,[7], alongside the rising global burden of myopia has simultaneously prompted studies into the relationship between refractive error and mental health. In a prospective study of Japanese participants, Yokoi et al., approximate 25% of patients with high myopia burden had symptoms suggestive of anxiety or depressive disorders [8]. In adolescents, a study of nearly 900,000 people revealed that myopia was associated with up to twofold increased odds of anxiety and mood disorders [9]. Moreover, a Mendelian randomization study has suggested a potential causal relationship between depression, anxiety, and increased risk of myopia, proposing that the improvement of anxiety and depression-related symptoms may facilitate control of myopia. However, the mechanisms underlying this association remain unclear, and further research is needed to ascertain what factors may contribute [10]. Concurrently, Li et al. conducted a meta-analysis of 15 studies which had also indicated a bidirectional relationship between myopia and mental health disorders, citing that they share environmental and behavioural risk factors [11]. Other studies postulate that the link between myopia and anxiety is more significant than with depression [12, 13].

Despite the growing interest in this area, large-scale, population-based studies examining the association between myopia and mental health remain limited and vary in the results depending on the population studied and variables adjusted for. Prior studies examining myopia and mental health have varied in their adjustment for confounding variables and may not have comprehensively accounted for sociodemographic and social determinants of health [14, 15]. In addition, prior studies have largely focused on mental health diagnoses or symptom measures,[14–16]. with limited evaluation of treatment-related variables such as medication use and therapy. Lastly, previous findings have remained inconsistent across populations and study design [14–16]. Accordingly, further large-scale, diverse population-based studies are needed to better clarify this relationship while accounting more broadly for a variety of confounding variables.

In this cross-sectional study, we analyzed data from the 2023 National Health Interview Survey (NHIS) to examine the association between myopia and mental health conditions, such as depression and anxiety, and related treatment interventions in adults. Our primary objective was to determine whether depression or anxiety in a United States civilian, noninstitutionalized population is associated with self-reported myopia, while accounting for sociodemographic and other factors.

Methods

Study population

The National Health Interview Survey is a survey that monitors the health of the United States population, providing statistical insights on people of varying age, sex, race, ethnicity, location, and socioeconomic status. The NHIS survey was chosen due to its large sample of data from approximately 27,000 adults each year [17]. For this study we collected responses from participants aged 18 or older. This study adhered to the tenets of the Declaration of Helsinki. As the NHIS consists of a publicly available, de-identified dataset, this study was exempt from research ethics board approval by the University of Toronto Research Ethics Board.

Outcome measures

Myopia was categorized through self-report. Participants were classified as having myopia if they answered 'yes' to the following NHIS question: "Do you wear prescription eyeglasses or contact lenses to drive, read road and street signs, watch TV, or see things in the distance?" Participants who answered 'no' were classified as not having myopia. Participants with missing, 'refused', or 'don't know' responses were excluded from analyses involving this variable.

Our primary outcome was the association between myopia and a previously diagnosed mental health condition, namely, an anxiety and/or depressive disorder. Secondary outcomes were related to anxiety and/or depressive disorder symptom frequency, severity and whether participants were treating the condition with medication or therapy. The presence of mental health conditions was assessed through participant self-report. Anxiety diagnosis was defined as a 'yes' response to the question: "Have you ever been told by a doctor or other health professional that you had any type of anxiety disorder?". Participants answering 'no' were classified as not having the corresponding diagnosis. Those who refused to respond or answered 'don't know' to this question were excluded. Depression diagnosis was defined as a 'yes' to the following question: "Have you ever been told by a doctor or other health professional that you had any type of depression?"

Secondary mental health variables included symptom frequency, severity, medication use, and therapy use. Anxiety symptom frequency was categorized with a 'yes' response to: "How often do you feel worried, nervous or anxious? Would you say daily, weekly, monthly, a few times a year, or never?" Anxiety severity was determined with a 'yes' response to: "Thinking about the last time you felt worried, nervous or anxious, how would you describe the level of these feelings? Would you say a little, a lot, or somewhere in between?" Anxiety medication use was defined by a 'yes' response to: "Do you take prescription medication for these feelings?" Depression symptom frequency was categorized with a 'yes' response to: "How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year, or never?" Depression severity was determined with a 'yes' response to: "Thinking about the last time you felt depressed, how depressed did you feel? Would you say a little, a lot, or somewhere in between?" Depression medication use was defined by a 'yes' response to: "Do you take prescription medication for depression?" Those who refused to respond or answered 'don't know' to these questions were excluded from analyses involving these variables.

To assess if participants received any mental health care, the following question from the NHIS was used: “During the past 12 months, did you receive counseling or therapy from a mental health professional such as a psychiatrist, psychologist, psychiatric nurse, or clinical social worker?” Those who answered this question as ‘yes’ were considered to have utilized mental health care. Those who did not respond to this question were excluded (Supplementary Table 1).

The following variables were collected as sociodemographic and healthcare-related factors in adults: age, sex, sexual orientation, race, citizenship, healthcare insurance status, education level, employment status, income, region, and city classification (Supplementary Table 1).

Statistical analysis

The association between myopia and mental health-related variables (depression and anxiety), as well as relevant sociodemographic characteristics, were analyzed with univariate and multivariate logistic regression analyses. The primary endpoint was self-reported myopia, defined as a ‘yes’ response to the corresponding NHIS question. Primary exposure variables were self-reported anxiety diagnosis and self-reported depression diagnosis. Secondary exposure variables included anxiety and depression symptom frequency, severity, medication use, and use of mental health therapy.

Univariable logistic regression analyses were first performed to examine the association between self-reported myopia with each mental health, sociodemographic, and healthcare-related variables individually. Variables assessed in univariable analyses included age, sex, sexual orientation, race/ethnicity, citizenship, insurance status, educational level, employment status, household income, geographic region, city classification, anxiety diagnosis, anxiety symptom frequency, anxiety severity, anxiety medication use, depression diagnosis, symptom frequency, severity, depression medication use, and therapy use. Univariable analyses only included participants with complete data for all variables. Separate multivariable analysis was conducted for each mental health variable. Each multivariable model assessed the association between self-reported myopia with a mental health variable and each sociodemographic and health-care related variable (Sex; Age; Region; Race; Income; Sexual Orientation; Citizenship; Insurance; City Classification; Employment; Education) that showed a significant association with myopia .

Logistic regression was used for outcomes with two categories. As is standard when analyzing NHIS data, the population estimate was computed using a complex sample weighting procedure for all analyses [18]. All analyses were conducted using Stata (StataCorp LLC, College Station, TX). The adjusted odds ratios (ORs) with corresponding 95% confidence intervals (CIs) were reported for all regression models. Statistical significance was defined using a two-tailed p-value threshold of < 0.05.

Results

Baseline Characteristics of Study Participants

Our sample from the 2023 NHIS survey included 29,522 adult participants who answered questions regarding if they wear prescription eyeglasses or contact lenses to drive, read street signs, watch TV, or see things in the distance. A small portion, 0.02% of participants, were excluded from the analysis due to missing data (n = 6). Of the adult participants included, 45.58% of respondents were male (n = 13,457) and 54.50% were female (n = 16,059). In terms of age distribution, 22.29% were aged 18–35 (n = 6,581), 19.96% were aged 36–50 (n = 5,893), 23.59% were aged 51–65 (n = 6,965), 22.05% were aged 66–80 (n = 6,511), and 7.06% were aged 80 years and older (n = 2,083). Table 1 shows the distribution of participants by demographic characteristics. Table 2 summarizes the sociodemographic profile of participants and illustrates how reported myopia is distributed across key demographic and socioeconomic characteristics.

