

## Original article

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### ETIOLOGY OF VISUAL IMPAIRMENT AND BLINDNESS AND DEMOGRAPHIC PROFILE OF AFFECTED INDIVIDUALS

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**Key words:** visual impairment, blindness, cataract

#### *Abstract*

#### **Background:**

*Eye diseases and low vision are the most significant health and socioeconomic risks in developing countries like India. Globally, 253 million people are visually impaired, of these 36 million are blind and 217 million have moderate to severe visual impairment. With population growth and increasing life expectancy, the magnitude of blindness is expected to increase further.*

**Objectives:** *To study the demographic profile of individuals with visual impairment and blindness and its causes in adults aged 50 years and above in a district of Central India.*

**Material and methods:** *Cluster sampling was employed from November 2015 to November 2017 to randomly select 3000 individuals aged 50 years or more in 30 clusters from a district of Central India. Demographic details of individuals were noted. Visual assessment was done using*

*ETDRS chart in full day light. Ophthalmic examination was done to detect the cause of visual impairment and blindness.*

**Result and discussion:** *Mean age of study population was  $62.3 \pm 7.9$  years. There were 48.9% males and 51.1% females. Visual impairment was seen in 17.4% individuals and blindness was noted in 3.5% individuals. Cataract was the cause of visual impairment in 18.57%, uncorrected refractive error in 4.17%, posterior segment disorders in 1.84% and glaucoma in 1.40% individuals.*

**Conclusion:** *Visual impairment contributes to a significant health problem in rural population in Central India. Cataract was found to be the principal cause of visual impairment followed by uncorrected refractive error, posterior segment disorders and glaucoma.*

## **Introduction:**

Eye diseases and low vision are the most significant health and socioeconomic risks in developing countries like India. Globally, 253 million people are visually impaired, of these 36 million are blind and 217 million have moderate to severe visual impairment (VI).<sup>1</sup> With population growth and increasing life expectancy, the magnitude of blindness is expected to increase further.<sup>2</sup>

Avoidable causes that can be either prevented or corrected easily amounts to almost 80% of the load of blindness.<sup>3</sup> Adults aged more than 50 years contributes the maximum load of visual impairment (81%).<sup>1</sup>

The present study provides information regarding demographic profile of individuals with visual impairment and blindness and its causes in adults aged 50 years and above.

### **Aims and Objectives:**

- To study the demographic profile of individuals with visual impairment and blindness in adults aged 50 years and above.
- To determine the causes of visual impairment and blindness in adults aged 50 years and above.

### **Material and methods:**

A population based survey was carried out in the district to study demographic profile and causes of visual impairment and blindness in individuals aged  $\geq 50$  years.

For determining the sample size estimated prevalence of avoidable blindness among 50+ was taken to be 8.0% (Murthy et al., 2005). Among the statistical criteria 80% power, 20% relative precision, 95% confidence interval and design effect of two for clustering effect were considered. Based on the criteria, sample size came out to be 2500 and 3000 individual aged 50+, were taken as survey population.

Stratification of population of the District in to rural and urban strata was done. Stratified Cluster Sampling was adopted to select 30 clusters (22 rural and 8 urban) depending upon their total population.

**Survey Methodology:** The team performed door to door enumeration and examination of 100 people aged  $\geq 50$  years, in each cluster. A standardized survey record was filled in for each eligible person.

**Visual assessment:** Presenting distance visual acuity (with or without available glasses) was tested separately for each eye using an ETDRS chart cut out with “E” optotypes. The ‘E’s on one side correspond to 6/60 equivalent of Snellen’s chart while the ‘E’s on the reverse correspond to 6/18 on the Snellen’s chart at 4-m distance. This was done in full day light in courtyard or on the street. Participants who read the largest letter (confirms VA 6/60) were then shown the other side of chart showing small size letter E (VA 6/18), those who read small size letter E, their visual acuity was recorded as 6/18 or better for each eye. Participants failing to read the largest letter at 4m were retested at 2-m and visual acuity was recorded as 3/60. When necessary, testing included the ability to count fingers, to detect hand movements, or to perceive light. Participants were deemed to have sufficient visual acuity to read a particular line if a minimum of four of five letters in a line was identified correctly.

