Prevalence, causes of blindness, visual impairment and cataract surgical services in Sindhudurg district on the western coastal strip of India

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Background: Konkan coast of India is geographically distinct and its pattern of blindness has never been mapped. **Aim**: To study the prevalence and causes of blindness and cataract surgical services in Sindhudurg district of West Coast. **Subjects**: Individual aged > 50 years. **Materials and Methods:** Rapid assessment of avoidable blindness used to map blindness pattern in the district. Statistical analysis: SPSS version 19. **Results:** Amongst those examined 1415 (51.7%) had visual acuity (VA) >20/60, 924 (33.8%, confidence interval (C.I) 30.5%-36.8%) had VA 20/200-<20/60(visual impairment), 266 (9.7%, C.I. 6.1%-13.3%) had VA < 20/200-20/400 (severe visual impairment) and 132 (4.8%, C. I. 1.1%-8.5%) had VA < 20/400 (blindness by WHO standards). There was no significant gender difference in prevalence of blindness, but blindness and visual impairment was more in older and rural residing individuals. Amongst those with presenting vision < 20/200 in better eye, 309 (82.4%) had cataract, 36 (9.7%) had corneal scars, 13 (3.5%) had diabetic retinopathyand 3 (0.8%) had glaucoma. Cataract surgical coverage for the district was only 30.5%; 32% for males and 28.4% for females. Unable to afford, lack of knowledge and lack of access to services were the commonest barriers responsible for cataract patients not seeking care. Amongst those who had undergone cataract surgery, only 50% had visual acuity ≥ 20/60.46.9% of the population had spectacles for near, but only 53.3% of the population had presenting near vision < N10. **Conclusion**: Cataract, refractive errors and diabetes were significant causes of visual impairment and blindness.

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The past two decades have seen tremendous improvement in eye care services in India.[1,2]There have been large surveys looking at the prevalence and causes of blindness across different states in the country.[3]but they had data from a single district in each state and there are vast differences amongst the populace and services amongst the large states like Maharashtra and within districts as well. There is a need for disaggregated data at the district level for planning. Sindhudurg, nestled in the south Konkan region, the western coastal strip, has long been a neglected backwater.[4] It is one of the few districts in the country to have a positive gender ratio, partly due to egalitarian ethos and partly due to out-migration of men for economic opportunities.[5] Bordering Goa in the south, the region has long been economically underdeveloped with few eye care service providers. This survey was planned to help anon-profit organization assess need for eye care services in an area considered underserved but not evidenced and to help set up a secondary eye care centre in order to contribute to the broad objective of 'VISION 2020: The Right to Sight'.

The Rapid Assessment of Avoidable Blindness (RAAB) has been developed as a simple and rapid survey methodology that can provide data on the prevalence and causes of blindness.[6,7]RAAB surveys have been conducted in several countries and given useful information for planning for blindness prevention and control.[3,8-12] The main aims of this study were to estimate the prevalence and causes of avoidable blindness and visual impairment in people aged 50 and above; to assess cataract surgical coverage; to identify the main barriers to the uptake of cataract surgery, to measure outcome after cataract surgery and collect data on presbyopia services.

Materials and Methods

The extended RAAB methodology was used to collect data.[6,7] As prevalence of blindness is very low in individuals aged < 50 years, only those aged > 50 years were included in the study.[7] The entire population of the district was enumerated using village and town-wise tables from the district authorities. Permission was sought and obtained from the ethical committee of the institution.

Stratified cluster random sampling was used for the survey. The sampling universe consisted of all those who were living in the district (staying in the village/town for at least the previous six m). The following parameters were considered for calculating the sample size: Estimated prevalence of blindness, the estimated prevalence of avoidable blindness, power of 80%, 20% relative précision, 95% Confidence Interval and a design effect of 1.5 (maximum for clustering effects). The minimum acceptable prévalence was considered as 6.6% from previous studies.[3]Based on these criteria of stratified cluster random sampling, 2500 individuals aged 50 + were needed to be examined in the district. Clusters of 50 people who were 50 years and above were selected with probability proportionate to size using a multistage cluster random

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sampling method.A total of 55 clusters (49 rural and 6 urban) were covered, 50 individuals aged > 50 years were examined in each cluster. A total of 2750 subjects were to be examined.