Table 1
Distribution of Adult Participants Included by Demographic Characteristics
in the 2023 National Health Interview Survey

Category	Frequency	Percentage (%)
Sex		
Male	13457	45.58
Female	16059	54.40
Missing Data	6	0.02
Total	29522	100
Age (y)		
18–35	6581	22.29
36–50	5893	19.96
51–65	6965	23.59
66–80	6511	22.05
80+	2083	7.06
Missing Data	1489	5.04
Total	29522	100
Region		
Northeast	4630	15.68
Midwest	6469	21.92
South	10954	37.10
West	7469	25.30
Total	29522	100
Race		
White	19495	66.04
Hispanic	4418	14.97
Black/African American	3216	10.89
Asian	1668	5.65
American Indian/Alaskan	409	1.39
Other	316	1.06
Total	29522	100

Category	Frequency	Percentage (%)
Income		
>5 × poverty threshold	9175	31.08
2–5 × poverty threshold	11855	40.16
1–2 × poverty threshold	5384	18.23
<1 × poverty threshold	3108	10.53
Total	29522	100
Education		
College	15000	50.81
Some College	4339	14.70
High School/General Education Diploma	7514	25.45
Less than high school	2525	8.55
Missing Data	144	0.49
Total	29522	100
Sexual Orientation		
Straight	26575	90.02
Gay, Lesbian, or Bisexual	1178	3.99
Other (Something else)	181	0.61
Missing Data	1588	5.38
Total	29522	100
Citizenship		
Yes	26342	89.23
No	1907	6.46
Missing Data	1273	4.31
Total	29522	100
Insurance		
Private	13661	46.27
Public	13321	45.12
Other Coverage	407	1.38
No Coverage	2007	6.80

Category	Frequency	Percentage (%)
Missing Data	126	0.43
Total	29522	100
City Classification		
Large central metropolitan area	8914	30.19
Large fringe metropolitan area	6854	23.22
Medium and small metropolitan area	9232	31.27
Non-metropolitan	4522	15.32
Total	29522	100
Employment		
Employed	15641	52.98
Unemployed	12616	42.73
Missing Data	1265	4.29
Total	29522	100
Anxiety Status		
No Anxiety	24035	81.41
Anxiety	5431	18.40
Missing Data	56	0.19
Total	29522	100
Anxiety Medication Status		
No Anxiety Medication	24470	82.89
Anxiety Medication	4329	14.66
Missing Data	723	2.45
Total	29522	100
Anxiety Level		

Category	Frequency	Percentage (%)
Mild Anxiety	10248	34.71
Moderate Anxiety	7881	26.70
High Anxiety	2380	8.06
Missing Data	9013	30.53
Total	29522	100
Anxiety Frequency		
Never	17261	58.47
Monthly	3376	11.44
Weekly	4267	14.45
Daily	3489	13.04
Missing Data	769	2.60
Total	29522	100
Depression Status		
No Depression	23708	80.31
Depression	5769	19.54
Messing Data	45	0.15
Total	29522	100
Depression Frequency		
Never	23323	79.00
Monthly	2311	7.83
Weekly	1818	6.16
Daily	1269	4.30
Missing Data	801	2.71
Total	29522	100
Depression Medication Status		
No Depression Medication	25235	85.48
Depression Medication	3553	12.04
Missing Data	734	2.49
Total	29522	100

Category	Frequency	Percentage (%)
Depression Level		
Mild Depression	7094	24.03
Moderate Depression	5019	17.00
High Depression	1860	6.30
Missing Data	15549	52.67
Total	29522	100
Therapy Status		
No Therapy	24980	84.61
Therapy	3804	12.89
Missing Data	738	2.50
Total	29522	100

Table 2
Relationship Between Myopia and Adult Participant Sociodemographic Characteristics in the 2023
National Health Interview Survey

Category	Report of myopia		
	No myopia (%)	Myopia (%)	All participants (%)
Sex (n = 28,457)			
Male	56.60	43.40	48.95
Female	44.74	55.26	51.05
Total	50.55	49.45	100.00
Age group (y) (n = 27,018)			
18–35	52.88	47.12	32.43
36–50	56.46	43.54	23.21
51–65	45.88	54.12	23.57
66–80	44.52	55.48	16.04
>80	47.77	52.23	4.75
Total	50.48	49.52	100.00
Race (n = 28,462)			
White	47.54	52.46	62.30
Hispanic	59.72	40.28	17.44
Black/African American	54.98	45	.02
Asian	46.93	53.07	6.20
American Indian/Alaskan	49.11	50.89	1.28
Other	51.15	48.85	1.23
Total	50.55	49.45	100.00
Sexual orientation (n = 27,916)			
Straight	50.94	49.06	94.68
Gay, lesbian, bisexual	41.87	58.13	4.54
Other	36.92	63.08	0.78
Total	50.42	49.58	100.00
Citizenship (n = 28,223)			

Category	Report of myopia		
	No myopia (%)	Myopia (%)	All participants (%)
Yes	48.60	51.40	91.53
No	70.18	29.82	8.47
Total	50.42	49.58	100.00
Education (n = 28,335)			
College	45.2	54.8	46.41
Some college	49.36	50.64	16.25
High school/general education diploma	55.32	44.68	26.91
Less than high school	63.46	36.54	10.43
Total	50.50	49.50	100.00
Employment (n = 28,234)			
Employed	50.99	49.01	60.91
Unemployed	49.52	50.48	39.09
Total	50.42	49.58	100.00
Income (n = 28,462)			
>5X poverty threshold	46.64	53.36	31.53
2-5X poverty threshold	50.62	49.38	40.54
1-2X poverty threshold	53.63	46.37	18.02
<1X poverty threshold	57.11	42.89	9.91
Total	50.55	49.45	100.00
Insurance (n = 28,357)			
Private	48.77	51.23	51.95
Public	48.02	51.98	38.31
Other coverage	59.20	40.80	1.51
No coverage	71.86	28.14	8.23
Total	50.54	49.46	100.00
Region (n = 28,462)			
Northeast	48.77	51.23	17.15

Category	Report of myopia		
	No myopia (%)	Myopia (%)	All participants (%)
Midwest	46.45	53.55	20.74
South	52.79	47.21	38.45
West	51.81	48.19	23.66
Total	50.55	49.45	100.00
City classification (n = 28,462)			
Large central metropolitan area	51.52	48.48	30.26
Large fringe metropolitan area	51.08	48.92	25.42
Medium/small metropolitan area	50.70	49.30	30.42
Non-metropolitan area	47.13	52.87	13.90
Total	50.55	49.45	100.00
Anxiety (n = 28,415)			
No anxiety	52.82	47.18	81.43
Anxiety	40.60	59.40	18.57
Total	50.55	49.45	100.00
Anxiety level (n = 20,257)			
Mild anxiety	49.64	50.36	48.85
Moderate anxiety	45.62	54.38	39.67
High anxiety	45.55	54.45	11.48
Total	47.57	52.43	100.00
Anxiety frequency (n = 28,364)			
Never	53.70	46.30	58.38
Monthly	48.95	51.05	12.05
Weekly	45.60	54.40	15.56
Daily	44.12	55.88	14.01
Total	50.53	49.47	100.00
Anxiety medication (n = 28,410)			
No anxiety medication	52.43	47.57	85.60

