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Research Article

Higher Dementia Incidence in Older Adults with Poor Visual Acuity

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Abstract

Background: Longitudinal evidence of poor visual acuity associating with higher risk of incident dementia is mixed. This study aimed to examine if poor visual acuity was associated with higher dementia incidence in a large community cohort of older adults, independent of the possible biases relating to misclassification error, reverse causality, and confounding effects due to health problems and behaviors.

Methods: A total of 15,576 community-living older adults without dementia at baseline were followed for 6 years to the outcome of incident dementia, which was diagnosed according to the ICD-10 or a Clinical Dementia Rating of 1 to 3. Visual acuity was assessed using the Snellen's chart at baseline and follow-up. Important variables including demographics (age, sex, education, and socioeconomic status), physical and psychiatric comorbidities (cardiovascular risks, ophthalmological conditions, hearing impairment, poor mobility, and depression), and lifestyle behaviors (smoking, diet, physical, intellectual, and social activities) were also assessed.

Results: Over 68,904 person-years of follow-up, 1,349 participants developed dementia. Poorer visual acuity at baseline was associated with higher dementia incidence in 6 years, even after adjusting for demographics, health problems, and lifestyle behaviors, and excluding those who developed dementia within 3 years after baseline. Compared with normal vision, the hazard ratio of dementia was 1.19 ($p = .31$), 2.09 ($p < .001$), and 8.66 ($p < .001$) for mild, moderate, and severe visual impairment, respectively.

Conclusions: Moderate-to-severe visual impairment could be a potential predictor and possibly a risk factor for dementia. From a clinical perspective, older adults with poor visual acuity might warrant further risk assessment for dementia.

Keywords: Poor vision, Visual impairment, Cognitive impairment

Poor vision and dementia are prevalent among older people, causing significant functional impairments, lower quality of life, and aggravation of comorbidities (1–5). Although poor vision has been postulated to increase risk of cognitive decline (6–14), longitudinal evidence of poor vision independently increasing risk of dementia is scarce (15,16). To date, only two longitudinal studies have examined the association between poor visual acuity and risk of dementia (17,18), and their results are conflicting. Several possible reasons relating to the methodology might explain the difficulty in finding such an association. First, people with visual impairment might have more perceptual difficulty during cognitive testing, especially with items that require good vision, and thereby score worse (19). Misclassifying them as having dementia would introduce bias in the study of poor vision and dementia. One way to minimize this is to use comprehensive clinical assessment rather than vision-dependent cognitive tests to identify dementia in this special population. Second, although previous longitudinal studies have excluded participants without dementia at baseline, those in the preclinical stage of dementia might already have visual disturbance and neuronal degeneration as reflected by retinal nerve fiber layer thinning, both of which are potential early markers of Alzheimer's disease (20,21), or have trouble in following the instructions of the visual acuity test owing to subtle cognitive impairment, thus risking reverse causation. Having a longer interval between assessment of visual acuity

and diagnosis of dementia and excluding those who developed dementia shortly after baseline might help minimize the possibility of reverse causation. Third, people with poor vision might experience more difficulties in accessing services for their health problems and in participating in physical, intellectual, and social activities (22). Whether poor visual acuity increases the risk of dementia independent of these health conditions and behaviors, which themselves have already been shown to be associated with dementia, requires further investigation.

Based on a large well-characterized cohort of community-living older Chinese adults who were free of dementia at baseline, we examined if poor visual acuity at baseline was independently associated with higher risk of incident dementia in 6 years. Our findings might support and extend the previous literature that poor vision is important to the development of dementia, and highlight the importance of including visual acuity examination in dementia risk assessment.

Methods

Study Design, Setting, and Participants

This longitudinal observational study was based on the Year 2005 cohort of the Elderly Health Centres (EHCs) of the Department of Health of the Government of Hong Kong, which has been described in more detail elsewhere (23). Briefly, this cohort was composed of a total of 18,298 Chinese individuals aged 65 years or older at inception in 2005, and was followed for 6 years to the outcome of incident dementia. During the study period, participants received annual standardized clinical assessment of cognitive status and comprehensive examination of a wide range of lifestyle behaviors, physical and psychiatric comorbidities, and sociodemographic factors at the EHCs. Those who missed the follow-up assessments at the EHCs were actively traced and interviewed by geriatric psychiatrists, or cross-checked with the Deaths Registry for the cause of death. In this study, informed consent was obtained from all individual participants, or from their relatives if they were mentally incapable of giving consent before the follow-up assessment was conducted. This study was approved by the Ethics Committee of the Department of Health of the Government of Hong Kong and the Joint Clinical Research Ethics Committee of the Chinese University of Hong Kong and the New Territories East Cluster of the Hospital Authority.

