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ORIGINAL ARTICLE

Changing Scenario of Cataract Blindness in Kolar District, Karnataka, South India. The Utility of Rapid Assessment of Avoidable Blindness in Reviewing Programs

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ABSTRACT

Purpose: To estimate the prevalence and causes of blindness in persons aged 50 years and over in Kolar district, India, using rapid assessment of avoidable blindness (RAAB) methodology and compare results with a similar study done in 1995.

Methodology: A total of 61 clusters of 50 people aged 50 years and over were selected by probability proportional to size sampling. Households were selected by compact segment sampling. Participants were evaluated using standard RAAB methodology.

Results: Of 3050 people visited, 2907 were examined (95.3%). Prevalence of bilateral blindness (visual acuity, VA, <3/60 in the better eye with available correction) was 3.9%, and severe visual impairment (SVI; VA <6/60 – 3/60 in the better eye with available correction) was 3.5%. Untreated cataract was the leading cause of blindness (74.6%) and SVI (73.3%). Compared with the previous study, results showed a significant drop in prevalence of blindness from all causes from 8.0% to 3.9% ($p < 0.001$). Prevalence of cataract blindness (VA <3/60) had also decreased. Cataract surgical coverage (CSC) showed a significant increase from the previous survey (46.2% to 81.7%).

Conclusion: Rapid assessments conducted once in 8–10 years at a district level, give reliable estimates on the prevalence of blindness and help monitor planning and implementation of eye care programs. Despite a turnaround in Kolar district seen over the last 16 years, with a decrease in the prevalence of blindness and increased CSC, untreated cataract continues to be the leading cause of blindness, warranting sustained service delivery efforts and careful planning.

Keywords: Cataract blindness, cluster sampling, healthcare programs, Kolar, rapid assessment

INTRODUCTION

Cataract accounts for 50–80% of bilateral blindness in India.[1] India was the first country to prioritize blindness control by launching the National Programme for Control of Blindness.[2] The World Bank assisted cataract blindness control project was launched in seven states in 1994.[3,4] Vision 2020: The Right to Sight was launched globally in 1999, and in India in 2001, as a joint initiative of the World Health Organization and the International Association for the Prevention of Blindness with the primary aim of eliminating avoidable blindness by 2020.[5] With the concerted efforts of various agencies, the number of cataract surgeries in India has increased from 1.2 million/year in the late 1980s and early 1990s to

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TABLE 1. Comparison of Indian demographics in 1995 and 2011.

Age group, years	1995 Total population (in millions)	1995 %	2011 Total population (in millions)	2011 %	Net increase in total population (in millions)
0–14	327.3	34.4	352.8	29.6	25.5
15–64	586.1	61.5	771.4	64.9	185.3
≥65	38.6	4.1	64.8	5.5	26.2

TABLE 2. Comparison of the populations of Kolar and Chikkaballapur districts.

	Kolar			Chikkaballapur		
	Rural	Urban	Total	Rural	Urban	Total
Male, *n*	536,486	242,915	779,401	496,413	141,091	637,504
Female, *n*	520,467	240,363	760,830	478,775	138,098	616,873
Total population, *n*	1,056,953	483,278	1,540,231	975,188	279,189	1,254,377
Average annual exponential growth rate for 2001–2011		1.05			0.88	
Proportion of total population of Karnataka, %		2.52			2.05	

around 6 million/year by 2010–2011.[6,7,20] At the same time, the population aged 65+ years, which constituted around 4% of the total population in 1995, rose to 5.5% in 2011 (Table 1).[17,18]

Population-based surveys have guided programming, implementation and monitoring of various eye care programs. Rapid assessment of cataract surgical services (RACSS) is a simple, rapid and easy technique which provides estimates of the prevalence of cataract blindness, cataract surgical coverage (CSC) and post-operative visual outcomes. With attention now on prevention of all causes of avoidable blindness rather than just cataract, the RACSS has been suitably modified to a more comprehensive technique; the rapid assessment of avoidable blindness (RAAB), which has now found universal acceptance and is being undertaken in many countries worldwide.[2,9–13]

In India, the district forms the nucleus for implementation of health programs, with the average population of each district being around 2 million.[8] District-level surveys assess local needs and trends and offer data, based on which health care services can be planned. Rapid assessment techniques which are quick and easy to conduct can provide much needed data for such district level planning. Also, such techniques conducted every 8–10 years indicate trends in prevalence and coverage, and facilitate effective monitoring.[3]

Karnataka was the first state in India where RACSS was carried out in 1995. Subsequently, all districts in Gujarat in Western India were surveyed in 1996. In 1998, rapid assessments were carried out in the seven states covered under the World Bank assistance project. Similar surveys were carried out in other states in 2002 and 2004.[4] Aside from generating evidence for program planning, RAAB performed at frequent intervals provide good estimates of the magnitude of blindness, indicate changing trends, and serve as a good service indicator.