Category	Report of myopia		
	No myopia (%)	Myopia (%)	All participants (%)
Anxiety medication	39.46	60.54	14.40
Total	50.57	49.43	100.00
Depression (n = 28,425)			
No depression	52.71	47.29	81.01
Depression	41.31	58.69	18.99
Total	50.55	49.45	100.00
Depression frequency (n = 28,346)			
Never	52.04	47.96	81.04
Monthly	44.80	55.20	8.45
Weekly	44.12	55.88	6.29
Daily	42.62	57.38	4.22
Total	50.54	49.46	100.00
Depression medication (n = 28,409)			
No depression medication	52.03	47.97	88.57
Depression medication	39.25	60.75	11.43
Total	50.57	49.43	100.00
Therapy (n = 28,423)			
No therapy	51.94	48.06	86.61
Therapy	41.57	58.43	13.39
Total	50.55	49.45	100.00

Univariable Analysis

In our univariable logistic regression analysis self-reported myopia was found to have significant associations across several sociodemographic domains (Table 3). Females had significantly higher odds of reporting myopia compared to males (OR = 1.61 [95% CI: 1.52–1.70]; $p < 0.001$). Relative to adults aged 18–35, increased odds of myopia were observed among those aged 51–65 (OR = 1.32 [95% CI: 1.22–1.44] $p < 0.001$), 66–80 (OR = 1.40 [95% CI: 1.29–1.52]; $p < 0.001$), and 80 years and older (OR = 1.23 [95% CI: 1.09–1.39]; $p = 0.001$). Hispanic (OR = 0.61 [95% CI: 0.56–0.66]; $p < 0.001$) and

Black/African American participants (OR = 0.74 [95% CI: 0.67–0.82]; $p < 0.001$) had lower odds of reporting myopia relative to White participants.

Table 3

Univariable Logistic Regression Analysis of Odds of Self-Reported Myopia by Based on Sociodemographic Factors of Participants in the 2023 National Health Interview Survey

Category	Univariable Analysis		
	Unadjusted OR	95% CI	p-value
Sex (n = 28,457)			
Male	Ref	-	-
Female	1.61	[1.52–1.70]	< 0.001
Age (y) (n = 27,018)			
18–35	Ref	-	-
36–50	0.87	[0.80–0.94]	0.001
51–65	1.32	[1.22–1.44]	< 0.001
66–80	1.40	[1.29–1.52]	< 0.001
80+	1.23	[1.09–1.39]	0.001
Region (n = 28,462)			
Northeast	Ref	-	-
Midwest	1.10	[0.99–1.22]	0.080
South	0.85	[0.78–0.93]	0.001
West	0.89	[0.80–0.98]	0.016
Race (n = 28,462)			
White	Ref	-	-
Hispanic	0.61	[0.56, 0.66]	< 0.001
Black/African American	0.74	[0.67, 0.82]	< 0.001
Asian	1.02	[0.91, 1.16]	0.690
American Indian/Alaskan	0.94	[0.74, 1.19]	0.605
Other	0.86	[0.65, 1.15]	0.310
Income (n = 28,462)			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	0.85	[0.80, 0.91]	< 0.001
1–2 × poverty threshold	0.76	[0.69, 0.82]	< 0.001
<1 × poverty threshold	0.66	[0.59, 0.73]	< 0.001

Category	Univariable Analysis		
	Unadjusted OR	95% CI	p-value
Sexual Orientation (n = 27,916)			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.44	[1.25, 1.66]	< 0.001
Other (Something else)	1.77	[1.23, 2.57]	0.002
Citizenship (n = 28,223)			
Yes	Ref	-	-
No	0.40	[0.35, 0.46]	< 0.001
Insurance (n = 28,357)			
Private	Ref	-	-
Public	1.03	[0.97, 1.09]	0.305
Other Coverage	0.66	[0.52, 0.83]	< 0.001
No Coverage	0.37	[0.33, 0.42]	< 0.001
City Classification (n = 28,462)			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	1.02	[0.94, 1.10]	0.665
Medium and small metropolitan area	1.03	[0.96, 1.11]	0.386
Non-metropolitan	1.20	[1.09, 1.31]	< 0.001
Employment (n = 28,234)			
Employed	Ref	-	-
Unemployed	1.06	[1.00, 1.13]	0.054
Education (n = 28,335)			
College	Ref	-	-
Some College	0.85	[0.78, 0.92]	< 0.001
High School/General	0.67	[0.62, 0.71]	< 0.001
Less than High School	0.47	[0.43, 0.53]	< 0.001
Anxiety (n = 28,415)			

Category	Univariable Analysis		
	Unadjusted OR	95% CI	p-value
No Anxiety	Ref	-	-
Anxiety	1.64	1.52–1.76	< 0.001
Anxiety Medication Status (n = 28,410)			
No Anxiety Medication	Ref	-	-
Anxiety Medication	1.69	1.57–1.83	< 0.001
Anxiety Frequency (n = 28,364)			
Never	Ref	-	-
Monthly	1.21	[1.11, 1.32]	< 0.001
Weekly	1.38	[1.28, 1.49]	< 0.001
Daily	1.47	[1.35, 1.60]	< 0.001
Anxiety Level (n = 20,257)			
Mild Anxiety	Ref	-	-
Moderate Anxiety	1.18	[1.09, 1.26]	< 0.001
High Anxiety	1.18	[1.05, 1.32]	0.004
Depression Status (n = 28,425)			
No Depression	Ref	-	-
Depression	1.58	[1.47, 1.70]	< 0.001
Depression Medication Status (n = 28,409)			
No Depression Medication	Ref	-	-
Depression Medication	1.68	[1.55, 1.82]	< 0.001
Depression Frequency (n = 28,346)			
Never	Ref	-	-
Monthly	1.34	[1.21, 1.48]	< 0.001
Weekly	1.37	[1.22, 1.55]	< 0.001
Daily	1.46	[1.27, 1.68]	< 0.001
Depression Level (n = 13,796)			
Mild Depression	Ref	-	-
Moderate Depression	1.08	[0.99, 1.18]	0.086

Category	Univariable Analysis		
	Unadjusted OR	95% CI	p-value
High Depression	1.11	[0.98, 1.26]	0.105
Therapy Status (n = 28,423)			
Therapy	-	-	-
No Therapy	1.52	[1.40, 1.65]	< 0.001

Regional differences were evident, with lower odds of self-reported myopia among individuals living in the South (OR = 0.85 [95% CI: 0.78–0.93]; $p = 0.001$) and West (OR = 0.89 [95% CI: 0.80–0.98]; $p = 0.016$) compared to the Northeast.

Socioeconomic gradients were observed across income and education. Compared to individuals with household income greater than five times the poverty threshold, progressively lower odds of myopia were found among those with income levels of 2–5 $\times$ (OR = 0.85 [95% CI: 0.80–0.91]; $p < 0.001$), 1–2 $\times$ (OR = 0.76 [95% CI: 0.69–0.82]; $p < 0.001$), and less than 1 $\times$ the poverty threshold (OR = 0.66 [95% CI: 0.59–0.73]; $p < 0.001$). Similarly, compared to college-educated participants, those with some college (OR = 0.85 [95% CI: 0.78–0.92]; $p < 0.001$), high school or equivalent education (OR = 0.67 [95% CI: 0.62–0.71]; $p < 0.001$), and less than high school education (OR = 0.47 [95% CI: 0.43–0.53]; $p < 0.001$) had lower odds of self-reported myopia.