Participants who could not read 6 / 18 from either eye had their visual acuity checked again with pin hole and improvement if any was recorded for each eye separately.

**Anterior segment and fundus examination:** The lens status was assessed by torch light examination. All individuals with VA < 6/18 in either eye were examined at clinics set up in the village. In the clinic basic eye examination consisted of:

- Reconfirmation of visual acuity
- Torch light Examination
- Fundus Examination was done with Direct Ophthalmoscope after dilating the pupil with mydriatric eye drops.
- Intraocular pressure was recorded by Applanation Tonometer.
- In patients with hazy media B-Scan Ultrasonography was done (as and when required).

- Ocular disorders present were recorded for each eye separately in individuals with presenting vision < 6/18 in either eye.
- Main cause of blindness for each eye and individual was recorded separately in all participants with presenting vision < 6/18 in either eye.

Ocular findings were recorded on pre-tested proforma.

Data was entered and analyzed using EPI INFO6 Software Programme with internal consistency check.

### **Observations:**

#### **AGE AND SEX DISTRIBUTION (Table No. I)**

- Mean age of study population was  $62.3 \pm 7.9$  years. (Range 50-92 years).
- Out of 3000 persons included in the study 1467 (48.9%) were males and 1533 (51.1%) were females.
- Mean age of males was  $62.8 \pm 8.0$  years (range 50-89 years) and for females it was  $61.9 \pm 7.8$  years (range 50-92 years).
- In the study population majority of the persons (1458, 48.6%) were in the age group 60-69 years.

**Table No. I : Sex and Age Distribution of the Survey Population**

<b>Age group (in years)</b>	<b>Male</b>	<b>Female</b>	<b>Total Number (%)</b>
50-54	245 (43.4%) (16.7%)	320 (56.6%) (20.9%)	565 (18.8%)
55-59	197 (57.8%) (13.4%)	144 (42.2%) (9.4%)	341 (11.4%)
60-64	474 (44.7%) (32.3%)	587 (55.3%) (38.3%)	1061 (35.4%)
65-69	211 (53.1%) (14.4%)	186 (46.9%) (12.1%)	397 (13.2%)
70-74	202 (52.2%) (13.8%)	185 (47.8%) (12.1%)	387 (12.9%)
75-79	83 (55.0%) (5.7%)	68 (45.0%) (4.4%)	151 (5.0%)
≥80	55 (56.1%) (3.7%)	43 (43.9%) (2.8%)	98 (3.3%)
<b>Total</b>	<b>1467(48.9%) (100%)</b>	<b>1533(51.1%) (100%)</b>	<b>3000 (100%)</b>

**VISUAL STATUS OF INDIVIDUALS (Table No. II)**

- Out of 3000 persons surveyed 2238 (74.6%) had normal / near normal vision.
- Visual impairment was seen in 521 (17.4%) persons with vision of (<6/18 - ≥6/60).
- Severe visual impairment (Visual acuity <3/60) was noted in 134 (4.5%) individuals.
- Blindness was noted in 107 (3.5%) individuals including 12 (0.4%) who were suffering from absolute blindness (PL negative).

**Table No. II: Visual Status of Individuals**

<b>Visual Status (WHO) (Best Corrected Visual Acuity)</b>	<b>No. of persons</b>	<b>Percentage</b>
Near Normal ( $\geq 6/18$ )	2238	74.6
Visual Impairment ( $< 6/18 - \geq 6/60$ )	521	17.4
Severe Visual Impairment ( $< 6/60 - \geq 3/60$ )	134	4.5
Blindness ( $< 3/60 - PL +$ )	95	3.1
Absolute Blindness PL Negative	12	0.4
<b>Total</b>	<b>3000</b>	<b>100</b>

**VISUAL STATUS OF EYES (Table No. III)**

- Of the 6000 eyes of 3000 persons included in this survey 4249 (70.81%) eyes had pinhole visual acuity normal/near normal, 907 (15.12%) eyes had visual impairment.
- Severe visual impairment was noted in 361 (6.02%) eyes & 483 (8.05%) eyes were blind which includes 86 (1.43%) eyes which were PL negative.

