Baseline Risk Factors for Incidence of Blindness in a South Indian Population: The Chennai Eye Disease Incidence Study

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Purpose. To report the baseline risk factors and causes for incident blindness.

Methods. Six years after the baseline study, 4419 subjects from the cohort underwent a detailed examination at the base hospital. Incident blindness was defined by World Health Organization criteria as visual acuity of less than 6/120 (3/60) and/or a visual field of less than 10° in the better-seeing eye at the 6-year follow-up, provided that the eye had a visual acuity of better than or equal to 6/120 (3/60) and visual field greater than 10° at baseline. For incident monocular blindness, both eyes should have visual acuity of more than 6/120 (3/60) at baseline and developed visual acuity of less than 6/120 (3/60) in one eye at 6-year follow-up.

Results. For incident blindness, 21 participants (0.48%, 95% confidence interval [CI], 0.3–0.7) became blind; significant baseline risk factors were increasing age ($P = 0.001$), smokeless tobacco use ($P < 0.001$), and no history of cataract surgery ($P = 0.02$). Incident monocular blindness was found in 132 participants (3.8%, 95% CI, 3.7–3.8); it was significantly more ($P < 0.001$) in the rural population (5.4%, 95% CI, 5.4–5.5) than in the urban population (1.9%, 95% CI, 1.8–1.9). Baseline risk factors ($P < 0.001$) were increasing age and rural residence, and no history of cataract surgery was a protective factor ($P = 0.03$).

Conclusions. Increasing age was a significant risk factor for blindness and monocular blindness. No history of cataract surgery was a risk factor for blindness and a protective factor for monocular blindness.

Keywords: blindness, incidence, India, cataract, epidemiology

According to the World Health Organization (WHO), global blindness is currently estimated at 39 million and cataract is the leading cause. The report also suggested that blindness is a major health issue and is unequally distributed among the WHO regions (including India).[1] In the past 2 decades, the prevalence of blindness in South Asia has decreased, mainly because of increased cataract surgery rates. In spite of this, the prevalence of blindness in South Asia is three times higher than in Central Asia.[2] It is apparent that less-developed countries are likely to have a greater burden of blindness. Population-based studies are key to health care planning and resource allocation. A number of epidemiological studies on blindness in India have reported that cataract is the leading cause for blindness in the country.[3–5] There is an intensive cataract surgical program in the country to tackle cataract blindness. In spite of this effort, the burden of cataract blindness has not reduced, mainly because of an increase in the aging population. Available information about the incidence of blindness globally is limited.[6–13] There is no information on the incidence of blindness in India. Incidence studies could be of help in identifying the risk factors and planning periodic assessments for eye diseases in a high-risk population. From our baseline cohort from South India, we reported the prevalence of blindness in rural and urban populations.[4,5] In the current study, we report the 6-year incidence, causes, and baseline risk factors for incident blindness and monocular blindness from the same cohort.

Methods

The methodology of the Chennai Glaucoma Study (CGS) was reported previously.[14] In summary, the CGS was a cross-sectional population-based study conducted in rural and urban South India. The study cohort consisted of 9600 (rural:urban, 4800:4800) subjects aged 40 years or older and was carried out from 2001 to 2004. From the cohort, 7774 (rural:urban, 3924:3850) subjects participated in the study. All subjects underwent a comprehensive evaluation and were offered treatment, including cataract surgery, as appropriate for any detected ocular pathology. The present study, the Chennai Eye Disease Incidence Study (CEDIS), was conducted 6 years after the baseline examination (2007 to 2010). The subjects in the cohort were reenumerated by social workers. These subjects were invited for an examination at the base hospital to determine the incidence of the eye diseases. Written informed

consent was obtained and the study was conducted in accordance with the tenets of the Declaration of Helsinki after the institutional review board approved the study.

