WORLD VIEW

Utilisation of eye care services in rural south India: the Aravind Comprehensive Eye Survey

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Aim: To determine utilisation of eye care services in a rural population of southern India aged 40 years or older.

Methods: 5150 subjects aged 40 years and older selected through a random cluster sampling technique from three districts in southern India underwent detailed ocular examinations for vision impairment, blindness, and ocular morbidity. Information regarding previous use of eye care services was collected from this population through a questionnaire administered by trained social workers before ocular examinations.

Results: 3476 (72.7%) of 5150 subjects examined required eye care examinations. 1827 (35.5%) people gave a history of previous eye examinations, primarily from a general hospital (n = 1073, 58.7%). Increasing age and education were associated with increased utilisation of eye care services. Among the 3323 people who had never sought eye care, 912 (27.4%) had felt the need to have an eye examination but did not do so. Only one third of individuals with vision impairment, cataracts, refractive errors, and glaucoma had previously utilised services.

Conclusions: A large proportion of people in a rural population of southern India who require eye care are currently not utilising existing eye care services. Improved strategies to improve uptake of services is required to reduce the huge burden of vision impairment in India.

Approaches to address blindness in India have specifically focused on improving the capacity of eye care programmes and centres to deal with blinding eye diseases.[1] The National Programme for Control of Blindness in India has also adopted disease specific approaches targeting certain highly prevalent eye diseases like cataract.[1 2] Despite efforts by eye care programmes in India, the uptake of services has not been optimal.[3 4] Several barriers to uptake of services have been identified, although the major focus of these studies was on uptake of cataract services.[3 5 6] Attempts to address these barriers have focused on improving services to rural areas, primarily through an outreach approach.[7] Despite reduction in blindness burden achieved through such approaches, there still remains a considerable backlog of people with blindness not receiving appropriate care at the appropriate time.[8] Understanding patterns of eye care service utilisation, especially among rural populations, may help formulate better strategies to reach the underserved.

We previously reported that 4.3% (95% CI: 3.8 to 4.9) of people aged 40 years and over have presenting vision worse than 3/60, and 11.4% (95% CI: 10.6 to 12.3) of people have presenting vision worse than 6/60, from a cross sectional study in a rural population of southern India.[9] Over 70% of subjects improved their vision by at least one line and nearly a third by three lines after refraction.[9] Age related cataract was the most common potentially reversible blinding disorder (72.0%) among eyes presenting with blindness.[9] This paper reports on the utilisation of available eye care services in the same rural population of southern India that has a considerable burden of vision impairment and blindness.

METHODS

The Aravind Comprehensive Eye Survey (ACES) is a population based cross sectional assessment of ocular morbidity and blindness performed during the period between November 1995 and February 1997, among rural residents aged 40 years and above in three districts of southern India. The study design and methodology have been described elsewhere.[9] Briefly, the study population was identified from Madurai, Tirunelveli, and Tuticorin districts of southern India through a stratified systematic random cluster sampling technique. The sampling frame for this study consisted of a sample of typical rural districts provided eye care services by the Aravind Eye Hospitals located in Madurai and Tirunelveli in order to best reflect the rural population in the southern part of India. We selected three districts that were later combined by the government (after selection) into two districts for geographic and administrative reasons. For this reason, villages were sampled from two strata, representing geographic access to two of the Aravind Hospitals (Madurai and Tirunelveli). We selected 14 blocks at random from within these two districts and then 25 villages proportionate to size within these 14 blocks (lists of villages for these blocks were obtained based on data from the 1991 Indian national census). Each village was divided into sectors that would contain approximately 100 people aged 40 and older, and one sector was selected at random from each of the 25 villages in each of the two districts, in order to produce a sample size of 2500 subjects aged 40 and older in each of the two district strata. Villages of less than 350 people were excluded from the list of villages for selection since they would not produce at least 100 subjects aged 40 and older. This was done so as to conserve resources and minimise lengthy travel to very small villages where there would be very few eligible subjects. This sample is representative of rural areas in south India, but not necessarily of urban areas