**Table No. III: Visual Status of Eyes**

<b>Visual Status</b>	<b>Number of Eyes (%)</b>
$\geq 6/18$	4249 (70.81)
$< 6/18 - \geq 6/60$	907(15.12)
$< 6/60 - \geq 3/60$	361 (6.02)
$< 3/60 - \text{PL} +$	397 (6.62)
PL Negative	86 (1.43)
<b>Total</b>	<b>6000</b>

**CAUSES OF BLINDNESS AND VISUAL IMPAIRMENT (Table No. IV)**

- Out of a total of 6000 eyes surveyed, 1751 (29.2%) had visual acuity  $< 6/18$ .
- Cataract was noted to be the principal cause (1114, 18.57%). uncorrected refractive error were noted in 250 (4.17%) eyes. 39 (0.65%) eyes had pthisis bulbi. Glaucoma was noted in 84 (1.40%) eyes. 88 (1.47%) eyes had other / undetermined causes.
- Among 551 pseudophakic eyes 209(37.9%) had visual acuity  $< 6/18$  due to uncorrected refractive error. Glaucoma was noted in 26 (4.7%) of these eyes. ARMD was noted in 15 (2.7%).



**Table No. IV: Causes of visual acuity <6/18 in survey population – Eyes**

Cause	Total Eyes		Pseudophakic Eyes	
	Number (n=6000)	Percentage	Number (n=551)	Percentage
Cataract	1114	18.57	-	-
Uncorrected Aphakia	41	0.68	-	-
Uncorrected refractive error	250	4.17	209	37.9
Pthisis Bulbi	39	0.65	-	-
Corneal Scar / Opacity / Ulcer	68	1.13		
Globe abnormalities	5	0.08	-	-
Glaucoma	84	1.40	26	4.7
Diabetic Retinopathy	09	0.15	03	0.5
Age Related Macular Degeneration	52	0.87	15	2.7
Others / Undetermined	88	1.47	22	4.0
<b>Total</b>	<b>1751</b>	<b>29.17</b>	<b>275</b>	<b>49.8</b>

**OTHER CAUSES OF ACUITY <6/18 IN SURVEY POPULATION – EYES (Table V)**

- Out of 1751 eyes with vision <6/18 optic atrophy was noted in 27 (0.45%) eyes. 12 (0.20%) eyes had macular scar. High / pathological myopia was noted in 9 (0.15%) eyes.
- Among 551 pseudophakic eyes among the other causes, vascular occlusion was present in 03(0.5%) of eyes, choreoretinal degeneration in 02(0.4%) eyes, high / pathological myopia in 02(0.4%) eyes, optic atrophy was noted in 11(2.0%)eyes & retinitis pigmentosa in 02(0.4%)of pseudophakic eyes.

**Table No. V: Other causes of Pinhole Visual Acuity <6/18 in Survey Population – Eyes**

Cause	Total Eyes (n=6000)		Pseudophakic Eyes (n=551)	
	Number	Percentage	Number	Percentage
Amblyopia	1	0.02	-	-
Vascular occlusion (BRVO)	3	0.05	03	0.5
Chorioretinal degeneration / Scar	7	0.12	02	0.4
Dislocated / Absorbed lens	1	0.02	-	-
Eviscerated Socket	2	0.03	-	-
Hypertensive Retinopathy	1	0.02	-	-
Gyrate atrophy	2	0.03	-	-
Heredomacular degeneration	2	0.03	-	-
High / Pathological Myopia	9	0.15	02	0.4
Macular Scar	12	0.20	02	0.4
Optic Atrophy	27	0.45	11	2.0
Retinal Detachment	4	0.07	-	-
Retinitis pigmentosa	8	0.13	02	0.4
Vitreous haemorrhage	1	0.02	-	-
Undetermined	8	0.13	-	-
<b>Total</b>	<b>88</b>	<b>1.47</b>	<b>22</b>	<b>4.1</b>

