


Memory and Confusion Complaints in Visually Impaired Older Adults: An Understudied Aspect of Well-Being

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Abstract

Objective: To determine the prevalence of cognitive (memory or confusion) complaints in older adults with visual impairment (VI). **Method:** We assessed the relationship between VI (corrected visual acuity [VA] < 20/40) and self-reported confusion or problems with memory among participants aged 60 years to 85 years in the 1999–2006 cycles of National Health and Nutrition Examination Survey ($n = 5,795$). Prevalence estimates of cognitive complaints were calculated using Current Population Surveys. **Results:** Memory/confusion complaints were reported in 22% of the VI group and 11% of the no VI group ($p < .001$). In individuals aged ≥ 80 years, 30% of those with VI reported cognitive complaints, as compared with 19% with no VI ($p = .003$). In fully adjusted models, individuals with VI were more likely (OR = 1.3, $p = .049$) to report cognitive complaints as compared with those without VI. **Conclusion:** Subjective reports of memory or confusion are highly prevalent in older individuals with VI.

Keywords

cognition, epidemiology, quality of life, visual impairment, aging

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Introduction

Subjective complaints of confusion or memory loss are troublesome for patients and their families and have been posited to be early indicators of cognitive decline, although the evidence for this association is mixed (L. Wang et al., 2004). Estimates of these complaints range from 25% to 50% of older adults, and the prevalence increases with age, with 24% in older adults aged 65 years to 69 years to 57% in those aged 90 years and above (Jonker, Geerlings, & Schmand, 2000; Montejo, Montenegro, Fernández, & Maestú, 2011). Previous studies have examined the prevalence of memory and confusion complaints in various populations categorized by age group, sex, race, level of education, employment status, and living status (Taylor, Bouldin, & McGuire, 2018). There is limited research, however, on the prevalence of these complaints in specific populations (i.e., those with visual impairment [VI]) and on whether there is an association between impaired functioning across domains such as vision and cognitive function. The importance of identifying subjective memory or confusion complaints is threefold: (a) subjective memory complaints may indicate risk of progression to dementia in some individuals, (b)

self-perceived problems with cognition have been associated with quality of life, well-being, and ability for self-care (McHorney, Ware, & Raczek, 1993; Verhaeghen, Geraerts, & Marcoen, 2000), and (c) characterizing specific older populations with expressed concerns about memory or confusion allows for the identification of patients who may benefit advanced care planning and health care coordination (Taylor et al., 2018). Here, we investigate the prevalence of memory and confusion complaints in visually impaired older adults.

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Literature Review

Association of Subjective Complaints With Objectively Assessed Cognitive Function

Studies on the association between subjective memory or confusion complaints and objectively assessed cognitive function have yielded mixed results. Cross-sectionally, the association between subjective memory complaints and current cognitive function is inconsistent (Mitchell, 2008; Reid & MacLulich, 2006). For example, Thompson et al. found no association between self-report of memory function as measured by the prospective and retrospective memory questionnaire and cognitive scores on the mini mental status exam (MMSE) in individuals with normal cognition, mild cognitive impairment, and dementia (Thompson, Henry, Rendell, Withall, & Brodaty, 2015). Some longitudinal studies have found that subjective memory complaints in older adults are associated with subsequent cognitive decline and incident dementia (Glodzik-Sobanska et al., 2007; Kryscio et al., 2014; Mitchell, Beaumont, Ferguson, Yadegarfar, & Stubbs, 2014; Reisberg, Shulman, Torossian, Leng, & Zhu, 2010; L. Wang et al., 2004). Notably, subjective memory complaints assessed by a single question was associated with higher progression to dementia and a shorter dementia-free survival time in older adults (75+ years; Luck et al., 2015). However, other longitudinal studies have found that subjective memory complaints were not predictive of future cognitive decline or incident dementia (Flicker, Ferris, & Reisberg, 1993; Jorm et al., 1997; P.-N. Wang et al., 2000). One of these studies extensively assessed for memory complaints using a series of questions on global cognitive complaints as well as specific areas of everyday memory. This study found that cognitive complaints were not associated with MMSE scores, or scores on an episodic memory test or a test of mental speed (Jorm et al., 1997). Studies examining brain pathology have demonstrated that memory complaints are associated with pathology consistent with Alzheimer's disease (AD; Barnes, Schneider, Boyle, Bienias, & Bennett, 2006; Kryscio et al., 2014; Saykin et al., 2006; Schultz et al., 2015). However, some have questioned the usefulness of assessing these complaints to identify individuals at risk of cognitive impairment given the high prevalence of these complaints (L. Wang et al., 2004) and the unclear association with objectively assessed cognitive function (Edmonds, Delano-Wood, Galasko, Salmon, & Bondi, 2014).

