

## Differential cataract blindness by sex in India: Evidence from two large national surveys

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**Aims:** Women suffer disproportionately more from cataract blindness compared to males in low- and middle-income countries. Two large population-based surveys have been undertaken in India at an interval of 7 years and data from these surveys provided an opportunity to assess the trends in gender differentials in cataract blindness. **Materials and Methods:** Data were extracted from the surveys to discern sex differences in cataract blindness. Multivariate analysis was performed to adjust for confounders and their impact on gender differences in cataract blindness. Blindness was defined as presenting vision <20/400 in the better eye, and a cataract blind person was defined as a blind person where the principal cause of loss of vision was cataract. **Results:** Prevalence of cataract blindness was higher in females compared to males in both surveys. The odds of cataract blindness for females did not change over time as observed in the surveys (1999–2001 and 2006–2007). Adjusted odds ratio from logistic regression analysis revealed that females continued to be at a higher risk of cataract blindness. **Conclusions:** Sex differences continued in India in relation to cataract blindness despite the gains made by the national program.

**Key words:** Blindness, cataract, gender, India, prevalence

Women bear a disproportionate burden of health inequity across the globe and face unique barriers in accessing health care.<sup>[1]</sup> Not only are women more likely to have higher rates of blindness, but they are also less likely to access appropriate eye services. Several studies have documented such disparities.<sup>[2–4]</sup> It has been documented that women account for 67% of all individuals with visual problems, adjusted for age and irrespective of any biological attributes, but women are found to utilize eye care services 40% lesser than men.<sup>[2,3]</sup> Studies in India have also observed that females are less likely to have surgery for cataracts although cataract blindness burden is higher for women.<sup>[5]</sup>

A meta-analysis of population-based prevalence studies found that approximately two out of every three blind people in the world were women, most of whom were over the age of 50 years, and 90% lived in poverty.<sup>[6]</sup>

Evidence on prevalence of blindness, disaggregated by sex, has been collected at periodic intervals on large population denominators in India. This allows a comparison on the gender dimension of blindness, with special reference to cataract blindness, in the Indian context. The present study describes the sex differentials in cataract blindness in India using data from the two large surveys conducted during 1999–2001 and 2006–2007.<sup>[7,8]</sup>

### Materials and Methods

Detailed methodology used in the two surveys in India has been described earlier.<sup>[7,8]</sup> In the 1999–2001 survey, one

district in each of the 15 major states of India was covered. Twenty-five clusters were randomly selected in each district and all individuals aged 50 years and above in these clusters were eligible for examination.

In 2006–2007, a rapid assessment of avoidable blindness (RAAB) survey was undertaken in 16 districts in 15 states of India.<sup>[8]</sup> The sampling universe consisted of all those aged more than 50 years who were habitual residents (staying in the village for at least the previous 6 months). Presenting vision was recorded for all individuals in both surveys. Similarly, individuals with presenting vision <20/60 in any eye underwent a detailed eye examination to identify the cause of vision loss. Individuals were dilated if the posterior segment needed to be examined in detail to identify the cause of visual loss. Vision was recorded by trained ophthalmic assistants while the basic and detailed eye examinations were performed by a trained ophthalmologist.

Blindness was defined as presenting visual acuity (PVA) <20/400 in the better eye. A cataract blind person was defined as a person with PVA <20/400 in the better eye with cataract as the principal cause of blindness. Cataract was assigned the principal cause of blindness if the lens opacity affected visual acuity and vision did not improve by refraction (for the detailed survey, 1999–2001) or with pin hole (for RAAB, 2006–2007) to 20/60 or better.

A systematic approach of exploring the sex disparity was undertaken. In the first step, the existence of sex difference

#### Access this article online

**Website:**  
www.ijo.in

**DOI:**  
10.4103/ijo.IJO\_28\_15

#### Quick Response Code:



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**Manuscript received:** 08.01.15; **Revision accepted:** 26.01.17

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**Cite this article as:** Pant HB, Bandyopadhyay S, John N, Chandran A, Gudlavalleti MV. Differential cataract blindness by sex in India: Evidence from two large national surveys. Indian J Ophthalmol 2017;65:160-4.

among cataract blind was documented. Test of proportion and adjusted odds ratios from logistic regression were used for this purpose. The surveys were conducted nationwide covering a large number of districts which naturally have a different demographic and economic distribution. The results could be biased due to the fact that there are some districts where the sex difference is comparatively more than other districts, thus inflating the overall gender difference. To investigate the district-wise sex differentials, the district-wise odds ratios were also calculated. The entire computation was performed using R statistical software (R foundation for statistical computing, Vienna, Austria).<sup>[9]</sup>

