

Eye health in the Indian Sunderbans: an Endline Study

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Executive Summary

Background

Visual impairment is a global public health problem. Recent estimates from WHO suggest that 253 million people suffer from visual impairment, of whom 36 million are completely blind. Cataract and uncorrected refractive errors are the leading causes of visual impairment in most parts of the developing world, including India. According to the National Programme for the Control of Blindness (NPCB), Ministry of Health and Family Welfare, Government of India Survey on Blindness (2006-2007) these two causes constitute about 81% blindness in the age group 50 years and above.

With support from Standard Chartered Bank under the “Seeing is Believing” initiative, Sightsavers is strengthening eye care services in the Sundarbans region of West Bengal State in Eastern India. The objective of the five-year project is to contribute to the elimination of avoidable blindness in the area. In order to assess the success of the Sundarbans Eye Health Service Strengthening Project, Sightsavers conducted surveys to investigate eye health status and health seeking behaviour at both the beginning and end of the projects to assess any changes that may have taken place. This report describes the results of the endline study.

Methods

A population-based survey took place in 19 blocks of the North 29 Parganas and the South 24 Parganas (The Sunderbans), West Bengal, India. 3,782 people were enumerated through choosing 76 blocks using probability proportional to size sampling, and then 50 people aged over 40 years in each block using compact segment methodology. Heads of households were asked about key characteristics and then all eligible people ordinarily resident were enrolled; they then participated in a visual examination and a short questionnaire about their own health seeking behaviour. Data was collected using a handheld device and transmitted at the end of each day. Data was analysed using simple descriptive statistics using Stata version 15.

Results

Results show significant changes in several key project indicators between the time of the baseline and endline studies. Notably, prevalence of blindness has decreased from 2.4% to 1.3% among people aged over 50 years. The proportion of severely visually impaired people requiring cataract surgery who have received it has increased from 49.6% to 55.5%. The proportion of people requiring spectacles who have access to them has also increased from 46.2% to 60.3%. In addition, survey respondents reported marked increases in their satisfaction with services received, and demonstrated increased knowledge of eye health issues and the services available to them.

Conclusions

The results of the study indicate good progress in the Sunderbans region in improving the coverage and quality of eye health services. Improvements in virtually every key performance indicator indicates the project was successful in delivering its stated aims and objectives. With little

difference between men and women, the data also suggest good levels of gender equity with regards to access to health services in Sunderbans.

Table 1. Key project indicator values at baseline and endline

Type of indicator	Indicator	2014 baseline values	2018 endline values
Goal	Prevalence of blindness	40+: 1.5%	40+: 0.7%
	<i>Bilateral best corrected vision (age and sex adjusted)</i>	50+: 2.4%	50+: 1.3%
	Cataract surgical coverage (person, in sample)	3/60: 75.0%	3/60: 86.3%
		6/60: 49.6%	6/60: 55.5%
Objective 1.2	Extent of coverage of eye health services within the project area (access to near glasses)	46.2%	60.3%
Objective 1.3	Percentage of patients receiving non-surgical services expressing satisfaction with services.		
	Satisfied with glasses	79.1%	88.5%
	Satisfied with accessibility of facility	51.2%	66.7%
	Satisfied with affordability of facility	47.4%	68.0%
	Satisfied with quality of facility	54.6%	70.5%
Objective 2.2	<i>Percentage of surveyed individuals able to correctly identify eye care conditions (Proportion of HHs responding correctly shown)</i>		
	Cataract is curable	80.6%	88.6%
	Spectacles can improve your eye sight	71.9%	93.0%
	You would visit an eye doctor if you were unable to see clearly	44.3%	90.1%
	Some eye problems in adults and children require surgery	44.2%	75.7%
	Government provides free cataract surgeries	43.1%	81.0%
	Government has a health insurance scheme	38.8%	85.4%
	Home remedies can treat most eye diseases	31.8%	69.6%
	Infants can be born with cataract	33.3%	44.2%
	Diabetes affects eyesight and can lead to gradual loss of vision	20.4%	64.3%
	It is natural to lose your eyesight as you grow older and nothing can be done about it	7.3%	0.6%

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Background

Standard Chartered Bank, under the “Seeing is Believing” (SiB) initiative, supported Sightsavers in India to strengthen eye care services in the Sunderbans region of West Bengal State in Eastern India. The objective of the five-year project (2013-2018) was to contribute to the elimination of avoidable blindness in the area. The project was implemented across 19 administrative blocks of Sunderbans in the two districts of North and South 24 Parganas in West Bengal. The project was implemented with the support of three local NGOs: Sunderbans Social Development Centre (SSDC), Southern Health Improvement Society (SHIS) and Vivekananda Mission Asram (VMA). In order to assess the success of the project, a study to assess the status of eye health and health seeking behaviour in the region was undertaken at the outset, and repeated at the end of the project.