Association of Subjective Memory/Confusion Complaints With Personality, Mood, and Quality of Life

Beyond the relationship with objective measures of cognitive function, subjective memory and other cognitive complaints are consistently associated with mood and

personality. Longitudinal data suggest that memory complaints are affected by depression (Bassett & Folstein, 1993; Christensen, Griffiths, MacKinnon, & Jacomb, 1997; Kahn, Zarit, Hilbert, & Niederehe, 1975; Kim, Stewart, Shin, Choi, & Yoon, 2003; Kliegel, Zimprich, & Eschen, 2005), concerns about aging (Pearman & Storandt, 2004), and neuroticism (Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Merema, Speelman, Foster, & Kaczmarek, 2013; Pearman, Hertzog, & Gerstorf, 2014; Snitz et al., 2015), and these complaints are hypothesized to be mediators of the relationship between mood or personality and actual cognition (Yates, Clare, Woods, & Matthews, 2015).

More recently, there has been a focus on the relationship between memory and other cognitive complaints with quality of life and overall functioning. Health-related quality of life has been inversely associated with memory complaints (Bazargan & Bazargan, 1997; Commissaris, Ponds, & Jolles, 1998; Derouesné et al., 1989; Derouesné, Lacomblez, Thibault, & Leponcin, 1999; Verhaeghen et al., 2000), particularly among aspects related to limitations in daily living (McHorney et al., 1993). A correlation between memory complaints and domains of the 36 item Short Form Health Survey (SF-36) have also been found, including pain, mental health, social performance, energy-fatigue, physical health, and limitations due to emotional problems (McHorney et al., 1993; Waldorff, Rishoj, & Waldemar, 2008). Thus, cognitive complaints may be an important metric regardless of its association with current or future cognition.

Association of Subjective Complaints With Other Domains of Function

Prior work identifying cognitive complaints as a consequence of other aspects of health and well-being suggests that the presence of cognitive complaints may be reflective of decreased functioning in a number of domains, not solely limited to cognitive function. Comijs et al. (2002) suggest that complaints about memory in the absence of actual cognitive impairment may reflect psychoaffective or health problems. The authors posit that memory complaints may result from reduced overall functioning and well-being due to a number of diseases and conditions as well as an individual's psychological state or personality. Montejo, Montenegro, Fernández, and Maestú (2012) hypothesize that impairment in one area of functioning (i.e., impaired vision) affects other types of functioning and leads to a global decline in well-being, and this negative perception of overall health status may result in complaints about memory and cognitive function. Therefore, memory or confusion complaints may provide additional insight on health-related well-being and functional ability in other domains. Research in this area has moved toward examining the relationship between cognitive complaints and its association with overall health (Cosentino, Devanand,

& Gurland, 2018). However, there is limited research testing these hypothesized relationships between cognitive complaints within specific patient populations, and it remains unknown if impaired functioning outside of cognitive functioning (i.e., impaired vision) is associated with a greater likelihood of having memory or confusion complaints.

The aim of this study is to compare the prevalence of memory and confusion complaints in older adults with and without VI using National Health and Nutrition Examination Survey (NHANES) data. In NHANES, subjective complaints about memory and confusion were assessed with a single question. Our *a priori* hypothesis was that visually impaired older adults would be more likely to report memory and confusion complaints. This research is the first to use subjective memory and confusion complaints in characterizing the perceived cognitive functioning of visually impaired older adults.

Research Design

Survey Data

Analyses used data from the 1999-2006 cycles of NHANES, a national study probability sample representative of the noninstitutionalized U.S. civilian population (Centers for Disease Control and Prevention [CDC], 2013a), as these cycle years collected both vision examination data and assessed memory and confusion complaints (CDC, 1999). Our analyses were further limited to adults ≥ 60 years of age with complete vision testing and the physical function questionnaire data ($n = 5,795$). The study was approved by the CDC/NCHS (National Center for Health Statistics) ethics review board (ERB) and all survey participants gave written informed consent.