Two teams of ophthalmologist, ophthalmic assistants, social workers and a manager were trained for data collection and management. A separate session was conducted for their standardization and acceptable agreement as per the RAAB details.We looked at the inter-observer variation between teams and this was done for visual acuity presenting, pin hole and lens examination and all of them were > 60%.

An Early treatment diabetic retinopathy study (ETDRS) cut out chart with E Optotypes was used for recording vision. The top row of E's corresponded to 20/60 equivalent of Snellen's charts, while the E's on the bottom row correspond to 20/200 on the Snellen's charts at 4 metres. A person had to correctly identify at least four out of five E's of one line to be considered as normal vision at that line. Vision was first recorded with the habitual correction that the person was wearing (presenting vision) and it was recorded whether the person is using glasses or not. The initial vision examination was done at home. If vision was <20/60, the pinhole vision was recorded. All individuals with vision <20/60 were examined at a central site, as were all cataract operated (either eye) individuals irrespective of their vision. At the central examination site/clinic, visual acuity was re-checked and an external eye examination was performed using a hand held slit-lamp by one of the two ophthalmologists. Lens status was recorded and also all probable pathology. The most probable cause of visual impairment in each eye was identified. In identifying the probable cause, the currently more treatable/preventable cause was given higher rank in the hierarchy of causes compared to an untreatable cause. The most important cause of blindness in the person was identified by comparing the cause in the right and left eye for the bilaterally blind. If on torch light and slit lamp examination, a diagnosis of uncorrected refractive error, cataract, uncorrected aphakia, corneal scar, phthisis or globe abnormality could not be made, then the pupil was dilated by using 1% Tropicamide and the fundus examined with direct ophthalmoscope.

A person was defined as blind by WHO standards if the best corrected visual acuity (BCVA) in the better eye was <20/400. If a person had BCVA <20/200 to 20/400, the visual disability was considered as severe visual impairment (SVI) by WHO standards but still blind by Indian standard. Moderate visual impairment (MVI) was defined as the BCVA between <20/60 and 20/200. These definitions were to measure prevalence with presenting vision and with the best correction. If vision improved to <20/60 with pin hole, the cause of visual disability was considered to be refractive error. Cataract impairing the vision in an eye was defined as having cataract as underlying cause of visual disability. In the absence of any other obvious cause, presence of significant pallor, cup: disc (C: D) ratio > 0.6, pigment changes and other signs such as iridectomy/blebs and C: D asymmetry of >0.2 between the two eyes were used to define glaucoma. A person with sight threatening diabetic retinopathy was considered to have visual disability due to diabetes. In the presence of macular scar, drusen at macula, geographic atrophy, a person was categorized as having age-related macular degeneration. All persons in need of medical or surgical eye care were referred to the new secondary centre set up at Kankavli in the same district.

Information about previous cataract surgery, satisfaction with surgery and barriers to cataract surgery were collected. The respondent's near vision was recorded, with specs if they had one on them and without them for all others.

The cataract surgical coverage of people was defined as the proportion of people having undergone cataract surgery amongst those who have had cataract.[13]

The data was collected and entered in RAAB India software. Analysis was done by excel and SPSS version 19.

Results

Of the 2750 selected subjects aged ≥50 years, 2747 were interviewed but 10 did not allow their vision to be measured and the eye examined. Table 1 shows the composition of population examined in survey area by gender. There was no statistically significant difference between age and gender (P = 0.061). However; in the age group 50-59yrs and 60-69 yrs females were predominant and in older age groups males were predominant.

