

Current status of cataract blindness and Vision 2020: The right to sight initiative in India

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Background: India is a signatory to the World Health Organization resolution on Vision 2020: The right to sight. Efforts of all stakeholders have resulted in increased number of cataract surgeries performed in India, but the impact of these efforts on the elimination of avoidable blindness is unknown.

Aims: Projection of performance of cataract surgery over the next 15 years to determine whether India is likely to eliminate cataract blindness by 2020.

Materials and Methods: Data from three national level blindness surveys in India over three decades, and projected age-specific population till 2020 from US Census Bureau were used to develop a model to predict the magnitude of cataract blindness and impact of Vision 2020: the right to sight initiatives.

Results: Using age-specific data for those aged 50+ years it was observed that prevalence of blindness at different age cohorts (above 50 years) reduced over three decades with a peak in 1989. Projections show that among those aged 50+ years, the quantum of cataract surgery would double (3.38 million in 2001 to 7.63 million in 2020) and cataract surgical rate would increase from 24025/million 50+ in 2001 to 27817/million 50+ in 2020. Though the prevalence of cataract blindness would decrease, the absolute number of cataract blind would increase from 7.75 million in 2001 to 8.25 million in 2020 due to a substantial increase in the population above 50 years in India over this period.

Conclusions: Considering existing prevalence and projected incidence of cataract blindness over the period 2001-2020, visual outcomes after cataract surgery and sight restoration rate, elimination of cataract blindness may not be achieved by 2020 in India.

Key words: Blindness, cataract, the right to sight, vision 2020

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Cataract has been documented to be the most significant cause of bilateral blindness in India where vision < 20/200 in the better eye on presentation is defined as blindness.¹⁻⁶ In India cataract has been reported to be responsible for 50-80% of the bilaterally blind in the country.¹⁻⁶ Global agencies for the elimination of avoidable blindness have pledged support to operationalizing strategies to reduce the burden of cataract blindness by the "Vision 2020: The right to sight" initiative.⁷ Coordinated national efforts were supplemented by a world bank-assisted cataract blindness control project which was launched in seven states of India in 1994.⁸ From around 1.2 million cataract surgeries per year in the 1980s,⁹ the cataract surgical output increased to 3.9 million per year by 2003.¹⁰ Recent data from the World Health Organization (WHO) shows that there is a 25% decrease in blindness prevalence in India.¹¹ This could be due to the increased cataract surgeries in the country. At the same time the proportion of the aged has also increased significantly in the country. The 60+ population which

stood at 56 million in 1991 will double by 2016.¹² This increase in population means that the population 'at-risk' of blinding cataract will also increase tremendously. India is committed to the goal of elimination of avoidable blindness by 2020 in line with the Global Vision 2020: the right to sight initiative. We used existing surveys, cataract surgical output, and population data, to determine whether India can meet the Vision 2020: the right to sight cataract blindness goals.

Materials and Methods

Three national level surveys have been undertaken in India over the past three decades. The first survey was done in 1971-74 and the results of this survey led to the inception of the National Program for Control of Blindness in 1976.⁶ The second survey was done over the period 1986-89 to evaluate the impact of the National Program.⁵ Based on the findings of this survey, control of cataract blindness was given the highest priority and a world bank-assisted cataract blindness control program was initiated in 1994.⁸ To assess the impact of the new strategies adopted, a survey was undertaken in 15 districts (one district each in all the major Indian States) over the period 1999-2001.¹³

A model was developed to predict the magnitude of cataract blindness and the impact of the Vision 2020: the right to sight initiative in India over the period 1989 to 2020. The following inputs were considered for this purpose:

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- The total population and the age-specific population was determined using Census of India data for 1971, 1991 and 2001.¹⁴⁻¹⁶ Future projections of population trends were obtained from the US Census Bureau.¹⁷
- Data on the number of cataract surgeries performed in the country over the past two decades were available from the Govt. of India.^{18,19} These figures were used to calculate cataract surgical rate (CSR) per million population.
- Available unpublished data from sentinel surveillance units in India shows that 11% of cataract surgery is performed before the age of 50 years.²⁰ Therefore, in projecting the cataract surgery above the age of 50 years, a correction of 10% was made to the total cataract surgeries in the country. It was assumed that this would remain constant till 2020.