Vision Assessment

Presenting visual acuity (VA) was assessed unilaterally for each eye with participants wearing their corrective lenses if present. VA was assessed using the built-in chart in an auto-refractor (NIDEK ARK-760; Nidek Co Ltd, Tokyo, Japan). The chart had the following lines, each consisting of a combination of five items (letters and numbers): 20/20, 20/25, 20/30, 20/40, 20/50, 20/60, 20/80, and 20/200. Participants were first asked to read the 20/50 line and were allowed to proceed to the next line if they answered at least four out of the five items in the previous line. If they stopped reading in the middle of a line, they were prompted to guess and continue. If participants were unable to read the 20/50 line, the 20/200 line was presented. The test ended once the participant read the 20/20 line correctly or missed more than one item on a line for two lines in a row (CDC, 2008). For eyes with a presenting VA worse than 20/25, VA was

reassessed after autorefraction. VI was defined as autorefractor corrected VA worse than 20/40 in the better-seeing eye.

Memory or confusion complaints were defined as present if participants responded “yes” to the question—“(Are you/is survey participant) limited in any way because of difficulty remembering or because (you/s/he) experience(s) periods of confusion?”

Other Measurements

Information on age, sex, race, body mass index (BMI), education, smoking status, and total number of comorbidities was also collected. Smoking status was categorized into never, current, and former smokers based on survey responses to smoking (cigarette or tobacco use) at least 100 cigarettes (no responses categorized as never smokers) and smoking currently. Diabetes was defined as present based on a self-reported physician diagnosis of diabetes, or currently taking insulin or oral medication to lower blood sugar. Hypertension was defined as a mean of the second and third blood pressure measurements, with a systolic blood pressure ≥ 130 , or diastolic blood pressure ≥ 80 , or self-report of a physician diagnosis of hypertension, or currently taking prescription medication for high blood pressure. Other comorbidities including arthritis, cancer, coronary heart disease, liver disease, and stroke were based on self-report of a physician diagnosis.

Statistical Methods

Estimates were weighted to account for planned oversampling of specific subgroups, survey non-response and poststratification (CDC, 2013b). We used Chi-square and *t* tests to compare categorical and continuous sociodemographic characteristics, respectively, between individuals with and without VI. Age-stratified prevalence estimates of memory or confusion complaints in the groups with and without VI were calculated using the relevant population totals from the Current Population Surveys (CPS) for the years 1999-2002, 2003-2004, and 2005-2006 (CDC & NCHS, 2009). Logistic regression models were used to determine odds ratios (ORs) and associated 95% confidence intervals (CI) to determine the relationship between covariates and the presence of complaints about memory or confusion, and effect modification by age was examined by stratifying by age group (60- <70 and 70-85 years). Taylor linearization was used to derive variance estimation. Covariates in the final models were included if significant in the univariate analysis and/or clinically relevant. The covariates included were VI status, age, sex, race, education, diabetes, and total number of comorbidities. A *p* value $< .05$ was considered statistically significant. All analyses were conducted in STATA 14 (StataCorp, College Station, TX).

Table 1. Participant Characteristics by Vision Impairment Status, NHANES, 1999-2006 ($n = 5,795$).

	Nonvisually impaired $n = 5,439$ (95%)	Visually impaired ^a $n = 396$ (5%)	p value
Age, $M \pm SD$	70.3 \pm 7.2	77.8 \pm 8.2	< .001
Female, n (%)	2,698 (55)	186 (61)	.053
Race, n (%)			.211
Non-Hispanic White	3,227 (83)	219 (79)	
Non-Hispanic Black	915 (8)	53 (9)	
Mexican American	1,021 (3)	63 (4)	
Other Hispanics and other race	276 (6)	21 (9)	
Body mass index, $M \pm SD$	28.4 \pm 0.1	27.3 \pm 0.3	.004
Education, n (%)			< .001
Less than high school	2,103 (27)	199 (51)	
High school or equivalent	1,341 (30)	81 (24)	
More than high school	1,985 (43)	74 (25)	
Smoking, n (%)			.141
Never	2,468 (78)	180 (83)	
Former	545 (17)	32 (13)	
Current	172 (6)	10 (3)	
Diabetes, n (%)	996 (16)	91 (21)	.017
Total comorbid conditions ^b , $M \pm SD$	1.7 \pm 0.9	1.8 \pm 1.1	.137

Note. All results reported as n (weighted%). NHANES = National Health and Nutrition Examination Survey; n = sample size.