The examination techniques and the definitions used were the same as that of the baseline prevalence study. In brief, the examination consisted of measuring presenting and best-corrected visual acuity by using logMAR 4-meter charts (Light House Low Vision Products, New York, NY, USA), external examination and pupillary evaluation using a flashlight, slit-lamp biomicroscopy, IOP measurements using a Goldmann applanation tonometer (Zeiss AT 030 Applanation Tonometer; Carl Zeiss, Jena, Germany), gonioscopy using a 4-mirror Sussmann lens (Volk Optical, Inc., Mentor, OH, USA), grading of lens opacification at the slit lamp using the Lens Opacities Classification System II (LOCS II) and LOCS III with a minimum pupillary dilation of 6 mm, detailed retinal examination with a binocular indirect ophthalmoscope, and stereoscopic evaluation of the optic nerve head and macula using a +78-diopter lens (Volk Optical, Inc.) at the slit lamp, the Zeiss SL 130 (Carl Zeiss). A nonsimultaneous stereo photograph of optic disc and macula was taken in eyes with clear media. Automated visual fields were performed for all the subjects with best-corrected visual acuity of 4/16 (logMAR 0.6) or better, using a screening C-20-1 program of frequency doubling perimetry (FDP; Carl Zeiss Meditec, Inc., Dublin, CA, USA). Visual acuity measurement, refraction, visual field examination, and optic disc photography was done by the optometrist and the rest of the examination was conducted by an ophthalmologist. The agreement among examiners was high for grading of occludability ($k = 0.87$), the vertical and horizontal cup-to-disc ratios (CDR) assessment ($k = 0.87$), IOP measurement ($k = 0.71$), LOCS II grading ($k = 0.80$), visual acuity estimation ($k = 0.65$), and refraction ($k = 0.86$).

We measured the presenting and best-corrected visual acuity using logMAR 4-meter charts. Landolt's C chart was used for those who could not read English. Monocular visual acuity was determined with current spectacle prescription if any. Pinhole acuity was assessed in eyes with presenting visual acuity less than 20/20 (logMAR 0.0). Refraction was performed on all subjects. The best-corrected visual acuity was ascertained and the value recorded. If the visual acuity could not be measured, we used the following tests sequentially: counting fingers, hand movements, and light perception. Automated threshold visual field test using SITA standard 24-2 program (Model 750; Humphrey Instruments, San Leandro, CA, USA) was performed for all the subjects with diseases such as glaucoma, optic atrophy, retinitis pigmentosa, and suspected glaucoma. The diagnosis classification and the definition for blindness were similar to the prevalence study.[4,5] After the completion of examination, the diagnosis was recorded using the *International Classification of Diseases, Ninth edition*.[15] If more than one disease was present, the disease that was most likely to have a significant effect on vision was considered as the cause for the blindness. Cases of glaucoma were defined using the International Society of Geographical and Epidemiologic Ophthalmology classification.[16] Glaucoma was classified according to three levels of evidence. In category 1, diagnosis was based on structural and functional evidence. It required CDR or CDR asymmetry equal to or greater than the 97.5th percentile for the normal population or a neuroretinal rim width reduced to 0.1 CDR (between 10 and 1 o'clock or 5 and 7 o'clock) with definite visual field defects consistent with glaucoma. Category 2 was based on advanced structural damage with unproven field loss. This included those subjects in whom visual fields could not be done or were unreliable, with CDR or CDR asymmetry equal to or greater than the 99.5th percentile for the normal population. Last, category 3 consisted of persons with an IOP greater than the 99.5th percentile for the normal population, whose optic discs could not be examined because of media opacities. Diagnosis of diabetic retinopathy was based on cystoid macular edema, hard exudates, intraretinal hemorrhages, and microaneurysms. Retinal vein occlusion was defined as edematous and hemorrhagic changes or partially occluded veins with or without collaterals. Age-related macular degeneration was diagnosed by The International Age-Related Macular Degeneration Epidemiological Study Group.[17] If no obvious eye abnormalities were found to be the cause for the blindness, then it was categorized as unknown cause. Blindness was defined by WHO criteria as best-corrected distance visual acuity of less than 6/120 (3/60) and/or less than 10° visual field in the better eye. Incident blindness was defined as visual acuity of less than 6/120 (3/60) and/or a visual field of less than 10° in the better seeing eye at the 6-year follow-up provided that eye had a visual acuity better than or equal to 6/120 (3/60) and visual field greater than 10° at baseline. For incident monocular blindness, both eyes should have had visual acuity of 6/120 (3/60) or better at baseline and developed visual acuity of less than 6/120 (3/60) in one eye at 6-year follow-up. We classified people with at least primary education as literate and people with no formal education as illiterate. Diabetes mellitus and systemic hypertension were detected based on current use of antidiabetic or systemic antihypertensive medication. Body mass index (BMI) was defined as weight in kilograms divided by the square of height in meters (kg/m^2). BMI categories were grouped as underweight (<18.5 kg/m^2), normal (18.5–25 kg/m^2), overweight (>25 kg/m^2), or obese (≥30.0 kg/m^2).