CSR is defined as:²¹

Total number of cataract surgeries performed / Total population x 1,000,000.

Conventionally, a rate as defined in epidemiology has a numerator which is related to and derived from the denominator and has a specific time dimension (such as one year). As against 'rates', CSR is a proportion, where the numerator may not be derived from the denominator.²² Therefore it was felt that using the 50+ population as the denominator rather than the whole population would be more appropriate as cataract blindness and cataract surgery are commonly seen above the age of 50 years. Therefore a new indicator was defined and labeled as "CSR 50+". This indicator was defined as:

Total number of cataract surgeries performed / Total 50+ population x 1,000,000

- Data available in India shows that all cataract surgeries are not sight-restoring surgeries as nearly 40-50% surgeries are done in individuals with a vision > 20/200 in the better eye.²³ Therefore it was felt that in interpreting the data on CSR, the proportion of sight restoration surgeries should also be considered. This is important as Vision 2020 targets the bilaterally blind as the immediate priority. Sight restoration rate (SRR) is defined as:²⁴

Persons blind preoperatively (minus) - Persons blind postoperatively x 100

Total persons operated

- Available data shows that there is a decrease in the

prevalence of cataract blindness above 50 years of age from 7.6% in 1989⁵ to 5.3% in 2001.¹³ In estimating the cataract blindness rates at different time periods, age-specific prevalence rates in the 1989 and 2001 surveys were used to estimate the number of cataract blind in the country over the period 2005-2020 [Table 1].

- Computing the age-specific prevalence rates of cataract blindness it was observed that over the period 1989-2001, there was a 32% reduction in the prevalence of cataract blindness at age 50-59 years, 54% reduction at ages 60-69 and 22% reduction at ages 70+ years over a one-year period. It has been assumed that this trend will continue till 2020.
- The 50+ population has increased from 13% in 1991 to 13.7% in 2001,^{14,15} The US Census Bureau projections of Indian population in different age cohorts (50-59 years; 60-69 years; 70+ years) were used to estimate the population of different age groups over the period 2005-2020.¹⁷ These projections use life table techniques to adjust for the mortality that would be experienced by this population in the future.
- The CSR in 1989-1990 in India was 1342/million while in 2001 it was 3620/million.¹⁸ This has further increased to 4500 per million population in 2005.¹⁹
- The available figures for cataract surgery in India over the period 1989-2005, show that there has been an increase of 238,000 surgeries per year over the 16-year period. These figures have then been used to calculate the projected CSR over the period 2005-2020. Age-specific CSR data is not available in India.

Results

Data available from three national level surveys in India was used to project the estimates of cataract blindness in the country. The surveys done in the seventies⁶ and eighties⁵ included the general population while the most recent survey included only those aged 50 years or above.¹³ Using the age-specific data for those aged 50 years and above from all three surveys, it was observed that the prevalence of blindness at different age cohorts above the age of 50 years changed over the three decades with a peak in cataract blindness prevalence rates in 1989 [Table 1]. The prevalence of blindness (presenting vision < 20/200) was observed to be 8.5% [95% CI: 8.1 - 8.9] in the recent survey.¹³ It appears that there is a declining trend over the period 1989-2001. Extrapolating the observations to the entire

Table 1: Available data on blindness and cataract blindness in India

Parameters	1971-74 survey	1986 - 89 survey	1999-2001 survey
Total population 50+	60,97,62 ^a (1971)	109,013,840 ^b (1991)	140,863,227 ^c (2001)
Surveyed 50+ population whose data was available	51556	30285	63337
No. of 50+ Blind	4835	2874	5385
Prevalence of blindness (<20/200) in 50+	9.4 % [CI: 9.1-9.6]	9.5% [CI: 9.2 - 9.8]	8.5% [CI: 8.1 - 8.9]
Prevalence of cataract blindness 50-59 y	1.7%	3.2%	1.85% [1.65-2.05]
Prevalence of cataract blindness 60-69 y	6.26%	20.6%	5.63% [5.15-6.11]
Prevalence of cataract blindness 70+ yrs	15.23%	23.1%	13.3% [12.47-14.13]

^a - 1971 Census, ^b - 1991 Census, ^c - 2001 Census

country it was estimated that in 2001, there were 7.75 million individuals whose blindness could be attributed to cataract and this would increase to 8.25 million by 2020 [Table 2]. There is an increase in the total number of cataract blind in the age group above 70 years, over the period 2001-2020 as against a decrease in the other age groups. By 2020, the prevalence of cataract blindness in the population aged 70+ will be four times higher than the prevalence of cataract blindness in other age groups, while the population in this age bracket increases by 108% over the period 2001-2020 [Table 2].