Visual impairment is a global public health problem. Recent estimates from the World Health Organisation (WHO) suggest that 253 million people suffer from visual impairment, of whom 36 million are completely blind (1). Worldwide, more than 75% of visual impairment is avoidable. This means that it can either be treated (refractive error, cataract and uncorrected aphakia) or prevented (trachoma, corneal scarring, some causes of childhood blindness, onchocerciasis and - to a certain extent - glaucoma and diabetic retinopathy). 1.1 billion people live with near-vision impairment simply because they do not have a pair of spectacles to correct Presbyopia. Furthermore, 89% of visually impaired people live in low and middle-income countries and 55% are women, meaning that there are significant equity issues related to access to quality care.

Cataract and uncorrected refractive errors are the leading causes of visual impairment in most parts of the developing world, including India. According to the National Programme for the Control of Blindness (NPCB), India Survey on Blindness (RAAB Report, 2006-2007) these two causes of visual impairment constitute about 81% of blindness (presenting vision <6/60 in better eye, NPCB definition, 2006-07) in the age group 50 years and above (2).

A Rapid Assessment of Avoidable Blindness (RAAB) study conducted by the NPCB in 2007 elsewhere in the state of West Bengal found the all-age prevalence of blindness to be 1.2%, compared to the national average of 1.0% (2). The survey undertaken at the outset of the project found prevalence among people aged over 50 years in the study area to be 2.4% (3).

Unsurprisingly, the major cause of blindness was cataract and cataract surgical coverage was moderate at just under 50%.

2.1 Study definitions

Visual acuity is defined in this study as described in Table 2.

Table 2. Definitions by the World Health Organisation (WHO – ICD10)

Moderate Visual Impairment (MVI)	VA < 6/18 – 6/60 in better eye with available correction (PVA) or with best correction or pinhole (BCVA or Pinhole VA)
Severe Visual Impairment (SVI)	VA < 6/60 – 3/60 in better eye with available correction (PVA) or with best correction or pinhole (BCVA or Pinhole VA)

Blindness	VA < 3/60 in better eye with available correction (PVA) or with best correction or pinhole (BCVA or Pinhole VA)
Visual Impairment	VA < 6/18 in better eye with available correction (PVA) or with best correction or pinhole (BCVA or Pinhole VA)

For the purposes of this study, the causes of visual impairment are defined as follows:

- **Uncorrected Refractive Error** is defined as presenting VA < 6/18, but improving to 6/18 or better with pinhole.
- **Un-operated cataract** is defined as opacity of crystalline lens in the pupillary area as seen with a torch and causing visual impairment (presenting VA < 6/18 and not improving with pinhole).
- **Corneal opacity** is defined as an easily visible opacity over the cornea.
- **Others** are considered any other visual impairing condition not covered by the above definitions.

In cases where there is more than one cause for visual impairment, the one which was more easily treatable or correctable to achieve a VA \geq 6/18 is considered the primary cause of visual impairment. For example, if a patient had an operable cataract and uncorrected refractive error, the cause is marked as “refractive errors” as it is easier to correct compared to the surgical intervention for cataract as per the recommendation of the WHO.