Abbreviations: ACES, Aravind Comprehensive Eye Survey; ARM, age related maculopathy; CSMO, clinically significant macular oedema; DR, diabetic retinopathy; NPDR, non-proliferative diabetic retinopathy; PACG, primary angle closure glaucoma; POAG, primary open angle glaucoma; PDR, proliferative diabetic retinopathy; PPDR, pre-proliferative diabetic retinopathy; PSC, posterior subcapsular cataract; RPE, retinal pigment epithelium

Table 1 Distribution of people with previous utilisation of eye care services in this population

	Total (n = 5150)	No (%) reporting previous utilisation	Odds ratio (95% CI)*
Age categories			
40–49	2066	599 (29.0)	1.0
50–59	1466	486 (33.1)	1.3 (1.1 to 1.5)
60–69	1201	496 (41.3)	1.6 (1.3 to 1.9)
⩾70	417	246 (49.5)	2.8 (2.1 to 3.6)
Sex			
Female	2836	925 (32.6)	1.0
Male	2314	902 (38.9)	1.0 (0.9 to 1.1)
Education†			
I	2025	652 (32.2)	1.0
II	1860	650 (34.9)	1.4 (1.2 to 1.6)
III	1098	444 (40.4)	2.2 (1.8 to 2.6)
IV	84	56 (66.6)	7.1 (4.4 to 11.4)
V	67	24 (35.8)	1.8 (1.1 to 3.1)
Presenting vision‡			
⩾6/18	2932	887 (30.3)	1.0
6/24–3/60	1761	617 (35.0)	1.2 (1.0 to 1.3)
<3/60	222	177 (79.7)	8.3 (5.8 to 11.9)

*Multivariate adjusted for age, sex, education, and presenting vision.
†I, illiterate; II, up to class 5; III, class 6–10; IV, class 11–12; and V, more than class 12.
‡Presenting vision in the better eye.

in southern India, or of rural or urban areas further north in India. These areas did have access to one of two hospitals in the Aravind system, and this may also make their access to care somewhat better than other rural areas in India.

Subjects aged 40 years and over were subjected to a comprehensive ocular examination at the base hospital that included slit lamp biomicroscopy, lens grading using LOCS III classification,[10] applanation tonometry, gonioscopy, visual fields using automated perimetry and dilated fundus exams with indirect ophthalmoscopy and a 90 dioptre lens for all subjects. Visual acuity was measured using ETDRS charts and refraction was performed for all subjects. All examinations were performed by examiners who were standardised to each other before the start of the study, and at regular intervals during the study period.

Definitions of vision impairment and ocular diseases

Blindness and visual impairment categories were defined based on the guidelines drafted by the World Health Organization.[11] We defined a definite cataract as LOCS III nuclear opalescence ⩾3.0 and/or cortical cataract ⩾3.0 and/or posterior subcapsular cataract (PSC) ⩾2.0. Definite primary open angle glaucoma (POAG) was defined as angles open on gonioscopy, and glaucomatous optic disc changes with matching visual field defects; while ocular hypertension was defined as IOP more than 21 mm Hg without glaucomatous optic disc damage and visual field defects in the presence of an open angle. Manifest primary angle closure glaucoma (PACG) was defined as glaucomatous optic disc damage or glaucomatous visual field defects with anterior chamber angle partly or totally closed, appositional angle closure or synechiae in angle, and absence of signs of secondary angle closure. Secondary glaucoma was defined as glaucomatous optic nerve damage and/or visual field abnormalities suggestive of glaucoma with ocular disorders that contribute to a secondary elevation in IOP. We classified diabetic retinopathy (DR) as non-proliferative DR (NPDR), pre-proliferative DR (PPDR), and proliferative DR (PDR).[12] Non-proliferative DR included levels 1–3, pre-proliferative DR included levels 4 and 5, and proliferative DR included levels 6 and 7. The presence of clinically significant macular oedema (CSMO) was assessed using a 90 dioptre lens at the slit lamp. The presence of retinal photocoagulation scars was assessed using indirect ophthalmoscopy. Age related maculopathy