Characteristics of the study area are shown in Table 2.[17] In 1995, the population of old Kolar district, Karnataka, was around 2.3 million. Later, it was divided into Kolar and Chikkaballapur districts. We conducted a RAAB in the new Kolar district entity, and in this article we discuss the changes that have taken place regarding prevalence of cataract blindness, CSC and barriers to the uptake of surgical services in Kolar district over the last 16 years. Since the RAAB methodology is an extension of the RACSS methodology, the results of the two surveys can be compared using the same definitions of presenting visual acuity, and conclusions drawn.

MATERIALS AND METHODS

The survey was carried out by a team consisting of trained personnel from the departments of Ophthalmology and Community Medicine, Sri Devaraj Urs Medical College, Kolar, between March and June 2011, in accordance with the Declaration of Helsinki. Ethics approval was provided by the ethics committee of Sri Devaraj Urs Medical College. Written informed consent was obtained from all study

participants, after explaining the purpose of the study in their local language.

Sample size was determined using a prevalence estimate of 4% for blindness among those aged 50 years and over (based on RAAB studies in the region and country). Using 95% confidence intervals (CIs), 22.5% precision, design effect of 1.5 and a 10% non-response rate, sample size was calculated to be 3017, which would require 61 clusters of 50 people aged 50 years and over. Clusters were then selected using the probability proportional to size method. Households within each cluster were selected by compact segment sampling and all eligible participants enumerated. A map of the selected cluster was drawn and divided into equal population segments to give 50 people aged 50 years and over. Segments were numbered and one segment was chosen by draw of lots and another as a backup in case the requisite number of participants was not found in the selected segment.

Standard RAAB protocol was used for gathering information and for eye examination.[14] A survey form comprising seven sections was filled in for each participant. Visual acuity (VA) was measured using a tumbling Snellen E chart using optotype size 6/18 on one side and 6/60 on the other. All measurements were taken in full daylight with available correction. If VA was <6/18 in either eye, pinhole vision was tested. An ocular examination was performed by an ophthalmologist on each participant inside their respective households. Lens status was assessed by a bright torchlight or distant direct ophthalmoscopy. If presenting vision was <6/18, then the pupil was dilated and ophthalmoscopy done to assess the cause of visual impairment. People with unilateral or bilateral cataract were asked about the reasons for not having undergone surgery, using the questionnaire included in the survey form. Those who had undergone cataract surgery were asked about the surgical experience.

Double data entry and analysis was done using the RAAB software program version 4.02 (International Centre for Eye Health, London, UK). To check for errors made during data entry of the survey record forms, data were entered twice by different data entry clerks in two separate databases and then compared.[14] Any variations were indicated and corrected at the data entry level.

RESULTS

A total of 3050 persons aged 50 years and over were visited, and of these 2907 (95.3%) were examined. Of these, 1360 (47%) were male and 1547 (53%) female. Table 3 shows demographic data of persons enumerated and those who were examined. District and sample populations are compared in Table 4.

The prevalence of blindness (VA <3/60 in the better eye with available correction) from all causes in persons aged 50 years and over was 3.9%, and severe visual impairment (SVI; VA <6/60 – 3/60 in the better eye with available correction) was 3.5%. (Table 5). The age- and sex-adjusted prevalence of blindness was 3.4%, and SVI was 3.1% (Table 6).

Prevalence of bilateral cataract blindness (VA <3/60) in persons aged 50 years and over was 2.5% (Table 7). For VA <6/60, the prevalence of bilateral cataract was 4.8%.