Methodology

Aims and objectives of the study

The general objective of the study is to provide endline data to measure the change in key project indicators since the baseline study. Specifically the study objectives are:

- To determine the prevalence and causes of blindness, SVI and VI among the population aged >40 years in the Sunderbans and how it has changed between baseline and endline studies.
- To determine the coverage of eye care services - specifically spectacles and cataract surgery - among the population aged >40 years requiring such services and how it has changed between baseline and endline studies.
- To determine the proportion of good surgical outcomes among cataract patients aged >40 years in the area and how it has changed between baseline and endline studies.
- To determine how these services are perceived in terms of accessibility, affordability and quality, by the population requiring them and how it has changed between baseline and endline studies.
- To determine the perceived barriers to accessing such services among the population aged >40 years requiring such services and how it has changed between baseline and endline studies.
- To determine the proportion of the population aged >40 years who have been reached through awareness-raising events and who can correctly recall key messages and how it has changed between baseline and endline studies.
- To understand the eye health seeking behaviour among individuals aged >40 with eye problems in the area, and the motivations behind the behaviour and how it has changed between baseline and endline studies.
- To determine the willingness of the population aged >40 years to pay for eye health services and how it has changed between baseline and endline studies.

Study site

The Sunderbans are located in the extreme south of West Bengal and lie within two districts - the North and South 24 Parganas which consist mainly of villages spread over islands and adjacent mainland. It is an area of extreme poverty, exacerbated by access difficulties. Almost half of the 4.7 million population (47%) belong to historically marginalised groups such as Scheduled Castes and Tribes. More than 40% of households live below the poverty line and 13% are officially declared as the “poorest of the poor”. The population above 40 years is estimated to be 29% of the total (approximately 1,363,000).

Methodology and tools

The study was conducted in collaboration with Sightsavers and Vivekananda Mission Asram (VMA), with VMA being the technical agency for data collection. VMA constituted a team of

optometrists headed by Dr. Asim Sil (Medical Director, VMA) for the data collection. Furthermore, social data collectors from Promancy were involved in field level implementation of the project and supported the technical team during the data collection process. This way, each field survey team consisted of one optometrist and one social data collector.

The data collection team was trained by Sightsavers with the support of VMA in June 2018 and an inter-observer variation (IOV) test undertaken by all teams ensured confidence in the team's consistency. Sightsavers, along with the project staff, prepared the fieldwork plan in different blocks across Sunderbans. Sightsavers, supported by VMA, supervised the data collection in all blocks. Working together with the local field staff helped in reaching the clusters and completing the data collection in an organised and timely manner.

A cross-sectional survey was used to gather data using mobile tablets. Data collection for this study was undertaken during June-July 2018. The survey tool was designed carefully using an app designed in CommCare (4) to meet the study objectives, and draws components from a variety of standardised study designs. This survey tool was deployed to Android tablets for data collection.

The person responding on behalf of the household was asked a number of questions on both the household socio-economic position, and their knowledge of eye health issues, available services, and the practices of the household generally in seeking care for eye health services. The person responding on behalf of the household was asked to list all the other members of the household and provide details for everyone (including themselves) of their name, gender, age and an affirmation of whether they live in the household permanently or not.

Every person identified in the household aged over 40 years and above was eligible for inclusion in the last two sections of the study. Questions in this section were predominantly those from the standardised methodology, Rapid Assessment of Avoidable Blindness (RAAB) (5), with additional sections on spectacle use and barriers drawn from the adapted methodology, the Rapid Assessment of Visual Impairment (RAVI) (6). Following the visual acuity and eye health assessment, the same participants were asked a number of questions about their eye health status over the previous six months. Those that experienced problems were asked about their treatment seeking behaviour; their reasons for choosing the facilities they chose; the cost and travel implications; and their satisfaction with the services they received. Participants who had experienced problems but did not access services were asked for the reasons. The survey also included the Equity Measurement Tool (EMT) to measure the household-level wealth according to asset ownership, and the Washington Group Short Set of questions (WGSS) to measure functional disability among the eligible population examined in the study (6, 7). Since the WGSS tool was administered for the first time in Sunderbans, the cognitive testing of the tool in local language was conducted prior to the main survey among a small group of population in the region. This helped to finalise the translation of the tool into local language.

All participants to these two sections were provided with a printed study information sheet and consent form, and asked to provide written consent to participate in the study - once the interviewer was sure they understood the implications of participation. Since the data collection was app based, there was also a section on information and consent in the app; once participants gave written consent, the app was updated and the interview was conducted by the field survey team.

For participants who refused or were unable to be examined, a family member or neighbour was asked a simple question about the individual's visual status.

All eligible participants presenting VA <6/18 in any eye, or those who needed services, were referred to the nearest eye care facility for management of the eye problem. A printed referral slip was provided to the referred subjects by the field team.

