

# Association of vision impairment with suicide ideation, plans, and attempts among adults in the United States

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## Abstract

**Objective:** This study aims to investigate the relative strength of association between vision impairment (VI) and suicidal ideation, plans, and attempts among adults in the United States.

**Method:** The study sample consisted of 214,505 adults, aged 18 years and older. Researchers used data from the 2015–2019 National Survey on Drug Use and Health, in which respondents were asked whether they had any suicidal thoughts, plans, and attempts, in the past 12 months.

**Results:** Approximately, 4.4% of respondents reported experiencing VI, being blind, or having serious difficulty seeing. Compared to their sighted peers, a relatively high proportion of adults with VI had serious thoughts about suicide (9.0%), suicidal plans (3.0%), or suicidal attempts (1.6%) in the past year. The findings showed that individuals with VI may disproportionately experience suicidal ideation, plans, and attempts, after controlling potentially confounding variables (adjusted odds ratio [AOR] = 1.36; AOR = 1.27; AOR = 1.40, respectively).

**Conclusion:** With findings demonstrating such a strong association between VI and suicide, this study suggests the

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importance of screening for suicidal ideation, plans, and attempts among adults with VI, and the strong need for developing behavioral health services which keep this correlation in mind.

#### KEYWORDS

national study, suicide behaviors, suicide ideation, suicide risk, vision impairment

## 1 | INTRODUCTION

Between 1999 and 2019, suicide rates increased by 33% in the United States (Hedegaard et al., 2018). According to the three-step theory (3ST) of suicide, intolerable physical pain and/or inescapable psychological pain must be present for there to be suicide motivation, while suicidal ideation is a function of the combination of inescapable pain (physical or psychological) and hopelessness. Klonsky and May (2015) suggested that an “ideation-to-action” link should guide suicide research in its theoretical development and prevention measures, arguing that the conception of suicidal ideation and the progression from ideation to suicide attempt are two distinct processes.

Prior work has examined risk factors for individuals known to be at high suicide risk based on age, sex, and mental health diagnoses (Choi et al., 2015; Fässberg et al., 2016). The prevalence of suicide was high among those with major depression and perceived unmet treatment needs while receiving mental health services (Han et al., 2014; Van Orden et al., 2010). It is not until recently that suicide risk for people with disabilities has been examined. Marlow et al. (2021) found that people with various types of functional disabilities had an elevated risk for suicide-related outcomes, compared with their nondisabled peers.

Vision impairment (VI) is one of the top 10 disabilities among adults aged 18 years and older, and it causes substantial social and economic hardships for millions of people, including significant suffering, disability, loss of productivity, and diminished quality of life (Brown & Barrett, 2011; Senra et al., 2015). Individuals with VI may disproportionately experience negative outcomes. Whereas VI itself may not be the cause of these hardships, lack of accessibility, stigma, discrimination, or a combination of these factors, may be contributors to these negative outcomes, including those related to suicide (Park & Lee, 2020).

According to the 2018 National Health Interview Survey, an estimated 32.2 million Americans (or about 13% of all adults) reported that they either “have trouble” seeing, even when wearing glasses or contact lenses, or that they are blind or unable to see at all (American Foundation for the Blind, 2020). VI includes a refractive error (correctable with glasses) and eye diseases, such as irrevocable age-related vision loss and ocular complications of diabetes mellitus (Crews et al., 2017). In the U.S., uncorrected refractive error accounts for approximately 79% of VI, while cataracts are the most common eye disease, accounting for approximately 50% of VI caused by eye disease (Swenor et al., 2020).

VI increases with advancing age. The Centers for Disease Control and Prevention's analysis of the 2016 Behavioral Risk Factor Surveillance System (BRFSS) data found that 6.6% of older adults reported having a vision-related disability, compared to 2.7% in the 18–44 age group, and 6.1% in the 45–64 age group (Okoro et al., 2018). The BRFSS data also showed that regardless of age, VI, like other types of disabilities, is more prevalent among women, racial/ethnic minorities, and those living at a lower income level.

VI has a variety of functional consequences, restricting many daily activities that require proper vision. People living with severe VI were five times more likely to experience limitations in daily activities, compared to those with better vision (National Academies of Sciences, Engineering and Medicine [NASEM], 2016). Adults with VI are prone

to serious depressive symptoms; they are more likely than adults without impaired eyesight to report poor health, obesity, nicotine use, and a sedentary lifestyle (Klein et al., 2014). They also report poorer life satisfaction and less social support, greater stress, and poor cognitive performance (Brown & Barrett, 2011; Chen et al., 2017; Senra et al., 2015). Not surprisingly, poor health is strongly associated with VI and chronic conditions. Crews et al. (2017) reported that older adults (aged 65 and older) living with VI have a broad range of physical and mental health comorbidities, and a higher prevalence of chronic conditions (e.g., hypertension, heart disease, stroke, arthritis, asthma, cancer, diabetes, depression, and hearing impairment).