Statistical analysis was performed using SPSS version 15 (IBM SPSS Statistics; IBM Corporation, Chicago, IL, USA). Subjects were classified into four groups based on baseline age of 40 to 49 years, 50 to 59 years, 60 to 69 years, and 70 years and older. Comparison of variables between subjects with and without blindness was done using *t*-test for continuous variables and χ^2 test for categorical variables. Risk factors for blindness were assessed using generalized estimating equation logistic regression incorporating age, sex, location of residence, occupation, literacy, and history of any cataract surgery. Model fit was assessed using quasi likelihood under independence model criterion. Statistical significance was assessed at *P* value less than 0.05 and odds ratios (ORs) were presented with 95% confidence intervals (CIs).

Results

Study Cohort

For the prevalence study at baseline, 7774 subjects were examined. Out of these, 1752 subjects (rural:urban, 877:875) had migrated with no forwarding address and could not be contacted. Of the 6022 subjects (rural:urban, 3047:2975) who could be contacted/information was available, 590 persons were not alive. The final eligible subjects were 5432, and 4421 (rural:urban, 2510:1911) were examined. The study response rate was 81.3%. The reasons for nonparticipation were migration (804, 14.8%), refusal (145, 2.7%), and being bedridden (62, 1.1%). Table 1 provides the characteristics of participants, nonparticipants, and the deceased. In comparison with participants, nonparticipants and deceased were older and likely to be diabetic and hypertensive. Among the nonparticipants, 11% were operated for cataract at baseline as compared with 8% in participants ($P < 0.001$). Two subjects were excluded because of incomplete data.

Blindness

Of 4419 subjects, 59 subjects with blindness at baseline were excluded. We analyzed 4360 subjects for incident blindness.

Table 1. Comparison of Baseline Characteristics of Participants, Nonparticipants, and Deceased in CEDIS

Parameter Studied	*P* Value*	Nonparticipants, *n* = 2763	Participants, *n* = 4421	Deceased, *n* = 590	*P* Value†
Age, y, mean (SD)	<0.001	54.6 (10.7)	52.8 (9.7)	64.8 (10.1)	<0.001
Male:female (%)	0.02	1152 (41.7):1611 (58.3)	1972 (44.6):2449 (55.4)	348 (59.0):242 (41.0)	<0.001
Rural:urban (%)	<0.001	1032 (37.4):1731 (62.6)	2510 (56.8):1911 (43.2)	382 (64.7):208 (35.3)	<0.001
Cataract surgery, no:yes (%)	0.29	2515 (91.0):248 (9.0)	4056 (91.7):365 (8.3)	457 (77.5):133 (22.5)	<0.001
Smoking, no:yes, (%)	0.92	2294 (83.0):469 (17.0)	3666 (82.9):755 (17.1)	448 (76.0):142 (24.0)	<0.001
Smokeless tobacco, no:yes (%)	<0.001	2407 (87.1):356 (12.9)	3714 (84.0):707 (16.0)	440 (74.6):150 (25.4)	<0.001
Alcohol use, no:yes (%)	0.81	2362 (85.5):401 (14.5)	3789 (85.7):632 (14.3)	473 (80.2):117 (19.8)	0.001
Literate:illiterate (%)	<0.001	1863 (67.4):900 (32.6)	2705 (61.2):1716 (38.8)	289 (49.0):301 (51.0)	<0.001
Occupation manual:nonmanual (%)	0.32	1772 (64.1):991 (35.9)	2887 (65.3):1534 (34.7)	420 (71.2):170 (28.8)	0.005
Hypertension, no:yes, (%)	<0.001	1296 (46.9):1467 (53.1)	2528 (57.2):1893 (42.8)	251 (42.5):339 (57.5)	<0.001
Diabetes mellitus, no:yes (%)	<0.001	2290 (82.9):473 (17.1)	3829 (86.6):592 (13.4)	479 (81.2):111 (18.8)	0.001