Sampling methodology

A two-stage cluster sampling was used to identify study participants. The 2011 National Census data was used to inform the sampling frame.

In the first stage of sampling, all the villages in the study area were listed, along with their population, in a Microsoft Excel worksheet. Small villages with populations of less than 200 people were grouped together to form units with populations greater than 200. The study clusters were selected from the list using random numbers generated by Microsoft Excel.

For the second stage sampling, the Compact Segment Sampling method was used to select individuals fulfilling the study criteria. On arrival at the study site, the team used a map of the village to divide the area into segments of roughly equal population size. In the absence of an official map developed by the government, the team developed a layout map of the village in quick discussions with key people of the village. The village population data was used to ensure that each segment was large enough to expect at least 50 people aged above 40 years of age. One segment was then picked at random, and all the households in the segment were sampled sequentially until 50 people aged >40 years were identified and interviewed. If there are fewer than 50 people in the first segment, a second segment was chosen at random and households were sampled sequentially until a total of 50 eligible people were identified and interviewed.

Sample size

The sample size was calculated based on the following assumptions: the prevalence of blindness in the age group aged >40 years is estimated at 1.5%; the desired precision estimate is $\pm 0.5\%$ around the prevalence estimate ($\pm 33.3\%$ of the prevalence) with a 95% confidence level; the design effect associated with the clustering design is 1.5; and 10% non-response rate. This gave a sample size of 3,782 people aged >40 years. This was expected to be achieved through enumerating 50 people from 76 clusters.

Data analysis

After data collection was completed, a finalised dataset was downloaded from the web version of Commcare in Excel format and was imported into STATA software (8) for cleaning and analysis.

Data was checked for completeness and consistency, and once that was complete, simple descriptive statistics were generated to understand the distribution and patterns of the data. The key project statistics were generated to answer the study objectives and quantify the margins of error associated with those estimates.

The WGSS and EMT data were calculated using recommended syntax and cut-offs. The EMT allocates households to quintiles referenced against national-level data, rather than specific to West Bengal.

Ethical approval and consent

Ethics approval for this study was given by the Institutional Review Board of Vivekananda Mission Ashram.

Both the consents of the household head and each study participant (questionnaire for data collection) were obtained before data collection. Information about the study and the use of data (from the questionnaire) was read out to the invited participants before they consented to taking part. The informed consent form and information sheets were translated into the local language. Where they were unable to sign their name, a thumbprint was taken.

All information collected was made anonymous and kept confidential. Any data identifying specific households and participants was separated from the survey data. The app-based electronic data was kept in a password-protected file at a secured location within a Sightsavers computer and no one apart from the research team had access to the data.

Results

Background characteristics of survey participants

All 19 blocks of Sunderbans were included in the baseline and endline surveys. Overall 3,868 individuals aged 40 or more years were enumerated across the study population in the endline, which was approximately 14% more than the 2014 baseline (3,388). 3,410 were examined at the endline (Table 3) compared with baseline (2,854), meaning the respective response rates were 88.2% in the endline and 84.2% in the baseline.

At baseline, more males were enumerated (55.4%) than females and were more likely to be unavailable (17.3% vs 13.0%). In this endline study, the numbers of participants enumerated were similar between the sexes (males representing 50.8% of the total) but men were more than twice as likely as females to be unavailable (15.4% vs 7.0%). Thus, the total number of females examined was higher than males (1,763 vs 1,647). This may be a result of the geography of the Sunderbans as men often travel far for work. This may be a limitation of the survey methodology as those absent due to work may be more likely to be fit and not visually impaired.

Table 3. Eligible persons for the eye health survey (aged over 40 years), coverage, absentees and refusals in survey

	Male		Female		Total	
	N	%	N	%	N	%
Total eligible	1,965	50.8	1,903	49.2	3,868	100.0
Study participation status						
Examined	1,647	83.8	1,763	92.6	3,410	88.2
Refused	7	0.4	2	0.1	9	0.2
Not capable	9	0.5	4	0.2	13	0.3
Not available (see Table 2)	302	15.4	134	7.0	436	11.3

Of the 458 eligible people who were not examined (Table 4), the majority were not at home, and a small minority (2.0%) refused or were not capable of answering the questions (2.8%). For those people not interviewed, a family member or neighbour was asked about their visual status. Of those eligible people who were not available, a majority (57.0%) were reported to be not blind. About 37% were reported to wear glasses. Eligible people who were reported to be blind due to cataract or operated for cataract were only 0.4% and 2.4% respectively. Patterns were similar to those observed in the baseline survey.

