• Investigation •

The association between socioeconomic status and visual disability among older adults in China

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Abstract

● AIM: To investigate the association between socioeconomic status (SES) and visual disability (VD) among older Chinese adults.

● METHODS: We obtained data from the Second National Sample Survey on Disability, conducted in China in 2006. A total number of 192 375 older adults (aged≥65y) were screened for suspected VD *via* interviews with trained examiners. Those who screened positively for VD were referred to ophthalmologists to obtain a final diagnosis.

● RESULTS: VD was prevalent among 7.29% of Chinese adults aged 65 and older, and was higher in rural areas (8.71%) than in urban areas (4.82%). After adjusting for SES indicators and covariates, we found that less-educated older adults were more likely to suffer from VD, with an odds ratio (OR) of 2.50 (95%CI: 2.26-2.82) for illiterates, compared with those who graduated from senior high school or above. Older adults who were in the lowest income quintile were more at risk of VD, with an OR of 1.81 (95%CI: 1.68-2.95), compared with adults in the highest income quintile. In urban areas, when compared with adults who graduated from senior high school or above, those who did not continue their education after junior high school, primary school, or those who were illiterate, were more likely to suffer from VD, with an OR of 1.35 (95%CI: 1.51-1.59), 1.84 (95%CI: 1.60-2.12), and 2.63 (95%CI: 2.27-3.04), respectively. Lower levels of income were statistically significant when associated with VD. In rural areas, adults who were illiterate had an OR of 2.21 (95%CI: 1.75-2.79) when compared to adults with senior high school or above education level. *Per capita*, household income remained significantly associated with VD. Older adults who were ≥85, female, single, and residing in rural areas were associated with higher risks of VD.

● CONCLUSION: Individual-level SES among the elderly, in the form of education and income, is associated with VD among elderly Chinese adults in both urban and rural areas; however, the association is stronger in rural areas. Further studies are still required to explore the mechanism behind the relationships.

● **KEYWORDS:** visual disability; prevalence; socioeconomic status; older adults; risk factors

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INTRODUCTION

Visual disability (VD), which is defined as blindness or visual impairment, is the third leading cause of impairment after anemia and hearing loss[1]. The World Health Organization (WHO) defines blindness as having a best corrected visual acuity (BCVA) level of ≤20/400 in the better eye and defines visual impairment as having a BCVA level of <20/60 in the better eye. Disorders of the sensory organs (vision loss and hearing loss) are the top-ranked cause of disability in older adults (those older than 65y)[1]. VD has become an increasingly important public-health issue. Blindness and visual impairment negatively impact on both physical and mental health. Individuals who are visually impaired or blind have a higher risk of accidents[2], depression[3], social withdrawal, and mortality[4-5]. Vision loss, like cancer, is one of mankind's most fearful diseases[6].

It is estimated that 36 million people worldwide were blind and an additional 216.6 million people had moderate to severe visual impairment[7]. In 2004, the WHO estimated that vision loss was responsible for 3.9% of the total global burden of disease, measured as disability-adjusted life years, even higher than that of coronary heart disease, which is the leading cause of death worldwide[8]. China has the largest number of people

with VD in the world, and this number is increasing rapidly. According to official estimates from the Chinese government in 2010, the total number of people with VD was 20.03 million, and new annual cases numbered 450 000[9-10]. Older adults account for the majority of the visually impaired population in China; this is due to demographic transitions and population aging. Lower socioeconomic status (SES), including area-level SES and individual-level SES, has been recognized as a crucial determinant of health, especially visual health. However, area-level SES and individual-level SES are closely linked and may affect visual health in different ways[11]. Although studies have been conducted on the relationship between SES and visual health, most, such as the Singapore Epidemiology of Eye Diseases study and the UK Biobank study, have been carried out in developed countries[12-13]. Literature that focuses on the association between SES and VD among older adults on an individual level in middle- and low-income countries is extremely limited, especially in China[14-15]. The current study uses data from the Second National Sample Survey on Disability (2nd CSSD), the most nationally representative survey of people with disabilities so far, ongoing to investigate the relationship between SES and VD in Chinese adults ≥65. This study fills in gaps within this field related to China and contributes to global literature on low- and middle-income countries.