Amongst those examined (2737individuals), 1415 (51.7%) had visual acuity (VA) >20/60, 924 (33.8%) had VA 20/200-<20/60 (visual impairment), 266 (9.7%) had VA <20/200-20/400 (severe visual impairment) and 132 (4.8%) had VA <20/400 (blindness by WHO standards). Table 2 demonstrates the unadjusted prevalence of visual impairment and blindness amongst the populace. Amongst the rural population, 121 (5%) were blind, 358 (14.9%) severely visually impaired and 1187 (49.4%) had visual acuity <20/60; while amongst the urban population, 11 (3.2%) were blind, 40 (11.6%) severely visually impaired and 135 (39.1%) had visual acuity <20/60. The prevalence of blindness amongst males was 5.4% (95% CI: 1.0 – 8.5) and femaleswas4.2% (95% CI: 0.7 - 7.6). Out of these, prevalence of blindness in age group between 50-59 was 2.3% (95% CI: -0.3- 4.9), between 60-69 was 4.8% (95% CI: 1.0 -8.5), 70-79 was 9.8% (95% CI: 4.6-14.9), 80-89 was 20% (95% CI: 13-27), above 90 years of age was 6.7% (95% CI: 2.3-11). The prevalence of blindness in rural population was 5.0% (95%CI: 1.2 - 8.8) and in urban population was 3.2% (95%CI: 0.1- 6.2).The prevalence of blindness by Indian standards (<6/60) amongst males was 132 (9.5%; 95% CI: 5.9 - 13.12) and females was 134 (9.8%; 95% CI: 6.2 - 13.5). Out of these, prevalence of blindness in age group between 50-59 was 2.9% (95% CI: 0.8- 5), between 60-69 was 11.5% (95% CI: 7.6 -15.4), 70-79 was 22% (95% CI: 16.9 -27),80-89 was 20% (95% CI: 19-29), above 90 years of age was 6.7% (95% CI: 30.7- 42.5).The prevalence of blindness in rural population was 9.8% (95% CI: 6.2 - 13.5) and in urban population was 8.4% (95% CI: 5- 11.8)

The various causes of blindness are shown in table 3, amongst those with presenting vision <20/200 in better eye,

Table 1: Age and Sex wise distribution of sample population

Age group	Male	%	Female	%	Total	%
50-59	643	46.4	648	47.7	1291	47.0
60-69	453	32.7	485	35.7	938	34.2
70-79	234	16.9	184	13.5	418	15.2
80-89	41	3.0	29	2.1	70	2.6
90+	16	1.2	14	1.0	30	1.1
Total	1387	100.0	1360	100.0	2747	100.0

Table 2: Prevalence of Blindness and Visual Impairment by presenting visual acuity in individuals>50 years of age

	Bilateral blind (WHO)<20/400 better eye			SVI (Blind by Indian def)<20/200 better eye			Visual impairment<20/60 in better eye			Total
	Population	%	95% CI	#	%	95% CI	#	%	95% CI	
Sindhudurg	132	4.8	(1.08, 8.53)	266	9.7	(6.06, 13.31)	924	33.6	(30.53, 36.75)	2747
Male	75	5.4	(1.47, 9.34)	132	9.5	(5.92, 13.12)	327	23.6	(20.78, 26.37)	1387
Female	57	4.2	(0.7, 7.68)	134	9.9	(6.20, 13.51)	597	43.9	(40.63, 47.16)	1360
50-59	30	2.3	(-0.30, 4.95)	38	2.9	(0.87, 5.02)	249	19.3	(16.69, 21.88)	1291
60-69	45	4.8	(1.08, 8.52)	108	11.5	(7.60, 15.43)	443	47.2	(43.94, 50.51)	938
70-79	41	9.8	(4.63, 14.99)	92	22.0	(16.93, 27.09)	206	49.3	(45.99, 52.57)	418
80-89	14	20.0	(13.04, 26.96)	17	24.3	(19.03, 29.54)	23	32.9	(29.77, 35.95)	70
90+	2	6.7	(2.32, 11.01)	11	36.7	(30.76, 42.58)	3	10.0	(8.03, 11.97)	30
Rural	121	5.0	(1.23, 8.84)	237	9.9	(6.21, 13.52)	829	34.5	(31.38, 37.64)	2402
Urban	11	3.2	(0.13, 6.25)	29	8.4	(5.00, 11.81)	95	27.5	(24.60, 30.48)	345

