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Prevalence and correlates of vision impairment and its association with cognitive impairment among older adults in India: a cross-sectional study

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ABSTRACT

Objective This study aimed to investigate the predictors of vision impairment in old age and how impaired vision is associated with cognitive impairment among the ageing population.

Design A cross-sectional study was conducted using a large country-representative survey data.

Setting and participants This study used data from the 'Building a Knowledge Base on Population Ageing in India' survey, conducted in 2011. Participants included 9541 older adults aged 60 years and above.

Primary and secondary outcome measures The outcome variables were vision impairment and cognitive impairment. Descriptive statistics along with bivariate analysis were presented. Additionally, multivariable binary logistic regression analysis was performed to fulfil the objectives.

Results A proportion of 59.1% of the respondents had vision impairment. Nearly 60% of the participants had cognitive impairment. Those who had vision impairment were 11% more likely to have cognitive impairment compared to their counterparts (OR: 1.11, 95% CI: 1.01 to 1.23). low psychological health (OR: 1.55; 95% CI: 1.36 to 1.77), low activities of daily living (OR: 1.80; 95% CI: 1.43 to 2.27), low instrumental activities of daily living (OR: 1.26; 95% CI: 1.14 to 1.40), poor self-rated health (OR: 1.28; 95% CI: 1.15 to 1.41) and chronic morbidity (OR: 1.27; 95% CI: 1.14 to 1.41) were found to be risk factors for cognitive impairment among older adults.

Conclusions Additional efforts in terms of advocacy, availability, affordability and accessibility especially in a country with big illiteracy issue are mandatory to increase the reach of eye-care services and reduce the prevalence of avoidable visual impairment and vision losses that lead to cognitive deficits among the older population.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Data used was nationally representative and examine a comprehensive list of chronic conditions in conjunction with vision impairment and its association with cognitive impairment.
⇒ Vision impairment was self-reported and therefore, subject to reporting bias, and the variable does not capture the severity of vision problem.
⇒ The cognitive impairment was measured on the basis of word recall and other domains of cognitive impairment were not available in the dataset.

INTRODUCTION

Cognitive deficit in an ageing population is becoming a global concern for health and social policy.[1] With advancing age, the incidence of sensory and intellectual loss increases affecting the cognitive functioning among older individuals.[2] Globally, the prevalence of moderate-to-severe vision impairment in older adults has been reported as highest in South Asia.[3]

It is shown that the public health burden due to vision impairment is substantial and comparable to that of other major diseases in assessing the health-related quality of life.[4] A recent study found that there has been no significant reduction in the amount of preventable visual impairment cases over the last decade.[5] A review of clinical and epidemiological studies on causes of vision loss found a strong independent association of hypertension with several eye conditions that ultimately result in visual impairment.[6] Further, evidence from population-based studies suggests that a large proportion of vision impairments are attributable to diabetic retinopathy during the first two decades of developing diabetes.[7 8] A study based on global burden of disease and available population-based studies worldwide indicate that in 2010, more than 40% of blindness and 20% of visual impairments in South Asia are caused by cataracts.[9] Other chronic health conditions such as heart disease, stroke and depression were more likely to be reported by people with vision impairment than those without and were associated with self-rating of poor health status.[10]

A growing body of literature based on cross-sectional and longitudinal data have shown that vision impairment is associated with cognitive decline among the older

population.[11–14] Changes in multiple measures of vision such as visual acuity, sensitivity and visual processing speed have been observed among the ageing population, and these changes have been associated with cognitive impairments.[15 16] On the other hand, some studies found no significant association between vision loss and cognitive impairment among older adults.[17] Thus, whether a visual impairment is accompanied by a decline in cognitive ability remains uncertain. However, a significant association has been found and well-documented between visual impairment and dementia.[18–21] Additionally, a wealth of epidemiological studies have indicated that people with age-related eye diseases have a reduced cognitive score compared with those with healthy eyes.[14 22–24]

Due to its increased prevalence and greater effect on physical and mental health, cognitive impairment deserves special attention among all chronic conditions. However, unlike other major chronic diseases, vision impairment as an independently associated risk factor of cognitive decline among older individuals is often overlooked by investigators and policymakers. Thus, we aim to investigate what are the predictors of vision impairment in old age and how impaired vision is associated with cognitive impairment among Indian older adults. In this study, we hypothesise that

H_1: Poor mental, physical and functional health is positively associated with vision impairment in older adults.