To examine the association between visual acuity and incidence of dementia while minimizing potential residual confounding due to suspected dementia, we excluded participants who were living in care homes, having Parkinson's disease, stroke, or dementia, and/or not completing the visual acuity tests at baseline. Given the potential confounding effect of lifestyle behaviors in the association between preexisting visual impairment and future development of dementia, which themselves are also associated with higher risk of incident dementia, we also excluded participants who did not provide a description of their leisure activity pattern. Thus, 15,576 individuals were included (Supplementary Figure 1).

Assessment of Visual Acuity

Habitual visual acuity was estimated using line scores from the 20-feet Snellen's E chart mounted on a wall at the EHCs. The Snellen's chart is commonly used in clinical setting for measuring visual acuity (24,25). Optical corrections were allowed during the clinical evaluation of visual acuity in this study, so participants needing eyeglasses in their daily lives were asked to look at the Snellen's chart with their glasses on. Given the non-normal distribution, the Snellen fractions were converted to LogMAR, with a higher score indicating poorer visual acuity.

Identification of Dementia Cases

The outcome of this study was incident dementia in 6 years. To minimize the risk of misclassifying individuals with poor vision as having dementia due to difficulty in completing vision-dependent cognitive tests, comprehensive clinical examination, including detailed history taking to look for evidence of impaired personal activities of daily living owing to a significant decline in memory and executive function rather than sensory impairments, and nonvisual cognitive testing, such as the delayed recall test and the Abbreviated Mental Test, were conducted by physicians at the EHCs at baseline and follow-up. Participants who missed these but agreed to a follow-up interview received the clinical examination and Clinical Dementia Rating by geriatric psychiatrists. Dementia was diagnosed according to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* (ICD-10) and a Clinical Dementia Rating (CDR) of 1 to 3 (26,27). A panel of geriatric psychiatrists reviewed all the diagnosis of dementia independently. For cases whose diagnosis was uncertain or in disagreement, the principal investigator adjudicated the final diagnosis.

Assessment of Other Variables

Sociodemographic factors (age, sex, educational level, and socioeconomic status), physical and psychiatric comorbidities (cataract, glaucoma, diabetes, hypertension, hypercholesterolemia, heart diseases, obesity, hearing impairment, poor mobility, and depression), and lifestyle behaviors (physical, intellectual, and social activities, fruit and vegetable intake, and smoking) were examined during the assessment. Low socioeconomic status was defined as receiving social security from the government. Cataract and glaucoma were diagnosed by ophthalmologists, whereas other health problems were diagnosed by physicians, all according to the ICD-10. Obesity was defined as body mass index equal to or greater than 25 kg/m^2 according to the Asian references (28). Hearing impairment was defined as 1- and 2-kHz loss of more than 40 decibels in the better ear during audiometric testing (Audioscope, Welch Allyn 23300). Poor mobility was defined as needing an aid to walk or being chairbound. Standardized self-reported questionnaire was used to assess the participants' lifestyle behaviors in the prior month. The leisure activity classification system has already been validated for the Hong Kong Chinese older people (29). Adequate amount of fruit and vegetable intake and regular participation in physical, intellectual, and social activities were defined as previously reported (23,30,31).

Sample Size Estimation

Sample size estimation was performed using the Power and Precision software, version 3.0 (Biostat). Sample size was calculated based on estimates of incidence rate of dementia (6% in 6 years) and people with visual impairment having an odds ratio of 1.78 for cognitive decline from previous literature (7). With alpha set at 0.05, a baseline sample of 10,000 participants would yield at least 80% power for detection of dementia at follow-up.

Statistical Analyses

Statistical analyses were performed using the IBM SPSS Statistics, Version 24.0 (IBM Corp). The number of participants with follow-up

over the 6-year study period was expressed as person-years, which was calculated by summing each participant's contribution of follow-up time. Comparison of visual acuity and other variables at baseline between participants with and without incident dementia was analyzed by the independent *t* test or the χ^2 test, as appropriate. Continuous variables that were not normally distributed were analyzed by the Mann–Whitney test.

To minimize the risk of reverse causality, we repeated the analysis by first selecting participants who were still free of dementia at Year 3 (ie, excluding those who developed dementia within 3 years after baseline and those who could not be confirmed to be still free of dementia by Year 3 owing to missing of the interim follow-up assessment) and then comparing the visual acuity measured at baseline between those with and without incident dementia at Years 4–6.