It is well documented that VI is a significant risk factor for lifetime depression. Nollett et al. (2016) estimated that 43% of patients at a low vision rehabilitation center had clinically significant depression, a rate nearly as high as cancer patients undergoing chemotherapy treatment. X. Zhang et al. (2013) reported that the estimated prevalence of depression was 10.7% among adults with VI, compared to 6.8% among adults with normal visual acuity. Furthermore, longitudinal studies found that depression and VI might exist in a bidirectional relationship, with VI worsening the depression and depression exacerbating the VI (Carrière et al., 2013; Zheng et al., 2016)

In addition, Lam et al. (2008) identified the significant indirect effect of VI on death by suicide via poorer self-rated health or the number of non-ocular health concerns. Park and Lee (2020) found that older adults with VI (aged 65 and older) were more likely to report suicidal ideation, compared to their counterparts without VI. Therefore, VI can be associated with an increased risk of suicide through its negative effect on health. The 3ST argues that intolerable pain caused by VI alone is not sufficient to cause suicide (Klonsky & May, 2015). For this reason, hopelessness is an important component and a likely pathway to suicidal ideation: It is the combination of pain and hopelessness or some inescapable pain that causes suicidal thoughts and behaviors.

In a systematic review, Lutz and Fiske (2018) concluded that depression was a likely mediator of suicide-related outcomes for persons with disabilities. The vast majority of suicides in the Western world are completed by people who are diagnosed with at least one type of mental disorder, including depression (Hedegaard et al., 2018; Joiner, 2005). In the U.S., an estimated 26% of adults suffer from a diagnosable mental disorder in a given year and most people who attempted suicide have a diagnosable mental disorder (Han et al., 2014). Whereas mental disorders and suicidal behavior are comorbid with a strong correlation, one may not necessarily cause the other.

Psychological strain, as a consequence of vision loss or perceived lack of social relations, coupled with a lack of social integration, was present in the majority of suicides (Joiner, 2005; Khazem & Anestis, 2019; Klonsky et al., 2021). Stronger psychological strain, from different values and coping skills in the face of vision loss, increase the odds of suicide attempts (J. Zhang, 2019). Conversely, if an individual living with VI is resourceful and hopeful that his/her situation could improve, they would likely focus on their diminished VI capabilities, rather than on the possibility of ending his or her life.

Economic deprivation has also been shown to be strongly linked to suicidality. Stack and Wasserman (2007) found that economic strains (e.g., anticipated loss of a home or a car, medical problems, death of a loved one) were related directly to the origin of suicide. In a study examining depressive symptoms and suicidality among older adults attending primary care facilities (the setting where geriatric depression is usually treated), drastic outcomes based on socioeconomic inequalities were found: low-income older adults with less social ties reported much higher levels of depression and suicidal ideation (Gilman et al., 2013).

In addition, it is hypothesized that individuals who are well-integrated socially, with connections to family, religious and/or academic institutions, and those who are employed, may be at lower risk of suicide, even when confronting a major psychological strain (Joiner, 2005). Hence, married couples have lower suicide rates than single, divorced, or widowed people, perhaps because married people are more socially integrated (Choi et al., 2015). Religiosity has also served as important protection (strength and comfort) against suicidality and even suicide acceptability. Studies show that if religiosity is experienced as a source of hope and confidence, it reduces the risk of depression in times of mounting stress, while also facilitating recovery and diminishing the risk of suicide (Gearing & Alonzo, 2018).

In terms of measures of religiosity, O'Reilly and Rosato (2015) reported religious affiliation was a poor measure of religiosity, except for a small group of conservative Christians, based on their longitudinal analysis with a sample of greater than 1 million. Additional research showed that religious affiliation protected against suicide attempts, but not against suicidal ideation. This may be attributed to the culture-specific affiliations with certain religions, as certain minority religious groups can feel socially isolated (Lawrence et al., 2016). They also identified that religious service attendance itself was not necessarily a protective factor against suicidal ideation, considering the effect of social support on suicidality. However, attendance did protect against suicide attempts (Lawrence et al., 2016).

In summation, previous studies on this topic have limitations including failure to control for covariates relating to suicidal thinking and behaviors. Whereas many risks and protective factors of suicide are dynamic and vary by life cycle, limited study exists to examine various factors related to suicidal thoughts and behaviors. To address these research gaps, this study aims to investigate the relative strength of association between VI on suicidal ideation, plans, and attempts among adults in the U.S. Specifically, this study investigates (1) the prevalence of suicidality among adults with and without VI, (2) differences in the prevalence of reported suicidality among adults with and without VI, and (3) associations between suicidality and people living with VI.

## 2 | METHODS

### 2.1 | Data sources

This study analyzed the National Survey on Drug Use and Health (NSDUH), a nationally representative and cross-sectional survey (Center for Behavioral Health Statistics and Quality [CBHSQ], 2020). Conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA), the NSDUH examined the prevalence of substance use, and evaluated mental health status, among U.S. residents. The NSDUH data were collected using a multistage area probability sampling design based on the number of people who reside in each state (CBHSQ, 2020).

We used the NSDUH findings from 2015 to 2019, because the assessment of VI has only been included in these datasets since 2015. The analyses were performed on this combined data for 5 years, both to increase the power of the study and to detect a low frequency of occurrence of suicidal ideation, plans, and attempts. A detailed explanation of the sampling strategies can be found on the SAMHSA website (<https://www.samhsa.gov/data>). The study sample was composed of 214,505 adults, aged 18 years and older. Of these, 8628 respondents identified themselves as having VI, which is approximately 4.4% of the overall sample, after applying sample weights.

### 2.2 | Measures

#### 2.2.1 | Measure of suicidality

Suicidality was measured by the presence of suicidal thoughts and behaviors in the past year, including suicidal ideation, plans, and attempts. Past-year serious suicidal ideation was assessed by asking respondents, "At any time in the past 12 months, did you seriously think about trying to kill yourself?" Suicidal plans were assessed by the question, "During the past 12 months, did you make any plans to kill yourself?" Suicidal attempts were assessed by asking the question, "During the past 12 months, did you try to kill yourself?" All responses were dichotomized (0 = no, 1 = yes).