WHO: World health organization, SVI: Severe visual impairment

Table 3: Causes of Blindness in individuals>50 years of age

Causes of blindness	WHO Blind (<20/400)		SVI (<20/200)	
		%	#	%
Cataract	80	69.0	309	82.4
Phthisis/globe abnormality	3	2.6	3	0.8
Corneal pathology	4	3.5	7	1.97
Glaucoma	2	1.7	3	0.8
Diabetic retinopathy	0	0.0	13	3.5
Other corneal scar	20	17.2	29	7.7
Other post segment	1	0.9	2	0.5
Other	22	16.7	31	7.8
Total	132	100.0	398	100.0

WHO: World Health Organization, SVI: Severe visual impairment

309 (82.4%) had cataract, 13 (3.5%) had diabetic retinopathy, 36 (9.7%) had corneal scars and 31 (7.8%) had other pathology including uncorrected refractive errors.

Of the proportion of cataract surgeries performed 166/582 (28.5%) were performed by government hospitals, 165/582 (28.3%) were by non-governmental organizations (NGO), 249/582 (42.7%) were by private surgeons and 2/582 (0.3%) was eye camp. Cataract surgery was offered free for: 211 (39.8%) out of 530, 319 (60.1%) was paid. In free surgery; 102 (48.3%) out of 211 were male and 109 (51.6%) were female whereas 161 (50.4%) out of 319 were male and 158 (49.5%) were female among the paid surgery. We did not have the details of 52 patients for cost of surgery. No details available for type of cataract surgeries in 14 individuals. Type of surgery: 9/568 (1.5%) were intra-capsular cataract surgery (ICCE); 45 (7.9%)/568 were extra-capsular cataract surgery (ECCE), 50 (8.8%) were ECCE with intra-ocular lens implant (IOL); 464 (81.7%) were manual small incision cataract surgery (SICS) or phacoemulsification with IOL. A vast majority of people who had undergone cataract surgery, 528/582 (90.7%) had received an intraocular lens.

Presenting visual outcome after surgery in aphakia was: >20/60 in 32/54 (59.3%), 20/80- 20/200 in 11/54 (20.4%), visual acuity <20/200-20/400 in 9/54 (16.6%), <20/400-PLPR in 2 (3.7%). In pseudophakics, 259/528 (49%) were >6/18; 199 (37.6%) were 20/80-20/200;visual acuity <20/200-20/400 in 51 (9.6%); <20/400-PLPR in 19 (3.5%).

Table 4 shows the reasons why individuals who had cataract did not seek cataract surgery. Of them 47.7% people not undergoing cataract surgery because of unavailability, no affordability or poor quality of cataract surgery services. The Cataract surgical coverage was 30.8%, 32% for males and 28.4% for females.

652 males and 632 females were found to be having spectacles during the examination (1284/2737, 46.9%).Of these 930 were N6 for near and 153 N8 for near in either of the eyes. Rest 201 had <N10 vision in each eye even if they were wearing specs. 196 of 1453 (13.5%) not wearing spectacles were still having near vision N6 or N8, perhaps due to immature cataract. Thus 1458/2737 (53.3%) had near vision <N10, only 46.7% did not.