It was observed that the number of cataract blind per million people aged 50 years and above would decrease from 53000 per million to 30088 per million by 2020 when prevalent cases of cataract blind are considered [Table 3].

If only the prevalence of cataract blind and the CSR above the age of 50 years is considered, India would be placed in a comfortable position for eliminating cataract blindness by 2020 [Figure 1]. However, if the incidence of cataract blindness and the number of surgeries on those already blind are considered among the 50+, there would be a big gap between the actual need and the surgical output in the country [Figure 1].

Discussion

At the turn of the century, WHO and the International Agency for Prevention of Blindness launched the Vision 2020: the right to sight initiative.²¹ The most recent estimates from WHO reveal that 47.8% of global blindness is due to cataract and in South Asia region which includes India, 51% of blindness is due to cataract.²⁵ Since cataract is a major cause of avoidable blindness in the developing countries, the key to the success of the Global Vision 2020: the right to sight initiative is a special effort to tackle cataract blindness.⁷ Cataract surgery has been viewed as one of the most cost-effective health interventions with a cost of disability-adjusted life years saved of US \$ 20-40.²⁵

Cataract surgical rate is a quantifiable measure of the delivery of cataract services in a country.^{24,25} It is thus a good indicator of how well a country is organizing its efforts in tackling cataract-related blindness. There has been a substantial increase in CSR in India especially after the inception of the World Bank-supported Cataract Blindness Control Project.⁸ Professional interest and technological upgradation of skills

and the availability of affordable equipment and intraocular lenses have all fuelled the increase in cataract surgery in India. A CSR of 3000 was targeted under Vision 2020: the right to sight, for India, by the year 2000.²⁵ Current trends show that this target has been achieved, but still there are regional disparities across the country. The CSR for the year 2002-03 ranges from a high of 8440 per million population to a low of 130 per million population.¹⁰ Most of the bigger states in the country have already achieved a CSR of > 4000 per million population. The states of Gujarat (8440), Puducherry (7440), Tamil Nadu (5920) Andhra Pradesh (5260), Delhi (5090), Punjab (4950), Maharashtra (4840), Karnataka (4560) and Haryana (4180) have already gone past the recommended norm for Vision 2020: the right to sight.¹⁰ In view of this encouraging performance, it is very likely that the entire country can achieve a CSR of 6000 + per million population by 2020. This increased performance will reduce the prevalence of blindness and severe visual impairment in the country as half the blindness in India is attributable to cataract.¹³

In epidemiologic parlance, a 'true' rate is a proportion and is defined as the presence or absence of a characteristic in a group of people among people who are at risk of developing the particular disease during a specific time period.²² Therefore the denominator should comprise only individuals in the

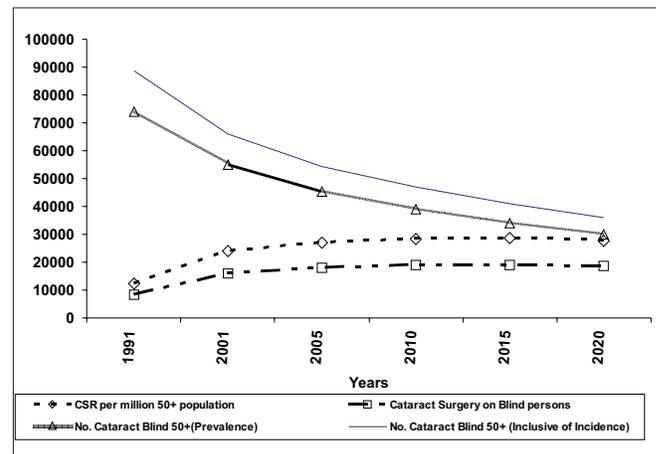


Figure 1: Cataract blindness and surgery projections per million 50+

Table 2: Estimated number of cataract blind in India (2001-2020)