### 2.2.2 | Measure of VI

VI was assessed by asking the respondents whether they were blind or if they had serious difficulty seeing. The responses were dichotomized (0 = no, 1 = yes). Although VI was not objectively assessed by professionals, self-reported VI has been used universally, as a convenient and efficient method for data collection, because it maintains a significant correlation with visual function (X. Zhang et al., 2013).

### 2.2.3 | Covariates

The NSDUH included various potentially confounding variables, including sociodemographic characteristics, health status, and behavioral health. Respondents' sociodemographic information included gender, race/ethnicity (White, non-White), and marital status (married, nonmarried). We categorize respondents' age into four groups (18–34 years, 35–49 years, 50–64 years, and 65 years and older). Socioeconomic indicators included education level (less than high school, high school graduation, some college or associate degree, and college graduation), poverty status (living in poverty with an income up to 100% of the federal poverty threshold or more), employment status (employed and not employed), and urbanicity (urban and rural).

Respondents' self-reported information about their health status and behaviors was examined. Perceived health status was assessed by asking participants to rate their perceived health: "Would you say your health is excellent, very good, good, fair, or poor?" The responses were dichotomized (0 = poor/fair/good, 1 = very good/excellent).

The presence of functional disabilities was measured using hearing loss and activities of daily living (ADL) and instrumental activities of daily living (IADL) criteria. Hearing loss is identified by asking, "Are you deaf, or do you have serious difficulty hearing?" ADL was assessed by the following questions: "Because of a physical, mental, or emotional condition, do you have serious difficulty (1) concentrating, remembering, or making decisions; (2) walking or climbing stairs; (3) dressing or bathing?" IADL was defined as having difficulty doing errands alone because of a physical, mental, or emotional condition. All disability responses were dichotomized as 0 = no and 1 = yes.

Smoking was measured by a single question, "During the past 30 days, have you smoked part or all of a cigarette?" The responses were dichotomized (0 = no, 1 = yes). Binge alcohol use was measured by the question, "During the past 30 days, on how many days did you have 5 or more (for men)/4 or more (for women) drinks of alcoholic beverages on the same occasion?" The responses were dichotomized (0 = no binge alcohol use, 1 = binge alcohol use).

The frequency of religious participation was assessed through the following question: "During the past 12 months, how many times did you attend religious services, except for special occasions such as weddings, funerals, or other special events?" The responses were categorized into three groups (0 = 0 times, 1 = 1–24 times, 2 = 25 times and more).

Researchers measured other behavioral health challenges including major depressive episodes (MDEs) and unmet mental health treatment needs. The MDE in the NSDUH was assessed by asking whether respondents had an MDE in the past year, based on the Diagnostic and Statistical Manual of Mental Disorders, fifth edition criteria (American Psychiatric Association, 2013). In terms of unmet mental health treatment needs, respondents were asked the following question: "During the past 12 months, was there any time when you needed mental health treatment or counseling for yourself but didn't get it?" All responses were dichotomized (0 = no, 1 = yes).

## 2.3 | Data analysis

Using Stata/MP version 17.0 (StataCorp., 2021), survey data analysis procedures were performed to account for the complex sample design and sampling weights of NSDUH. All analyses were performed on weighted data to produce point estimates for the NSDUH results. We used Wald  $\chi^2$  statistics for bivariate analyses in describing sociodemographic characteristics of the populations with and without VI. In addition, we assessed trends in the prevalence of suicidality by VI for recent 5 years, from 2015 to 2019 (CBHSQ, 2017). Multivariate logistic regression analyses were also used to examine the association between VI and suicidal ideation, plans, and attempts among all adult respondents, as well as among respondents with VI, after adjusting for a comprehensive list of control variables, including sociodemographic variables and health-related variables. The odds ratios of the association were calculated for statistical significance ( $\alpha < 0.05$ ). The variance inflation factor showed that multicollinearity was not detected in the model (Midi et al., 2010).

Responses such as "refused" or "don't know" were treated as missing data. Of 214,505 respondents, 3% showed patterns of missing values. For example, 806 (0.4%) had missing values in measuring VI, and 1572 (0.7%) and 1569 (0.7%) had missing values in assessing suicidal plans and attempts. The highest proportion of missing data in single variables was in the responses for MDE (1.2%). Since traditional complete case or listwise deletion methods are acceptable when less than 5% of the data for each of the variables are missing (Little et al., 2014), we excluded the missing values from the multivariate logistic regression analyses by using listwise deletion. We then performed a sensitivity analysis to avoid possible bias caused by the listwise deletion method. All missing values in the analysis model, including outcome variables (i.e., suicidal ideation; plans; attempts), were imputed using multiple imputations by chained equations (Royston & White, 2011).

## 3 | RESULTS

### 3.1 | Sample characteristics of respondents

Table 1 shows the sociodemographic characteristics of respondents with VI ( $n = 8628$ ; weighted % = 4.4) and those without VI ( $n = 205,877$ ; weighted % = 95.6). The results from a series of Wald tests indicated significant differences in all major study variables. The sample with VI consisted of a slightly higher proportion of women (57.7%), non-White (58.4%), not married (59.0%) respondents, in comparison to the sample without VI, which had slightly more men (48.5%), White (64.1%) and married (52.2%) respondents.

The vast majority of adults with VI were aged 50 or older (60.8%) and unemployed (60.8%), while only 44.7% and 36.4% of respondents without VI were aged 50 or older and unemployed. In comparison to their sighted peers, respondents with VI reported lower educational attainment and health status and higher rates of poverty (26.3% vs. 13.5%) and rural residency (17.8% vs. 14.0%).