Cox regression analysis was performed to examine the association between poorer visual acuity at baseline and time to dementia. Model 1 was unadjusted, whereas Model 2 was adjusted for the potential confounding factors. The data was censored when the participant remained free of dementia by the time the study ended, defaulted follow-up, or died without dementia before the study ended. The hazard ratios (HRs) were computed to yield point estimates with 95% confidence intervals (95% CIs).

Sensitivity analysis was performed to ascertain whether higher incidence of dementia was associated with poorer visual acuity at baseline rather than a longitudinal decrease in visual acuity. Participants who remained free of dementia by Year 3 were selected, and the longitudinal changes of visual acuity from baseline to Year 3 were compared within and between participants with and without dementia at Years 4–6 using paired *t* test and General Linear Model repeated measures, respectively.

Based on the latest classification of visual impairment from the ICD-11, a post hoc analysis was performed to test if the risk of dementia varied among different degrees of visual impairment. Normal vision and mild, moderate, and severe visual impairments were defined as <0.3, 0.3–0.47, 0.48–0.99, and ≥1.00 LogMAR, respectively. Comparison was then made with the normal vision group to examine if mild, moderate, and severe visual impairments were associated with higher incidence of dementia. Cox regression analysis was repeated, adjusting for the same confounders in the aforementioned models.

Results

A total of 15,576 participants constituted the present study sample. Nine thousand nine hundred and forty-five (63.8%) were women, and the mean age at baseline was 74.5 years (*SD*: 4.8 years). They had a median follow-up period of 5.0 years (interquartile range: 3.0–6.0 years), contributing 68,904 person-years of follow-up over the 6-year study period. 1,349 participants (8.7%) developed incident dementia in 6 years. Compared to those who remained free of dementia, they were older and were predominantly female, with lower educational attainment and socioeconomic status, higher prevalence of physical and psychiatric comorbidities (cataract, diabetes, hypertension, heart diseases, hearing impairment, poor mobility, and depression), and lower adherence to healthy lifestyle practices (less participation in physical exercise and intellectual activities, and lower intake of fruits and vegetables; Table 1).

Visual Acuity at Baseline and Risk of Incident Dementia

At baseline, the mean visual acuity of the study sample was 0.46 LogMAR (approximate Snellen equivalent 20/58). Participants with incident dementia had poorer visual acuity at baseline than those without (0.51 [0.17] vs 0.46 [0.16], in Log MAR; $p < .001$; Table 1). The HR of incident dementia was 15.07 (95% CI = 10.68–21.28; $p < .001$) for poorer visual acuity at baseline. After adjusting for age, sex, educational level, socioeconomic status, cataract, glaucoma, cardiovascular risks, hearing impairment, poor mobility, depression, physical exercise, intellectual activities, social activities, fruit and vegetable consumption, and smoking, the HR was 5.88 (95% CI = 4.04–8.57; $p < .001$). The attenuation of HR appears

Table 1. Comparison of Baseline Characteristics Between Participants With and Without Incident Dementia in 6 Years.

Baseline Characteristics	Incident Dementia		*p* Value
	No (*n* = 14,227)	Yes (*n* = 1349)	
Age, mean (*SD*)	74.3 (4.8)	76.4 (5.2)	<.001
Female, *n* (%)	8,965 (63.0)	980 (72.6)	<.001
No schooling received, *n* (%)	3,659 (25.7)	511 (37.9)	<.001
On social welfare, *n* (%)	1,780 (12.5)	195 (14.5)	.04
Cataract, *n* (%)	9,063 (63.7)	915 (67.8)	.003
Glaucoma, *n* (%)	492 (3.5)	52 (3.9)	.45
Diabetes mellitus, *n* (%)	2,112 (14.8)	246 (18.2)	.001
Hypertension, *n* (%)	9,081 (63.8)	943 (69.9)	<.001
Hypercholesterolemia, *n* (%)	6,001 (42.2)	584 (43.3)	.43
Heart disease, *n* (%)	1,575 (11.1)	188 (13.9)	.001
Obesity, *n* (%)	5,390 (37.9)	526 (39.0)	.43
Hearing impairment, *n* (%)	3,195 (22.5)	337 (25.0)	.03
Poor mobility, *n* (%)	988 (6.9)	168 (12.5)	<.001
Depression, *n* (%)	517 (3.6)	73 (5.4)	.001
Physical exercises, *n* (%)	7,208 (50.7)	550 (40.8)	<.001
Intellectual activities, *n* (%)	9,518 (66.9)	684 (50.7)	<.001
Social activities, *n* (%)	11,049 (77.7)	1,065 (78.9)	.28
Adequate intake of fruits and vegetables, *n* (%)	7,110 (50.0)	622 (46.1)	.007
Smoking, *n* (%)	699 (4.9)	59 (4.4)	.38
Visual acuity in LogMAR, mean (*SD*)	0.46 (0.16)	0.51 (0.17)	<.001