Table 2 Utilisation of services among people requiring eye care* in our study sample

	Total (n = 3746)	No (%) reporting previous utilisation	Odds ratio (95% CI)†
Age categories			
40–49	986	339 (34.4)	1.0
50–59	1210	416 (34.4)	1.1 (0.9 to 1.4)
60–69	1145	470 (41.1)	1.6 (1.3 to 1.9)
⩾70	405	236 (58.3)	3.2 (2.5 to 4.1)
Sex			
Female	2045	722 (35.3)	1.0
Male	1701	739 (43.4)	1.1 (0.9 to 1.2)
Education‡			
I	1661	573 (34.5)	1.0
II	1352	528 (39.1)	1.2 (1.1 to 1.5)
III	638	306 (48.0)	2.0 (1.6 to 2.5)
IV	49	36 (73.5)	6.5 (3.4 to 12.5)
V	33	17 (51.5)	2.2 (1.1 to 4.5)

*People requiring eye care defined as people with presenting vision in better eye worse than 6/18 and/or with a diagnosed ocular pathology/disease after examination.
†Adjusted for age, sex, and education.
‡I, illiterate; II, up to class 5; III, class 6–10; IV, class 11–12; and V, more than class 12.

Table 3 Multivariate adjusted* odds ratios (95% CI) for distribution of eye care service provider utilised

	Hospital	Eye doctor	Eye camp
Age categories			
40–49	1.0	1.0	1.0
50–59	0.9 (0.7 to 1.2)	0.9 (0.7 to 1.2)	1.4 (0.9 to 2.2)
60–69	0.8 (0.6 to 1.1)	0.9 (0.7 to 1.3)	1.9 (0.9 to 2.4)
⩾70	0.9 (0.6 to 1.3)	1.1 (0.7 to 1.7)	1.0 (0.6 to 1.8)
Sex			
Female	1.0	1.0	1.0
Male	1.7 (1.2 to 2.5)	0.9 (0.7 to 1.2)	0.8 (0.6 to 1.0)
Education†			
I	1.0	1.0	1.0
II	0.8 (0.6 to 1.1)	1.5 (1.1 to 2.0)	0.9 (0.6 to 1.4)
III	0.7 (0.5 to 0.9)	1.8 (1.3 to 2.5)	0.8 (0.5 to 1.4)
IV	0.8 (0.5 to 1.5)	2.1 (1.1 to 3.9)	0.3 (0.07 to 1.3)
V	0.5 (0.2 to 1.2)	2.9 (1.3 to 6.9)	0.7 (0.2 to 3.3)
Presenting vision‡			
⩾6/18	1.0	1.0	1.0
6/24–3/60	0.9 (0.7 to 1.1)	0.9 (0.7 to 1.2)	1.8 (1.2 to 2.5)
<3/60	1.2 (0.8 to 1.7)	0.7 (0.4 to 1.1)	1.7 (1.0 to 2.9)

*Multivariate adjusted to age, sex, education, and presenting vision.
†I, illiterate; II, up to class 5; III, class 6–10; IV, class 11–12; and V, more than class 12.
‡Presenting vision in the better eye.

(ARM) was defined according to the international classification developed by the International ARM Epidemiological Study Group.[13] Briefly, drusen were defined as discrete whitish yellow spots external to the neuroretinal or the retinal pigment epithelium (RPE). Pigmentary abnormalities included either increased pigmentation associated with drusen or depigmentation or hypopigmentation of the RPE, more sharply demarcated than drusen, without any visibility of choroidal vessels associated with drusen. Geographic atrophy was defined as any sharply delineated roughly round or oval area of hypopigmentation or depigmentation or apparent absence of the RPE in which choroidal vessels are more visible than in surrounding areas, at least 175 μm in size. Exudative AMD was defined as the presence of any of the following: (1) RPE detachments or serous detachment of the sensory retina, (2) subretinal or sub-RPE neovascular membranes, (3) subretinal haemorrhages, and (4) epiretinal, subretinal, intraretinal, or subpigment epithelial scar or glial tissue or fibrin-like deposits. Early ARM was defined as the presence of soft large drusen (>125 μm) with pigment epithelial abnormalities as described above. Late ARM was defined as the presence of signs of exudative ARM or geographic atrophy. Ophthalmologists assigned a principal cause for vision impairment after ocular examinations.