Among adults with VI, there was a higher prevalence than those without VI of hearing loss (24.7% vs. 4.5%), ADL disabilities (48.0% vs. 12.8%), IADL disabilities (24.4% vs. 4.4%), and smoking (27.4% vs. 19.2%). Adults with VI also reported slightly lower rates of binge alcohol use (22.3% vs. 26.6) and less frequency of religious participation (46.5% vs. 42.4%). A respondent with VI was twice as likely to experience MDEs (13.4% vs. 6.8%), and to have unmet mental health needs (10.1% vs. 5.3%), than those with good vision.

### 3.2 | Prevalence of suicidality

Prevalence of suicidality per year among those with VI was higher than those without VI, although trends in increases or decreases were not statistically significant (Figure 1). In detail, the prevalence among respondents with

**TABLE 1** Sample characteristics of U.S. adults by vision impairment

Characteristics	Vision impairment (unweighted <i>n</i> = 8628)	No vision impairment (unweighted <i>n</i> = 205,877)	<i>p</i> -Value
	% (95% CI)	% (95% CI)	
Gender			<0.001
Female	57.7 (56.1–59.3)	51.5 (51.2–51.8)	
Male	42.3 (40.7–43.9)	48.5 (48.2–48.8)	
Race/ethnicity			<0.001
White	58.4 (56.9–59.9)	64.2 (63.7–64.7)	
Non-White	41.6 (40.1–43.1)	35.8 (35.3–36.3)	
Marital status			<0.001
Married	41.0 (39.5–42.5)	52.2 (51.8–52.7)	
Not married	59.0 (57.5–60.5)	47.7 (47.3–48.2)	
Age			<0.001
18–34 years	22.2 (21.3–23.2)	30.2 (29.8–30.6)	
35–49 years	17.0 (15.9–18.1)	25.0 (24.7–25.3)	
50–64 years	30.9 (29.3–32.4)	25.1 (24.7–25.4)	
65 years and older	30.0 (28.4–31.5)	19.7 (19.3–20.1)	
Education			<0.001
Less than high school	25.9 (24.6–27.1)	12.0 (11.8–12.3)	
High school graduation	31.4 (29.9–33.0)	24.5 (24.2–24.8)	
Some college/associate degree	28.0 (26.6–29.5)	31.0 (30.7–31.3)	
College graduate	14.7 (13.4–16.1)	32.4 (32.0–32.9)	
Poverty			<0.001
Not in poverty	73.7 (72.4–75.0)	86.5 (86.2–86.8)	
In poverty	26.3 (25.0–27.6)	13.5 (13.2–13.8)	
Employment status			<0.001
Employed	39.2 (37.8–40.7)	63.6 (63.2–64.0)	
Unemployed	60.8 (59.3–62.2)	36.4 (36.0–36.8)	
Urbanicity			<0.001
Urban	82.2 (81.0–83.3)	86.0 (85.6–86.4)	
Rural	17.8 (16.7–19.0)	14.0 (13.6–14.4)	
Perceived health status			<0.001
Poor/fair/good	68.4 (66.9–69.9)	42.0 (41.5–42.5)	
Very good/excellent	31.6 (30.1–33.1)	58.0 (57.5–58.5)	

(Continues)

TABLE 1 (Continued)

Characteristics	Vision impairment (unweighted <i>n</i> = 8628)	No vision impairment (unweighted <i>n</i> = 205,877)	<i>p</i> -Value
	% (95% CI)	% (95% CI)	
Hearing loss			<0.001
Yes	24.7 (23.3–26.3)	4.5 (4.3–4.7)	
No	75.2 (73.7–76.7)	95.5 (95.3–95.6)	
Activities of daily living			<0.001
Yes	48.0 (46.3–49.8)	12.8 (12.6–13.0)	
No	52.0 (50.2–53.7)	87.2 (87.0–87.4)	
Instrumental activities of daily living			<0.001
Yes	24.5 (23.0–26.1)	4.4 (4.2–4.5)	
No	75.5 (73.9–77.0)	95.6 (95.5–95.8)	
Smoking			<0.001
Yes	27.4 (26.2–28.6)	19.2 (18.9–19.5)	
No	72.6 (71.4–73.8)	80.8 (80.5–81.1)	
Binge alcohol use			<0.001
Yes	22.3 (21.0–23.8)	26.6 (26.2–27.0)	
No	77.7 (76.2–79.0)	73.4 (73.0–73.8)	
Frequency of religious participation			<0.001
0 time	46.5 (44.7–48.3)	42.4 (42.0–42.8)	
1–24 times	31.3 (29.8–32.9)	31.7 (31.5–32.0)	
More than 24 times	22.2 (20.8–23.7)	25.8 (25.5–26.2)	
Major depressive episode			<0.001
Yes	13.4 (12.5–14.3)	6.8 (6.7–7.0)	
No	86.6 (85.7–87.5)	93.2 (93.0–93.3)	
Unmet mental health needs			<0.001
Yes	10.1 (9.2–11.0)	5.3 (5.2–5.5)	
No	89.9 (89.0–90.8)	94.7 (94.5–94.8)	