Among the nonparticipants and deceased, there was no significant difference in hypertension ($P = 0.06$) and diabetes ($P = 0.33$); all the other variables had significant difference ($P < 0.001$).

* *P* value represents the difference between participants and nonparticipants.

† *P* value represents the difference between participants and deceased.

Twenty-one subjects (male:female, 7:14, rural:urban, 15:6) had become blind in the 6-year follow-up period; 20 of those subjects were classified as being blind based on visual acuity criteria. Subjects with blindness were significantly older, illiterate, and smokeless tobacco users (Table 2). The 6-year incidence of blindness was 0.48% (95% CI, 0.3–0.7). The age- and sex-adjusted (to the population of Tamil Nadu) incidence of blindness among subjects 40 years and older was 0.53% (95% CI, 0.52–0.55), and was 0.62% (95% CI, 0.61–0.63) in the rural population and 0.54% (95% CI, 0.53–0.55) in the urban population. Baseline risk factors that predicted incident blindness are given in Table 3. Significant risk factors for incident blindness were age, smokeless tobacco use ($P < 0.001$), and no history of cataract surgery ($P = 0.02$). Using the 40- to 49-year age group as a reference population, the OR increased from 9.9 (95% CI, 1.2 to 84.1) for the 50- to 59-year age group to 36.7 (95% CI, 4.3–312.3) for those 70 years and older ($P = 0.001$). The Figure depicts the gradual increase in incident blindness from 0.05% for the 40- to 49-year age group to 1.6% for the group 70 years and older. Cataract (66.7%) was the leading cause of incident blindness followed by cataract surgery–related causes (19%) and retinal pathology (14.3%) (Table 4).

Monocular Blindness

At the baseline examination, 315 subjects (includes 59 bilaterally blind subjects) had visual acuity of less than 6/120 (3/60) in either eye and were excluded. Of the 4104 subjects examined, 132 (male:female, 64:68; rural:urban, 99:33) were blind in one eye. The 6-year incidence of monocular blindness was 3.2% (95% CI, 2.7–3.8). Among the subjects aged 40 years and older, the age- and sex-adjusted (to the population of Tamil Nadu) incidence of monocular blindness was 3.8% (95% CI, 3.7–3.8). It was significantly ($P < 0.001$) more in the rural population (5.4%, 95% CI, 5.4–5.5) than in the urban population (1.9%, 95% CI, 1.8–1.9). In comparison with the study population, subjects with monocular blindness were significantly older; were rural residents, illiterate, and smokeless tobacco users; and had a history of cataract surgery (Table 2). Baseline risk factors that predicted incident monocular blindness were age, rural residence, and history of cataract surgery (Table 3). The incidence increased exponentially from 0.97% for the age group of 40 to 49 years to 8.5% in the age group of 70 years and older (Fig.). Table 4 provides the causes for monocular blindness; cataract was again the leading cause for monocular blindness (64.4%).

Table 2. Comparison of Participants With and Without Incident Monocular (MO) Blindness and Incident Blindness in CEDIS