Non-citizens demonstrated substantially lower odds of reporting myopia compared to citizens (OR = 0.40 [95% CI: 0.35–0.46]; $p < 0.001$). Compared to participants with private insurance, those without private insurance, specifically those with other coverage (OR = 0.66 [95% CI: 0.52–0.83]; $p < 0.001$) or no coverage (OR = 0.37 [95% CI: 0.33–0.42]; $p < 0.001$), also had lower odds of myopia.

Previously diagnosed mental health conditions were strongly associated with self-reported myopia. Participants reporting anxiety had higher odds of myopia compared to those without anxiety (OR = 1.64 [95% CI: 1.52–1.76]; $p < 0.001$), with increasing odds observed among those reporting more frequent symptoms. Further, compared to those with mild anxiety severity, participants with moderate (OR = 1.18 [95% CI: 1.09–1.26]; $p < 0.001$), and high anxiety severity (OR = 1.18 [95% CI: 1.05–1.32]; $p = 0.004$), exhibited significantly higher odds of myopia. Similar patterns were observed for depression, where individuals reporting depression (OR = 1.58 [95% CI: 1.47–1.70]; $p < 0.001$), use of depression medication (OR = 1.68 [95% CI: 1.55–1.82]; $p < 0.001$), and not undergoing therapy (OR = 1.52 [95% CI: 1.40–1.65]; $p < 0.001$) had higher odds of self-reported myopia compared to their counterparts who did not report these conditions or treatments. In contrast to anxiety severity, no significant association was observed between depression severity and myopia, compared to those with mild depression, neither moderate (OR = 1.08 [95% CI: 0.99–1.18]; $p = 0.086$) nor high depression levels (OR = 1.11 [95% CI: 0.98–1.26]; $p = 0.105$) were associated with significantly increased odds of myopia.

Multivariable Analysis

In multivariable analysis, several mental health variables remained significantly associated with myopia, including anxiety diagnosis, anxiety medication use, moderate anxiety level, higher anxiety frequency, depression status, depression medication use, depression frequency, and therapy status. In contrast, high anxiety level and overall depression level were not significantly associated with myopia in the adjusted model.

Anxiety

After adjustment for sociodemographic factors, anxiety remained independently associated with higher odds of self-reported myopia (OR = 1.48 [95% CI: 1.36–1.60]; $p < 0.001$). Several associations observed in univariable analyses were attenuated, including regional differences and household income. Racial and ethnic associations were also reduced, although Asian participants continued to demonstrate higher odds of myopia compared to White participants (OR = 1.31 [95% CI: 1.15–1.50]; $p < 0.001$). A comprehensive summary of results is shown in Table 4.

Table 4
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Anxiety Diagnosis and Sociodemographic Factors in the 2023 National Health
Interview Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex			
Male	Ref	-	-
Female	1.53	[1.43, 1.60]	< 0.001
Age (y)			
18–35	Ref	-	-
36–50	0.88	[0.81, 0.96]	0.004
51–65	1.36	[1.24, 1.49]	< 0.001
66–80	1.40	[1.25, 1.56]	< 0.001
80+	1.27	[1.10, 1.48]	0.002
Region			
Northeast	Ref	-	-
Midwest	1.08	[0.97, 1.21]	0.172
South	0.93	[0.84, 1.03]	0.173
West	0.91	[0.81, 1.01]	0.076
Race			
White	Ref	-	-
Hispanic	1.00	[0.91, 1.10]	0.992
Black/African American	0.90	[0.81, 1.00]	0.050
Asian	1.31	[1.15, 1.50]	< 0.001
American Indian/Alaskan	0.91	[0.69, 1.19]	0.493
Other	0.99	[0.73, 1.34]	0.929
Income			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	0.97	[0.90, 1.05]	0.451
1–2 × poverty threshold	0.98	[0.89, 1.09]	0.765

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.90	[0.79, 1.02]	0.107
Sexual Orientation			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.29	[1.11, 1.50]	0.001
Other (Something else)	1.53	[1.04, 2.24]	0.029
Citizenship			
Yes	Ref	-	-
No	0.57	[0.49, 0.65]	< 0.001
Insurance			
Private	Ref	-	-
Public	0.98	[0.90, 1.08]	0.724
Other Coverage	0.75	[0.59, 0.96]	0.020
No Coverage	0.55	[0.48, 0.63]	< 0.001
City Classification			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.91	0.037	[0.83, 0.99]
Medium and small metropolitan area	0.97	0.530	[0.90, 1.06]
Non-metropolitan	1.11	0.033	[1.00, 1.24]
Employment			
Employed	Ref	-	-
Unemployed	0.94	0.120	[0.87, 1.02]
Education			
College	Ref	-	-
Some College	0.85	[0.78, 0.93]	0.001
High School/General	0.72	[0.66, 0.77]	< 0.001
Less than High School	0.60	[0.53, 0.68]	< 0.001
Anxiety			
No Anxiety	Ref	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Anxiety	1.48	[1.36, 1.60]	< 0.001

Anxiety Medication

Anxiety medication use was similarly associated with increased odds of self-reported myopia after adjustment (OR = 1.43 [95% CI: 1.32–1.55]; $p < 0.001$). As in the anxiety status model, regional and income effects were no longer statistically significant. Racial and ethnic differences were further attenuated; however, Asian participants continued to show elevated odds of myopia (OR = 1.30 [95% CI: 1.14–1.49]; $p < 0.001$). Associations related to sexual orientation, citizenship, insurance status, and education persisted. A comprehensive summary of results is shown in Table 5.

Table 5
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Anxiety Medication Status and Sociodemographic Factors in the 2023 National
Health Interview Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex			
Male	Ref	-	-
Female	1.52	[1.43, 1.61]	< 0.001
Age (y)			
18–35	Ref	-	-
36–50	0.87	[0.80, 0.95]	0.002
51–65	1.31	[1.20, 1.44]	< 0.001
66–80	1.34	[1.20, 1.49]	< 0.001
80+	1.22	[1.05, 1.41]	0.010
Region			
Northeast	Ref	-	-
Midwest	1.07	[0.96, 1.20]	0.208
South	0.92	[0.83, 1.02]	0.132
West	0.90	[0.81, 1.00]	0.057
Race			
White	Ref	-	-
Hispanic	0.99	[0.90, 1.09]	0.874
Black/African American	0.89	[0.80, 0.99]	0.032
Asian	1.30	[1.14, 1.49]	< 0.001
American Indian/Alaskan	0.91	[0.69, 1.20]	0.505
Other	0.99	[0.73, 1.34]	0.934
Income			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	0.97	[0.90, 1.05]	0.451
1–2 × poverty threshold	0.98	[0.89, 1.09]	0.765

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.90	[0.79, 1.02]	0.107
Sexual Orientation			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.35	[1.16, 1.56]	< 0.001
Other (Something else)	1.62	[1.10, 2.38]	0.015
Citizenship			
Yes	Ref	-	-
No	0.56	[0.48, 0.64]	< 0.001
Insurance			
Private	Ref	-	-
Public	0.98	[0.90, 1.08]	0.724
Other Coverage	0.75	[0.59, 0.96]	0.020
No Coverage	0.55	[0.48, 0.63]	< 0.001
City Classification			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.91	0.034	[0.83, 0.99]
Medium and small metropolitan area	0.97	0.531	[0.90, 1.06]
Non-metropolitan	1.11	0.043	[1.00, 1.23]
Employment			
Employed	Ref	-	-
Unemployed	0.94	0.150	[0.87, 1.02]
Education			
College	Ref	-	-
Some College	0.86	[0.79, 0.94]	0.001
High School/General	0.72	[0.67, 0.78]	< 0.001
Less than High School	0.60	[0.53, 0.69]	< 0.001
Anxiety Medication Status			
No Anxiety Medication	Ref	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Anxiety Medication	1.43	[0.87, 1.02]	< 0.001

Anxiety Level

In contrast to anxiety status and medication use, anxiety level demonstrated a more limited association with myopia. In the severity analysis, only moderate anxiety (OR = 1.11 [95% CI: 1.03–1.20]; $p = 0.010$) was associated with higher odds of myopia compared to mild anxiety. In contrast, high anxiety did not reach statistical significance for higher odds of myopia. Most socioeconomic and regional associations observed in univariable analyses were attenuated in this model. Asian race, citizenship status, insurance coverage, and educational attainment remained associated with self-reported myopia. Full results can be found in Table 6.