H_2: Vision impairment is positively associated with cognitive impairment in old age.

MATERIAL AND METHODS

Data

The present study extracted data from 'Building a Knowledge Base on Population Ageing in India' (BKPAI) which was a national-level survey and was conducted in 2011, across seven states of India.[25] The survey was sponsored by Institute for Social and Economic Change, Bangalore; Tata Institute for Social Sciences, Mumbai; United Nations Population Fund, New Delhi; and Institute for Economic Growth, Delhi. The survey gathered information on various sociodemographic, and health aspects of older adults among households of those aged 60 years and above. Seven regionally representative states were selected for the survey with the highest 60+ year's population than the national average.[25] This survey was carried out on a representative sample in the northern, western, eastern and southern parts of India following a random sampling process. The country representative estimates means the estimates provided in the study can be generalised at country level. The rural and urban samples within each state were drawn separately. The primary sampling units (PSUs) in the rural areas were villages, whereas the urban wards were the PSUs in the urban areas. First, villages were classified into different strata based on population size, and the number of PSUs to be selected was determined in proportion to the population size of each stratum. Using probability proportional to population size (PPS) technique, the PSUs were selected and within each selected PSU, elderly households were selected using systematic sampling.[25] A same procedure was applied for drawing samples from urban areas. Being a survey of the older, the sample size was equally distributed between urban and rural areas, irrespective of the proportion of the rural and urban population. The respondents to the household schedule included any usual resident member above the age of 15 years, while in the case of the individual schedule all those aged 60 and above in the sampled households were the respondents and were interviewed.[25] However, a total of 8329 households were interviewed and among them, 9852 older adults' interviews were conducted. Further details on the sampling procedure, the sample size is available in national and state reports of BKPAI, 2011.[25] For the current study, the effective sample size was 9541 older adults residing in seven states aged 60+ years.

Variable description

Outcome variable

There were two outcome variables in the study. The first outcome variable was visual impairment which was derived from the question of whether older adults were having any difficulty in vision which was recoded as 0 'no' and 1 'yes'.

The second outcome variable was cognitive impairment. Cognitive impairment was measured by the number of words recalled. To measure cognitive impairment, a scale of 0–10 was prepared representing higher the score lower the cognitive impairment. The words used were bus, house, chair, banana, sun, bird, cat, saree, rice and monkey. Remembering five or more words was recoded as 0 'low' representing lower cognitive impairment and remembering only four or less words was recoded as 1 'high' representing higher cognitive impairment.[26–28] High cognitive impairment represents cognitive disability among older adults in this study.

Explanatory variables

The explanatory variables were derived from the literature. Diabetes, hypertension, stroke, heart disease and cataract were self-reported as diagnosed by a doctor or health professional and recoded as no and yes.

The 12-item version of the General Health Questionnaire was used as a measure of low psychological health. Psychological health was having a scale of 0–12 based on experiencing stressful symptoms and was recoded as 0 'high' (representing 6+ scores) and 1 'low' (representing score 5 and less).[28–30] The low psychological health represents lower levels of psychological health or psychological distress among older adults (Cronbach alpha: 0.90). Ability to do activities of daily living was having a scale of 0–6 wherein it represents higher the score higher the independence. A score of was categorised as 0 'high' which represents full independence and 5 and less was categorised as 1 'low' which represents not fully independent to do activities of daily living (Cronbach's

alpha: 0.93). The ability to do instrumental activities of daily living was having a scale of 0–8 representing higher the score higher the independence. A score of 6+ was categorised as 0 'high' representing high instrumental activities of daily living (IADL) and a score of 5 and less was recoded as 1 'low' representing low IADL.[31 32] The International Classification of Functioning, Disability and Health (ICF) proposed the framework on which activities of daily living (ADL) and IADL were calculated. The ADL is an umbrella term relating to self-care, comprising those activities that people undertake routinely in their everyday life. The activities can be subdivided into personal care or ADL and domestic and community activities or IADL. The ADL and IADL have emerged as the most common approaches in empirical assessments of functionality among the elderly and are considered to be befitting to the ICF framework.[33] Self-rated health was having a scale of 1–5 'poor to excellent' and was categorised as 0 'good' (representing good, very good and excellent) and 1 'poor' (representing poor or fair).[34] Chronic morbidity was categorised as 0 'no' and 1 'yes'.[35]