Parameter Studied	Study Population, *n* = 4104: No MO Blindness, *n* = 3972	Study Population, *n* = 4104: Incident MO Blindness, *n* = 132	*P* Value	Study Population, *n* = 4360: No Incident Blindness, *n* = 4339	Study Population, *n* = 4360: Incident Blindness, *n* = 21	*P* Value
Age, y, mean ± SD	51.9 ± 9.4	59.2 ± 9.2	<0.001	52.6 ± 9.7	61.8 ± 9.6	<0.001
Male:female	1779:2193	64:68	0.23	1941:2398	6:15	0.10
Rural:urban	2164:1808	99:33	<0.001	2443:1896	15:6	0.12
Literate:illiterate	2511:1461	58:74	<0.001	2668:1671	6:15	0.003
Occupation manual:nonmanual	2553:1419	91:41	0.31	2822:1517	17:4	0.17
Diabetes mellitus, no:yes	3129:843	109:23	0.17	3430:909	15:6	0.27
Hypertension, no:yes	2132:1840	73:59	0.39	2334:2005	8:13	0.11
Smoking, no:yes	3166:806	100:32	0.16	3452:887	19:2	0.17
Alcoholism, no:yes	3165:807	101:31	0.22	3454:885	17:4	0.57
Smokeless tobacco, no:yes	3292:680	95:37	0.001	3537:802	6:15	<0.001
History of cataract surgery, no:yes	3182:790	57:75	<0.001	3285:1054	16:5	0.59

Table 3. Baseline Risk Factors for Incident MO Blindness and Incident Blindness in CEDIS

	Incident MO Blindness, $n = 132$			Incident Blindness, $n = 21$		
Baseline Risk Factors	**No. of Subjects**	**Adjusted OR (95% CI)**	***P* Value**	**No. of Subjects**	**Adjusted OR (95% CI)**	***P* Value**
Age, y						
40–49	1865	1		1896	1	
50–59	1197	4.03 (2.3–7.1)	<0.001	1257	9.9 (1.2–84.1)	0.03
60–69	795	7.76 (4.5–13.5)	<0.001	902	20.9 (2.6–166.1)	0.004
70+	247	10.2 (5.3–19.6)	<0.001	305	36.7 (4.3–312.3)	0.001
Sex						
Male	1843	1		1947	1	
Female	2261	1.05 (0.7–1.5)	0.78	2413	2.0 (0.8–5.2)	0.056
Location						
Urban	2263	1		1902	1	
Rural	1841	2.8 (1.9–4.2)	<0.001	2458	1.9 (0.7–5.3)	0.19
Literate	2569	1		2674	1	
Illiterate*	1535	1.46 (0.9–2.2)	0.07	1686	2.6 (0.8–8.0)	0.09
Occupation						
Manual	2644	1		2839	1	
Nonmanual*	1460	0.96 (0.8–1.5)	0.86	1521	0.8 (0.2–2.3)	0.62
Diabetes mellitus						
No	3551	1		3772	1	
Yes	553	0.76 (0.4–1.4)	0.37	588	1.7 (0.5–5.8)	0.43
Hypertension						
No	2349	1		2497	1	
Yes	1755	0.96 (0.7–1.4)	0.83	1863	1.5 (0.6–3.8)	0.39
Smoking						
No	3266	1		3471	1	
Yes	838	1.08 (0.6–1.8)	0.76	889	0.5 (0.1–2.5)	0.41
Alcoholism						
No	3266	1		3471	1	
Yes	838	1.1 (0.6–1.8)	0.75	889	1.5 (0.4–6.1)	0.53
Smokeless tobacco						
No	3387	1		3543	1	
Yes	717	1.07 (0.7–1.6)	0.72	817	7.5 (2.8–20.3)	<0.001
History of cataract surgery						
Yes	865	1		1059	1	
No	3239	0.4 (0.2–0.6)	0.03	3301	3.4 (1.1–10.8)	0.02

Adjusted for age, sex, and place of residence.
* Adjusted for each other.