Table 6
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Anxiety Level and Sociodemographic Factors in the 2023 National Health Interview
Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex			
Male	Ref	-	-
Female	1.53	[1.43, 1.65]	< 0.001
Age (y)			
18–35	Ref	-	-
36–50	0.92	[0.84, 1.02]	0.116
51–65	1.35	[1.22, 1.50]	< 0.001
66–80	1.33	[1.17, 1.51]	< 0.001
80+	1.21	[1.00, 1.46]	0.049
Region			
Northeast	Ref	-	-
Midwest	1.03	[0.91, 1.16]	0.641
South	0.89	[0.80, 1.00]	0.057
West	0.86	[0.76, 0.96]	0.009
Race			
White	Ref	-	-
Hispanic	1.01	[0.90, 1.13]	0.850
Black/African American	0.95	[0.83, 1.08]	0.394
Asian	1.54	[1.30, 1.82]	< 0.001
American Indian/Alaskan	0.84	[0.62, 1.15]	0.281
Other	0.98	[0.70, 1.38]	0.915
Income			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	1.01	[0.93, 1.10]	0.743
1–2 × poverty threshold	0.97	[0.86, 1.09]	0.613

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.90	[0.78, 1.05]	0.179
Sexual Orientation			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.25	[1.07, 1.46]	0.005
Other (Something else)	1.44	[0.99, 2.14]	0.071
Citizenship			
Yes	Ref	-	-
No	0.63	[0.53, 0.74]	< 0.001
Insurance			
Private	Ref	-	-
Public	0.98	[0.89, 1.09]	0.751
Other Coverage	0.86	[0.66, 1.14]	0.299
No Coverage	0.60	[0.52, 0.70]	< 0.001
City Classification			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.89	[0.80, 0.99]	0.040
Medium and small metropolitan area	0.92	[0.84, 1.02]	0.099
Non-metropolitan	1.13	[1.00, 1.27]	0.051
Employment			
Employed	Ref	-	-
Unemployed	0.96	0.440	[0.88, 1.06]
Education			
College	Ref	-	-
Some College	0.87	[0.78, 0.97]	0.009
High School/General	0.74	[0.67, 0.81]	< 0.001
Less than High School	0.64	[0.54, 0.74]	< 0.001
Anxiety Level			
Mild Anxiety	Ref	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Moderate Anxiety	1.11	[1.03, 1.20]	0.010
High Anxiety	1.09	[0.96, 1.22]	0.190

Anxiety Frequency

Frequency of anxiety symptoms showed a graded relationship with odds of self-reported myopia after adjustment. Compared to participants who never experienced anxiety, both monthly (OR = 1.13 [95% CI: 1.03–1.25]; $p = 0.010$) and weekly anxiety (OR = 1.29 [95% CI: 1.18–1.40]; $p < 0.001$) were associated with higher odds of myopia, indicating increasing odds with greater symptom frequency. Other sociodemographic patterns were largely consistent with prior models. Structural factors, including citizenship status, insurance coverage, urbanicity, and education, remained independently associated. Detailed results are summarized in Table 7.

Table 7
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Anxiety Frequency and Sociodemographic Factors in the 2023 National Health
Interview Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex (n = 28,457)			
Male	Ref	-	-
Female	1.52	[1.43, 1.62]	< 0.001
Age (y) (n = 27,018)			
18–35	Ref	-	-
36–50	0.90	[0.83, 0.98]	0.015
51–65	1.39	[1.27, 1.52]	< 0.001
66–80	1.43	[1.29, 1.60]	< 0.001
80+	1.30	[1.12, 1.51]	0.001
Region (n = 28,462)			
Northeast	Ref	-	-
Midwest	1.08	[0.96, 1.20]	0.195
South	0.92	[0.83, 1.02]	0.832
West	0.89	[0.80, 0.99]	0.802
Race (n = 28,462)			
White	Ref	-	-
Hispanic	1.00	[0.91, 1.10]	0.972
Black/African American	0.89	[0.80, 1.00]	0.041
Asian	1.31	[1.15, 1.50]	< 0.001
American Indian/Alaskan	0.90	[0.68, 1.19]	0.450
Other	0.98	[0.72, 1.34]	0.918
Income (n = 28,462)			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	0.96	[0.89, 1.04]	0.345
1–2 × poverty threshold	0.98	[0.89, 1.08]	0.696

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.89	[0.78, 1.01]	0.073
Sexual Orientation (n = 27,916)			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.33	[1.15, 1.55]	< 0.001
Other (Something else)	1.57	[1.06, 2.31]	0.024
Citizenship (n = 28,223)			
Yes	Ref	-	-
No	0.57	[0.49, 0.65]	< 0.001
Insurance (n = 28,357)			
Private	Ref	-	-
Public	0.99	[0.91, 1.09]	0.913
Other Coverage	0.75	[0.60, 0.95]	0.017
No Coverage	0.55	[0.48, 0.63]	< 0.001
City Classification (n = 28,462)			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.91	[0.83, 0.99]	0.028
Medium and small metropolitan area	0.98	[0.91, 1.06]	0.637
Non-metropolitan	1.12	[1.01, 1.24]	0.028
Employment (n = 28,234)			
Employed	Ref	-	-
Unemployed	0.95	[0.87, 1.03]	0.176
Education (n = 28,335)			
College	Ref	-	-
Some College	0.86	[0.79, 0.94]	0.001
High School/General	0.73	[0.67, 0.79]	< 0.001
Less than High School	0.61	[0.54, 0.69]	< 0.001
Anxiety Frequency (n = 28,364)			
Never	-	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Monthly	1.13	[1.03, 1.25]	0.010
Weekly	1.29	[1.18, 1.40]	< 0.001
Daily	1.40	[1.28, 1.53]	< 0.001

Depression Status

Depression status demonstrated a robust independent association with self-reported myopia in the multivariable model (OR = 1.43 [95% CI: 1.31–1.55]; $p < 0.001$). Adjustment attenuated several associations observed in univariable analyses, particularly income and regional differences. However, Asian participants continued to demonstrate higher odds of myopia and non-citizens had substantially lower odds compared to citizens. Sexual orientation, insurance coverage, urbanicity, and educational attainment also remained significantly associated (Table 8).