## Results

A total of 108,609 individuals were examined in the two surveys in India (63,432 in 1999–2001 and 45,177 in 2006–2007). The proportion of males examined were marginally higher in 1999–2001 (47.3%) compared to 2006–2007 (45%) [Table 1]. The mean age of respondents was 60.97 (8.93) years in 1999–2001 compared to 61.35 (8.89) years in 2006–2007, and males were older compared to females in both rounds of the survey [Table 1].

The prevalence of blindness (3393/63,432) in 1999–2001 was 5.3% (95% confidence interval [CI]: 4.97–5.62,  $P < 0.001$ ).<sup>[7]</sup> In 2006–2007, the prevalence of blindness (1710/45,177) was 3.6% (95% CI: 3.3–3.9,  $P < 0.001$ ).<sup>[8]</sup> In 2132 of the 3393 blind persons in 1999–2001, cataract was the principal cause of blindness (62.8%), while in 2006–2007, cataract was attributed as the principal cause of blindness in 73.0% (1249/1710).

The difference in the prevalence of cataract blindness was significant between the two surveys as there is no overlap in the CIs. Similarly, statistically significant differences were observed between males and females in the surveys and also when the data from the two surveys was pooled [Table 2]. It was observed that the prevalence of cataract blindness decreased by 17.6% between the two surveys [Table 2]. The decrease was steeper in males (20.23%) compared to females (17.19%).

The odds of cataract blindness were significantly higher in females compared to males in both rounds of surveys [Table 3]. Males had a 40% lower risk of cataract blindness in both rounds of blindness surveys in India. Respondents examined in the first survey had 22% higher odds of cataract blindness compared to the second survey [Table 3].

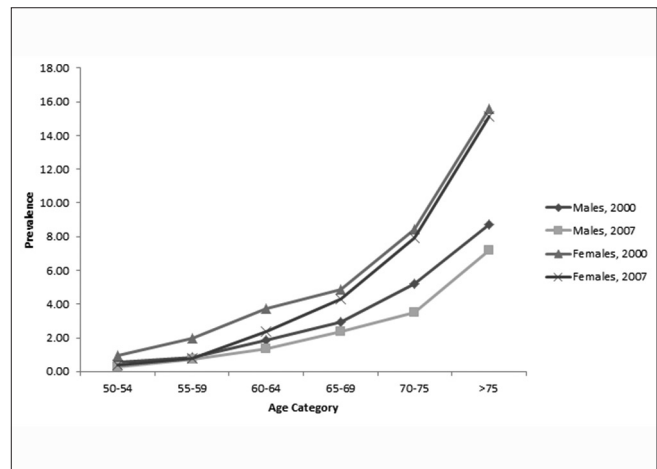
Age-specific cataract blindness rates were also compared between males and females in both surveys [Fig. 1]. It was observed that prevalence of cataract blindness increased significantly with increasing age in both males and females in both surveys. It was also observed that at the younger ages, the prevalence of cataract blindness was similar in males and females in both surveys, but at the older ages, there was a significant differential in the cataract blindness curves between males and females.

In nine districts, the survey was undertaken both in 2000 and 2007. When the data from these nine districts were compared, it was observed that in all districts, except one (Vaishali), the odds of blindness were significantly lower in 2007 compared to 2000 [Fig. 2]. The odds of being blind in 2007, if residing in any of these districts, compared to 2000 were 63% lower. These results indicate that there has been a significant decline

**Table 1: Comparison of sociodemographic characteristics of population examined in two large surveys in India**

Characteristics	1999-2001, n (%)	2006-2007, n (%)	Remarks (P)
Number of persons examined	63,432 (100)	45,177 (100)	
Male	30,013 (47.3)	20,331 (45.0)	<0.001
Female	33,419 (52.7)	24,846 (55.0)	
Mean age±SD	60.97±8.93	61.35±8.69	<0.001
Mean age±SD			
Male	61.52±8.89	62.04±8.69	<0.001
Female	60.4±8.93	60.78±8.65	<0.001
Age distribution			
50-59 years (male)	13,325 (44.40)	8658 (42.59)	<0.001
50-59 years (female)	16,540 (49.49)	11,960 (48.14)	<0.001
60-69 years (male)	10,437 (34.77)	7008 (34.47)	<0.001
60-69 years (female)	11,030 (33.01)	8340 (33.57)	<0.001
70+ years (male)	6251 (20.83)	4665 (22.95)	<0.001
70+ years (female)	5849 (17.50)	4546 (18.30)	<0.001
Rural residents	53,709 (84.67)	35,463 (78.50)	<0.001
Urban residents	9723 (15.33)	9714 (21.50)	0.22