CSC in persons was 81.7%, where males had greater use of surgical services (84.6%) than females (79.7%, Table 9). CSC for eyes was 69.6%, with males being more represented (72.1%) than females (67.8%). Of 707 eyes which had received surgery, 641 (90.7%) had an intra-ocular lens (IOL) implanted. Among patients with an IOL, 72.7% had VA ≥6/18 with available correction, which improved to 82.2% with best correction (Tables 10 & 11). An average of 8.3% of persons 50 years and over had undergone surgery in both eyes, and 7.7% in a single eye (Table 12). For all patients with surgery, 65.9% had first eye surgery, and 34.1% had second eye surgery.

Participants with unilateral or bilateral cataract were asked about the reasons for not having had the surgery performed and the main barriers were

TABLE 3. Comparison of proportion of response in the two surveys.

	1995			2011		
	Eligible, *n*	Examined, *n*	%	Eligible, *n*	Examined, *n*	%
Male	563	504	89.5	1440	1360	94.4
Female	795	766	96.4	1610	1547	96.1
Total	1358	1270	93.5	3050	2907	95.3

TABLE 4. Composition of district and sample population (2011).

Age group, years	Male				Female			
	District, *n*	%	Sample, *n*	%	District, *n*	%	Sample, *n*	%
50–59	55,340	50.7	550	40.4	54,016	48.6	634	41.0
60–69	33,520	30.7	481	35.4	35,791	32.2	552	35.7
70–79	17,153	15.7	263	19.3	18,273	16.5	275	17.8
80	3120	2.9	66	4.9	3,041	2.7	86	5.6

TABLE 5. Comparison of sample prevalence of all blindness in persons aged ≥50 years (visual acuity <3/60 with available correction).

	1995			2011			
	Examined, *n*	Blind, *n*	%	Examined, *n*	Blind, *n*	%	95% CI
Male	504	39	7.7	1360	39	2.9	1.68–4.06
Female	766	63	8.2	1547	75	4.8	3.29–6.41
Total	1270	102	8.0	2907	114	3.9	2.74–5.1

CI, confidence interval

TABLE 6. Comparison of age- and sex-adjusted prevalence of blindness by persons and eyes, 1995 and 2011.

		1995		2011		
	Sex	*n*	%	*n*	%	95% CI
Bilateral blind	Male	11,016	6.2	2571	2.4	1.15–3.55
	Female	13,320	8.3	4798	4.3	2.76–5.88
	Total	24,336	7.2	7369	3.4	2.17–4.53
Cataract blind	Male	9122	5.1	1613	1.5	0.68–2.28
	Female	10,248	6.4	3163	2.9	1.61–4.09
	Total	19,370	5.7	4776	2.2	1.31–3.03
Cataract blind eyes	Male	34,622	9.7	9531	4.4	3.28–5.46
	Female	37,781	11.7	15,956	7.2	5.78–8.58
	Total	72,403	10.6	25,487	5.8	4.78–6.8
Pseudo(aphakic) eyes	Male	11,543	3.2	19,883	9.1	7.0–11.2
	Female	9054	2.8	25,925	11.7	9.3–14.04
	Total	20,597	3.0	45,809	10.4	8.48–12.32

CI, confidence interval

TABLE 7. Comparison of sample prevalence of cataract blindness in persons aged ≥50 years (visual acuity <3/60).

	1995			2011			
	Examined, *n*	Blind, *n*	%	Examined, *n*	Blind, *n*	%	95% CI
Male	504	32	6.3	1360	25	1.8	1.04–2.64
Female	766	47	6.1	1547	48	3.1	1.87–4.34
Total	1270	79	6.2	2907	73	2.5	1.65–3.37

CI, confidence interval

TABLE 8. Comparison of prevalence of cataract blind eyes in persons aged ≥50 years (visual acuity <3/60).

	1995			2011			
	Examined, *n*	Blind, *n*	%	Examined, *n*	Blind, *n*	%	95% CI
Male	1008	119	11.8	2720	117	4.3	3.21–5.39
Female	1532	179	11.7	3094	192	6.2	4.8–7.61
Total	2540	298	11.7	5814	309	5.3	4.3–6.33

CI, confidence interval

TABLE 9. Comparison of cataract surgical coverage in persons and eyes.

	1995		2011	
	Persons	Eyes	Persons	Eyes
Male	50.0	25.0	84.6	72.1
Female	42.2	19.3	79.7	67.8
Total	46.2	22.1	81.7	69.6

TABLE 10. Post-operative visual acuity with available correction (2011).