SUBJECTS AND METHODS

Ethical Approval The survey was approved by the State Council of China (No.20051104) and conducted according to legal guidelines governed by the Statistical Law of the People's Republic of China (1996 Amendment). Visual-function tests and assessments of VD were performed by capable ophthalmologists (≥5y of clinical experience) after they obtained informed consent from each individual.

Data Source and Study of Population We utilized data collected as part of the 2nd CSSD, which was conducted from April 1, 2006 to May 31, 2006. This survey was designed to estimate the population-based prevalence, cause, and severity of disability; to examine SES as it relates to disability; and to document the functional conditions and health-service needs of adults with disabilities. A multistage, stratified, random cluster, and probability proportional to size sampling method was used to obtain a representative sample of the non-institutionalized populations in all province-level administrative regions of mainland China. Over 6000 doctors, 20 000 interviewers, and 50 000 survey assistants participated in this survey. Prior to the survey, a total of 2 526 145 residents from 5964 communities in 734 counties were selected. Information about the number of households, population numbers, and suspected numbers of disabled people in the sampling community was collected to ensure the survey was completed on time. Residents with potential disabilities were later examined by trained ophthalmologists. The response rate of the survey was 83.5%. The results of the survey were evaluated as valid and reliable and have been used as scientific evidence for policymaking by national and local governments in China. Details of the survey protocol and implementation have been described in previous studies[16-17]. In this study, we restricted our analysis to 192 375 adults aged 65 or older.

Vision Assessment Vision evaluation was based on the established protocol of the 2nd CSSD. The vision evaluation consisted of two steps. First, interviewers used Snellen charts and visual-field cards to survey households and identify individuals with suspected VD. Second, individuals suspected of having VD were referred to an ophthalmologist for further diagnosis. The procedure for diagnosing VD included a survey of medical history, visual-function tests, and an etiological diagnosis. According to the classification criteria for blindness and visual impairment proposed by the WHO, patients with a BCVA of ≤0.3 were diagnosed with VD. Etiological diagnoses were based on medical history, general ophthalmologic examinations, slit-lamp microscopies, and ophthalmoscopies. When individuals were unable to tolerate a physical examination (due to psychotic disorders, intellectual impairment, *etc*.), ophthalmologists would make comprehensive judgement[18].

Measures The outcome variable was to establish whether an older adult had a VD. The independent variable was individual-level SES, defined by two categorical variables: education (illiterate, primary school, junior high school, or senior high school) and income (quintiles of annual family income per capita). The majority of Chinese adults retire at age 60, therefore, occupation was not considered as an SES measure in this study. Covariates included age (65-74, 75-84, 85 or older), sex (man or woman), marital status (married, single, divorced, or widowed) and residence (urban or rural). Residence is an area-level SES variable. The independent variables and covariates were all self-reported.

Analytic Approach Logistic regression models were used to estimate multivariate associations between VD and indicators of SES, and odds ratios (ORs) with 95% confidence intervals (CIs) are presented. Studies have shown that indicators of SES are correlated but interchangeable[19]. Thus, we controlled for each indicator of SES and the related covariates in order to obtain the net effect of each indicator. We reported the final model with adjusted ORs of SES on VD; $P<0.05$ was considered statistically significant. Stata Version 13.0 for Windows (Stata, College Station, TX, USA) was used for the statistical analyses. All analyses were run separately for urban and rural areas.