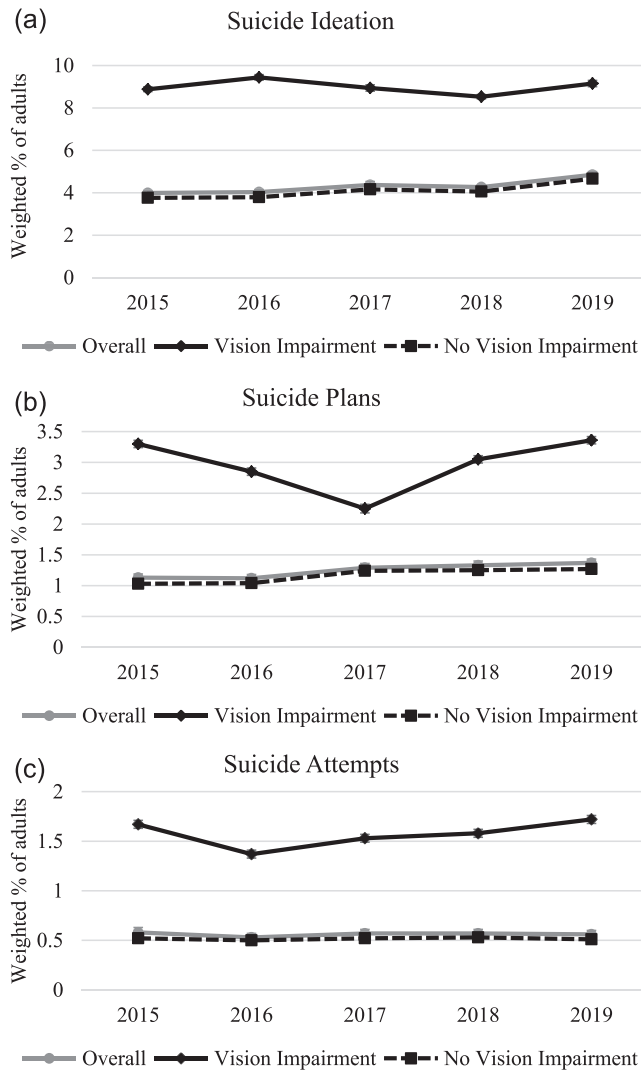
Note: All analyses adjusted for the complex survey design of the NSDUH.

Abbreviations: CI, confidence interval; NSDUH, National Survey on Drug Use and Health.

VI ranged from 8.53% to 9.44% for suicidal ideation, 2.25% to 3.36% for suicidal plans, and 1.37% to 1.72% for suicidal attempts, whereas those for respondents without VI ranged from 3.76% to 4.66% for suicidal ideation, 1.03% to 1.27% for suicidal plans, and 0.50% to 0.53% for suicidal attempts during the period from 2015 to 2019.

Table 2 shows suicidal thoughts and behaviors expressed by all respondents. Respondents with VI, living with socioeconomic disadvantages and health disparities, reported two or three times more suicidal ideation (9.0% vs. 4.1%), plans (3.0% vs. 1.2%), and attempts (1.6% vs. 0.5%), in comparison to the population without VI, in the





**FIGURE 1** Prevalence of suicidality by vision impairment from 2015 to 2019 in the (a) suicide ideation, (b) plans, and (c) attempts. Graphs are derived from logistic regression analyses using the NSDUH complex survey data. NSDUH, National Survey on Drug Use and Health.

past year. When adjusted for all sociodemographic variables, health status and behavioral health, VI was significantly associated with higher rates of suicidal ideation (adjusted odds ratio [AOR] = 1.36, 95% confidence interval [CI] = 1.21–1.53), plans (AOR = 1.27, 95% CI = 1.05–1.53), and attempts (AOR = 1.40, 95% CI = 1.16–1.70).

### 3.3 | Associations between VI and suicide

Results from multivariate logistic regression analyses revealed the association between VI and suicidal ideation, plans, and attempts among U.S. adults, after controlling for potentially confounding factors, including sociodemographic variables, health status and behaviors, and mental health challenges (Supporting Information: Table 1). Men were more likely to experience suicidal ideation (AOR = 1.28, 95% CI = 1.18–1.39) and plans

**TABLE 2** Suicidal ideation, plans, and attempts in U.S. adults by vision impairment

	VI % (95% CI)	No VI % (95% CI)	<i>p</i> -Value	Crude odds ratio (OR) OR (95% CI)	Adjusted odds ratio (AOR) AOR (95% CI)
Suicidal ideation	9.0 (8.3–9.7)	4.1 (4.0–4.2)	<0.001	2.31 (2.11–2.54)	1.36 (1.21–1.53)
Suicidal plans	3.0 (2.5–3.5)	1.2 (1.1–1.2)	<0.001	2.59 (2.20–3.04)	1.27 (1.05–1.53)
Suicidal attempts	1.6 (1.3–1.8)	0.5 (0.5–0.6)	<0.001	3.09 (2.63–3.63)	1.40 (1.16–1.70)

Note: All analyses were adjusted for the complex survey design of NSDUH. All values were significant at  $p < 0.05$ . Analyses for AORs included sociodemographic variables (gender, race/ethnicity, marital status, age, education, poverty, employment status, urbanicity), health status and behaviors, and mental health challenges.

Abbreviations: CI, confidence interval; NSDUH, National Survey on Drug Use and Health; VI, vision impairment.

