

3.8 Million blinded by cataract each year: projections from the first epidemiological study of incidence of cataract blindness in India

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Abstract

Data from a population based longitudinal study of randomly selected communities in Central India have for the first time provided direct estimates of age specific incidence of blindness from cataract. Person-time denominators have been used to compute age specific incidence rates (risk) of blindness from cataract for populations aged 35 and older. These age specific incidence measures have been applied to the 'population at risk' in each 5-year age class in order to estimate the total number of new cases of cataract blindness that occur in the country each year. The findings indicate that an estimated 3.8 million persons become blind from cataract each year in India (approximate 95% confidence limits: 3 to 4.5 million). The reasons why the estimates are considered as minima, and their implications concerning future national planning of ophthalmic services, are briefly discussed.

During the past decade a number of cross-sectional surveys have provided data on prevalence (existing cases) of cataract and of blindness due to cataract in various parts of the world.¹⁻⁵ These data indicate that cataract is by far the commonest cause of blindness and visual disability worldwide. However, these prevalence data provide useful information on only the backlog of the cataract problem and do not give information on the number of new cases that occur each year. The latter incidence information is an important prerequisite to rational long-term planning of basic ophthalmic services on a regional or national scale. This paper reports the findings of the first population based longitudinal study which was designed to provide a direct measure of incidence (new cases) of cataract blindness and to evaluate certain risk factors.

Material and methods

The collaborative study was started in 1982 and was conducted in the Arang Block of Raipur District in Central India. The baseline data were collected from a random sample of 19 communities in the Arang Block (population *c.* 100 000). The sample included 1735 persons aged 30 and older. These constituted the study cohort. Examinations and interviews were carried out by an ophthalmologist and an ophthalmic epidemiologist with the help of three specially trained ophthalmic assistants, using standardised methods. A third independent consulting ophthalmologist was employed to evaluate the field work during the study.

Visual acuity was measured with a standard Snellen's E chart at 6 m in shaded daylight. Cataracts (central lens opacities) were identified and graded according to a simple method that has been shown to have excellent interobserver agreement.⁶ The principal cause of any visual impairment below 6/12 was determined, with particular care to distinguish between cataract and other disorders as the main causes. Subsequently, in 1986, the people in the study sample were located, examined, and interviewed by the same standardised methods.

The data were entered into a specially designed relational database by means of a microcomputer and were subsequently analysed with software developed at ICEH in London. The exact period of follow-up was computed for each person so that precise person-time denominators could be calculated. The follow-up times for those who died before the final examination were estimated by ascertaining the time of death through interviews with the family. To ensure that the incidences would not be overestimated, persons who could not be re-examined at the follow-up visit were considered to have been followed up and not to have gone blind from cataract. Furthermore, in computing the number of new cases of cataract blindness, persons younger than 35 in the population were considered to have a minimal incidence, which was taken as zero, because none of these young people became blind from cataract. Infants and children becoming blind from congenital cataract were not included in the projected estimates.

Incidence rates with person-time denominators were computed for each 5-year age stratum. The age specific incidence rates were then applied to the age stratified 'at risk' population of the study area and also of the whole country to arrive at the number of new cases of cataract blindness that occur per year. In addition the 1-year cumulative incidence for each age stratum was derived from the incidence rate of the stratum by the density method.⁷ The equation used was: $CI = 1 - e^{-Rt}$ where CI is the cumulative incidence in time *t* (*t* being taken as 1 year), *R* is the incidence rate per year, and *e* is the constant 2.71828, the base of natural logarithms. Unlike the incidence rate, the cumulative incidence is not a rate but a proportion, and may be expressed as an absolute number, or a percentage of the original cohort, who became cases in a specified time period. The incidence rate on the other hand measures the average speed of occurrence of new cases, and it may be interpreted as the average number of new cases that have occurred *per unit of time* during the study period.

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The age specific cumulative incidence proportions were also used to estimate the number of new cases that occur in one year in the country.

The age stratified population for India was based on the United Nations publication ST/ESA/SER.R 170. The population 'at risk' were determined by excluding from the whole population those who were already blind or had had cataract surgery. The expected numbers of these prevalent cases were provided by our cross-sectional survey at the beginning of the study.

An incident case was defined as a person who was not blind at the beginning of the study but became blind (according to the WHO categories 3, 4, 5: vision less than 3/60 in both eyes) because of cataract by the end of the study.

Results

There were 1735 persons aged 30 and older in the sample. Of these, a cohort of 1655 persons were at risk of becoming blind during the study. The remainder were either already blind or had had cataract surgery. During the follow-up period 6% of the study cohort died.