^aVisual impairment defined as autorefractor-corrected visual acuity worse than 20/40.

^bTotal comorbid conditions included arthritis, cancer, coronary heart disease, hypertension, liver disease, and stroke.

Results

Sample Characteristics

As compared to the non-VI group, those with VI were more likely to be older (77.8 \pm 0.5 vs. 70.3 \pm 0.2), have a lower level of education (51% with less than a high school education vs. 27%), have a lower BMI (27.3 \pm 0.3 vs. 28.4 \pm 0.1), and have diabetes (21% vs. 16%; Table 1).

Prevalence of Complaints About Memory or Confusion

Overall, memory or confusion complaints were reported in 22% of the VI group and 11% of the non-VI group ($p < .001$). Figure 1 represents the weighted percentages of individuals ≥ 60 years in 5-year age bands reporting memory or confusion complaints by VI status. Of those aged 60 years to 64 years, memory or confusion complaints was reported in 6% of the VI group and 6% of the non-VI group. In each subsequent age category, there were similar percentages of memory or confusion complaints reported in the VI and non-VI groups (65-69: 13% vs. 8%; 70-74: 8% vs. 10%; 75-79: 17% vs. 16%; respectively, $p > .05$ for all).

The relevant U.S. population estimates are reported in Figure 1. Overall, an average of 396 sampled participants, representing an estimated 2.2 million U.S. adults, or an average of 4.7% of the U.S. population over the years 1999-2006, had VI. Of those visually impaired, 22% of individuals aged ≥ 60 years reported complaints about memory or confusion, representing an estimated 504,149 people in the U.S. population, as compared

with 11% (an estimated 4,667,008 people) of the non-VI group. Within each age category, the percentage reporting memory or confusion complaints were similar in both VI and non-VI groups, except in the oldest age category of ≥ 80 years, where 30% of the VI group had memory or confusion complaints as compared with 19% of the non-VI group ($p = .003$). This represents 384,365 individuals with VI reporting memory or confusion complaints and 1.38 million individuals without VI reporting complaints about memory or confusion.

Factors Associated With Complaints About Memory or Confusion

In fully adjusted models, individuals with VI were 1.30 times more likely to report memory or confusion complaints as compared with individuals without VI (OR = 1.30, 95% CI = [1.00, 1.70], $p = .049$, Table 2). When stratified by age, there was no association between memory or confusion complaints and VI in the younger age group 60-69 years (OR = 0.94, 95% CI = [0.33, 2.62], $p = .897$, Table 3). In the older age group (70+ years), individuals with VI were 1.43 times more likely to report memory or confusion complaints as compared with individuals without VI (OR = 1.43, 95% CI = [1.04, 1.96], $p = .027$, Table 4).

Discussion

In this study of a large, nationally representative sample, we found a high prevalence of memory or confusion complaints in older adults with VI. Overall, there was