Discussion

To our knowledge, CEDIS is the first longitudinal study from India to report the incidence of blindness from a rural and an urban South Indian population. The 6-year crude incidence of blindness and monocular blindness was 0.48% and 3.2%; after adjusting for age and sex, it was 0.53% and 3.8%. In the present study, older age at baseline was a significant risk factor for incident blindness and monocular blindness. Incident blindness increased from 0.05% for the 40- to 49-years age group to 1.6% for the group 70 years and older, whereas for the same age groups the incident monocular blindness was 0.97% and 8.5%, respectively. Older age has been reported as a risk factor in incident studies from other populations as well. Using WHO criteria, the reported incident blindness in the Afro-Caribbean population was 0.6% (95% CI, 0.4–1.0) at 4 years and 1.0% (95% CI, 0.7–1.4) at 9 years.[6,7] Using similar criteria for incident blindness, reported incidence at 4 years was 0.2% (95% CI, 0.1–0.3) among Latinos,[8] 0.3% (95% CI, 0.1–1.2) at 7 years among Italians,[9] and 0.1% (95% CI, 0.02–0.18) among Chinese[10] compared with 0.48% (95% CI, 0.3–0.7) at 6 years in our population. Regardless of the duration of the study period, older age at baseline was a significant risk factor. This is expected, as most eye diseases are age-related. These findings reinforce the fact that health-planning programs should target the older-age population to combat blindness across the globe.

Cataract surgery as a risk factor has shown a different pattern than incident blindness and monocular blindness. No history of cataract surgery was found to be a significant risk factor for incident blindness (OR 4.3, 95% CI, 1.4–13.4, $P = 0.01$), whereas it was protective for incident monocular blindness (OR 0.4, 95% CI, 0.2–0.5, $P < 0.001$). Because cataract is the major cause of blindness, the association with incident blindness is obvious. On the other hand, with monocular blindness, the complications following cataract surgery may be contributing to monocular visual loss (Table 4).

In the CGS, we had reported that use of smokeless tobacco was strongly associated with cataract formation in the rural

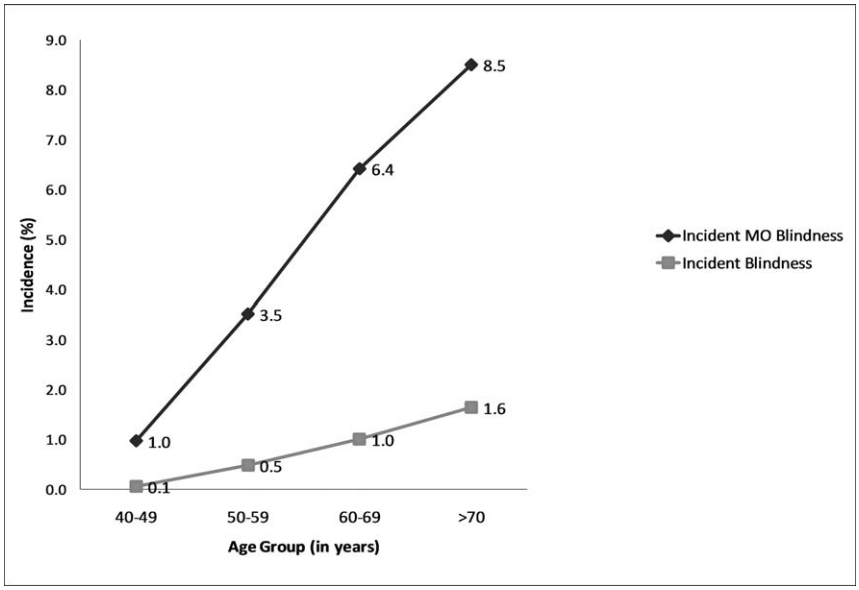

FIGURE. Agewise incidence of monocular blindness (MO) and blindness in CEDIS.

population.[18] In the present study, incident blindness was seven times greater among the smokeless tobacco users. Monocular blindness showed an association with smokeless tobacco use; however, after adjusting for age, sex, and residence, the association was not significant. Chewing tobacco by both men and women is very common practice in India. Increased blood cadmium levels with the use of tobacco are thought to influence cataract formation.[18] Similar to our baseline studies,[4,5] we have not found any significant association with sex.