Age was recoded as 60–69 years, 70–79 years and 80+ years, gender was recoded as men and women, marital status was recoded as not in a marital union and currently in union, educational status was recoded as no education, below 5 years, 6–10 years and 11+ years, working status (last 1 year) was recoded as no "currently not working/never worked", yes "currently working" and retired. Living arrangement was recoded as living alone and co-residing (with spouse or children or others). Community involvement was generated using the following questions: (a) Attended a public meeting in the last 11 months with a discussion on the local, community or political affairs; (b) Have attended any group, club, society, union or organisational meetings in the last 11 months; (c) Have worked with other people in the neighbourhood to fix or improve something in the last 11 months; (d) Have attended or participated in any religious programmes/services and so on (not including weddings and funerals) in last 11 months; and (e) Have gone out of the house for visiting friends or relatives in the last 11 months. The responses were never, rarely, occasionally and frequently. They were coded as 0 'never' and 1 'rarely/occasionally/frequently' a scale of 0–5 was generated and was coded as 0 'no community involvement' and 1–4 were coded as 1 'community involvement'. Trust over someone was assessed using the question 'do you have someone you can trust and confide in?' was recoded as 0 'yes' and 1 'no'.[36]

Wealth status was based on three quintiles, that is, poor (poorest and poorer), middle and rich (richer and richest). The wealth index drawn based on the BKPAI survey is based on the following 30 assets and housing characteristics: household electrification; cooking fuel; house ownership; type of toilet facility; drinking water source; type of house; ownership of a bank or post-office account; and ownership of a mattress, a pressure cooker, a chair, a cot/bed, a table, an electric fan, a black and white television, a radio/transistor, a colour television, a sewing machine, a mobile telephone, any landline phone, a computer, internet facility; a refrigerator, a bicycle, a motorcycle or scooter, a watch or clock, an animal-drawn cart, a water pump, a car, a thresher and a tractor.[25] The range of index was from poorest to the richest, that is, ranging from lowest to the highest.[36] Religion was recoded as Hindu, Muslim, Sikhs and others, caste was recoded as Scheduled Caste/Scheduled Tribe (SC/ST) and non-SC/ST which includes Other Backward Class (OBC) and others. The SC includes a group of population that is socially and financially/economically segregated by their low status as per the Hindu caste hierarchy. The SCs and STs are among the most disadvantaged socio-economic groups in India. The OBC is the group of intermediate castes which are identified as 'educationally, economically and socially backward'. The OBCs are considered low in the traditional caste hierarchy but are considered somewhat above the boundary of the most disadvantaged. The 'other' caste category is identified as having a higher social status.[37] The residence was recoded as rural and urban. Data were collected in seven states of India to make it representable, that is, Himachal Pradesh, Punjab, West Bengal, Odisha, Maharashtra, Kerala and Tamil Nadu.

Statistical analysis

Descriptive statistics and bivariate analysis was used to find the preliminary results. Further, multivariable binary logistic regression analysis [38 39] was performed to fulfil the objective of the study. The outcome variables were vision impairment (no and yes) and cognitive impairment (low and high). The results were presented in the form of adjusted OR (AOR) with a 95% confidence interval (CI).

The model is usually put into a more compact form as follows:

$$ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 x_1 + \ldots + \beta_M x_{m-1},$$

Where $\beta_0, \ldots, \beta_M$, are regression coefficients indicating the relative effect of a particular explanatory variable on the outcome variable. These coefficients change as per the context in the analysis in the study. The regression diagnostics for heteroscedasticity,[40] multicollinearity,[41] and outliers were performed via computation of variance inflation factors and visual inspection of residual plots for the regression models. The complex survey design effects were adjusted by using Stata *svyset* and *svy* commands. The whole statistical analyses were performed by using Stata V.14.[42]

Patient and public involvement

No patient involved.