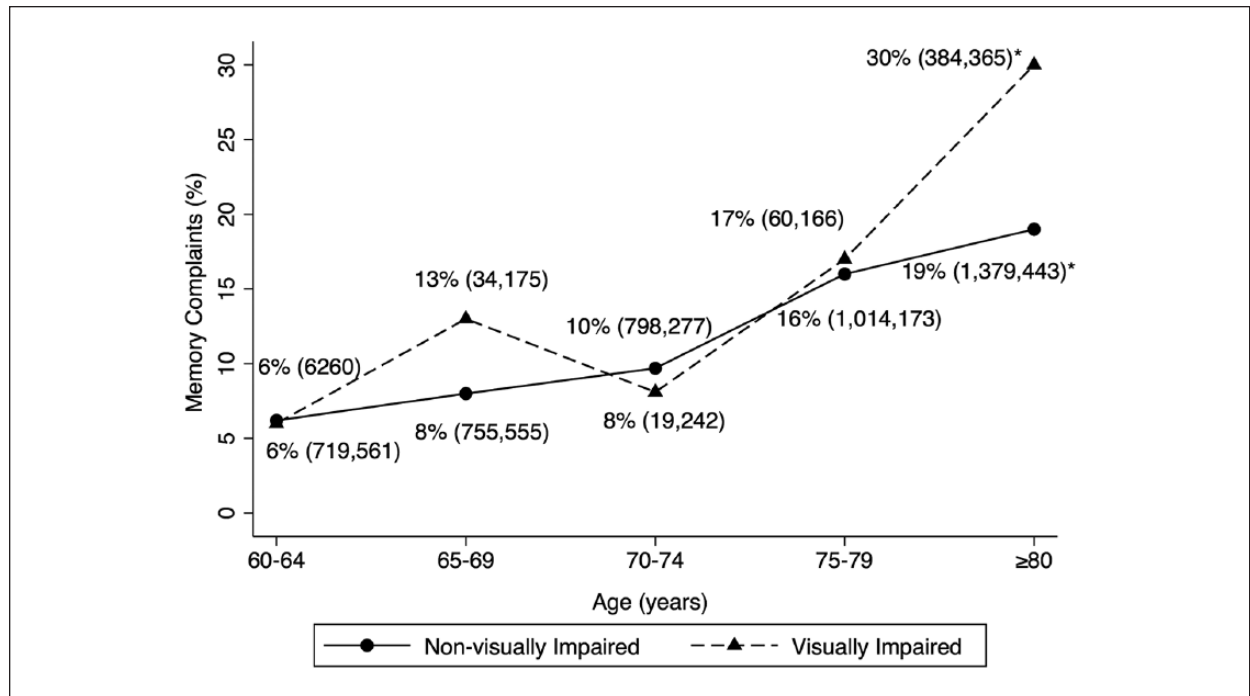


Figure 1. Weighted percentages and population estimates of individuals ≥ 60 with memory or confusion complaints by visual impairment status, NHANES, 1999-2006.

Note. Weighted% (population estimate). NHANES = National Health and Nutrition Examination Survey.

*Statistically significant difference ($p < .05$).

Table 2. Multivariable-Adjusted Relationship of Visual Impairment With Self-Report of Complaints About Memory or Confusion, NHANES, 1999-2006 ($n = 5,778$).

	Odds ratio (OR)	95% CI	p value
Visual impairment status ^a			
No visual impairment	Reference	—	—
Yes visual impairment	1.30	[1.00, 1.70]	.049

Note. NHANES = National Health and Nutrition Examination Survey; n = sample size.

^aVisual impairment defined as auto refractor corrected visual acuity worse than 20/40.

Table 3. Multivariable-Adjusted Relationship of Visual Impairment With Self-Report of Memory or Confusion Complaints Limited to 60-to-69-Year Olds, NHANES, 1999-2006 ($n = 2,635$).

	Odds ratio (OR)	95% CI	p value
Visual impairment status ^a			
No visual impairment	Reference	—	—
Yes visual impairment	0.94	[0.33, 2.62]	.897

Note. NHANES = National Health and Nutrition Examination Survey; n = sample size.

^aVisual impairment defined as auto refractor corrected visual acuity worse than 20/40.

an increasing proportion of older adults with memory or confusion complaints in both the VI and non-VI groups with increasing age, and a significantly higher

Table 4. Multivariable-Adjusted Relationship of Visual Impairment With Self-Report of Memory or Confusion Complaints Limited to 70+-Year Olds, NHANES, 1999-2006 ($n = 3143$).

	Odds ratio (OR)	95% CI	p value
Visual impairment status ^a			
No visual impairment	Reference	—	—
Yes visual impairment	1.43	[1.04, 1.96]	.027

Note. NHANES = National Health and Nutrition Examination Survey; n = sample size.

^aVisual impairment defined as auto refractor corrected visual acuity worse than 20/40.

prevalence of memory or confusion complaints in the VI group as compared with the non-VI group in adults ≥80 years old. This nonlinear increase of memory or confusion complaints with age is similar to that found in other studies (Caracciolo et al., 2012). The slight decrease in prevalence of memory or confusion complaints noted in our 70 to 74 year age group with VI may be due to the increased use of services and reliance on regular help after recognizing the need for such services following retirement (62-64 years), (Munnell, 2015) and thus less perceived limitations due to problems with cognition.(J. J. Wang, Mitchell, Smith, Cumming, & Attebo, 1999)

In addition, we explored age-stratified analyses, as only the older age bands 70+ were associated with memory or confusion complaints in the full model. In

fully adjusted age-stratified models, VI was associated with memory or confusion complaints in the older age group 70+, but not in the younger age group 60 to 69 years. This may, in part, be due to the high prevalence of VI and memory or confusion complaints in older age groups, and may indicate that it may be important to inquire about memory or confusion complaints in older adults ≥ 70 years of age, but that assessment for memory or confusion complaints may not be as important a consideration in older adults between the ages of 60 and 69 years unless there is a clear indication to inquire about memory complaints (Jonker et al., 2000; Klaver, Wolfs, Vingerling, Hofman, & de Jong, 1998).