Table 4. Visual status of unavailable subjects reported by household head

	Not available		Refused		Not able		Total	
	N	%	N	%	N	%	N	%
Not blind	245	56.2	4	44.4	12	92.3	261	57.0
Blind due to cataract	2	0.5	0	-	0	-	2	0.4
Blind due to other causes	15	3.4	0	-	0	-	15	3.3

Operated for cataract	10	2.3	1	11.1	0	-	11	2.4
Wears glasses	164	37.6	4	44.4	1	7.7	169	36.9
Total	436	95.2	9	2.0	13	2.8	458	100.0

The mean age of the survey participants was found to be 53 years with a difference of two years between males and females. Over 46% of the participants were in the age group of 40 to 49 followed by 25.5% and 17.1% in the age group of 50 to 59 and 60 to 69 years respectively.

Figure 1. Percentage distribution of survey participants by age group

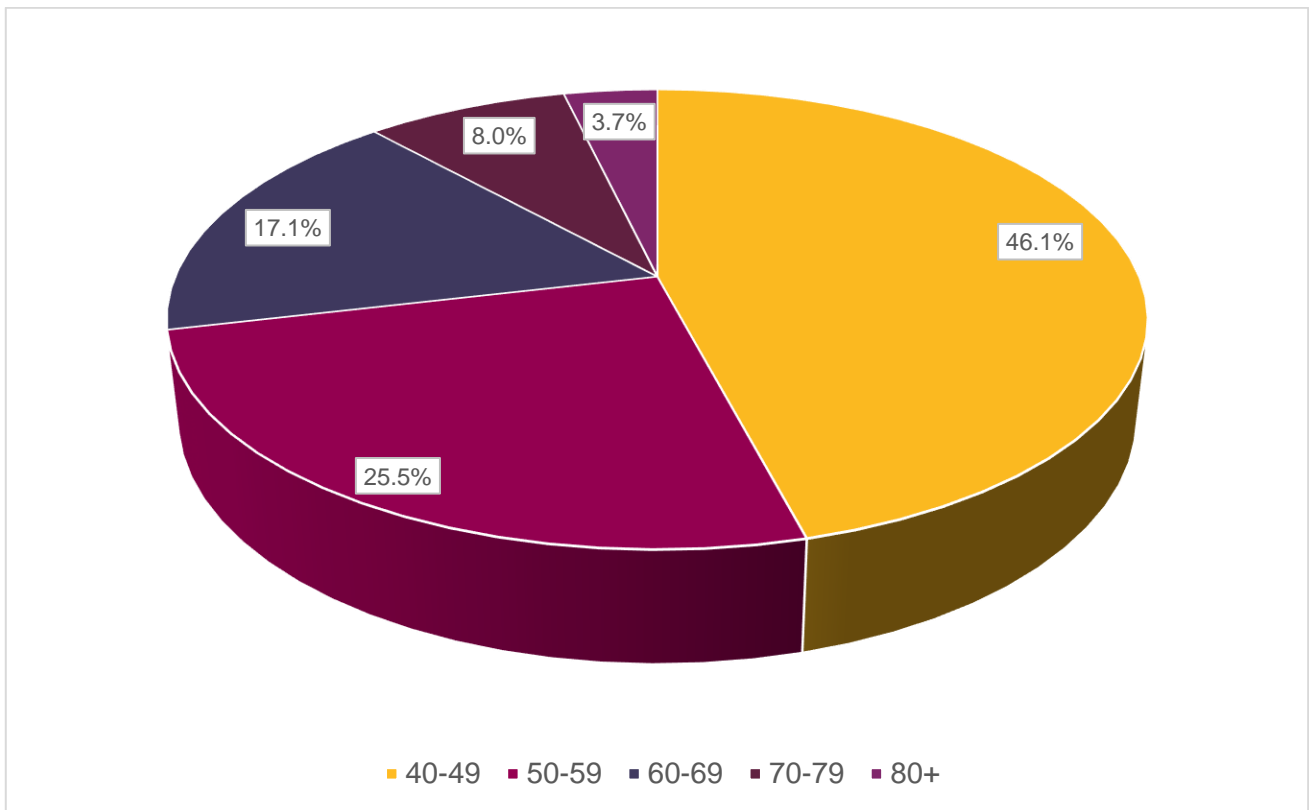


Table 5. Age and sex distribution of participants

	Male		Female		Total	
	N	%	N	%	N	%
Mean age (range)	54	(40-98)	52	(40-100)	53	(40-110)
Median age (IQR)	51	(45-61)	49	(42-60)	50	(44-60)
Age group						
40-49	689	41.8	882	50.0	1,571	46.1
50-59	443	26.9	425	24.1	868	25.5
60-69	304	18.5	280	15.9	584	17.1
70-79	161	9.8	113	6.4	274	8.0
80+	50	3.0	63	3.6	113	3.3
	1,647		1,763		3,410	

The mean age was also 53 years in the baseline study. The age distribution of participants was very similar in both studies.

Over 50% of the survey participants said they were head of their household with a large majority of male participants holding this position in the household (77.8%). The gender differentials are quite stark in this case with only 24.5% of females reporting to be household heads, reflecting the social norm in which men are mostly found to be heads of households. Despite this, 7.1% of male respondents reported being the husband of the household head. Over half of the females (58.3%) were the spouse of the household head.

Table 6. Household position of respondent by sex

Household position	Male		Female		Total	
	N	%	N	%	N	%
Household head (HH)	1,281	77.8	431	24.5	1,712	50.2
Spouse of HH	117	7.1	1,027	58.3	1,144	33.6
Child of HH	150	9.1	16	0.9	166	4.9