Table 8
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Depression Diagnosis and Sociodemographic Factors in the 2023 National Health
Interview Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex (n = 28,457)			
Male	Ref	-	-
Female	1.52	[1.43, 1.61]	< 0.001
Age (y) (n = 27,018)			
18–35	Ref	-	-
36–50	0.88	[0.81, 0.96]	0.003
51–65	1.34	[1.22, 1.46]	< 0.001
66–80	1.37	[1.23, 1.53]	< 0.001
80+	1.25	[1.07, 1.45]	0.004
Region (n = 28,462)			
Northeast	Ref	-	-
Midwest	1.07	[0.96, 1.20]	0.219
South	0.93	[0.83, 1.03]	0.140
West	0.90	[0.80, 1.00]	0.044
Race (n = 28,462)			
White	Ref	-	-
Hispanic	1.00	[0.90, 1.10]	0.908
Black/African American	0.90	[0.80, 1.00]	0.033
Asian	1.31	[1.15, 1.50]	< 0.001
American Indian/Alaskan	0.91	[0.69, 1.20]	0.490
Other	0.98	[0.72, 1.32]	0.869
Income (n = 28,462)			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	0.96	[0.89, 1.04]	0.315
1–2 × poverty threshold	0.97	[0.88, 1.07]	0.561

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.88	[0.78, 1.00]	0.049
Sexual Orientation (n = 27,916)			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.30	[1.12, 1.51]	0.001
Other (Something else)	1.52	[1.04, 2.23]	0.029
Citizenship (n = 28,223)			
Yes	Ref	-	-
No	0.56	[0.49, 0.65]	< 0.001
Insurance (n = 28,357)			
Private	Ref	-	-
Public	0.98	[0.89, 1.07]	0.618
Other Coverage	0.75	[0.59, 0.95]	0.016
No Coverage	0.55	[0.48, 0.63]	< 0.001
City Classification (n = 28,462)			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.91	[0.83, 0.99]	0.001
Medium and small metropolitan area	0.97	[0.90, 1.06]	< 0.001
Non-metropolitan	1.12	[1.01, 1.24]	< 0.001
Employment (n = 28,234)			
Employed	Ref	-	-
Unemployed	0.94	[0.87, 1.02]	0.133
Education (n = 28,335)			
College	Ref	-	-
Some College	0.86	[0.78, 0.94]	0.001
High School/General	0.72	[0.67, 0.78]	< 0.001
Less than High School	0.60	[0.53, 0.68]	< 0.001
Depression Status (n = 28,425)			
No Depression	-	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Depression	1.43	[1.31, 1.55]	< 0.001

Depression Medication

Use of depression medication remained independently associated with higher odds of self-reported myopia after adjustment (OR = 1.39 [95% CI: 1.27–1.52]; $p < 0.001$). Socioeconomic indicators such as income were no longer significant, while demographic patterns related to age, sex, and race were largely consistent with other mental health models. Structural access factors, including citizenship status, insurance coverage, and education, continued to show strong associations. Geographic differences were minimal in this model (Table 9).

Table 9
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Depression Medication Status and Sociodemographic Factors in the 2023 National
Health Interview Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex (n = 28,457)			
Male	Ref	-	-
Female	1.53	[1.45, 1.63]	< 0.001
Age (y) (n = 27,018)			
18–35	Ref	-	-
36–50	0.87	[0.80, 0.95]	0.001
51–65	1.31	[1.20, 1.44]	< 0.001
66–80	1.33	[1.19, 1.48]	< 0.001
80+	1.21	[1.04, 1.40]	0.014
Region (n = 28,462)			
Northeast	Ref	-	-
Midwest	1.08	[0.96, 1.20]	0.199
South	0.93	[0.83, 1.03]	0.141
West	0.90	[0.81, 1.00]	0.053
Race (n = 28,462)			
White	Ref	-	-
Hispanic	0.99	[0.90, 1.08]	0.761
Black/African American	0.89	[0.80, 0.98]	0.024
Asian	1.29	[1.13, 1.47]	< 0.001
American Indian/Alaskan	0.92	[0.70, 1.21]	0.544
Other	0.98	[0.72, 1.33]	0.885
Income (n = 28,462)			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	0.97	[0.90, 1.04]	0.368
1–2 × poverty threshold	0.98	[0.89, 1.08]	0.699

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.89	[0.79, 1.02]	0.084
Sexual Orientation (n = 27,916)			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.36	[1.17, 1.58]	< 0.001
Other (Something else)	1.66	[1.13, 2.44]	0.010
Citizenship (n = 28,223)			
Yes	Ref	-	-
No	0.56	[0.48, 0.64]	< 0.001
Insurance (n = 28,357)			
Private	Ref	-	-
Public	0.99	[0.90, 1.08]	0.809
Other Coverage	0.76	[0.60, 0.96]	0.023
No Coverage	0.56	[0.48, 0.64]	< 0.001
City Classification (n = 28,462)			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.91	[0.83, 0.99]	0.031
Medium and small metropolitan area	0.98	[0.90, 1.06]	0.580
Non-metropolitan	1.11	[1.00, 1.23]	0.043
Employment (n = 28,234)			
Employed	Ref	-	-
Unemployed	0.95	[0.87, 1.02]	0.171
Education (n = 28,335)			
College	Ref	-	-
Some College	0.86	[0.79, 0.94]	0.001
High School/General	0.72	[0.67, 0.78]	< 0.001
Less than High School	0.60	[0.53, 0.69]	< 0.001
Depression Medication Status (n = 28,409)			
No Depression Medication	-	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Depression Medication	1.39	[1.27, 1.52]	< 0.001

Depression Frequency

Frequency of depressive symptoms was consistently associated with self-reported myopia after adjustment (Table 10). Compared to participants who never experienced depressive symptoms, both monthly (OR = 1.31 [95% CI: 1.18–1.46]; $p < 0.001$) and weekly symptoms (OR = 1.31 [95% CI: 1.16–1.49]; $p < 0.001$) were associated with higher odds of myopia, suggesting a stable association across frequency categories.

Table 10
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Depression Frequency and Sociodemographic Factors in the 2023 National
Health Interview Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex (n = 28,457)			
Male	Ref	-	-
Female	1.55	[1.46, 1.64]	< 0.001
Age (y) (n = 27,018)			
18–35	Ref	-	-
36–50	0.88	[0.82, 0.96]	0.006
51–65	1.35	[1.23, 1.48]	< 0.001
66–80	1.37	[1.12, 1.52]	< 0.001
80+	1.23	[1.06, 1.43]	0.006
Region (n = 28,462)			
Northeast	Ref	-	-
Midwest	1.07	[0.96, 1.20]	0.210
South	0.92	[0.83, 1.02]	0.134
West	0.89	[0.80, 0.99]	0.036
Race (n = 28,462)			
White	Ref	-	-
Hispanic	0.99	[0.90, 1.09]	0.841
Black/African American	0.88	[0.80, 0.98]	0.019
Asian	1.29	[1.13, 1.47]	< 0.001
American Indian/Alaskan	0.90	[0.68, 1.18]	0.441
Other	0.96	[0.70, 1.31]	0.793
Income (n = 28,462)			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	0.97	[0.90, 1.04]	0.368
1–2 × poverty threshold	0.98	[0.89, 1.08]	0.699