(AOR = 1.19, 95% CI = 1.06–1.35) than women. While non-White respondents reported lower odds of suicidal ideation (AOR = 0.87, 95% CI = 0.82–0.92), but higher odds of attempts (AOR = 1.24, 95% CI = 1.08–1.43). Respondents who were not married were more likely to report suicidal ideation (AOR = 1.33, 95% CI = 1.23–1.44), plans (AOR = 1.41, 95% CI = 1.24–1.61), and attempts (AOR = 1.78, 95% CI = 1.45–2.18) than their married counterparts. Findings from middle-aged and older respondents (aged 35–49 years, 50–64 years, and 65 years and older) showed decreased odds of suicidal ideation, plans, and attempts, compared to young adults (aged 18–34 years). In comparison with lower educational attainment, reports from those who attended some college or obtained a graduate degree showed increased odds of suicidal ideation but decreased odds of suicidal attempts. College graduates were associated with decreased odds of suicidal plans and attempts. Unemployed participants were more likely to have suicidal attempts (AOR = 1.34, 95% CI = 1.12–1.60), when compared to employed respondents. As for behavioral associations, respondents who perceived their health as *good* were less likely to have suicidal ideation, plans, and attempts than their counterparts who rated their health as *poor* or *fair*. Hearing loss was associated with increased odds of suicidal ideation (AOR = 1.19, 95% CI = 1.03–1.38). Respondents who reported ADL (AOR = 1.87, 1.86, 1.86, respectively), IADL disabilities (AOR = 1.36, 1.47, 1.41, respectively), smoking (AOR = 1.15, 1.33, 1.53, respectively), or binge alcohol use (AOR = 1.15, 1.13, 1.23, respectively) were more likely to experience suicidal ideation, plans, and attempts. Respondents who participated in religious activities were less likely to report suicidal ideation and plans. As expected, personal experiences of MDE and unmet mental health needs were positively associated with suicidal ideation, plans, and attempts.

Table 3 shows results, for individuals with VI, produced by three logistic regression models that tested for associations between sociodemographic variables, health status, and behaviors. Men with VI were more likely to report suicidal ideation than women (AOR = 1.67, 95% CI = 1.29–2.16). Non-White respondents with VI reported higher rates of suicidal attempts (AOR = 1.62, 95% CI = 1.02–2.60).

Middle-aged and older adults with VI (aged 35–49 years, 50–64 years, and 65 years and older) were associated with decreased odds of suicidal ideation, plans, and attempts when compared to their younger peers. Respondents who were high school graduates or had some college or an associate's degree were more likely to report suicidal ideation than those with less than high school education. As for behavioral associations, respondents with hearing loss were more likely to report suicidal attempts than those without hearing loss (AOR = 1.88, 95% CI = 1.27–2.77). ADL disabilities were significantly associated with increased risks for suicidal ideation (AOR = 2.07, 95% CI = 1.56–2.75), plans (AOR = 1.80, 95% CI = 1.21–2.68), and attempts (AOR = 3.37, 95% CI = 2.22–5.10). IADL disabilities were positively associated with suicidal plans (AOR = 1.69, 95% CI = 1.16–2.46). Occasional religious participation (1–24 times a year) was associated with a decreased risk for suicidal ideation (AOR = 0.76, 95% CI = 0.58–0.99), when compared to peers who did not attend any religious activities.

TABLE 3 Logistic regression models of the associations with suicidal ideation, plans, attempts, and vision impairment among U.S. adults with vision impairment

Characteristics	Suicidal ideation (unweighted <i>n</i> = 8295) AOR (95% CI)	<i>p</i> -Value	Suicidal plans (unweighted <i>n</i> = 8272) AOR (95% CI)	<i>p</i> -Value	Suicidal attempts (unweighted <i>n</i> = 8273) AOR (95% CI)	<i>p</i> -Value
Gender (ref: Female)						
Male	<b>1.67 (1.29–2.16)***</b>	0.000	1.38 (0.97–1.97)	0.073	0.86 (0.57–1.32)	0.492
Race/ethnicity (ref: White)						
Non-White	0.90 (0.74–1.10)	0.310	1.11 (0.82–1.52)	0.481	<b>1.62 (1.02–2.60)*</b>	0.043
Marital status (ref: Married)						
Not married	1.23 (0.95–1.60)	0.120	<b>1.52 (1.02–2.28)*</b>	0.042	1.35 (0.86–2.12)	0.187
Age (ref: 18–34 years)						
35–49 years	<b>0.58 (0.46–0.74)***</b>	0.000	<b>0.56 (0.36–0.88)*</b>	0.012	<b>0.60 (0.42–0.87)**</b>	0.008
50–64 years	<b>0.35 (0.25–0.48)***</b>	0.000	<b>0.37 (0.21–0.63)***</b>	0.000	<b>0.21 (0.10–0.42)***</b>	0.000
65 years and older	<b>0.28 (0.18–0.44)***</b>	0.000	<b>0.12 (0.04–0.32)***</b>	0.000	<b>0.03 (0.01–0.13)***</b>	0.000
Education (ref: Less high school)						
High school graduation	<b>1.38 (1.00–1.89)*</b>	0.050	1.37 (0.88–2.12)	0.160	0.82 (0.51–1.33)	0.421
Some college/associate degree	<b>1.55 (1.09–2.21)*</b>	0.016	1.64 (0.99–2.70)	0.054	0.86 (0.44–1.66)	0.638
College graduate	1.38 (0.90–2.12)	0.136	0.98 (0.56–1.71)	0.947	0.38 (0.13–1.17)	0.090
Poverty (ref: Not in poverty)						
In poverty	1.26 (0.96–1.66)	0.096	1.09 (0.72–1.64)	0.675	1.08 (0.64–1.82)	0.764
Employment status (ref: Employed)						
Unemployed	1.20 (0.91–1.58)	0.190	1.33 (0.86–2.05)	0.189	1.26 (0.74–2.13)	0.389
Urbanicity (ref: Urban)						
Rural	1.04 (0.82–1.32)	0.753	1.36 (0.93–2.01)	0.114	0.76 (0.46–1.26)	0.285