For the purpose of analysis, we defined people requiring eye care in our study population as people with presenting vision in the better eye worse than 6/18 and/or a diagnosed ocular pathology/disease after examination.

Before ocular examinations, trained social workers conducted interviews to collect demographic and other details using a structured questionnaire. Information was collected regarding previous eye examinations, including the service provider visited, the duration since the last examination, and the reason for an eye examination. We also collected information on whether people did not visit an eye doctor even though they had a need and the reason for not visiting an eye doctor.

The study protocol was approved by the institutional review board/ethical committee, Aravind Eye Hospital, Madurai, and the committee on human research at the Johns Hopkins Bloomberg School of Public Health, Baltimore. Informed consent was obtained at three different levels before the actual study—community, household, and individual. Meetings were held with community leaders and all health related personnel in the area to explain the purpose of the study. Once approval was obtained at these meetings, the study was fully explained to all adults in the household in order to address any concerns and to secure consent for members of the household to participate. Before both screening and definitive examinations, the study was explained in detail to all potential participants and their voluntary consent was solicited. All informed consent was obtained verbally, as a significant proportion of this population is illiterate. Both the study and data analysis were done before the advent of HIPA regulations.

We performed bivariate and multivariate logistic regression to explore for associations with utilisation patterns using Stata version 7.0 (College Station, TX, USA). Confidence intervals have been estimated using generalised estimation equation taking into consideration the multistage cluster sampling design of the study. We considered p values <0.05 to denote statistical significance.

RESULTS

We enumerated 5539 eligible people aged more than 40 years; 5150 of those enumerated were examined—a response rate of 93.0%. The median age of those examined was 51.0 years, and 55.1% were females. Information on utilisation of services was obtained from all of the 5150 participants who were examined.

In all, 1827 (35.5%) people gave a history of previous eye examinations. After adjusting for sex, the odds for utilising

Table 4 Reasons provided by subjects who felt the need for eye care and yet did not utilise eye care services (n = 912)*

Reason	No (%)
No money	713 (78.2)
No time	639 (70.0)
No escort	531 (58.2)
Did not think the problem was important	493 (54.1)
Fear	262 (28.7)
Advised by others to do something else	220 (24.1)
Did not know where to go	115 (12.6)

*Data shown as number of people (%).

services increased with increasing age (reference category 40–49 years, 50–59 years—OR: 1.2, 95% CI: 1.0 to 1.4, 60–69 years—OR: 1.7, 95% CI: 1.5 to 2.0, and ⩾70 years OR: 3.4, 95% CI: 2.7 to 4.2). After adjusting for age, males were more likely to utilise services (OR: 1.2, 95% CI: 1.1 to 1.4); however, after multivariate analysis the difference between sexes was not statistically significant (table 1). After adjusting for age and sex, the odds for utilisation increased with increasing education. People with unilateral or bilateral vision impairment or blindness were more likely to use services ($p<0.01$).

We found that 3746 (72.7%) people required eye care services in our study population. Approximately two thirds of those requiring eye care services (n = 2285, 61%) had not previously sought such services. Among those who required eye care services, people aged 60 years and older and those with more education were more likely to utilise eye care services (table 2). Nearly half (44.5%) of those who had not utilised eye care services had some level of presenting vision impairment, and 28.1% of people had some ocular abnormality diagnosed on examination in the survey.