Discussion

RAAB Surveys have been conducted in several countries.[3,8-12,14-18] In most of the surveys conducted in or after the year 2004, the prevalence of blindness ranged from 1.10% to 8.6%. In the National Survey done in India in the year 2007, the prevalence of blindness was found to be 3.6% (WHO <20/400), 8% (Indian Std <20/200).[4] In this RAAB, however the prevalence of blindness was found to be 4.8% (WHO <20/400) and 14.5% (Indian Std <20/200). This is comparable to prevalence at Kenya and Oman,[8,19] but much higher than what has been reported in China, East Africa and Bangladesh.[9,12,14,18] This may be due to unavailability of eye care services in the district. Sindhudurg district is geographically secluded, even though it is few hours' drive from Mumbai and is just across a creek from Goa. Table 5 compares the results of this study with RAAB studies world-wide.

Overall, cataract remains the main cause of blindness 82.4%, higher than that reported by the RAAB India study at 77.5%.[3] Recent Indian studies from Karnataka, Maharashtra and Gujarat also put cataract as the leading cause of blindness, accounting for almost three-fourths of the blindness burden

like this study.[23-25] The avoidable causes of blindness like cataract, refractive errors, surgical aphakia, cataract surgery complications, trachoma, causes of corneal scarring and diabetic retinopathy constituted 95.3%, compared to 88.2% in the RAAB India study,[3]again stressing the need for provision of eye care services in the region. But mercifully eye camp surgery had become extinct (<1.5% of all cataract surgeries) though outcomes after cataract surgery still remain a cause for concern.[26]

An alarmingly high prevalence of diabetic retinopathy i.e., 3.5% was recorded. In previous population based studies from India, diabetes was the cause for < 1% blindness.[3,23]India is now being recognized as global capital of diabetes and unlike in past, it has now become the disease of masses. The rural population is also showing a high prevalence of diabetes and thus this may be the first study to demonstrate this fact. This could be because of the centralized examination and more detailed posterior segment examination as opposed to other RAAB methods. There is a need for services to diagnose and treat diabetic retinopathy to be integrated into general medical services. Amongst the 1284 using near vision specs, 201 needed new spectacles for clearer near vision. So if we say 100% have presbyopia, 53.1% need a spectacle as they do not have any, while 201would need a change of lenses. Near vision impairment was common in the populace. The spectacle coverage in Andhra study was 18.8% for presbyopics, 19.9% for females and 18.0% for males.[27] For general refractive error it was 29% in Andhra, it was 46.9% in Sindhudurg.

In this study, both men and women did not show significant difference in prevalence of blindness and visual impairment. The pattern of blindness was also similar in both the genders. In some Indian studies, prevalence of blindness and severe visual impairment (<20/200 in the better eye) was higher among females (9.2%) compared to males (6.5%).[3,28]The Konkan region of which Sindhudurg is a part of has one of the most positive gender ratios in the country with high female literacy rates in spite of relative economic deprivation.[4,5]

Thus 291/582 (50%) subjects failed to have a vision > 20/60 post cataract surgery. This fails to meet the WHO target > 80% of eyes having good vision with available correction. The poor outcome (<20/200) was 81/582 (13.9%) compared to the permissible 5% by WHO norms.[29] Such results do not inculcate great trust in the cataract surgical services. So 13.2% of cataract patients who knew they had cataract but did not feel the need for surgery and another 9.4% had been told by health

Table 4: Barriers to cataract surgeryin individuals>50 years of age

Why cataract surgery not done?	Frequency	Percent
Cannot afford surgery	219	22.1
Unaware of cataract	198	20.0
No need	131	13.2
No one to accompany	125	12.6
Told waitto mature	93	9.4
Old age	43	4.3
Waiting for camp	38	3.8
No time	30	3.0
Surgical service unavailable	30	3.0
Have to travel far	25	2.5
One eye adequate vision	17	1.7
Fear of surgery	11	1.1
Believes it to be fate	9	0.9
Fear of losing eyesight after surgery	6	0.6
Other	17	1.7
Total	992	100.0

Table 5: Comparisons of severe visual impairment and blindness with other studies