Table 1 Characteristics of older adults, aged 65y and above, in urban and rural areas *n* (%)

Characteristics	Urban		Rural	
	Not having VD (*n*=66695)	Having VD (*n*=3375)	Not having VD (*n*=111656)	Having VD (*n*=10649)
Independent variables				
Education				
Senior high school or above	15066 (22.59)	281 (8.33)	2440 (2.19)	76 (0.71)
Junior high school	11864 (17.79)	333 (9.87)	6535 (5.85)	324 (3.04)
Primary school	21346 (32.01)	1001 (29.66)	36129 (32.36)	2352 (22.09)
Illiteracy	18419 (27.62)	1760 (52.15)	66552 (59.60)	7897 (74.16)
Income				
Quintile 1 (highest)	31087 (46.61)	1024 (30.34)	5815 (5.21)	353 (3.31)
Quintile 2	18360 (27.53)	944 (27.97)	16731 (14.98)	1252 (11.76)
Quintile 3	8073 (12,10)	564 (16.71)	21870 (19.59)	1999 (18.77)
Quintile 4	6050 (9.07)	532 (15.76)	35368 (31.68)	3417 (32.09)
Quintile 5 (lowest)	3125 (4.69)	311 (9.21)	31872 (28.54)	3628 (34.07)
Covariates				
Age group (y)				
65-74	48078 (72.09)	1690 (50.07)	80141 (71.77)	5430 (50.99)
75-84	16627 (24.93)	1402 (41.54)	27952 (25.03)	4387 (41.20)
85 and above	1990 (2.98)	283 (8.39)	3563 (3.19)	832 (7.81)
Gender				
Woman	35170 (52.73)	2342 (69.39)	57609 (51.60)	6714 (63.05)
Man	31525 (47.27)	1033 (30.61)	54047 (48.40)	3935 (36.95)
Marital status				
Married	46231 (69.32)	1735 (51.41)	69865 (62.57)	4986 (46.82)
Single	229 (0.34)	35 (1.04)	1359 (1.22)	194 (1.82)
Divorced	420 (0.63)	20 (0.59)	481 (0.43)	56 (0.53)
Widowed	19815 (29.71)	1585 (46.96)	39951 (35.78)	5413 (50.83)

VD: Visual disability.

RESULTS

Table 1 shows the characteristics of the urban and rural samples. In urban areas, of individuals aged 65 or older with a VD, 52.15% were illiterate, 30.34% were in the highest income quintile, 50.07% were aged 65-74y, 69.39% were woman, and 51.41% were married. In rural areas, of individuals aged 65 or older with a VD, 74.16% were illiterate, 34.07% were in the lowest income quintile, 50.99% were aged 65-74y, 63.05% were woman, and 50.83% were widowed. It is notable that older adults living in households of a higher SES in urban areas had a higher percentage of VD than those living in poorer households, but the situation was reversed in rural areas: the lower the SES status, the higher the percentage of VD.

Table 2 presents the prevalence of VD in adults aged 65 or older in urban and rural areas. The prevalence of VD among all older adults studied was 7.29%, with 8.71% and 4.82% in rural and urban areas, respectively, with statistical difference. The prevalence of VD among older adults increased among those with lower levels of education and lower household income *per capita*. Those who were 85 and above, female, and single had a higher prevalence than others. In both urban and rural areas, the prevalence of VD increased with decreasing education levels and lower quintiles of annual family income *per capita*. VD prevalence also increased with age (prevalence: 12.45% and 18.93% for those aged 85y and above, respectively). In both urban and rural areas, females and those who were single or widowed had a higher prevalence of VD.

Table 3 presents the results of the logistic regression analyses conducted on the association between SES and VD among older Chinese adults. In Model 1, which only contains SES variables, education levels and annual family income *per capita* were statistically significant when associated with VD. In Models 2 and 3, which are adjusted for age, gender, and marital status, the association between education, income, and VD remained significant. In particular, compared to married adults, the older, single adults were more likely to have VD. In Model 4, after adjusting for age, gender, marital status, and residence, the association between education, income, and VD remained significant, but the magnitude of the association decreased.