TABLE 4. Causes for Incident MO Blindness and Incident Blindness in CEDIS

Causes	Incident MO Blindness, $n = 132$, n (%)	Incident Blindness, $n = 21$, n (%)
Cataract	85 (64.4)	14 (66.7)
Postcataract surgery	19 (14.4)	4 (19.0)
Posterior capsule opacification	8 (42.1)	2 (50.0)
Corneal decompensation	6 (31.6)	2 (50.0)
Glaucoma	2 (10.5)	
Retinal detachment	1 (5.3)	
Cysoid macular edema	1 (5.3)	
Unknown	1 (5.3)	
Open-angle glaucoma	7 (5.3)	
Retinal pathology	12 (9.1)	3 (14.3)
Retinitis pigmentosa	2 (17.0)	1 (33.3)
Diabetic retinopathy	1 (8.0)	1 (33.3)
AMD	3 (25.0)	1 (33.3)
Macular scar	1 (17.0)	
Myopic macular degeneration	1 (8.0)	
Retinal detachment	1 (8.0)	
Vein occlusion	3 (25.0)	
Corneal pathology	4 (3.0)	
Failed graft	1 (25.0)	
Spheroidal degeneration	2 (50.0)	
Pterygium	1 (25.0)	
Others	5 (3.8)	
Amblyopia	1 (20.0)	
Optic atrophy	2 (40.0)	
Trauma	1 (20.0)	
Enucleated	1 (20.0)	

The causes for blindness can be multifactorial and can differ across the world.[19] The leading cause for blindness in the high-income population was AMD, whereas it was cataract in low-income countries.[20] In the present longitudinal study, cataract was the single most important cause for incident blindness and monocular blindness in more than 60% of subjects. Available data suggest that cataract surgery programs are reaching more people in middle-income countries, such as India.[21,22] Cataract surgery rate for the baseline study population was 12.0% (rural 13.5%, urban 10.5%) and increased to 16.7% (rural 19.5%, urban 13.1%) in the follow-up study population. In spite of this increase in cataract surgery rates, cataract was the leading cause of incident blindness. Possible reasons for this can be increased life expectancy, poor utilization of services, or difficulty in accessing those services. Outcomes of cataract surgeries remain a challenge in developing countries.[23–25] We have reported high rates of cataract surgery–related complications resulting in blindness in our prevalence study.[26,27] In this study also, cataract surgery complications were the second cause for incident blindness and monocular blindness. Innovations and improvements in cataract surgery have improved visual outcomes; however, it has not eliminated the possibility of visual impairment or blindness.[23] All those evaluated in this cohort had undergone a complete evaluation at baseline and were offered cataract surgery free of cost if they had visually significant cataract at that time. The high incidence reinforces the difficulties in access to eye care and the argument that cataract blindness elimination surgical programs should have a good follow-up component. This can at least eliminate the treatable causes, such as posterior capsule opacification. Diabetes mellitus has become a major health concern in India. In the present study, 21% (915 subjects) had diabetes and one subject (0.1%) each had incident blindness and monocular blindness with diabetic retinopathy. Our findings suggest that diabetes is not a major cause for incident blindness in our population.

Any population-based longitudinal study will have its strengths and weaknesses. The main strength of the study is

that we followed standardized protocols for definition and data collection. As with other population-based incidence studies, the main limitation of the study was losses to follow-up. Inability to contact subjects, mortality, and migration were the main causes for loss to follow-up. In comparison with participants, nonparticipants were older and likely to be diabetic and hypertensive. This difference in these three parameters would have influenced our results. Older age and diabetes can influence blindness rates, so missing older subjects and diabetic individuals might have caused underestimation of blindness rates. The other weakness of the study is response bias. Cataract-operated subjects were less likely to participate. Because they had undergone cataract surgery, they possibly did not feel the need for an eye examination (at least in subjects with good vision) and, therefore, perhaps did not participate in the study. In our study, among the nonparticipants, 11% were operated for cataract, whereas among participants, it was 8%. This response bias might have resulted in an exaggeration of the rates of cataract blindness and the magnitude of the incidence rates. Last, there was lack of dietary data for the study population. In view of the nonavailability of this information, we were unable to comment about the high incidence of cataract and possible nutritional deficiency in the population.

In this longitudinal study, we report the 6-year incidence of blindness and monocular blindness. In spite of an increase in the proportion of those who had cataract surgery, cataract was the leading cause and age was a significant risk factor. This information adds to the existing knowledge and probably will help to better understand and implement blindness-eradication programs.

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