Son/ daughter-in-law of HH	6	0.4	52	3.0	58	1.7
Grandchild of HH	51	3.1	137	7.8	188	5.5
Parent of HH	0	-	1	0.1	1	0.03
Parent-in-law of HH	21	1.3	72	4.1	93	2.7
Sibling	18	1.1	14	0.8	32	0.9
Other	3	0.2	13	0.7	16	0.5
	1,647		1,763		3,410	

The baseline survey enrolled a higher proportion of household heads (62.2% than this survey. 81.6% of males and 39.1% of females were household heads in the baseline survey.

Nearly 40% of participants were found to be illiterate (cannot read or write) but 8.8% had not attended school but could still read or write. 37.5% had primary education, 11.3% secondary education and 2.4% higher secondary education. 2.0% were graduates and 0.4% were post-graduates. More than 48% of the participants had either primary or secondary education.

Education was generally lower among women, with nearly half (47.8%) illiterate compared to only one quarter (26.8%) of men.

Table 7. Percentage distribution of survey participants by education qualification and gender

Highest educational qualification	Male		Female		Total	
	N	%	N	%	N	%
Cannot read or write	442	26.8	842	47.8	1,284	37.7
Can read/write but did not attend school	131	8.0	168	9.5	299	8.8
Primary	705	42.8	574	32.6	1,279	37.5
Secondary	249	15.1	135	7.7	384	11.3

Higher secondary	53	3.2	30	1.7	83	2.4
Graduate	58	3.5	11	0.6	69	2.0
Post-graduate	9	0.6	3	0.2	12	0.4
	1,647		1,763		3,410	

Results were similar to those reported in the baseline study, although this time more respondents had completed primary school (37.5% vs 27.9% in the baseline study) and less could read and write without ever having attended primary schools (8.8% vs 17.4% in the baseline study).

Over 60% of male participants are engaged in agriculture and daily wage labour work, followed by small business enterprises. Over 70% of women are homemakers with only 7.0% engaged in any kind of agriculture activity or daily wage labour. About 7% of men and women are engaged in 'other' economic activities beyond those options provided. Participant occupations were broadly similar to those reported during the baseline survey.