	IOL		Non-IOL		Total	
Visual acuity	Eyes	%	Eyes	%	Eyes	%
≥6/18	466	72.7	7	10.6	473	66.9
<6/18 but ≥6/60	105	16.4	1	1.5	106	15.0
<6/60	70	10.9	58	87.9	128	18.1

IOL, intraocular lens

TABLE 11. Post-operative visual acuity with best correction (2011).

	IOL		Non-IOL		Total	
Visual acuity	Eyes	%	Eyes	%	Eyes	%
≥6/18	527	82.2	36	54.5	563	79.6
<6/18 but ≥6/60	55	8.6	1	1.5	56	7.9
<6/60	59	9.2	29	43.9	88	12.4

IOL, intraocular lens

TABLE 12. Sample prevalence of (pseudo)aphakia (2011).

	Male		Female		Total	
	n	%	*n*	%	*n*	%
Bilateral (pseudo)aphakia	101	7.4	140	9.1	241	8.3
Unilateral (pseudo)aphakia	100	7.4	125	8.1	225	7.7
(Pseudo)aphakic eyes	302	11.1	405	13.1	707	12.2

"waiting for maturity (of cataract)" and "no one to accompany them" (Figure 1).

DISCUSSION

Cataract continues to be the single largest cause of blindness in India. Large scale surveys can provide estimates regarding the magnitude of blindness, but they are expensive and time consuming. Also, prevalence and causes of blindness as well as surgical services vary from region to region due to variations in the socioeconomic conditions of the population.[3]

Here, we discuss the changes that have taken place in cataract prevalence and surgical services over the past 16 years. As can be seen in Table 3, the response rate was quite good showing a slight increase in the second survey. The current survey also had a greater proportion of females examined, similar to other RAAB surveys.[2,5,10,11]

The greatest turnaround and impact of program implementation can be seen in the prevalence of blindness from all causes which dropped from 8.0% to 3.9% (Table 5). The change in prevalence of blindness from all causes was found to be very highly significant for males ($p<0.001$) and highly significant for females ($p<0.01$). The prevalence of cataract blindness (VA <3/60) also showed a decreasing trend (Tables 7 and 8), found to be very highly significant ($p<0.001$) for both males and females. This decreasing trend is very encouraging considering increasing life expectancy. It would appear that any reduction in the proportion of blindness in persons 50 years and over can be directly attributed to the success of the blindness control programs achieved through World Bank funding, decentralization, intense training, and surgical outcome monitoring.[4]

CSC showed a significant increase over the previous survey with 81.7% of people having at least one eye operated on among those having VA <3/60 and who were blind due to cataract (Table 9). This increase in CSC (in persons) seen in the 2011 survey was found to be very highly significant ($p<0.001$). This increased CSC is mainly due to the coordinated efforts of the governmental, non-governmental (NGO) and private institutions which have taken up the task of reducing the burden of cataract blindness by widespread outreach cataract screening, and providing surgery to the needy at the respective hospitals/institutions. In our opinion better health care program implementation through the decentralized approach involving all major stakeholders including sharing of service delivery information in Kolar district could be one of the key factors for this increased CSC compared to the previous survey.

Since its inception, The National Programme for Control of Blindness has been constantly trying to focus on improving the cataract surgical rate and coverage in India. The program has been able to deliver effective eye care services through successful and vibrant public private partnerships (PPPs) through a decentralized mode under state/district health societies of the National Rural Health Mission (NRHM).[19] These PPPs are the key to future eye care planning programs and implementation. One more reason for the increased CSC could be the increased awareness in patients about cataract and the available resources for its management. This is likely due to the extensive health awareness and education