The incidence rate of cataract blindness in the at risk cohort was 0.0019 per person-year for the age group 35-39 and 0.0581 per person-year for the age group 65 and older. The corresponding annual cumulative incidences were 0.19% and 5.64%. The estimated number of new cases of cataract blindness which occur in the sampled population of Arang was 470 new cases per year per 100 000 persons at risk. The projected estimate for the whole country was 3 811 185 new cases of cataract blindness per year, with approximate 95% confidence limits of 3 to 4.5 million. The details are shown in Table I. The estimate derived from the cumulative incidence

was 3 738 947 new cases in one year. This amounts to 0.46% of the population at risk.

About 0.6% of the original cohort of 315 persons aged 30-34 developed cataract in at least one eye during the study. However, none of these were blinded by cataract in the sample, reflecting a very low incidence rate of cataract blindness in this stratum of young people. The age and sex distribution of the study sample, together with the follow-up times in person-years, are shown in Table II.

Discussion

The projected numbers of new cases of blindness from cataract should be considered as minimal estimates because of the following considerations. First, since there were no incident cases of cataract blindness in the youngest age cohort in the sample (younger than 35), the incidence in that population stratum was considered to be very small and was taken as zero. Secondly, persons who could not be examined at the end of the study were included in the denominators and were counted as non-cases. This was mostly justified because by far the commonest reason for being absent at the time of the second survey was new employment. These persons were not likely to be blind. In this follow-up study 80.2% of the original cohort were successfully located again and re-examined (if alive) at the end of the follow-up period. Thirdly, blindness and aphakia prevalence measures were used to exclude those who were already blind (or had had cataract surgery), so that only the populations at risk of becoming blind were used in computations. Finally, new cases of blindness from congenital cataract were not included in the estimates. The projection for the whole country assumes that the age specific incidence rates in the population of the Arang Block in Central India are fairly similar to the average incidence rates for the country.

At present some 1.2 million cataract extractions are performed in India each year. In spite of this huge effort evidence from recent prevalence data indicates that cataract blindness is increasing (survey conducted by the National Blindness Prevention and Control Programme/World Health Organisation). This has led to a recent suggestion that the ophthalmic services in India should aim to do more than 2 million cataract operations each year. Our findings suggest that the cataract blindness problem in India is too massive to be solved by the surgical programme alone, particularly in view of the aging population trend which is expected substantially to increase the number of new cases of blindness from cataract. Moreover, even under very favourable conditions, cataract surgery is not entirely free of risk. Some of the effort in control of cataract blindness should be directed at developing strategies to reduce the incidence of blinding cataract. Our earlier findings on dehydration crises as a major risk factor for cataract⁸ offer an opportunity to initiate and test community based interventions to control dehydration crises and perhaps to control other important risk factors that may be identified through further epidemiological research, thus

TABLE I Incidence of blindness from cataract in India. Projections from a population based follow-up study in Central India

Age	Population*	Population at risk	Incidence rate/person-year	Projected number of new cases of cataract blindness per year
0-34	579 810 000	576 197 477	0.00†	0†
35-39	50 376 000	50 205 811	0.00190	95 486
40-44	41 665 000	41 301 114	0.00253	104 473
45-49	35 783 000	35 203 518	0.00595	209 610
50-54	31 654 000	29 867 081	0.01336	399 157
55-59	27 369 000	25 138 933	0.02388	600 218
60-64	22 088 000	18 182 195	0.03734	678 842
65+	38 407 000	29 660 851	0.05810	1 723 399
Totals	827 152 000	805 756 980		3 811 185‡

*Population of India: based on United Nations publication ST/ESA/SER.R 170. †Very low incidence in the population; taken as zero, since no incident cases occurred in the sample. ‡Approximate 95% confidence limits=3 to 4.5 million.

TABLE II Age and sex distribution of the study sample and age specific follow-up times in person-years

Age	Males		Females		Males+females		Person-years follow-up
	No.	%	No.	%	No.	%	
30-34	124	15.92%	191	19.98%	315	18.16%	1123.92
35-39	110	14.12%	186	19.46%	296	17.06%	1055.58
40-44	120	15.40%	109	11.40%	229	13.20%	797.66
45-49	134	17.20%	113	11.82%	247	14.24%	854.16
50-54	98	12.58%	150	15.69%	248	14.29%	867.33
55-59	68	8.73%	67	7.01%	135	7.78%	455.24
60-64	77	9.88%	87	9.10%	164	9.45%	541.99
65+	48	6.16%	53	5.54%	101	5.82%	329.16
Totals	779	100.00%	956	100.00%	1735	100.00%	6025.04

aiming to reduce substantially the number of new cases of cataract blindness that occur each year.

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