RESULTS

Table 1 represents the socio-demographic profile of older participants in the study. It was revealed that about 10% of respondents suffered from diabetes while the older adults

Table 1 Socio-demographic profile of older adults

Background characteristics	Sample	Percentage
Diabetes		
No	8570	89.8
Yes	971	10.2
Hypertension		
No	7520	78.8
Yes	2021	21.2
Stroke		
No	9448	99
Yes	93	1
Heart disease		
No	8991	94.2
Yes	550	5.8
Cataract		
No	8305	87.1
Yes	1236	13
Psychological health		
High	7218	76.6
Low	2209	23.4
ADL		
High	8732	92.6
Low	695	7.4
IADL		
High	4092	43.4
Low	5335	56.6
Self-rated health		
Good	4212	44.7
Poor	5215	55.3
Chronic morbidity		
No	3320	35.2
Yes	6107	64.8
Age (years)		
60-69	5891	61.8
70-79	2613	27.4
80+	1036	10.9
Gender		
Men	4526	47.4
Women	5015	52.6
Marital Status		
Not in union	3758	39.4
Currently in union	5783	60.6
Education		
None	4870	51.1
Below 5 years	1955	20.5
6–10 years	2137	22.4
11+ years	578	6.1
Working status (last 1 year)		
No	6421	67.3
Yes	2310	24.2
Retired	810	8.5
Living arrangement		
Alone	561	5.9
Co-reside	8871	94.1
Community involvement		
No	1965	20.9
Yes	7462	79.2
Trust over someone		
No	1617	17.2
Yes	7810	82.9
Wealth status		
Poor	4367	45.8
Middle	1969	20.6
Rich	3204	33.6
Religion		
Hindu	7572	79.4
Muslim	671	7
Sikh	898	9.4
Others	400	4.2
Caste		
SC/ST	2510	26.3
Non-SC/ST	7031	73.7
Residence		
Rural	7044	73.8
Urban	2497	26.2
State		
Himachal Pradesh	1470	15.4
Punjab	1354	14.2
West Bengal	1127	11.8
Orissa	1453	15.2
Maharashtra	1379	14.5
Kerala	1356	14.2
Tamil Nadu	1403	14.7
Total	9541	100

ADL, activities of daily living; IADL, instrumental activities of daily living; SC/ST, Scheduled Caste/Scheduled Tribe.

who suffered from hypertension were about 21%. Almost 1% of older adults suffered from a stroke while only 6% of older adults suffered from heart diseases. About 13% of the older adults had cataracts. Nearly 23% of older adults had low psychological health. Older adults with low ADL and IADL were nearly 7% and 57%, respectively.

Table 2 Percentage distribution and multivariable regression estimates of older adults having vision impairment by their background characteristicss

Background characteristics	Vision impairment (%)	P value <0.05 χ^2	AOR (95% CI)
Diabetes		*	
No	57.5		Ref.
Yes	72.8		1.55* (1.32 to 1.81)
Hypertension		*	
No	55.1		Ref.
Yes	73.8		1.60* (1.42 to 1.80)
Stroke		*	
No	58.9		Ref.
Yes	73.6		0.94 (0.57 to 1.57)
Heart disease		*	
No	58.1		Ref.
Yes	73.8		1.43* (1.16 to 1.76)
Cataract		*	
No	54.4		Ref.
Yes	90.6		5.97* (4.83 to 7.38)
Age (years)		*	
60–69	52.7		Ref.
70–79	67.0		1.66* (1.49 to 1.85)
80+	75.3		2.41* (2.02 to 2.88)
Gender			
Men	57.3		Ref.
Women	60.6		0.98 (0.87 to 1.10)
Marital status		*	
Not in union	63.8		Ref.
Currently in union	56.0		0.88* (0.79 to 0.99)
Education		*	
None	59.1		Ref.
Below 5 years	63.5		1.10 (0.97 to 1.25)
6–10 years	53.0		0.90 (0.78 to 1.03)
11+ years	66.0		1.31* (1.07 to 1.62)
Working status		*	
No	62.1		Ref.
Yes	53.8		0.89 (0.79 to 1.01)
Retired	50.0		0.81* (0.68 to 0.96)
Living arrangement			
Alone	56.5		Ref.
Co-reside	59.2		0.77* (0.63 to 0.95)
Wealth status		*	
Poor	58.1		Ref.
Middle	55.9		0.91 (0.80 to 1.04)
Rich	62.3		1.18* (1.03 to 1.36)
Religion		*	
Hindu	57.7		Ref.