Tables 4 and 5 present the degree of association between SES and VD among the elderly in both urban and rural areas. The

Table 2 Prevalence with 95% confidence intervals of VD in older adults aged 65y and above

Characteristics	Total	Urban	Rural	χ^2	*P*
VD	7.29 (7.17-7.41)	4.82 (4.66-4.98)	8.71 (8.55-8.87)	997.58	<0.001
Independent variables					
Education				2600.00	<0.001
Senior high school or above	1.99 (1.80-2.21)	1.83 (1.63-2.05)	3.02 (2.41-3.77)	15.62	<0.001
Junior high school	3.45 (3.20-3.72)	2.73 (2.45-3.03)	4.72 (4.25-5.25)	52.41	<0.001
Primary school	5.51 (5.33-5.70)	4.48 (4.21-4.76)	6.11 (5.88-6.35)	72.36	<0.001
Illiteracy	10.21 (10.01-10.40)	8.72 (8.34-9.11)	10.61 (10.39-10.83)	61.58	<0.001
Income				1500.00	<0.001
Quintile 1 (highest)	3.60 (3.42-3.79)	3.19 (3.00-3.39)	5.72 (5.17-6.33)	95.82	<0.001
Quintile 2	5.89 (5.65-6.13)	4.89 (4.59-5.20)	6.96 (6.60-7.34)	72.11	<0.001
Quintile 3	7.88 (7.60-8.18)	6.53 (6.03-7.07)	8.37 (8.03-8.73)	29.72	<0.001
Quintile 4	8.70 (8.45-8.97)	8.08 (7.44-8.77)	8.81 (8.53-9.10)	3.75	0.05
Quintile 5 (lowest)	10.12 (9.82-10.42)	9.05 (8.14-10.06)	10.22 (9.90-10.54)	4.70	0.03
Covariates					
Age group (y)				3000.00	<0.001
65-74	5.26 (5.14-5.38)	3.39 (3.24-3.56)	6.34 (6.18-6.51)	549.37	<0.001
75-84	11.49 (11.22-11.77)	7.78 (7.39-8.18)	13.56 (13.20-13.94)	381.39	<0.001
85 and above	16.72 (15.84-17.64)	12.45 (11.15-13.87)	18.93 (17.80-20.12)	45.19	<0.001
Gender				822.55	<0.001
Woman	8.89 (8.72-9.07)	6.24 (6.00-6.49)	10.43 (10.20-10.68)	514.55	<0.001
Man	5.49 (5.34-5.64)	3.17 (2.99-3.37)	6.79 (6.58-6.99)	525.05	<0.001
Marital status				1700.00	<0.001
Married	5.47 (5.35-5.60)	3.62 (3.45-3.79)	6.66 (6.48-6.84)	523.66	<0.001
Single	12.60 (11.15-14.21)	13.26 (9.67-17.92)	12.49 (10.94-14.23)	0.12	0.73
Divorced	7.78 (6.26-9.63)	4.54 (2.95-6.94)	10.43 (8.11-13.31)	11.67	0.001
Widowed	10.48 (10.25-10.72)	7.41 (7.06-7.76)	11.93 (11.64-12.23)	317.42	<0.001

VD: Visual disability. The Wald χ^2 test was used to determine the prevalence of VD within demographic and SES variables. In each category of independent variables, the prevalence of VD within areas of residence (urban and rural) was also tested by the Wald χ^2 test.

Table 3 OR with 95%CI on the association between SES and VD in older adults aged 65y and above