to be driven mainly by age (HR = 1.06; 95% CI = 1.05–1.07; $p < .001$), sex (female; HR = 1.22; 95% CI = 1.07–1.40; $p = .004$), low educational level (HR = 1.17; 95% CI = 1.03–1.33; $p = .01$), diabetes (HR = 1.19; 95% CI = 1.03–1.36; $p = .02$), hypertension (HR = 1.13; 95% CI = 1.00–1.28; $p = .04$), heart diseases (HR = 1.18; 95% CI = 1.01–1.38; $p = .04$), lack of physical exercise (HR = 1.24; 95% CI = 1.11–1.39; $p < .001$), and lack of intellectual activities (HR = 1.49; 95% CI = 1.32–1.68; $p < .001$). Neither cataract (HR = 0.95; 95% CI = 0.85–1.07; $p = .41$) nor glaucoma (HR = 1.03; 95% CI = 0.78–1.36; $p = .83$) was associated with a higher HR of incident dementia.

Visual acuity at baseline was compared again between participants with and without incident dementia, after excluding those who developed dementia within 3 years after baseline ($n = 588$) and those who could not be confirmed to be still free of dementia by Year 3 owing to missing of the interim follow-up assessment ($n = 3,479$). Consistent with the above finding, those with incident dementia ($n = 761$) had poorer visual acuity at baseline than those who remained cognitively stable ($n = 10,748$) (0.51 [0.17] vs 0.45 [0.16], in LogMAR; $p < .001$). The HR of incident dementia was 19.41 (95% CI = 12.37–30.47; $p < .001$) for poorer visual acuity at baseline, and 8.24 (95% CI = 5.06–13.44; $p < .001$) after adjusting for the same confounding factors as above. Again, neither cataract (HR = 0.95; 95% CI = 0.81–1.11; $p = .51$) nor glaucoma (HR = 0.99; 95% CI = 0.68–1.45; $p = .97$) was associated with a higher HR of incident dementia.

Longitudinal Changes of Visual Acuity Prior to Onset of Dementia

Visual acuity declined significantly from baseline to Year 3 in both participants who remained cognitively stable and those who developed incident dementia at Years 4–6 (Supplementary Figure 2). However, there was little difference in the longitudinal changes of visual acuity between the two groups (Table 2); thus, the principal group difference was in visual acuity at baseline.

Degree of Visual Impairment at Baseline and Risk of Incident Dementia

The frequency of distribution of participants with different severities of visual impairment at baseline was described in Table 3. Participants with normal vision or mild visual impairment at baseline were more prevalent in the cognitively stable group, whereas those with moderate or severe visual impairment were more prevalent in the incident dementia group.

However, comparing to those with normal vision, the proportion of those with mild visual impairment at baseline was higher in the incident dementia group than in the cognitively stable group (701 of 755 [92.8%] vs 8,214 of 9,646 [85.2%]; $p < .001$), with a HR of 1.56 (95% CI = 1.17–2.06; $p = .002$) for incident dementia after adjusting for the confounding factors (Table 4). Nevertheless, we found no evidence of an association between mild visual impairment and higher risk of dementia (HR = 1.19; 95% CI = 0.86–1.65; $p = .31$), after adjusting for the confounding factors and excluding those who developed dementia within 3 years after baseline (Table 5).

For moderate and severe visual impairments, both were associated with higher risk of incident dementia over 6 years, even after adjusting for confounding factors (Table 4) and additionally excluding participants who developed dementia within 3 years after baseline (Table 5); their HRs were 2.09 (95% CI = 1.47–2.97; $p < .001$) and 8.66 (95% CI = 4.60–16.30; $p = <0.001$), respectively.