The results from this study may have implications for ophthalmic care settings, as many older patients with VI may have complaints about memory or confusion. For ophthalmologists, this is an important consideration as the majority of patients in the ophthalmologic setting are older and are at increased risk of memory impairment (American Academy of Ophthalmology, 2015). In patients with age-related eye disease, self-monitoring or medication adherence may be an important aspect of care, which may be complicated by issues with memory and cognition (Sleath et al., 2011). Ophthalmologists may consider inquiring about memory or confusion complaints to better address the underlying cause of medication nonadherence or difficulty with self-monitoring. Assessing for memory and confusion complaints may also provide insight into a patient's awareness and perception of cognitive health, psychological status, and overall well-being, allowing ophthalmologists and other providers to give more individualized advice regarding health promotion and medication adherence. Future research is needed to determine whether visually impaired individuals who report memory or confusion complaints are at increased risk of cognitive impairment, decreased quality of life, and whether these individuals may benefit from advanced planning/health care coordination.

To our knowledge, this is the first study to investigate the prevalence of memory or confusion complaints in individuals with VI. Other strengths of this study include the use of a nationally representative sample that allowed us to generate population estimates and prevalence rates. In addition, we used objective measures of vision to define VI rather than subjective measures in association with complaints about memory or confusion.

Limitations

Limitations of the study include the absence of objective measures of cognition that may be examined in conjunction with reported complaints about memory or confusion. NHANES collected cognitive data from only the digital symbol substitution test (DSST), a test

highly dependent on vision, over the time period when vision was objectively measured, but strikingly, we found that over 40% of DSST scores were missing from individuals with VI. This could indicate a possible bias in the assessment of cognitive function in individuals with VI using this test score. We did not have depression data available for our study population for the years 1999-2004, thus we could not account for this potential confounding or mediating variable in our model. In addition, in NHANES, the question about memory or confusion was worded as "Are you limited in any way because of difficulty remembering or because you experience periods of confusion?," which is a "double-barreled" question, as it asks about two different things but only allows one answer, and we are unable to examine memory and confusion complaints separately. In addition, it is possible that VI in itself may have caused limitations in function, which may lead to confusion, potentially leading to positive responses to the questionnaire. Furthermore, the NHANES survey assesses specifically for limitations experienced by memory problems and confusion. This categorization may have excluded individuals who felt that their memory problem or confusion did not result in any restriction of activities. A limitation inherent with all NHANES analyses is the exclusion of institutionalized populations, and thus a lack of data on older U.S. adults in facilities such as nursing homes. This may have led to an underestimation of prevalence estimates, as older adults in nursing homes and assisted living facilities may disproportionately experience problems with memory (Waldorff, Siersma, & Waldemar, 2009a, 2009b). Finally, we did not have vision data or reports of memory or confusion complaints for individuals > 85 years of age due to the truncation of age at 85 years in NHANES to reduce the risk of disclosure, but CPS population totals used to estimate prevalence rates included all those aged ≥ 80 years (CDC, 1999). This may also have contributed to lower prevalence estimates of memory or confusion complaints and VI in the oldest age groups.

In conclusion, our study found a high prevalence of memory or confusion complaints in older adults with VI and an increased likelihood of reporting memory or confusion complaints in individuals with VI as compared with individuals without VI. This study adds to the increasing body of literature on the aging profiles of visually impaired older adults. Further studies are needed to investigate the implications of memory or confusion complaints in individuals with VI to determine if these complaints are associated with medication adherence, dementia, other patient outcomes and health-related well-being. In addition, research into potential mechanisms underlying this association is warranted, as these complaints may represent an understudied dimension of quality of life among older adults with VI.

Declaration of Conflicting Interests

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