Parameter		2001	2005	2010	2015	2020
Cataract blindness rate	50 - 59 y	1.85	1.62	1.38	1.17	1.00
	60 - 69 y	5.63	4.51	3.42	2.59	1.96
	70+ y	13.30	12.17	10.89	9.74	8.72
Age-specific population	50 - 59 y	64,240,906	80,893,608	94,366,652	110,644,431	129,616,852
	60 - 69 y	47,323,734	51,338,873	59,756,688	70,308,544	83,694,054
	70+ y	29,298,587	30,932,141	38,474,514	48,387,493	60,960,859
No. of cataract blind	50 - 59 y	1,188,457	1,313,976	1,302,772	1,298,244	1,292,602
	60 - 69 y	2,664,326	2,314,831	2,041,339	1,819,669	1,641,098
	70+ y	3,896,712	3,763,718	4,188,654	4,713,340	5,313,014
Population 50+		140,863,227	163,164,622	192,597,854	229,340,468	274,271,765
No. of cataract blind 50+ (Prevalent cases)		7,749,495	7,390,301	7,535,813	7,828,473	8,252,359
No. cat blind 50+ (Preval+ Incidence)		9,299,394	8,868,361	9,042,976	9,394,168	9,902,831
Cataract blindness rate 50+		5.50	4.53	3.91	3.41	3.01

Table 3: Projected estimates of cataract blindness and cataract surgical rate over the period 1989-2020

Population estimates (adjusted for prevailing mortality)	% 50+	Estimated 50+ population (adjusted for prevailing mortality)	Prevalence cataract blind 50+ (%)	Estimated cataract blind 50+	Cataract blind / mil 50+ (Prev)	Cataract blind / mil 50+ (Prev+ Incidence)	No cataract surgeries	CSR/ million total population	No. catops \geq 50 years (90% of all surgery)	CSR/ mil 50+
838,568,000 ^a	13 ^a	109,013,840	7.40	8,067,024	74,000	88,800	1,512,000	1,803	1,360,800	12483
1,027,015,247 ^a	13.7 ^a	140,701,089	5.50	7,749,495	55,078	66,094	3,756,000	3,657	3,380,400	24025
1,093,563,426 ^b	15.3 ^b	163,164,622	4.53	7,390,301	45,294	54,353	4,905,619	4,486	4,415,057	27059
1,184,090,490 ^b	16.4 ^b	192,597,854	3.91	7,535,813	39,127	46,952	6,096,125	5,148	5,486,513	28487
1,273,629,594 ^b	17.9 ^b	229,340,468	3.41	7,828,473	34,135	40,962	7,286,631	5,721	6,557,968	28595
1,362,053,154 ^b	20.2 ^b	274,271,765	3.01	8,252,359	30,088	36,106	8,477,137	6,224	7,629,423	27817

^a-Census of India data; ^b-US Census Bureau estimates; Mortality adjusted population projections

population who are at risk of developing the disease. In such a case, the denominator of the general population is not appropriate for defining CSR as the younger population would not be at risk of age-related cataract. It is therefore recommended that since most blinding cataract occurs after the age of 50 years, the denominator for CSR should consist only of the 50+ population.

If CSR per million 50+ population is considered, then by 2020, elimination of avoidable blindness due to cataract does not seem to be possible [Table 2]. In addition, if the incidence of new cataract blind individuals is added to the prevalent cases, it appears that India would be a long way off from eliminating avoidable blindness due to cataract by 2020 [Figure 1].

If 30% continue to remain blind after cataract surgery, then the CSR/ million 50+ will need to increase by a third at different time periods.

The situation gets compounded further if in addition to the above parameters, sight restoration is considered, and only 60% of all cataract surgeries are done on the blind, then the elimination of avoidable blindness due to cataract appears to be a dream in India unless a significant proportion of the 50+ have been 'prevented' from going blind by operating at better visual acuity [Figure 1] and by ensuring a better postoperative outcome.