Table 8. Percentage distribution of survey participants by current occupation and gender

Current occupation	Male		Female		Total	
	N	%	N	%	N	%
Housewife/home maker	15	0.9	1,275	72.3	1,290	37.8
Agriculture	581	35.3	37	2.1	618	18.1
Wage labourer	408	24.8	87	4.9	495	14.5
Fishing	90	5.5	13	0.7	103	3.0
Van driver	46	2.8	0	-	46	1.4
Small business	205	12.5	14	0.8	219	6.4
Government job	29	1.8	13	0.7	42	1.2
Other	116	7.0	129	7.3	245	7.2
	1,647		1,763		3,410	

Household characteristics: social, economic and health seeking behaviour

Household characteristics were collected from household heads and everyone living within the same home will share the same characteristics. Household economic status, caste and knowledge and attitudes of household heads with regards to eye health are characteristics that affect everyone living within a household equally. Results shown here are presented for each household.

2,056 houses were approached by the study teams, of which 108 (5.3%) houses had no one living there aged over 40 years. The remaining 1,948 houses had 3,410 examined participants living within, or a mean of 1.8 people aged over 40 years in each house, and a median of two. The minimum number of examined people living in a household was one and the maximum number was seven.

Among the 1,948 households, 1,373 (70.5%) were headed by men, and 575 (29.5%) by women (Table 9). The youngest head of household was 18 and the oldest was 105. The mean age was 54 and median 52.

Table 9. Percentage distribution of households by sex of the household heads and household size

Total household size	Male		Female		Total	
	N	%	N	%	N	%
1	11	0.8	36	6.3	47	2.4
2	158	11.5	70	12.2	228	11.7
3	269	19.6	80	13.9	349	17.9
4	360	26.2	130	22.6	490	25.2
5	293	21.3	145	25.2	438	22.5
6	157	11.4	69	12.0	226	11.6
7	66	4.8	26	4.5	92	4.7
8+	59	4.3	19	3.3	78	4.0
Total	1,373	70.5	575	29.5	1,948	

Among the 1,948 households with eligible participants, 45.7% were Scheduled Caste, 42.5% were General, 8.3% were Other Backwards castes, and 3.6% were Scheduled Tribes (Table 10). Sex of household head was related to caste. Scheduled castes and general were more likely to be female headed households ($p=0.02$).

Table 10. Percentage distribution of households by caste and sex of household head

Caste of HH	Male		Female		Total	
	N	%	N	%	N	%
Scheduled Caste	617	44.9	273	47.5	890	45.7
Scheduled Tribe	51	3.7	19	3.3	70	3.6
Other backward Caste	131	9.5	30	5.2	161	8.3
General	574	41.8	253	44.0	827	42.5
	1,373		575		1,948	

Among the 1,948 households with eligible participants, none fell into the poorest quintile compared to nationally standardised data, indicating the area to be generally wealthy compared to other parts of the country. 12.9% fell into the second poorest quintile, 29.8% fell into the middle quintile, 47.1% fell into the second richest quintile and 10.2% fell into the richest quintile. The sex of the household head was not related to household wealth (Table 11). Total household size is associated with household wealth ($p=0.012$), with larger households being more likely to be in a higher wealth quintile.

Table 11. Wealth of households compared to nationally standardised data

Household wealth	Male		Female		Total	
	N	%	N	%	N	%
Poorest	0	-	0	-	0	-
Second	188	13.7	63	11.0	251	12.9
Third	416	30.3	165	28.7	581	29.8
Fourth	633	46.1	285	49.6	918	47.1
Richest	136	9.9	62	10.8	198	10.2
	1,373		575		1,948	

This profile is quite different from the household wealth data presented at baseline because we used a different tool and analysis technique for this survey, and it is not comparable.

Household head knowledge and attitudes towards eye health

Household heads were asked about their family's eye health seeking behaviour; participants living within the same households will share the same results.

NGO and private hospitals are the most popular service providers among the sample with over 75% of household heads saying they usually frequent them (Table 12). Only 14% of household heads most often frequented government facilities. There is no difference according to the sex of the household head. This trend is similar to the findings in the baseline survey, although previously nearly 25% lived in households that most often frequented government services and only 3.3% listed 'other' facilities.

The majority of household heads felt that the services they frequented were accessible (75.8%), affordable (74.0%), and good quality (76.0%). 14.0% felt they were inaccessible, 13.7% unaffordable, and 8.9% felt they were poor quality.