(Continues)

TABLE 3 (Continued)

Characteristics	Suicidal ideation (unweighted <i>n</i> = 8295)		Suicidal plans (unweighted <i>n</i> = 8272)		Suicidal attempts (unweighted <i>n</i> = 8273)	
	AOR (95% CI)	<i>p</i> -Value	AOR (95% CI)	<i>p</i> -Value	AOR (95% CI)	<i>p</i> -Value
Health status (ref: Poor/fair/good)						
Very good/excellent	1.04 (0.80–1.34)	0.786	1.14 (0.76–1.71)	0.526	1.21 (0.74–1.96)	0.440
Hearing loss (ref: No)						
Yes	1.07 (0.81–1.41)	0.639	1.29 (0.88–1.90)	0.190	<b>1.88 (1.27–2.77)**</b>	0.002
ADL (ref: No)						
Yes	<b>2.07 (1.56–2.75)***</b>	0.000	<b>1.80 (1.21–2.68)**</b>	0.005	<b>3.37 (2.22–5.10)***</b>	0.000
IADL (ref: No)						
Yes	1.29 (0.99–1.68)	0.061	<b>1.69 (1.16–2.46)**</b>	0.008	1.35 (0.82–2.23)	0.231
Smoking (ref: No)						
Yes	1.05 (0.80–1.38)	0.701	1.13 (0.81–1.58)	0.466	1.39 (0.92–2.10)	0.115
Binge alcohol use (ref: No)						
Yes	1.14 (0.92–1.41)	0.230	1.31 (0.93–1.85)	0.121	1.48 (0.93–2.37)	0.097
Religious participation (ref: 0 time)						
1–24 times	<b>0.76 (0.58–0.99)*</b>	0.044	0.92 (0.65–1.29)	0.610	0.72 (0.46–1.13)	0.146
More than 24 times	0.77 (0.53–1.11)	0.151	0.75 (0.47–1.22)	0.246	0.47 (0.22–1.02)	0.057
Major depressive episode (ref: No)						
Yes	<b>5.01 (3.97–6.33)***</b>	0.000	<b>5.13 (3.43–7.68)***</b>	0.000	<b>2.72 (1.79–4.14)***</b>	0.000
Unmet mental health needs (ref: No)						
Yes	<b>3.17 (2.44–4.12)***</b>	0.000	<b>2.72 (1.87–3.96)***</b>	0.000	<b>2.42 (1.52–3.88)***</b>	0.000

Note: All analyses were adjusted for the complex survey design of the NSDUH.

Abbreviations: ADL, activities of daily living; AOR, adjusted odds ratio; IADL, instrumental activities of daily living; NSDUH, National Survey on Drug Use and Health.

\**p* < 0.05, significant values are indicated by bold typeface; \*\**p* < 0.01, significant values are indicated by bold typeface; \*\*\**p* < 0.001, significant values are indicated by bold typeface.

As expected, respondents who experienced a past-year MDE were more likely to report suicidal ideation (AOR = 5.01, 95% CI = 3.97–6.33), plans (AOR = 5.13, 95% CI = 3.43–7.68), and attempts (AOR = 2.72, 95% CI = 1.79–4.14). Finally, the identification of unmet mental health needs was associated with a significant increase in risk of suicidal ideation (AOR = 3.17, 95% CI = 2.44–4.12), plans (AOR = 2.72, 95% CI = 1.87–3.96), and attempts (AOR = 2.42, 95% CI = 1.52–3.88). In the sensitivity analysis conducted after completing multiple imputations, results were similar to those in the analyses using the listwise deletion method (Supporting Information: Table 2).

## 4 | DISCUSSION

In a nationally representative sample of individuals in the U.S. persons with vision-related disabilities had significantly greater odds of past-year suicidal thoughts and behaviors after adjusting disability-related variables. As explained in an ideation-to-action theory of suicide, our findings reflected ideation, plans, and attempts as separate outcomes, presenting the odds of having attempted suicide, as compared to experiencing ideation only (Klonsky & May, 2015).

Our findings revealed that certain serious chronic conditions alone, such as VI, can affect suicidal thoughts and behaviors among adults, even in the absence of other psychiatric disorders (Fässberg et al., 2016; Khazem & Anestis, 2019). Study findings contributed to the body of knowledge by updating and expanding on Lam et al. (2008). The detrimental effect of vision loss on suicidal ideation has been replicated in recent population-based studies in other countries such as France (Cosh et al., 2019) and South Korea (Kim et al., 2015).

Whereas the 3ST argues that there are two distinct processes that lead to suicide (thinking and the progression to attempts and plans), this study identified other variables possibly related to suicide among adults with VI. Most notable were IADL disabilities, depression, and mental health needs, across the spectrum of the ideation-to-action framework. Furthermore, depression and unmet mental health needs are robust predictors of suicidality, encompassing ideations, plans, and attempts (Han et al., 2014; Ullman et al., 2021; Van Orden et al., 2010). Psychiatric illnesses, such as major depression, could be a function of severe strain and lack of social integration. Social disconnectedness associated with functional impairments can also be a major risk factor, as hearing loss and ADL and IADL disabilities were shown to escalate suicidality in this sample.