Among those who reported having sought eye care service from any available eye care provider, 1073 (58.7%) sought treatment from a general hospital rather than an optometrist or ophthalmologist. Additional eye care service providers consulted included ophthalmologists (n = 427, 23.4%), eye camps (n = 213, 11.7%), general practitioners (n = 51, 2.8%), and opticians (n = 18, 1.0%). Additionally, four people sought treatment from traditional healers and two from non-allopathic practitioners. Educated people were more likely to consult an eye doctor after adjusting for age and sex. Males and people with moderate visual impairment were more likely to attend eye camps after adjusting for age and education of subjects (table 3).

The last eye examination ranged from 1 to 55 years before our survey (mean 5.5 (SD 5.9), median 4.0 years). We arbitrarily classified subjects as those reporting utilisation of eye care services within the past 2 years and those reporting utilisation of services anytime in the past but not within the preceding 2 years. Only 526 (28.8%) of the 1827 people who had previous eye examinations had their examinations within the 2 years preceding our survey. The proportion of people utilising services of different eye care providers did not differ significantly between those who utilised services within the past 2 years and those who utilised services over 2 years preceding the survey (p = 0.5).

The most common reason that was reported for previously seeking eye care was vision problems among subjects (n = 836, 45.8%). Additional reasons for eye consultations included general problems such as headache, watering of eyes, pain in eyes (n = 596, 32.6%), cataracts including surgery (n = 132, 7.2%), and injuries (n = 88, 4.8%). Three people sought eye care for corneal problems and three people had laser treatment for retinal pathology.

Among the 3323 people who had never sought eye care before our survey, 912 (27.4%) had felt the need to have an eye examination but did not do so. The major reasons for not seeking eye care even though there was a felt need included the lack of money, the lack of time to spare, and the lack of an escort (table 4). Nearly three quarters of people with blindness, globe anomalies, corneal disorders, and non-glaucomatous optic atrophy in our study population had previously utilised eye care services (table 5).

However, only about one third of people with vision impairment, cataracts and refractive errors, and glaucoma had utilised services. Utilisation of services did not necessarily mean having treatment for the ocular disorder diagnosed during our survey. We found only six of the 57 people with glaucoma who had utilised services to have been using antiglaucoma therapy.

DISCUSSION

Data from our study reveal that older people with vision problems in this rural population do not utilise eye care services to a large extent. Nearly two thirds of this rural population aged 40 years or older have not utilised any eye care services despite a large burden of ocular disease.

An increased utilisation of services with increasing age is consistent with an increased burden of blindness and vision impairment among the elderly. We did not find any significant differences overall between sexes for utilisation of eye care services in this rural population. This is similar to a report from an urban population in the city of Hyderabad in southern India.[4] Similar to a previous study from the same region, we did find that males were more likely to access eye camps.[3] The association of increasing education levels with improved utilisation of eye care services, especially from eye doctors, suggests the need to consider characteristics of the populations served when designing strategies to improve resource utilisation. Although we found that the odds for utilisation of eye care services was not highest among those with the highest educational levels, the small sample size for people in these groups (class 11 or above) precludes us from making any inferences. It may also be possible that people with higher education may have a lower need for eye care services in this rural population because of improved health status; however, the relatively small number of people in these groups (class 11 or above) does not allow us to comment further on this issue. However, a population based study from southern India has previously reported that literacy of the subject was the most important predictor for a person to be operated on for age related cataract and reported a 34.0% increase in the odds for cataract surgery among

Table 5 Burden of vision impairment, ocular disease and utilisation of services in the study sample*

	Never used eye care Service	Ever used eye care service	Total
Presenting vision in better eye			
6/24–3/60	1144 (65.0)	617 (35.0)	1761
<3/60	45 (20.3)	177 (79.7)	222
Ocular disease			
Refractive error	1848 (66.2)	943 (33.8)	2791
Cataract	1538 (62.8)	911(37.2)	2449
Retinal diseases	251 (47.4)	278 (52.5)	529
Glaucoma	75 (56.8)	57 (43.2)	132
Corneal disorders	10 (20.4)	39 (79.6)	49
Optic atrophy	7 (31.8)	15 (68.2)	22
Globe anomalies	5 (18.5)	22 (81.5)	27
Total	3323 (64.5)	1827 (35.4)	5150