Characteristics	Model 1	Model 2	Model 3	Model 4
Independent variables				
Education				
Senior high school or above	Reference	Reference	Reference	Reference
Junior high school	1.54 (1.35-1.75)	1.50 (1.32-1.72)	1.48 (1.29-1.68)	1.45 (1.27-1.65)
Primary school	2.23 (1.98-2.50)	2.06 (1.84-2.32)	1.92 (1.71-2.16)	1.84 (1.64-2.07)
Illiteracy	4.06 (3.63-4.55)	3.29 (2.93-3.69)	2.68 (2.38-3.01)	2.50 (2.26-2.82)
Income				
Quintile 1 (highest)	Reference	Reference	Reference	Reference
Quintile 2	1.21 (1.13-1.30)	1.27 (1.19-1.37)	1.29 (1.20-1.39)	1.23 (1.14-1.32)
Quintile 3	1.48 (1.38-1.59)	1.59 (1.48-1.71)	1.62 (1.50-1.74)	1.47 (1.37-1.59)
Quintile 4	1.56 (1.46-1.67)	1.70 (1.59-1.82)	1.75 (1.63-1.87)	1.56 (1.45-1.68)
Quintile 5 (lowest)	1.77 (1.65-1.90)	1.94 (1.81-2.07)	2.04 (1.90-2.18)	1.81 (1.68-2.95)
Covariates				
Age group (y)				
65-74		Reference	Reference	Reference
75-84		2.11 (2.03-2.19)	2.01 (1.93-2.09)	2.02 (1.94-2.10)
85 and above		3.08 (2.87-3.30)	2.74 (2.55-2.94)	2.75 (2.56-2.96)
Gender				
Man			Reference	Reference
Woman			1.25 (1.20-1.30)	1.27 (1.22-1.33)
Marital status				
Married			Reference	Reference
Single			2.22 (1.92-2.56)	2.21 (1.92-2.56)
Divorced			1.57 (1.23-1.99)	1.58 (1.24-2.01)
Widowed			1.30 (1.25-1.35)	1.30 (1.25-1.35)
Residence				
Urban				Reference
Rural				1.23 (1.17-1.28)

OR: Odds ratio; VD: Visual disability; SES: Socioeconomic status; CI: Confidence interval.

Table 4 OR with 95%CI on the association between SES and VD in older adults, aged 65y and above, in urban areas

Characteristics	Model 1	Model 2	Model 3	Model 4
Independent variables				
Education				
Senior high school or above	Reference	Reference	Reference	Reference
Junior high school	1.42 (1.21-1.67)	1.39 (1.18-1.63)	1.35 (1.15-1.59)	1.35 (1.15-1.59)
Primary school	2.22 (1.93-2.55)	2.03 (1.76-2.33)	1.86 (1.61-2.14)	1.84 (1.60-2.12)
Illiteracy	4.19 (3.66-4.81)	3.33 (2.90-3.82)	2.68 (2.32-3.11)	2.63 (2.27-3.04)
Income				
Quintile 1 (highest)	Reference	Reference	Reference	Reference
Quintile 2	1.14 (1.04-1.26)	1.21 (1.10-1.33)	1.23 (1.12-1.36)	1.23 (1.12-1.35)
Quintile 3	1.35 (1.21-1.51)	1.44 (1.29-1.61)	1.49 (1.33-1.67)	1.47 (1.31-1.64)
Quintile 4	1.55 (1.38-1.74)	1.66 (1.48-1.86)	1.73 (1.54-1.95)	1.69 (1.50-1.90)
Quintile 5 (lowest)	1.64 (1.43-1.89)	1.78 (1.55-2.05)	1.91 (1.65-2.19)	1.87 (1.63-2.16)
Covariates				
Age group (y)				
65-74		Reference	Reference	Reference
75-84		2.04 (1.89-2.19)	2.08 (1.93-2.25)	2.03 (1.88-2.19)
85 and above		3.06 (2.67-3.50)	3.12 (2.72-3.58)	2.94 (2.55-3.39)
Gender				
Man			Reference	Reference
Woman			1.47 (1.35-1.60)	1.44 (1.32-1.57)
Marital status				
Married				Reference
Single				3.05 (2.11-4.42)
Divorced				1.31 (0.83-2.06)
Widowed				1.14 (1.05-1.24)

OR: Odds ratio; VD: Visual disability; SES: Socioeconomic status; CI: Confidence interval.