Continued

Table 2 Continued

Background characteristics	Vision impairment (%)	P value <0.05 χ^2	AOR (95% CI)
Muslim	68.6		0.98 (0.81 to 1.2)
Sikh	56.2		0.74* (0.59 to 0.93)
Others	73.9		1.12 (0.87 to 1.44)
Caste			
SC/ST	59.0		Ref.
Non-SC/ST	59.1		1.02 (0.91 to 1.14)
Residence			
Rural	59.1		Ref.
Urban	58.8		1.04 (0.94 to 1.15)
State		*	
Himachal Pradesh	48.5		Ref.
Punjab	58.8		1.30* (1.06 to 1.59)
West Bengal	79.7		3.48* (2.87 to 4.22)
Orissa	59.8		1.55* (1.32 to 1.83)
Maharashtra	65.0		1.74* (1.47 to 2.06)
Kerala	72.4		1.69* (1.41 to 2.04)
Tamil Nadu	34.1		0.58* (0.49 to 0.69)
Total	59.1		

*If p<0.0.
Ref., Reference; SC/ST, Scheduled Caste/Scheduled Tribe.

Nearly 55% of older adults had poor self-rated health (SRH). About 65% of older adults suffered from one or more chronic diseases. Nearly 39% of older adults were not in a union as per their marital status. About 51% of older adults had no education while 67% of older adults were currently not working. Almost 6% of older adults were living alone and about 21% of older adults had no community involvement. Nearly 17% of older adults had no trust over someone.

Table 2 gives an insight into the distribution and multivariable regression estimates of older participants having vision disability by their background characteristics. It was found that the odds of vision impairment were significantly high among older adults with diabetes in comparison to older adults who do not have diabetes (AOR: 1.55, 95% CI: 1.32 to 1.81). Older adults with hypertension were 60% significantly more like to have vision impairment in comparison to the older adults who do not suffer from hypertension (AOR: 1.60, 95% CI: 1.42 to 1.80). Older adults who suffered from stroke were 6% less likely to have visual impairments in comparison to the older adults who have not suffered from stroke (AOR: 0.94, 95% CI: 0.57 to 1.57). The odds of vision impairment were significantly high among older adults with heart disease in comparison to older adults who do not have heart disease (AOR: 1.43, 95% CI: 1.16 to 1.76). Older adults with cataracts were almost six times significantly more like to have vision impairment in comparison to those who do not have cataract (AOR: 5.97, 95% CI: 4.83 to 7.38). Older adults in the age group 80+ were almost 2.4 times significantly more likely to have vision impairment (AOR: 2.41, 95% CI: 2.02 to 2.88) while older adults among the age group 70–79 were 66% significantly more likely to have vision impairment compared with the 60–69 years' age group (AOR: 1.66, 95% CI: 1.49 to 1.85). The odds of vision impairment were significantly low among the older adults who were currently in the marital union as per marital status (AOR: 0.88, 95% CI: 0.79 to 0.99). Older adults who had living arrangements as co resided were 13% significantly less likely to suffer from vision impairment compared with those who lived alone (AOR: 0.77, 95% CI: 0.63 to 0.95). The odds of vision impairment were significantly high among older adults from the rich wealth quintile as compared with older adults from the poor wealth quintile (AOR: 1.18, 95% CI: 1.03 to 1.36).

Table 3 is a representation of the distribution and multivariable regression estimates of older adults having cognitive impairment. It revealed that the older adults who had vision impairment were 11% significantly more likely to have cognitive impairment when compared with the older adults who do not suffer from vision impairment (AOR: 1.11, 95% CI: 1.01 to 1.23). The odds of cognitive impairment were significantly high among older adults with low psychological health issues (AOR: 1.55, 95% CI: 1.36 to 1.77). The older adults with low ADL and

Table 3 Percentage distribution and multivariable regression estimates of older adults having cognitive impairment by their background characteristics