*Data presented as number of people (%).

females if the subject was literate after adjusting for age and place of residence.[14]

Problems related to vision were the most common reasons to seek eye care in addition to other general ocular symptoms. We found profound vision loss (blindness or vision loss due to optic atrophy) or grossly symptomatic ocular diseases, including globe anomalies and corneal diseases, led to an increased utilisation of services.

The fact that nearly two thirds of people with vision impairment and the major causes of needless blindness in India—age related cataracts and refractive errors—had not utilised services, is a matter of great concern. It is possible that such people did not have a problem performing their routine functions with the level of visual acuity they possessed, and hence did not seek treatment. Only six of the 57 people with glaucoma who had utilised eye care services had received antiglaucoma therapy including surgery, and this may suggest that utilisation of services did not always translate into receiving the appropriate treatment. However, as our study design was cross sectional in nature, we are unable to comment if subjects diagnosed with glaucoma in our study actually had glaucoma at the time they utilised eye care services. It is possible they utilised services and received treatment for symptoms other than those relating to glaucoma and this may possibly explain the higher utilisation for glaucoma compared to cataracts in our study population.

We find it interesting that hospitals were the primary source of eye care in this rural population compared to eye camps or eye doctors. Our questionnaire, however, limited collection of information to the last visit to an eye care provider and we may have missed information if more than one eye care service provider had been consulted. This may have led to an underestimation of the utilisation of other eye care service providers as hospitals are generally the last line of treatment and may potentially explain the reported low utilisation rates for traditional healers and for eye camps in this rural population. The lower number of visits to eye care providers other than general hospitals may potentially be related to lack of access to such providers. Convenience and availability of eye care services may also potentially influence the eye care provider visited by subjects in this rural population. The lack of any association of seeking eye care service in a hospital with age, sex, education, or presenting vision, however, suggests to us that this rural population may actually prefer seeking treatment from hospitals rather than individual practitioners. Significant associations for seeking care at eye camps included being male, older ages of 60–69, and having moderate visual impairment. The lack of social support for the very elderly may possibly explain the lower utilisation of eye camps among those aged 70 years and above, and by the severely blind population. We are not clear as to why males were more likely to utilise eye camp services than females. We did not collect information on distance to camp and other potential confounders to make any valid statements for this difference. However, the disparity between sexes in utilisation of eye camps is similar to that reported previously from the same region.[3]

The preference for hospitals as opposed to eye camps as sources of treatment has previously been reported in this population.[3] Our questionnaire was not designed to explore reasons for this preference. Further research is required to determine why people prefer seeking treatment from hospitals than organised eye camps. The preference for treatment from hospitals, however, suggests to us the potential for introducing primary eye care services in the vast primary healthcare network in India. Each primary health centre serves approximately 30 000 people, and imparting training in primary eye care to staff at these centres can be an alternative approach to the current eye camp model.

The burden of eye diseases is expected to increase in India with the increasing of life expectancies and a demographic shift towards ageing.[15] A suboptimal utilisation of eye care services will thus result in a larger backlog of people requiring but not receiving eye care. If we extrapolate our data to the approximately 98 million people aged 40 years and over residing in rural areas of India, nearly 63 million may not have utilised any eye care service in their lifetime. Nearly 28 million of the 63 million who did not utilise eye care services may be visually impaired and 17 million may have an ocular disease. These figures have to be interpreted with caution as our study may not be representative of the entire rural population of India, and our study population had access to eye care service providers offering free or highly subsidised services, which may not be true for most other parts of rural India. However, the figures above reflect the challenges faced by eye care programmes in India and the necessity to focus on improving utilisation simultaneous to improving capacity and infrastructure.

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