Table 5 OR with 95%CI on the association between SES and VD in older adults, aged 65y and above, in rural areas

Characteristics	Model 1	Model 2	Model 3	Model 4
Independent variables				
Education				
Senior high school or above	Reference	Reference	Reference	Reference
Junior high school	1.47 (1.14-1.90)	1.48 (1.15-1.91)	1.45 (1.13-1.88)	1.43 (1.11-1.85)
Primary school	1.87 (1.48-2.37)	1.79 (1.41-2.26)	1.70 (1.34-2.14)	1.64 (1.30-2.08)
Illiteracy	3.34 (2.65-4.21)	2.77 (2.20-3.50)	2.36 (1.86-2.98)	2.21 (1.75-2.79)
Income				
Quintile 1 (highest)	Reference	Reference	Reference	Reference
Quintile 2	1.13 (1.00-1.28)	1.15 (1.02-1.03)	1.16 (1.03-1.31)	1.16 (1.03-1.31)
Quintile 3	1.34 (1.19-1.50)	1.37 (1.22-1.55)	1.39 (1.23-1.56)	1.39 (1.23-1.56)
Quintile 4	1.37 (1.22-1.54)	1.42 (1.27-1.60)	1.45 (1.29-1.63)	1.45 (1.29-1.63)
Quintile 5 (lowest)	1.56 (1.39-1.75)	1.63 (1.45-1.83)	1.67 (1.49-1.87)	1.69 (1.51-1.90)
Covariates				
Age group (y)				
65-74		Reference	Reference	Reference
75-84		2.14 (2.05-2.36)	2.15 (2.06-2.24)	2.02 (1.93-2.11)
85 and above		3.10 (2.85-3.36)	3.07 (2.83-3.33)	2.69 (2.48-2.93)
Gender				
Man			Reference	Reference
Woman			1.28 (1.22-1.34)	1.24 (1.18-1.29)
Marital status				
Married				Reference
Single				2.10 (1.79-2.46)
Divorced				1.69 (1.28-2.25)
Widowed				1.35 (1.29-1.41)

OR: Odds ratio; VD: Visual disability; SES: Socioeconomic status; CI: Confidence interval.

results show that the association between SES and VD remains strong, even in residence subgroups. It is of interest that the OR of the lowest individual SES is higher in urban areas than in rural areas (*e.g.* adults who are illiterate compared to those educated to senior-high-school level and adults with the lowest household income *per capita* compared to the highest). Illiterate older adults living in urban areas had a greater likelihood of contracting a VD than those who graduated from senior high school, with an OR of 2.63 (95%CI: 2.27-3.04), while in rural areas, the OR is 2.21 (95%CI: 1.75-2.79).

DISCUSSION

We investigated the association between multiple measures of SES and VD among older Chinese adults in a large-scale, population-based survey of disability. After the initial screening for suspected VD cases by trained interviewers, a final diagnosis of VD was made by ophthalmologists. Previous studies in Singapore and the United States have reported the influence of geographic variations, such as area-level SES indicator surrogates, on VD; geographic variation in China is usually divided into urban and rural areas[20]. To the best of our knowledge, this is the first study to report the association between multiple measures of SES and VD among older adults in mainland China using population-based survey data and medical diagnoses. We examined the association between individual SES and VD, and the association remains robust in both urban and rural areas. We found that among adults aged 65 or older, in both urban and rural areas, lower SES, in the form of education and annual household income per capita, was associated with a higher risk of VD.

The overall prevalence of VD among Chinese adults aged 65 or older in this sample was 7.29% in 2006, with 8.71% in rural areas and 4.82% in urban areas. In 2002, the WHO estimated the prevalence of blindness in people aged 50 or older in China was 2.3% and 6.46 million, respectively[21]. These estimates were mainly based on two blindness studies conducted in suburban Beijing (the Shunyi study) and rural Guangzhou (the Doumen study)[22-23]. Other surveys in mainland China have indicated that the prevalence of blindness ranges from between 1.7% to 2.3% in those aged 50 and above[24]. A population-based study of adults aged 60 or older in Hong Kong found the prevalence of blindness to be 0.49%[25]. The prevalence of blindness and poor vision was 0.59% (0.25%-1.16%) and 2.94% (2.11%-3.99%) in Taiwan, respectively[26]. Population-based epidemiological studies of individuals aged between 65 and 84 in developed countries have shown that the prevalence of VD is roughly 2.87% (visual impairment: 2.24%; blindness: 0.53%)[27-29]. Because of differences in age and areas studied, the prevalence of VD cannot be directly compared with previous literature, but the range of prevalence-estimates suggests that the results of this study are credible. The prevalence of VD among older adults in this study was higher than estimates provided in previous studies.