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.89	[0.79, 1.02]	0.084
Sexual Orientation (n = 27,916)			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.32	[1.14, 1.53]	< 0.001
Other (Something else)	1.56	[1.07, 2.30]	0.022
Citizenship (n = 28,223)			
Yes	Ref	-	-
No	0.56	[0.48, 0.64]	< 0.001
Insurance (n = 28,357)			
Private	Ref	-	-
Public	0.99	[0.90, 1.08]	0.758
Other Coverage	0.75	[0.59, 0.95]	0.015
No Coverage	0.54	[0.47, 0.62]	< 0.001
City Classification (n = 28,462)			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.91	[0.83, 0.99]	0.034
Medium and small metropolitan area	0.98	[0.91, 1.06]	0.653
Non-metropolitan	1.12	[1.01, 1.24]	0.037
Employment (n = 28,234)			
Employed	Ref	-	-
Unemployed	0.95	[0.87, 1.02]	0.175
Education (n = 28,335)			
College	Ref	-	-
Some College	0.86	[0.78, 0.94]	0.001
High School/General	0.72	[0.66, 0.77]	< 0.001
Less than High School	0.60	[0.53, 0.68]	< 0.001
Depression Frequency (n = 28,346)			
Never	-	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Monthly	1.31	[1.18, 1.46]	< 0.001
Weekly	1.31	[1.16, 1.49]	< 0.001
Daily	1.47	[1.26, 1.72]	< 0.001

Depression Level

Depression severity was not independently associated with self-reported myopia in the adjusted model (Table 11). Neither moderate nor high depression differed significantly from mild depression, indicating that severity did not explain additional variation beyond depression presence or frequency. Despite this attenuation, several demographic and structural associations persisted, including higher odds among females and Asian participants and lower odds among non-citizens and those without insurance.

Table 11
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Depression Level and Sociodemographic Factors in the 2023 National Health
Interview Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex (n = 28,457)			
Male	Ref	-	-
Female	1.61	[1.48, 1.75]	< 0.001
Age (y) (n = 27,018)			
18–35	Ref	-	-
36–50	0.91	[0.81, 1.03]	0.140
51–65	1.30	[1.14, 1.48]	< 0.001
66–80	1.23	[1.06, 1.44]	0.008
80+	1.08	[0.86, 1.36]	0.507
Region (n = 28,462)			
Northeast	Ref	-	-
Midwest	1.14	[0.97, 1.33]	0.109
South	0.97	[0.84, 1.12]	0.667
West	0.88	[0.76, 1.03]	0.112
Race (n = 28,462)			
White	Ref	-	-
Hispanic	1.01	[0.88, 1.16]	0.877
Black/African American	0.89	[0.76, 1.04]	0.139
Asian	1.42	[1.16, 1.76]	0.001
American Indian/Alaskan	0.72	[0.50, 1.02]	0.065
Other	0.90	[0.61, 1.32]	0.581
Income (n = 28,462)			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	1.08	[0.97, 1.20]	0.148
1–2 × poverty threshold	1.07	[0.93, 1.24]	0.329

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.99	[0.83, 1.18]	0.934
Sexual Orientation (n = 27,916)			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.27	[1.07, 1.52]	0.008
Other (Something else)	1.41	[0.93, 2.14]	0.108
Citizenship (n = 28,223)			
Yes	Ref	-	-
No	0.58	[0.47, 0.72]	< 0.001
Insurance (n = 28,357)			
Private	Ref	-	-
Public	1.03	[0.91, 1.16]	0.672
Other Coverage	0.93	[0.65, 1.33]	0.689
No Coverage	0.60	[0.47, 0.69]	< 0.001
City Classification (n = 28,462)			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.91	[0.80, 1.03]	0.134
Medium and small metropolitan area	0.98	[0.87, 1.06]	0.663
Non-metropolitan	1.13	[0.98, 1.30]	0.100
Employment (n = 28,234)			
Employed	Ref	-	-
Unemployed	0.94	[0.84, 1.06]	0.298
Education (n = 28,335)			
College	Ref	-	-
Some College	0.93	[0.83, 1.06]	0.288
High School/General	0.75	[0.67, 0.85]	< 0.001
Less than High School	0.60	[0.50, 0.72]	< 0.001
Depression Level (n = 13,796)			
Mild Depression	-	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Moderate Depression	1.08	[0.99, 1.19]	0.094
High Depression	1.12	[0.98, 1.28]	0.109

Therapy

Therapy status remained associated with self-reported myopia in the adjusted model (Table 12). Participants not receiving therapy had higher odds of myopia compared to those engaged in therapy (OR = 1.33 [95% CI: 1.21–1.46]; $p < 0.001$). This association persisted alongside consistent sociodemographic patterns observed across models, including higher odds among females and older age groups and lower odds among non-citizens.

Table 12
Multivariable Logistic Regression Analysis of Odds of Self-Reported Myopia by
Therapy Status and Sociodemographic Factors in the 2023 National Health
Interview Survey

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
Sex (n = 28,457)			
Male	Ref	-	-
Female	1.54	[1.45, 1.64]	< 0.001
Age (y) (n = 27,018)			
18–35	Ref	-	-
36–50	0.89	[0.81, 0.97]	0.006
51–65	1.36	[1.24, 1.49]	< 0.001
66–80	1.38	[1.24, 1.54]	< 0.001
80+	1.25	[1.08, 1.45]	0.003
Region (n = 28,462)			
Northeast	Ref	-	-
Midwest	1.08	[0.97, 1.21]	0.144
South	0.93	[0.84, 1.04]	0.204
West	0.90	[0.81, 1.00]	0.053
Race (n = 28,462)			
White	Ref	-	-
Hispanic	0.98	[0.89, 1.08]	0.720
Black/African American	0.88	[0.79, 0.97]	0.015
Asian	1.29	[1.13, 1.48]	< 0.001
American Indian/Alaskan	0.90	[0.69, 1.18]	0.458
Other	0.97	[0.71, 1.32]	0.835
Income (n = 28,462)			
>5 × poverty threshold	Ref	-	-
2–5 × poverty threshold	0.97	[0.90, 1.05]	0.489
1–2 × poverty threshold	0.99	[0.90, 1.10]	0.876

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
<1 × poverty threshold	0.90	[0.79, 1.02]	0.113
Sexual Orientation (n = 27,916)			
Straight	Ref	-	-
Gay, Lesbian, or Bisexual	1.35	[1.16, 1.56]	< 0.001
Other (Something else)	1.59	[1.08, 2.36]	0.020
Citizenship (n = 28,223)			
Yes	Ref	-	-
No	0.56	[0.48, 0.64]	< 0.001
Insurance (n = 28,357)			
Private	Ref	-	-
Public	1.00	[0.91, 1.10]	0.953
Other Coverage	0.76	[0.60, 0.96]	0.020
No Coverage	0.56	[0.48, 0.64]	< 0.001
City Classification (n = 28,462)			
Large central metropolitan area	Ref	-	-
Large fringe metropolitan area	0.91	[0.83, 1.00]	0.044
Medium and small metropolitan area	0.99	[0.91, 1.07]	0.784
Non-metropolitan	1.13	[1.02, 1.26]	0.017
Employment (n = 28,234)			
Employed	Ref	-	-
Unemployed	0.95	[0.88, 1.03]	0.206
Education (n = 28,335)			
College	Ref	-	-
Some College	0.86	[0.79, 0.95]	0.001
High School/General	0.73	[0.68, 0.79]	< 0.001
Less than High School	0.61	[0.54, 0.69]	< 0.001
Therapy Status (n = 28,423)			
Therapy	-	-	-

Category	Multivariable Analysis		
	Adjusted OR	95% CI	p-value
No Therapy	1.33	[1.21, 1.46]	< 0.001

Discussion

Given the high prevalence of myopia and the rising incidence of mental health conditions, understanding the associations between mental health conditions, symptom burden, treatment engagement, and myopia may help inform population-level strategies aimed at improving both vision and mental health outcomes. Our study found that mental health conditions are consistently associated with self-reported myopia, but the nature of the association varies by construct. Across the models in our analysis, self-reported myopia was associated with multiple mental health indicators, including anxiety status, depression status, medication use, symptom frequency, and a lack of therapy engagement. However, these associations were not uniform.