In addition, the 3ST and ideation-to-action framework imply that dispositional, acquired, and practical factors contribute to the capacity for attempted suicide (Klonsky & May, 2015). Therefore, the likelihood of a person with VI attempting suicide depends on a number of factors such as genetics, habituation to painful experiences of vision loss, and access to means. Our findings also identified covariates that can be associated with risk and protective factors such as poverty and religious participation. Aligned with prior research findings (Crews et al., 2017; Okoro et al., 2018), adults with VI in this study revealed significant socioeconomic disadvantages and health disparities, characterized by a higher prevalence of poor health status, depression, and unmet mental health needs, when compared to their peers with good vision. This study further examined various correlates of suicide risks observed in the general population that could be applicable to those with VI.

As indicated in many national studies, religious participation is linked to lower suicide rates in the U.S., a country that today still remains highly religious due to immigration and more decentralized educational and political systems that are more tolerant of religious views (Hsieh, 2017). Likewise, religious participation appeared to protect against suicidality in this sample. Considering the tremendous social burden of suicide, more research should be done to identify risks and protective factors associated with suicidal thoughts and behaviors for vulnerable populations.

There have been mixed results found on the association between age and suicide. Consistent with recent epidemiological studies using the NSDUH data (Lange et al., 2021; Twenge et al., 2019), this study reported lower risks for suicidality among older adults in comparison with younger adults. However, Stone et al. (2021) found that the greatest rate of suicide cases in 2019 was in the population aged 85 years and older. Thus, further studies are

needed to identify the associations with suicide among older adults. As increased depression, as well as a strong link between depression, unmet mental health treatment needs, and suicidality is seen among young adults with VI, further studies are needed to examine effective mental health interventions and barriers to access to mental health services in this population.

## 4.1 | Limitations

Nevertheless, the directionality of mental health treatment which focuses on suicidal ideation and behaviors (plans and attempts), cannot be determined by this study, because NSDUH did not fully explore the temporal order. The public NSDUH data did not allow researchers to fully examine the association between the age of onset for VI and the severity of VI and suicidality. The dataset did not include a number of known risks or protective factors directly associated with suicidal thoughts and behaviors, such as hopelessness, social isolation, and cultural beliefs. Since the NSDUH data is cross-sectional, researchers can neither draw any causal conclusions from the observed associations nor can they assess changes in suicidality and VI over time.

Our research sheds light on this largely unexplored area, prompting more questions and highlighting the need for future investigation. Despite these limitations, the primary strengths of the present secondary analysis are its use of a large, national epidemiological database and the researchers' ability to draw comparisons between adults with and without VI. Therefore, this study contributes considerably to the scarce literature by identifying the relative strength of association between VI and suicidality. Including the three outcomes of the ideation-to-action framework illuminates the subject, distinguishing the distinctive pathways.

## 4.2 | Implications

With findings demonstrating such a strong association between VI and suicide, this study suggests the importance of screening for suicidal ideation, plans, and attempts among adults with VI, and validates the need for developing mental health services targeted to this population. To this end, it is imperative to develop evidence-based clinical practice guidelines and screening tools that can be used by both eye-care professionals and behavioral health professionals to prevent, screen for, monitor, diagnose and treat VI (NASEM, 2016).

Vision care remains almost nonexistent in major community programs and federal public health agendas, while VI becomes an increasing social burden as the population ages (NASEM, 2016). More than half of adult Americans do not seek regular eye care due to their lack of awareness or costs. Whereas over 70% of survey respondents from the National Eye Health Education Program recognized the impact of vision loss on their everyday tasks, less than 11% were aware of the early warning signs of glaucoma and diabetic retinopathy (Alexander et al., 2008). The fragmentation within the eye care system is a barrier to early detection and impedes upon access to high-quality treatment. Certain improvements to the vision care system could increase the trajectory for correctable VI, potentially reducing related costs for patients.

According to Senra et al. (2015), better adjustment to irrevocable vision loss was associated with greater acceptance of vision loss, a more positive outlook, and better use of instrumental coping skills, social supports, and other assistive technology. Individuals with VI report discriminatory practices in employment at twice the rate of those with other disabilities (Graham et al., 2019). Consequently, they cited stigma as a common reason for choosing to not use assistive technology (Spafford et al., 2010). The high prevalence of unmet mental health needs and suicidality among adults with VI implies that partnership between vision care specialists and mental health service providers could be essential in helping those with VI improve their quality of life.

For the purpose of suicide prevention, community services should be expanded upon to assist adults living with VI maintain their independence so that they can perform their instrumental activities such as shopping, financing,

and transportation. Psychologists and behavioral health professionals have important roles to play in supporting adults with VI and helping them cope with challenges at work, interpersonal relationships, and psychological strain caused by VI. Special attention should be paid to providing culturally congruent services for minoritized subgroups with VI (e.g., non-White, young adults, low-income, and having other disabilities). Clinicians need to dig more deeply to unearth other possible underlying causes of hopelessness and focus their attention on social, ecological, and cultural factors (Ullman et al., 2021).

Bearing in mind the protective function of religious participation in this sample, suicide prevention initiatives should consider cultural norms, religious values, and the potential for collaboration with faith-based communities which could be a source of informal support and caregiving for IADL disabilities and social integration. Current evidence from this study reveals the need for future research on protective and cultural factors related to suicide across social-ecological domains. More research is needed to understand the complexity of the pathways from mental illnesses and suicidal thoughts and behaviors that are likely moderated and mediated by other variables causing psychological strain beyond mental health diagnoses.

### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in National Survey on Drug Use and Health at <https://nsduhweb.rti.org/respweb/homepage.cfm>

### PEER REVIEW

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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