This study demonstrates that among older adults in China, lower levels of household income are associated with a greater risk of VD after important covariates (age, gender, and marital status) are considered. In a regression analyses based on area (urban or rural) and gender (supplementary materials), the results remained robust. Previous studies have shown that countries with higher levels of socioeconomic development have a lower prevalence of VD[30]. Moreover, in a given country, residents with lower income levels are more likely to suffer from VD[23,31-33]. The findings of the present study are consistent with prior research. A possible explanation for these findings may be found in the fact that people with lower levels of income are less likely to have access to medical or eye-care services that can address treatable and preventable causes of blindness.

Education, usually measured by years of schooling, is an important proxy for SES. Studies have shown that educational attainment is an independent risk factor for VD[26]. Our findings show that lower levels of education were associated with an increased risk of VD among older adults, even in urban and rural subgroups. This is consistent with previous studies[33-35]. The relationship between education and health inequality has been explained in previous studies[36]. Although the specific mechanisms of the relationship are unclear, we offer several possible explanations for this relationship. One of these possible explanations is that cataracts are a principal cause of blindness in China[37]. Studies have shown that people with lower levels of education are more likely to engage in agricultural activities that carry a risk of extensive exposure to ultraviolet radiation, which may lead to more cataract blindness[38]. Another explanation is due to a lack of medical knowledge, as people with lower education levels are more likely to develop chronic, irreversible blindness, such as glaucoma or age-related macular degeneration[39-40]. Older adults with lower levels of education may have poor access to health-care services for vision-related conditions. Furthermore, people with lower levels of education are more likely to have unhealthy habits such as smoking; these habits may be important risk factors for eye conditions[41].

There are several limitations to this study. First, uncorrected refractive errors (UREs) were not taken into consideration. UREs are the primary cause of low vision and the second leading cause of blindness. According to estimates by the WHO, roughly 153 million people experience visual impairments as a result of UREs; similar to the scale of VD causes by other eye conditions except UREs, about 161 million[8]. Global researchers emphasize the importance of refractive errors in VD[42]. To enable comparisons with previous international studies, we

took BCVA as the criterion for VD, which is consistent with the WHO's International Classification of Diseases, 10th Revision. Second, the etiological diagnosis data presented in the 2nd CSSD are retrospective, and the high prevalence of senile cataracts in China may have obscured the real causes of VD. Thus, we did not explore differences in etiology between urban and rural participants. This study shows that indicators of SES are related to the prevalence of VD among older Chinese adults. It investigated the association between individual SES and VD, with the area-level SES partially controlled. However, the causal relationship is still undefined.

Despite these limitations, the strength of this study lies in its scope: It is the largest population-based, random-sampling survey conducted in mainland China to date. Although Chinese ophthalmologists have conducted many epidemiological investigations, those studies have either been regional studies or have focused on certain age-groups. However, because the study samples and measurement methods were not uniform, the results are not perfectly comparable. Our study provides empirical baseline data for further evaluation of the prevention of age-related eye disease in mainland China.

In conclusion, lower individual-level SES, in the form of household income and education levels, was associated with a higher risk of VD among the older Chinese adults in this study. The observed associations remain significant for both urban and rural samples as well as men and women. This is a preliminary study, and further examination is needed to confirm the findings and identify the mechanisms behind the relationships. More up-to-date information and surveys with regard to VD, especially etiology-prevalence studies, are needed to identify specific policy implications.

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