Cataract surgical coverage (CSC) is an efficient indicator for planning as it provides information on what proportion of those needing surgery have been covered and therefore is a good indicator of the work remaining. However, CSC needs population-based surveys to provide information which is not easily available as against CSR which is most readily available. It is difficult to say if there is any over-reporting in cataract surgery when information is compiled at the national level. For the present study, it has been assumed that this is a reasonably accurate description of the existing situation.

In our opinion, it is important to look at what proportion of cataract surgeries actually lead to a decrease in blind people (presenting vision < 20/200 in the better eye) after surgery compared to their preoperative status. Other researchers also consider that monitoring sight restoration rate is very important for planning at the national level.^{24,26} This is important because the Vision 2020: the right to sight approach is targeted towards the bilaterally blind. Surgeries on people who have a presenting vision better than 20/200, surgeries on the second eyes, and surgeries on the unilaterally blind would not help in restoring vision though they have a role in preventing future blindness and should not be accounted for when monitoring progress towards the goal of elimination of avoidable blindness due to cataract. For the immediate future when a significant proportion of the 50+ are blind, the first priority should be given to restoring vision to those already blind. Therefore, it would be more meaningful to monitor sight restoration in addition to CSR/ million population and CSR/ million 50+ population to monitor progress towards Vision 2020. Recent evidence in India suggests that the visual outcomes after cataract surgery are not very good in some regions wherein the operated people continue to remain blind after surgery. Poor visual outcome has been reported in 15-25% of eyes following cataract surgery.²³ A study in southern India reported poor or very poor visual outcome after cataract surgery in 51.9% of the operated eyes.²⁷

Another study in northern India showed that one-third of the eyes which had a preoperative vision of less than 20/200 continued to have vision less than 20/200 with best correction after cataract surgery.²⁸ A study in Mysore, India, demonstrated that more than one-third were blind in the operated eye.²⁹ Improving the quality of surgery is a major input that needs to be emphasized now that the quantity of surgery has been increased. This along with improved SRR will be more effective in eliminating cataract blindness.

The projections have been made using a simple dynamic model using Microsoft Excel software considering assumptions as mentioned. If the assumptions change, then the projections would also change. Age-specific mortality has been used to project future population in different age cohorts and it is assumed that most of the surgical patterns and outcomes will remain constant to a large extent.

Most literature concentrates on the prevalence of cataract blindness in projecting future trends. However it is also important to consider the newly blinded individuals (incident cases of cataract blindness) as they would also need to be treated. The backlog of cataract blindness can be tackled effectively only if the incident cases are also accounted for. Unfortunately, estimates of incidence of cataract blindness are difficult to obtain because of the long duration of the disease and the uncertainty of the pace of progression to blindness in cataract. Conventionally, it has been stated that the incidence of cataract blindness is 20% of prevalence.^{30,31} Studies in South Africa and India have documented that the incidence ranges between 23-30% of prevalence.^{9,32,33} Assuming that the incidence of newly blinded cataract is 20%, it appears that the present number of cataract surgeries need to be scaled up significantly if the elimination of avoidable cataract blindness is to be a reality by 2020. It needs to be emphasized that outcome measures like CSR and CSR 50+, by themselves are inadequate to describe the benefit to the operated individuals and their quality of life. More widespread use of indicators like SRR and developing sensitive indicators for assessment of visual function after surgery should be effectively used in the future. At the same time, other causes of avoidable blindness need to be given adequate attention. Even if we get a handle on cataract blindness, we are actually at the beginning and not the end of the process.

As may be evident, this study faces a few limitations. About 10% of the cataract surgeries are done on patients <50 years of age and this trend may increase with increased incidence of diabetes, increase in posterior subcapsular cataract and improved phacoemulsification surgery penetration in India. More number of people would be operated upon sooner than they are today. Data from three surveys conducted in India have been used in this study. Different methodologies were used in these surveys, and any inappropriate estimation in these surveys could affect the comparability of their findings in this study. The CSR and SRR suffer from the fact that they are based on reported figures whose validity or accuracy cannot be scrutinized. Some program managers suggest that the incidence of cataract in India has been overestimated.³⁴ If this is true, it may be easier to achieve the targets for elimination of avoidable blindness due to cataract in India as would improving visual outcomes after cataract surgery which is eminently feasible in the immediate future.

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