**Discussion:**

In 2015, it was estimated that 36 million people were blind (visual acuity worse than 3/60), 217 million had moderate or severe vision impairment (worse than 6/18 but 3/60 or

better), and 188 million had mild vision impairment (worse than 6/12 but 6/18 or better).<sup>1</sup>

Worldwide, chronic eye diseases are the main cause of vision loss. The two top causes of visual impairment are uncorrected refractive errors and then un-operated cataract. In low- and middle-income countries, un-operated cataract remains the leading cause of blindness.<sup>1</sup>

Estimates of magnitude and causes of blindness are the basis for appropriate eye health care planning, allocation of resources, and prioritization of research. In the present study demographic profile and causes of visual impairment in adults aged 50 years and above.

A total of 3000 individuals were examined. The mean age of study population was  $62.3 \pm 7.9$  years, with mean age of males being  $62.8 \pm 8.0$  years and mean age of females being  $61.9 \pm 7.8$  years. Majority of population studied was between 60-69 years. Similarly in a community based cross-sectional study, Malhotra S et al found the mean age of population studied was  $62.9 \pm 9.7$  years with mean age of males to be  $63.1 \pm 9.9$  years and mean age of females to be  $62.9 \pm 9.5$  years.<sup>4</sup> Other studies also observed similar trends of increasing visual impairment and blindness with increase in age of individuals.<sup>2,5-7</sup>

With reference to gender predisposition, in the present study it was observed that females more commonly suffered visual impairment and blindness than males. Most other studies also demonstrated that the prevalence of visual impairment and blindness was higher in females than males.<sup>5,7,8</sup> Similar trends were observed in Pakistan,<sup>9</sup> Sudan,<sup>10</sup> , Kuwait<sup>11</sup> and Qatar<sup>6</sup>. Whereas, no sex-specific difference was found in other studies.<sup>12,13</sup>

The principal causes of blindness vary among different ethnic populations. In whites, age-related macular degeneration is the documented main cause of blindness whereas in blacks,

glaucoma or cataract is the leading cause of blindness.<sup>14</sup> Although, in Asia, the principal causes of blindness is cataract.<sup>15</sup>

Our study also showed that the main cause of visual impairment and blindness was cataract contributing to 18.57% cases. This matched the magnitude of visual impairment and blindness in other studies.<sup>6,16</sup> The other causes of visual impairment in our study includes uncorrected refractive error, posterior segment disorders and glaucoma. Similar trends were observed by other studies.<sup>7,17-20</sup>

In conclusion, cataract and uncorrected refractive error are the principal causes of visual impairment and blindness in individuals aged 50 years and above in the district of Central India. Hence, provision of good quality cataract surgical services and spectacles are required to tackle the problem of visual impairment and blindness.

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**References:**

1. Bourne RRA, Flaxman SR, Braithwaite T, et al. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and metaanalysis. *Lancet Glob Health* 2017;5:e888–97.
2. Resnikoff S, Pascolini D, Etya'ale D. Global data on visual impairment in the year 2002. *B World Health Organ.* 2004;82:844-851.