SD: Standard deviation



**Figure 1: Age-specific gender differences in prevalence of cataract blindness in India over a period of 7 years**

in the magnitude of blindness in most states of India over the period 2000–2007.

## Discussion

Evidence from India clearly shows that there is a sex differential in the prevalence of cataract blindness with females in a disadvantaged position compared to males. We were only able to adjust for place of residence and age. We were unable to adjust for socioeconomic status, education, and other risk factors as no data were available in comparable format in the two studies. These unadjusted factors might potentially confound the result. However, since this information was not collected for the RAAB, we were unable to include in the analysis. Another general limitation, as with any rapid assessment, was that there is a higher female participation.

**Table 2: Prevalence of cataract blindness in two large population surveys in India**

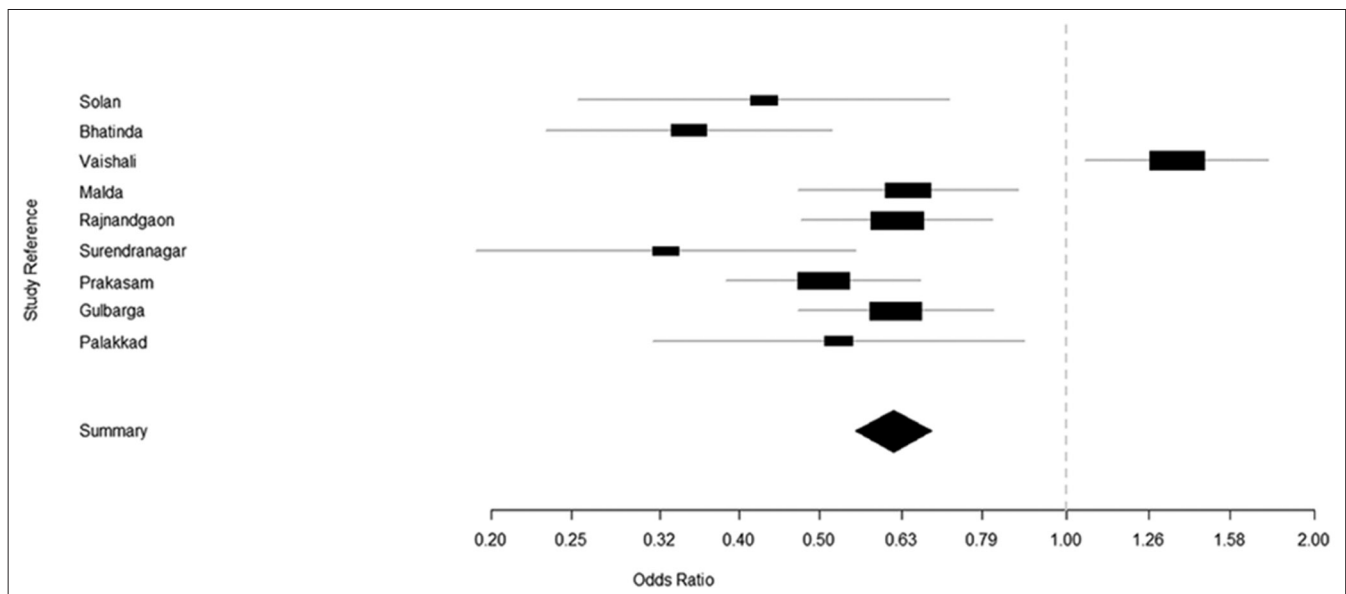
Characteristics	1999-2001		2006-2007		P
	n (%)	Prevalence (95% CI)	n (%)	Prevalence (95% CI)	
Number of persons examined	63,432		45,177		
Number of males examined	30,013 (47.32)		20,331 (45.00)		
Number of female examined	33,419 (52.68)		24,846 (55.00)		
Number of cataract blind	2132 (3.36)		1249 (2.77)		
Number of cataract blind (male)	756 (1.19)		409 (0.91)		
Number of cataract blind (female)	1376 (2.17)		840 (1.86)		
Prevalence cataract blindness (all)		3.36 (3.22-3.5)		2.76 (2.62-2.92)	<0.001
Prevalence of cataract blindness (male)		2.52 (2.35-2.7)		2.01 (1.83-2.22)	<0.001
Prevalence of cataract blindness (female)		4.12 (3.91-4.34)		3.38 (3.16-3.61)	<0.001
Overall prevalence (all respondents)		3.11 (3.01-3.22)			
Overall prevalence (male)		2.31 (2.19-2.45)			
Overall prevalence (female)		3.8 (3.65-3.96)			