Discussion

In this longitudinal study of over 15,000 community-living older adults, we found an association between poorer visual acuity at baseline and higher incidence of dementia. This association was not fully explained by the rate of visual decline prior to the clinical onset of dementia, and it remained significant even after excluding those who developed dementia shortly after baseline and controlling for other health problems and lifestyle practices. More importantly, this association was present only in those with moderate-to-severe, but not mild, visual impairment. These findings suggest that poor visual acuity is an important factor in the development of dementia in older people, and from a clinical perspective, health care professionals need to be aware of older adults with poor visual acuity being at higher risk of dementia.

Comparison with Previous Studies

To our knowledge, this is the largest longitudinal community cohort study that shows an independent association between poor visual acuity and higher incidence of dementia. Relative to the previous studies, this study is better controlled, with various important confounders considered, and care has been taken in the study design and data analysis to minimize the possibilities of misclassification error and reverse causation. Our findings thus provide additional evidence to the existing literature on the importance of poor vision in the development of dementia.

Although previous cross-sectional studies reported an association between visual impairment and dementia, it may be that people with poor vision have higher incidence of dementia because of the confounding effects of lower participation in physical exercise and cognitively stimulating activities such as reading, which themselves are associated with higher risk of incident dementia. However, these alone do not appear to fully account for the observed association, because it remained robust after we controlled for various lifestyle behaviors. Another possibility is that a common cause, such as ageing and vascular risk factors (in particular, hypertension and diabetes), leads to the development of both visual impairment and dementia (32,33). However, again, the observed association remained significant after adjusting for these factors. Moreover, we found no evidence of longitudinal decline in visual acuity associating with

Table 2. Longitudinal Changes of Visual Acuity Over the First 3 Years Among Participants With and Without Incident Dementia at Years 4–6

Incident Dementia at Years 4–6	Visual Acuity in LogMAR, Mean (*SD*)		*p* Value[a]	*p* Value[b]
	Baseline	Year 3		
No	0.45 (0.16)	0.47 (0.17)	<.001	.30
Yes	0.50 (0.16)	0.53 (0.18)	<.001	

Note: [a]Paired *t* test. [b]General linear model repeated measures.

Table 3. Differences in Proportion of Participants With Different Severities of Visual Impairment at Baseline Between Those With and Without Incident Dementia in 6 Years

Vision at Baseline	Total Population, No. (%)	Incident Dementia, No. (%)		*p* Value[a]	*p* Value[b]
		No (*n* = 14,227)	Yes (*n* = 1,349)		
Normal	1,486 (9.5)	1,432 (10.1)	54 (4.0)	-	<.001
Mildly impaired	8,915 (57.2)	8,214 (57.7)	701 (52.0)	<.001	
Moderately impaired	4,714 (30.3)	4,186 (29.4)	528 (39.1)	<.001	
Severely impaired	461 (3.0)	395 (2.8)	66 (4.9)	<.001	

Note: [a]Comparison was made with the normal group using χ^2 test. [b]Comparison was made across all groups using χ^2 test.

Table 4. HR and 95% CI of Incident Dementia Over 6 Years of Follow-up in Participants With Mild, Moderate, or Severe Visual Impairments at Baseline

Severity of Visual Impairment at Baseline	Model 1		Model 2[a]	
	HR (95% CI)	*p* Value	HR (95% CI)	*p* Value
Mild	2.21 (1.68–2.92)	<.001	1.56 (1.17–2.06)	.002
Moderate	3.20 (2.42–4.23)	<.001	2.27 (1.68–3.06)	<.001
Severe	18.54 (12.93–26.60)	<.001	10.84 (6.60–17.81)	<.001

Note: CI = confidence interval; HR = hazard ratio.

[a]Adjusted for age, sex, educational level, socioeconomic status, cataract, glaucoma, cardiovascular risks, hearing impairment, poor mobility, depression, physical exercise, intellectual activities, social activities, fruit and vegetable consumption, and smoking.

Table 5. HR and 95% CI of Incident Dementia at Years 4–6 in Participants With Mild, Moderate, or Severe Visual Impairments at Baseline

Severity of Visual Impairment at Baseline	Model 1		Model 2[a]	
	HR (95% CI)	*p* Value	HR (95% CI)	*p* Value
Mild	1.65 (1.20–2.26)	.002	1.19 (0.86–1.65)	.31
Moderate	2.79 (2.02–3.85)	<.001	2.09 (1.47–2.97)	<.001
Severe	13.63 (8.73–21.28)	<.001	8.66 (4.60–16.30)	<.001

Note: CI = confidence interval; HR = hazard ratio.