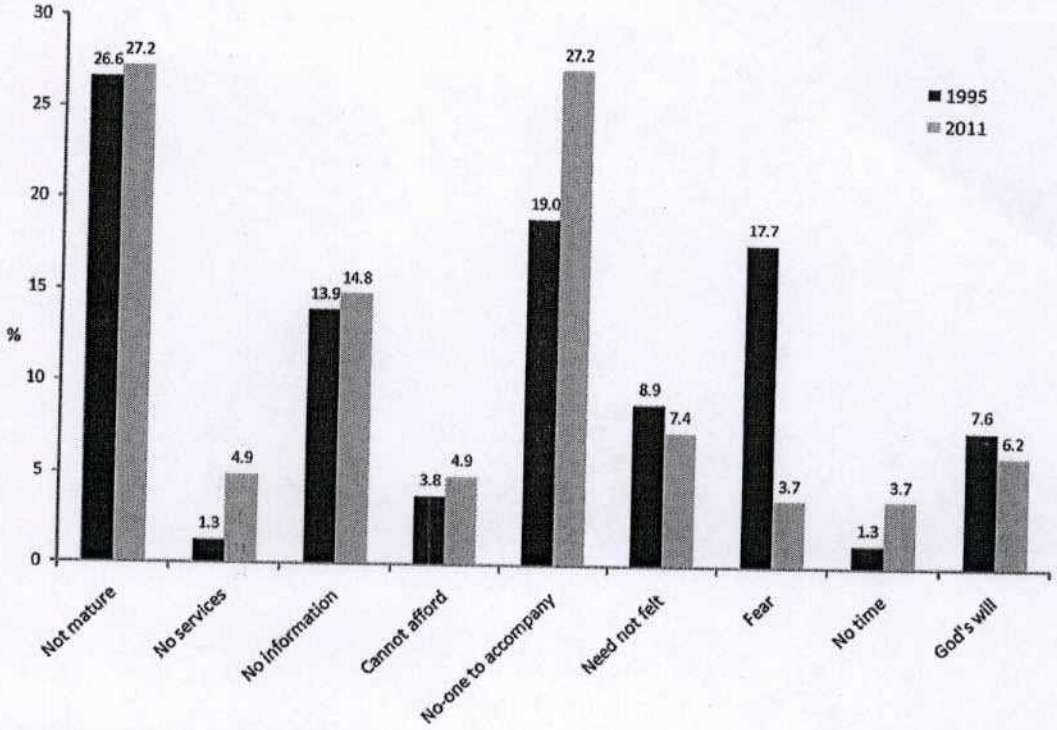

FIGURE 1. Barriers to uptake of cataract surgery.

campaigns in this region, which could still be further boosted.

CSR, which quantifies the delivery of cataract services in a country, is a good indicator of how well a country is organizing its efforts and achieving targets in its mission of tackling cataract-related blindness. Professional interest, technological upgrading of skills, and availability of affordable equipment and intraocular lenses coupled with increased surgical manpower, have all contributed to the increase in cataract surgery in India. The state of Karnataka with a CSR of 4560 per million population has gone past the recommended norm for Vision 2020.[1] This is also reflected in the estimated number of persons with cataract coming down from a high of 19,370 in 1995 to 4776 in the present study (Table 6).

The most common barriers to the uptake of cataract surgical services in our study were "waiting for maturity (of cataract)" and "no one to accompany them" (Figure 1). This trend is very similar to the previous survey wherein the most common barrier was again "(cataract) not mature" and "no one to accompany them". This indicates that even though there has been greater penetration into the rural areas of detection and treatment of cataract, those blind with cataract still have a barrier in the form of no escort to accompany them to the nearest hospital. This can only be alleviated by increased outreach services to the remote rural areas and proper education about the facilities that exist. The problem of waiting for cataract maturity is an indirect indicator of service deficiency.[15] It also, in our opinion, demonstrates that the barrier is more provider-driven than beneficiary-driven. Despite the drastic increase in CSC, some people with mild to moderate cataract may be asked to wait in preference of people with relatively dense cataract. Such people once turned back are unlikely to return because of reasons such as lack of funds for conveyance to the hospital, loss of daily wages during the visit to the hospital and relative lack of knowledge about when to return. Such patients are likely to remain blind due to various other personal commitments also. Thus increasing the quantity of surgical output without compromising the quality of surgery is the only answer to reduce this barrier. Another recent observation has been the suggestion that conducting eye camps at the same place/location by the same hospital/institution helps increase the trust among patients and is a major factor in reducing the barrier to use of cataract surgical services.[16]

In conclusion, rapid assessments conducted once every 8–10 years at the district level give reliable estimates on the prevalence of blindness and help monitor planning and implementation of eye care programs. Such rapid assessments also help develop student capacity as well as expose them to scientific survey methods of generating evidence for planning of eye care services. Despite a turnaround in Kolar district seen over the last 16 years, with a decrease in the prevalence of blindness and increase in CSC, untreated cataract continues to be the leading cause

of blindness. Augmenting outreach programs and addressing local needs by efficient distribution of information and increased education will help reduce the burden of cataract blindness.

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.
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