CI: Confidence interval

**Table 3: Gender differences in cataract blindness in the two large population-based surveys in India**

Year	Sex	Cataract blind	Other examined	Adjusted OR**	95% CI	P
1999-2001	Male	756	29,257	Reference	1.71-2.05	<0.0001
	Female	1376	32,043	1.87		
2006-2007	Male	409	19,922	Reference	1.77-2.25	<0.001
	Female	840	24,006	2.00		
1999-2001	Total	2132	61,300	1.26	1.19-1.37	<0.001
2006-2007	Total	1249	43,928	Reference		

\*\*Adjusted for age group and place of residence. CI: Confidence interval, OR: Odds ratio

**Figure 2: Forest plot depicting inter-district variation in districts included in surveys both in 2000 and 2007**

Based on our analysis, it is also evident that the trend has remained constant over the last decade. It is of great concern that females at older ages are significantly worse off compared to their male counterparts. This is despite the observation that at the age of 50–54 years, males and females have the same risk of cataract blindness. This dimension is

of public health concern as females outlive males, and the differential in life expectancy is around 3 years in low- and middle-income countries.<sup>[10]</sup> This increased life expectancy in females has been seen to be associated with higher rates of depression and chronic disease in India and therefore merits attention of public health practitioners and policymakers.<sup>[11]</sup>

In India, life expectancy for females is 67.57 years compared to 65.46 years for males.<sup>[12]</sup> This sex differential in life expectancy is associated with biological, economic, and social differences.

As observed in the two large population surveys reported here, evidence available from most of the low- and middle-income countries including India shows that the prevalence of cataract blindness is significantly higher in females compared to males.<sup>[4,5,13-16]</sup> The reason for the higher prevalence of cataract blindness is not exactly known, but it is generally hypothesized that poorer access to cataract surgical services is responsible for a large proportion of women remaining un-operated.<sup>[17]</sup> Data from surveys in Africa and Asia have consistently shown that cataract surgical coverage among females is significantly lower compared to males.<sup>[5,15-20]</sup> This is contrary to the situation existing in Latin America where sex differentials in cataract surgery are not witnessed.<sup>[21]</sup> The status of women in contemporary society may have an influence on their unhindered access to cataract services as was seen in Latin America.

The findings from the present analysis, for the first time, corroborate anecdotal evidence about a significant decrease in the prevalence of cataract blindness in India in the first decade of this century. All the districts barring Vaishali had reduced odds of blindness. The reason for lower prevalence in Vaishali was not very clear. However, similar trends were reported from an earlier National Programme for Control of Blindness survey 1986–1989.<sup>[22]</sup> This decrease in a population of a billion Indians will have an impact on the total number of cataract-blind globally. This decrease also shows that a concerted national effort built on an effective partnership between the public and the private sector (including the nongovernmental sector) can result in significant gains in a country/region.<sup>[23]</sup> There is no reason why the gains observed in a country of tremendous diversity in access, terrain, and population density cannot be successfully translated into a gender-focused initiative to reduce gender disparity in cataract blindness and surgical access.

In a country like India where the overall status of women in society is poor, a gender focus is essential if gender equity is to be ensured, especially when access to services is poor. Policymakers should consider innovative options to target the elderly female cataract blind in poor settings to improve coverage. Additional incentives for operating on poor elderly females, providing transportation for women, and counseling the males in the household who have the economic clout could be specific measures in this direction. This will help in enhancing coverage of needy women. These measures would generally be applicable in the short term as evidence also shows that when coverage rates peak and reach a saturation point, gender differentials disappear even in countries where women have a poorer social standing, as is seen from a survey in India from a region with high cataract surgical coverage.<sup>[24]</sup>

#### Financial support and sponsorship

Nil.

#### Conflicts of interest

There are no conflicts of interest.

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