[a]Adjusted for age, sex, educational level, socioeconomic status, cataract, glaucoma, cardiovascular risks, hearing impairment, poor mobility, depression, physical exercise, intellectual activities, social activities, fruit and vegetable consumption, and smoking.

higher incidence of dementia. These suggest that poor visual acuity is independently associated with higher risk of dementia.

With visual disturbances possibly developed before the clinical onset of cognitive symptoms, it may be that visual impairment is an early marker rather than a risk factor of dementia. Although the observational nature of this study does not allow us to conclude a causal relationship between the two, our findings showed that the association between poor visual acuity at baseline and higher incidence of dementia in 6 years remained robust after excluding those who developed dementia within 3 years after baseline. This is in line with the recent findings from the Salisbury Eye Evaluation Study, which suggest that worsening of vision has a stronger effect on cognitive decline than the other way round (13). Taken together, this evidence suggests the possibility of poor vision as a risk factor of dementia.

Interestingly, we did not find an independent association between cataract or glaucoma and higher incidence of dementia as suggested by some recent studies (34,35). One possible explanation for the difference in findings is that we did not assess the onset, duration, severity and treatment of these ophthalmic conditions in this study. Previous studies show that correcting cataract with surgery is associated with better cognitive performance and increased grey matter volume in the visual cortex (36–40). With our data also showing that moderate-to-severe, but not mild, visual impairment is associated with higher risk of dementia, it would be of interest to further examine whether early treatment of poor vision might help delay or prevent clinical manifestation of dementia in older adults.

Although the underlying mechanisms remain to be elucidated, we speculate that poor visual acuity might result in less visual input and thus attenuate the neuronal network that support cognitive processes. A number of neuroimaging studies have reported that visual impairments could potentially lead to structural changes not only within the visual cortex but also in other regions, including the hippocampus and frontal areas, and alterations in functional connectivity across different brain regions (41–46). These findings are in line of our observations that poor visual acuity might have an independent association with the development of dementia. It would be interesting to compare the risk of dementia between people with and without blindness in future studies.

Strengths and Limitations

This study had several strengths. We followed this large territory-wide community cohort for a long time, with a low attrition rate. We used comprehensive and in-depth clinical interview to ascertain the diagnosis of dementia, and excluded those who developed dementia

shortly after baseline in the analysis. In addition, a wide range of physical health problems, sociodemographic factors, and health behaviors were included in this study.

Nevertheless, this study had some limitations. First, given the observational nature of our study, care needs to be taken when making an inference about a causal association between visual impairment and dementia. The possibility of reverse causation, although minimized in this study, could not be completely excluded because the baseline cognitive capacities, onset of poor visual acuity, and duration of wearing eyeglasses prior to this study were unknown. As dementia is likely the consequence of a lifetime of injury, with pathologies developed years if not decades before the clinical manifestation (47,48), future studies involving a life course approach will be needed to delineate the relationship between visual impairment and dementia. Nevertheless, given that the previous evidence on the longitudinal association between the two has been unclear, our present findings provide some new evidence that poor vision is potentially important to the development of dementia, and support the need for further studies. Second, habitual rather than best-corrected visual acuity was examined in this study, though we speculate that the former might better reflect to the risk exposure in real life. Third, screening for other eye diseases and common causes of visual impairment in older people (such as age-related macular degeneration, diabetic retinopathy, myopia, hyperopia, and presbyopia), comprehensive eye testing (examination of visual field), genotyping (*APOE4*), and neuroimaging (PET, MRI, SPECT, and DAT scans) were not conducted. These limit us in examining if an association exists between a particular cause of visual impairment and a particular subtype of dementia. Last, one should exercise caution when generalizing our findings to older populations of other ethnicities or with more comorbidities, because our participants were ethnic Chinese, had a relatively lower educational level, and were relatively healthy.

Conclusions

Our findings support and extend the previous literature that poor visual acuity is an important factor in the understanding of dementia risk in older adults. With moderate-to-severe visual impairment being a potential predictor and possibly a risk factor for dementia in older adults, our findings suggest that those with poor visual acuity might warrant further dementia risk assessment and management. In future, trials should be conducted to test whether early correction of poor visual acuity could help slow or prevent clinical manifestation of dementia in older populations.

Supplementary Material

Supplementary data is available at *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences* online.

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Conflict of Interest

None reported.

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Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the Ethics Committee of the Department of Health of the Government of Hong Kong and the Joint Clinical Research Ethics Committee of the Chinese University of Hong Kong and the New Territories East Cluster of the Hospital Authority, and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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