In the multivariable analysis both the presence of anxiety and daily anxiety symptom frequency was significantly associated with higher odds of self-reported myopia. This is consistent with previous studies reporting associations between anxiety and myopia across different populations [10, 15, 19]. Similarly, both the presence of depression and daily symptom frequency was also significantly associated with higher odds of self-reported myopia. Prior studies examining the relationship between depression and myopia are inconsistent, however, with some reporting significant association across populations, [10, 14] while others have not identified significant associations [15, 19]. These inconsistencies may reflect differences in study populations, age groups or analytical approaches and point to a need for further exploration.

This also highlights ongoing uncertainty regarding the causal direction between myopia and mental health. Some authors have cited causal models that propose mental health variables may act as primary risk factors for myopia through genetic and behavioral predispositions [10]. Further, a recent longitudinal data from large adolescent cohorts suggest an asymmetric bidirectional relationship, with myopia more likely to drive new-onset emotional symptoms [20]. For instance, myopia is often associated with lifestyles involving concentrated near-work and limited sunlight exposure, factors that may increase psychological stress, disrupt sleep regulation, and elevate the risk for anxiety and depression, while social experiences such as bullying related to corrective devices may further contribute to emotional distress [20–22]. It is therefore likely that the relationship between myopia and mental health conditions is bidirectional [11, 23]

A recently developed framework speculates that these interactions may reflect interconnected biological pathways linking environmental light exposure, ocular development, and emotional regulation [23]. This perspective suggests that light detected by retinal signaling pathways influences brain systems involved

in circadian timing, stress responses, and mood regulation, while simultaneously contributing to mechanisms involved in axial elongation [24, 25]. Changes in light exposure patterns and related behavioral factors may therefore influence both visual development and psychological well-being through shared neurobiological processes. In this way, mood disturbances could indirectly contribute to myopia progression through altered daily behaviors and stress-related physiological changes, while myopia may also heighten vulnerability to emotional symptoms through overlapping neural and immune pathways that affect both visual and affective functioning [23]. Regardless of the underlying mechanisms, our findings provide additional insight into how this relationship may manifest clinically.^{10,11} Overall, the presence of a mental health condition and its frequency showed more consistent relationships with self-reported myopia than severity, suggesting that experiencing mental health conditions or recurrent symptoms may be more relevant than intensity. Given the inconsistencies in prior literature and our findings that higher symptom frequency was significantly associated with greater odds of myopia, frequency-based measures may offer a more informative lens for understanding this relationship. This distinction highlights the importance of how mental health may be operationalized when examining vision-related outcomes as frequency may better capture sustained stress exposure, behavioral adaptations, or healthcare engagement patterns relevant to visual health.

Beyond myopia-specific research, broader literature has also demonstrated associations between vision impairment and mental health outcomes including anxiety and depression [26–29]. Our findings extend this evidence by demonstrating that myopia, a widespread form of vision impairment, is similarly associated with mental health presence and symptom frequency in adults. These associations may reflect shared outcomes observed across vision impairments, such as functional limitation, reduced quality of life [30, 31], or increased health care engagement [32, 33].

Notably, associations between mental health treatment indicators and myopia were not uniform. Use of anxiety or depression medication was associated with higher odds of self-reported myopia, whereas lack of engagement in therapy was also associated with higher odds. These findings should be put into context of broader trends demonstrating increased prescription of pharmacologic treatments alongside declining use of psychological therapies, [34] despite evidence that some patients may prefer psychotherapy or combined treatment approaches [35]. This trend may also have significant clinical implications myopia management, as SSRIs and SNRIs, common medications used for depression and anxiety, can compromise tear film stability, while the mydriatic effects of tricyclic antidepressants may exacerbate the glare and night vision difficulties already prevalent in nearsighted individuals [36].

Several sociodemographic associations remained consistent across all multivariable models, regardless of the mental health variable included. Higher odds of myopia among females and Asian participants, and lower odds among non-citizens and uninsured individuals, were consistently observed, suggesting these factors may independently influence reported myopia. These findings are consistent with prior research demonstrating higher myopia progression among females and Asian populations [37, 38]. Similar sex differences have also been observed in adult populations, with higher rates of myopia among females compared to males [39, 40]. Experimental and clinical studies have also suggested that

sex hormones may influence ocular growth and refractive parameters [41, 42]. Lower odds of reported myopia among non-citizens, individuals with lower educational attainment, and uninsured participants may reflect differences in diagnosis awareness and access to eye care rather than true prevalence differences [43–45]. Given the reliance on self-reported myopia, these associations should be interpreted cautiously, as they may partially reflect disparities in healthcare access and diagnostic opportunity.

This study has several limitations that should be considered when interpreting the findings. First, myopia and mental health measures were based on self-report, which may be subject to recall bias and differences in diagnostic awareness. As a result, observed associations may reflect variation in healthcare access or reporting behaviours rather than true differences in underlying prevalence. Second, the cross-sectional nature of the data prevents causal inference, and the observed relationships should be interpreted as associations rather than evidence of directionality or causation between mental health and myopia. Finally, information on the degree or severity of myopia was not available, limiting the ability to examine whether associations differed by myopia severity. Future studies incorporating longitudinal designs and clinically measured refractive error would help address these limitations and further clarify the relationship between mental health and myopia.

Conclusion

In this cross-sectional population-based study, presence of a mental health condition, symptom frequency, lack of therapy, and use of prescription medications for treatment were consistently associated with higher odds of self-reported myopia in adults, whereas severity showed weaker associations. Persistent sociodemographic patterns, including higher odds of myopia among females and Asian participants and lower odds among non-citizens and uninsured individuals, underscore the role of structural and access-related factors in myopia reporting and diagnosis. Together, these findings highlight the interconnected nature of mental health, treatment patterns, vision health, and social determinants. Recognizing these overlapping influences may help clinicians better contextualize visual symptoms and patient experiences within broader mental health and social care pathways. These findings also support the need for integrated, equity-oriented approaches to patient management and underscore the importance of longitudinal research to clarify causal pathways and better understand how mental health, treatment patterns, and environmental exposures interact to influence visual health over time.

Declarations

Ethics Approval:

Exemption from research ethics board approval was granted by the University of Toronto Research Ethics Board.

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MMP: Financial support (to institution) – PSI Foundation, Fighting

Competing Interests

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Author Contribution

TJ - writing the original draft of the manuscript and reviewing and editing subsequent versions. DR - formal analysis, writing the original draft, and reviewing and editing the manuscript. CZ - formal analysis and reviewing and editing the manuscript. RH -Formal analysis and data curastion. PK - conceptualization, methodology development, investigation, data curation, supervision, and manuscript review and editing. RM - conceptualization, methodology, project administration, investigation, and manuscript review and editing. RK - conceptualization, data curation, supervision, investigation, and manuscript review and editing. MP - conceptualization, methodology, project administration, supervision, and manuscript review and editing.

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Data Availability

The data that support the findings of this study are publicly available from the National Health Interview Survey (NHIS), conducted by the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention. The 2023 NHIS public-use data files, questionnaires, and documentation are

available at the NHIS website: 2023 NHIS Questionnaires, Datasets, and Documentation. No new data were generated for this study.

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