Ref	Country	1st Author	Year	Blindness #	Prevalence	Target pop (years)	Sample size	Remark
19	Oman	KhandekarR	2005	WHO/India	6.9, 12	>40 Omani	2,239	National survey
8	Kenya	Mathenge W	2006	WHO	2	>50	3,503	Nakuru District, Rift valley
12	Bangladesh	Wadud Z	2006	WHO	29	>50	4,868	Suthkhira District Only
3	India	Neena J	2007	WHO/India	3.6, 8.0	>50	40,457	9 states, 1 district/state
20	Pakistan	Dineen B	2007	WHO	3.6	>30	16,507	National Survey
15	Cameroon	Oye J	2007	WHO, India	1.1, 1.4	>40	2,215	West Africa
16	Phillipines	Eusebio C	2007	WHO	2.6	>50	2,774	RAAB in Islands
9	Kunming, China	Wu M	2007	WHO	2.7	>50	2,588	RAAB in south China
10	Rawanda	Mathenge W	2007	WHO	1.8	>50	2,250	RAAB in war affected
21	Iceland	Gunnlagsdottir E	2008	WHO, India	0.57, 0.77	>50	1045	Prevalence survey
22	Qatar	Al Gamra H	2009	WHO/India	1.28, 1.67	>=50yrs citizen	2,433	All citizens
14	Jiangxi, China	Xiao B	2010	WHO	1.6	>50	11,394	3 counties
10	Tanzania	Habiyakire C	2010	WHO, India	2.4, 3.4	>50	3436	RAAB in East Africa
17	Palestine	Chiang F	2011	WHO, India	3.4, 5.4	>50	3579	Gaza, West Bank
23	Karnataka, India	Bettadapura GS	2012	WHO, India	3.9, 3.5	>50	2907	Kolar district of Karnataka
24	Maharashtra	Dhake P	2011	India	1.9, 6.7	>50	7281	Tribal north Maharashtra
25	Gujarat, India	Murthy GVS	2010	India	6.9	>50	5158	Tribal belt of Gujarat
This	Maharashtra, India	Patil S	2010	WHO/India	4.8, 9.7	>50	2,747	Western coastal region

WHO blindness definition, <20/400 in better eye for cut-off, Indian blindness definition, <20/200 in better eye for cut-off, WHO: World health organization

care workers to wait for their cataract to 'mature'. Another significant cause was unaware of cataract which could be due the lack of access to eye care services. The Andhra study had cataracts operated in older individuals and those undergoing free surgery as having a poorer outcome as also those operated before 2005 and illiterate individuals.[26] The series from Gujarat had poorer outcomes in older and illiterate individuals.[25]

Unable to afford cataract surgery still remains the principal barrier for its uptake. So the free and subsidized surgical services provided by the government and NGO sector are still the need of the hour. Not having anyone to accompany or having to travel too far were also listed as significant barriers; these underline the need of outreach services to bridge this gap. The cataract surgical coverage was much lower than the state average for Maharashtra, but report from tribal part of Maharashtra had even a lower cataract surgical coverage than our study.[24,30-32]

While the limitations of this study are that it's a rapid assessment and not a prevalence survey. But the study is unique in terms that the pattern in Konkan region had never been mapped, the respondent rate was very high and the near vision data was collected and analyzed. The high prevalence of diabetic retinopathy is an eye opener and should result in further demographical studies.

In conclusion, the study demonstrates that still a lot more has to be done in terms of service delivery for the two common causes of visual impairment-cataract and refractive errors. Gender was not a major barrier in uptake of service but diabetes as a cause of visual impairment and blindness is on the increase. Steps must be taken to make the existing cataract and refractive services more effective and have strategies in place to tackle the newer causes of visual impairment. Sindhudurg, like many neglected backwaters in India needs a government or NGO hospital not only to increase the Cataract Surgery Coverage but will also create awareness about cataract and refractive errors and their correction.

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