Background characteristics	Cognitive impairment (%)	P value <0.05 χ^2	AOR (95% CI)
Vision impairment		*	
No	51.6		Ref.
Yes	65.8		1.11* (1.01 to 1.23)
Psychological health		*	
High	55.0		Ref.
Low	76.2		1.55* (1.36 to 1.77)
ADL		*	
High	58.0		Ref.
Low	84.6		1.80* (1.43 to 2.27)
IADL		*	
High	49.7		Ref.
Low	67.9		1.26* (1.14 to 1.40)
Self-rated health		*	
Good	49.0		Ref.
Poor	68.9		1.28* (1.15 to 1.41)
Chronic morbidity		*	
No	51.6		Ref.
Yes	64.5		1.27* (1.14 to 1.41)
Age (years)		*	
60–69	53.1		Ref.
70–79	68.2		1.42* (1.27 to 1.59)
80+	78.6		1.83* (1.52 to 2.20)
Gender		*	
Men	52.9		Ref.
Women	66.4		1.1 (0.98 to 1.24)
Marital status		*	
Not in union	69.1		Ref.
Currently in union	54.1		0.91 (0.81 to 1.02)
Education		*	
None	70.7		Ref.
Below 5 years	63.3		0.68* (0.6 to 0.77)
6–10 years	40.5		0.43* (0.38 to 0.50)
11+ years	31.3		0.26* (0.21 to 0.32)
Working status		*	
No	66.0		Ref.
Yes	53.0		0.88* (0.77 to 1.00)
Retired	32.6		0.71* (0.59 to 0.85)
Living arrangement		*	
Alone	63.0		Ref.
Co-reside	59.8		1.01 (0.81 to 1.25)
Community involvement		*	
No	69.8		Ref.
Yes	57.4		0.79* (0.69 to 0.9)

Continued

Table 3 Continued

Background characteristics	Cognitive impairment (%)	P value <0.05 χ^2	AOR (95% CI)
Trust over someone		*	
No	68.4		Ref.
Yes	58.3		0.78* (0.68 to 0.89)
Wealth status		*	
Poor	68.1		Ref.
Middle	60.0		0.89 (0.78 to 1.02)
Rich	48.8		0.66* (0.57 to 0.76)
Religion		*	
Hindu	59.7		Ref.
Muslim	66.3		0.89 (0.73 to 1.09)
Sikh	56.1		0.93 (0.74 to 1.16)
Others	63.4		1.24 (0.98 to 1.56)
Caste		*	
SC/ST	67.4		Ref.
Non-SC/ST	57.3		0.94 (0.84 to 1.06)
Residence		*	
Rural	62.8		Ref.
Urban	52.0		0.94 (0.85 to 1.04)
State		*	
Himachal Pradesh	54.2		Ref.
Punjab	55.2		1.14 (0.93 to 1.41)
West Bengal	81.9		4.75* (3.84 to 5.86)
Orissa	69.3		1.60* (1.34 to 1.92)
Maharashtra	55.3		1.14 (0.96 to 1.36)
Kerala	66.3		2.44* (2.02 to 2.94)
Tamil Nadu	41.6		0.64* (0.53 to 0.77)
Total	60.0		

*If p<0.05
ADL, activities of daily living; IADL, instrumental activities of daily living; SC/ST, Scheduled Caste/Scheduled Tribe.

IADL were 80% and 26% significantly more likely to have cognitive impairment respectively in comparison to older adults with high ADL and IADL, (AOR: 1.80, 95% CI: 1.43 to 2.27) and (AOR: 1.26, 95% CI: 1.14 to 1.40). The odds of cognitive impairment among older adults with poor SRH was significantly high (AOR: 1.28, 95% CI: 1.15 to 1.41). The older adults with chronic morbidity were 27% significantly more likely to have cognitive impairment compared with older adults who do not have chronic morbidity (AOR: 1.27, 95% CI: 1.14 to 1.41). The older adults who were currently in a union as per marital status were 9% less likely to have cognitive impairment. The odds of cognitive impairment among older adults who had living arrangements as co resided was high (AOR: 1.01, 95% CI: 0.81 to 1.25) while among older adults who had community involvement was significantly low (AOR: 0.79, 95% CI: 0.69 to 0.9). The older adults who had trust over someone were 22% significantly less likely to have cognitive impairment in comparison to the older adults who do not have trust over someone (AOR: 0.78, 95% CI: 0.68 to 0.89).