3. World Health Organization. Vision impairment and blindness. Fact sheet. 2017 <http://www.who.int/pbd/blindness/WorldSightDay17Infographic.pdf> (accessed 18 Oct 2017).
4. Malhotra S, Vashist P, Kalaivani M, Gupta N, Senjam SS, Rath R, Gupta SK. Prevalence and causes of visual impairment amongst older adults in a rural area of North India: a cross-sectional study. *BMJ open*. 2018;8(3):e018894.
5. Murthy GV, Gupta SK, Bachani D, Jose R, John N. Current estimates of blindness in India. *Br J Ophthalmol*. 2005;89(3):257-60.
6. Gamra HA, Mansouri FA, Khandekar R, Elshafei M, Qahtani OA, Singh R, Hashim SP, Mujahed A, Makled A, Pai A. Prevalence and causes of blindness, low vision and status of cataract in 50 years and older citizen of Qatar—a community based survey. *Ophthalmic epidemiol*. 2010;17(5):292-300.
7. Gupta N, Vashist P, Malhotra S, *et al*. Rapid assessment of visual impairment in urban population of Delhi, India. *PLoS One* 2015;10:e0124206.
8. Kyari F, Gudlavalleti MV, Sivsubramaniam S, Gilbert CE, Abdull MM, Entekume G, Foster A. Prevalence of blindness and visual impairment in Nigeria: The national blindness and visual impairment survey. *Investigative ophthalmology & visual science*. 2009 May 1;50(5):2033-9.
9. Dineen B, Bourne RR, Jadoon Z, Shah SP, Khan MA, Foster A *et al*. Causes of blindness and visual impairment in Pakistan. The Pakistan national blindness and visual impairment survey. *Br J Ophthalmol*. 2007;91(8):1005–1010.

10. Ngondi J, Ole-Sempele F, Onsarigo A, Matende I, Baba S, Reacher M, Matthews F, Brayne C, Emerson PM. Prevalence and causes of blindness and low vision in southern Sudan. *PLoS Med.* 2006;3(12):e477.
11. Al-Merjan JI, Pandova MG, Al-Ghanim M, Al-Wayel A, Al-Mutairi S. Registered blindness and low vision in Kuwait. *Ophthalmic Epidemiol.* 2005;12(4):251–7.
12. Varma R, Kim JS, Burkemper BS, Wen G, Torres M, Hsu C, Choudhury F, Azen SP, McKean-Cowdin R. Prevalence and causes of visual impairment and blindness in Chinese American adults: the Chinese American eye study. *JAMA ophthalmol.* 2016;134(7):785-93.
13. Guo C, Wang Z, He P, Chen G, Zheng X. Prevalence, causes and social factors of visual impairment among Chinese adults: based on a national survey. *Int J Environ Res Public Health.* 2017;14(9):1034.
14. Wang JJ, Foran S, Mitchell P. Age-specific prevalence and causes of bilateral and unilateral visual impairment in older Australians: the Blue Mountains Eye Study. *Clin Experiment Ophthalmol* 2000;28:268 –73.
15. Wong TY, Loon SC, Saw SM. The epidemiology of age related eye diseases in Asia. *Br J Ophthalmol* 2006;90:506–11.
16. Cedrone C, Nucci C, Scuderi G, Ricci F, Cerulli A, Culasso F. Prevalence of blindness and low vision in an Italian population: a comparison with other European studies. *Eye.* 2006;20(6):661–667.
17. Zheng Y, Lavanya R, Wu R, Wong WL, et al. Prevalence and causes of visual impairment and blindness in an urban Indian population: the Singapore Indian Eye Study. *Ophthalmology.* 2011;118(9):1798-804.

18. Gupta N, Vashist P, Malhotra S, et al. Rapid assessment of visual impairment in urban population of Delhi, India. PLoS One 2015;10:e0124206.
19. Marmamula S, Khanna RC, Kunkunu E, et al. Population-based assessment of prevalence and causes of visual impairment in the state of Telangana, India: a cross-sectional study using the Rapid Assessment of Visual Impairment (RAVI) methodology. BMJ Open 2016;6:e012617.
20. Marmamula S, Narsaiah S, Shekhar K, *et al.* Visual impairment in the South Indian state of Andhra Pradesh: Andhra Pradesh – rapid assessment of visual impairment (AP-RAVI) project. PLoS One 2013;8:e70120.