DISCUSSION

A higher prevalence of chronic conditions such as diabetes, hypertension and heart disease consistent with past studies, is strongly associated with vision impairment among older people.[10] Consistently, the present study found that vision impairment is significant associated with reporting diabetes among older individuals. Again, studies have found patients with diabetes mellitus to be at an increased risk of developing vascular dementia and Alzheimer's disease.[43–45] Hence, establishing a link that relates diabetes and vision impairment with cognitive

functioning is required that may allow more effective screening for and prevention of vision impairment and/or cognitive decline to be developed in the future.

Vision impairment as a post-stroke disability has been well-acknowledged in the literature.[46 47] Concordant with past studies that have shown that people who experienced a stroke were at higher risk of visual defects than people without experiencing stroke,[48] results of the present study showed that stroke is significantly associated with visual impairment among older adults. Further, clinical studies found that high blood pressure increases the risk of developing diabetic retinopathy and other retinal vascular diseases.[49 50] In line with this, we found a significant association of hypertension with vision impairment among the study participants. Moreover, multiple studies have found that compared with older adults who have normal vision, visually impaired persons had higher chances to have heart diseases and cardiovascular mortality.[51–54] Similarly, the present study found a significant positive association of heart disease with reporting visual impairment in the older participants.

Cataracts are found to be the leading cause of blindness and visual impairment worldwide, especially in developing countries.[55 56] A meta-analysis of all available population-based studies found that the highest percentages of visual impairment caused by cataracts were recorded in the South Asian region.[9] The present analysis also shows that after controlling for socio-demographic variables, the chances of reporting vision impairment among older adults who had cataracts were almost six times higher than their counterparts. Although cataracts and resultant impairment cases can be avoided with early detection and timely intervention, the delivery of surgical interventions continues to be a challenge in developing countries.[57]

On the other hand, vision impairment among ageing populations is closely associated with their cognitive and behavioural manifestations.[58] A recent study in a multi-ethnic Asian population has also found that poor vision is independently associated with cognitive decline.[59] Consistently, our results suggested a significant relationship between visual and cognitive impairment, an association not previously demonstrated in any population-based studies in India. Findings from several cross-sectional and longitudinal studies in other countries, however, support such an association.[11 20 21 60] Another Japanese study found that older adults with both impaired vision and hearing had higher odds of cognitive impairment.[61] Further, such studies suggested that better visual acuity by means of cataract surgery or refractive correction and wearing glasses seem to correlate with better cognitive functioning.[12 62–64] Contrarily, some of them found that vision-enhancing interventions did not lead to short-term improvements in functioning or cognitive status.[65]

While the strength of this study is that it uses data from a large, nationally representative, population-based survey to examine a comprehensive list of chronic conditions in conjunction with vision impairment and its association with a cognitive deficit, it is subject to several limitations. First, the data are cross-sectional in nature; we, therefore, cannot confirm whether a cognitive decline preceded vision impairment or vision impairment preceded a cognitive deficit, and we cannot infer causality between chronic illnesses and vision impairment. Besides, a recent study suggested the bidirectional relationship between poor vision and cognitive decline,[66] which highlights the need for further investigation. Second, the data excludes people living in nursing homes and other institutional settings, who may report higher rates of vision impairment. Third, the vision question in BKPAI is a self-reported measure and maybe subjected to under-reporting or over-reporting. Also, the response for vision impairment was self-reported and does not capture the severity of vision problems or different eye diseases.

CONCLUSION

The findings underscore the risk of vision impairment in older ages as a public health burden compared with other major chronic diseases and the importance of normal vision for healthy brain ageing. Additional efforts in terms of advocacy, availability, affordability and accessibility especially in a country with big illiteracy issue are mandatory to increase the reach of eye-care services and reduce the prevalence of avoidable visual impairment and vision losses that lead to cognitive deficits among the older population.

Research and programmes must consider the strategies to include people with both vision and cognitive impairment along with chronic illnesses in efforts to reduce the burden of ageing and chronic conditions. Further, other causes of visual impairments should be explored using longitudinal studies and the clinical investigation is warranted to understand the underlying pathophysiology linking visual impairment and cognitive decline in ageing populations.

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