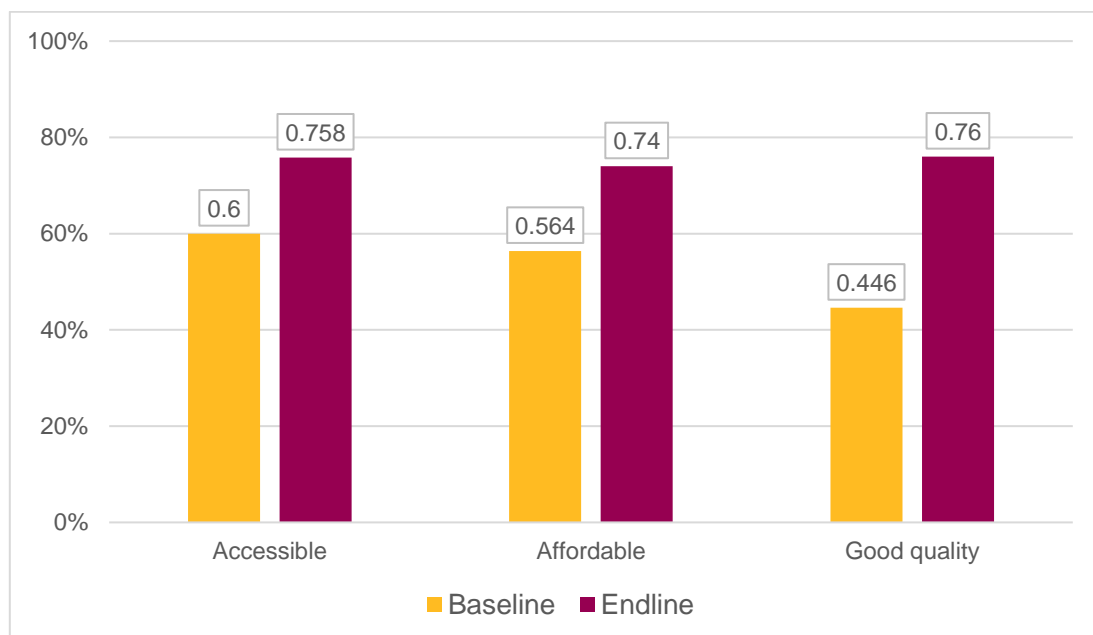
Table 12. Household head information (n=1,948) by sex of household head (no relationships observed)

	Male		Female		Total	
	N	%	N	%	N	%
Usual place to access eye health services						
Government hospital/health centre	179	13.0	85	14.8	264	13.6
Private hospital/health centre	426	31.0	200	34.8	626	32.1
NGO hospital, vision centre or eye camp	615	44.8	229	39.8	844	43.3
Other	153	11.1	61	10.6	214	11.0
Perception of accessibility of usual service						
Inaccessible	195	14.2	74	12.9	269	13.8
No opinion either way	149	10.9	58	10.1	207	10.6
Accessible	1,029	75.0	443	77.0	1,472	75.6

	Male		Female		Total	
	N	%	N	%	N	%
Perception of affordability of usual service						
Unaffordable	190	13.8	76	13.2	266	13.7
No opinion either way	187	13.6	67	11.7	254	13.0
Affordable	996	72.5	432	75.1	1,428	73.3
Perception of quality of usual service						
Low quality	120	8.7	61	10.6	181	9.3
No opinion either way	222	16.2	91	15.8	313	16.1
High quality	1,031	75.1	423	73.6	1,454	74.6
Respondent attended eye health event in past six months						
Yes	156	11.4	60	10.4	216	11.1
No	1,217	88.6	515	89.6	1,732	88.9
Respondent heard/saw eye health messages in one year						
Yes	468	34.1	178	31.0	646	33.2
No	905	65.9	397	69.0	1,302	66.8
Total	1,373		575		1,948	

Figure 2 highlights the differences in the proportion of head of households perceiving services to be accessible, affordable and good quality at the time of the baseline survey, and again at the time of the endline survey. Perceptions on all three qualities had positively increased between the two survey periods.

Figure 2. Proportion of household heads who perceive the services they normally use to have various qualities



Household heads' level of knowledge on eye health

Household heads were read a number of statements about eye health, and asked whether they agreed, partially agreed, or disagreed (Table 13). In general, there seemed to be a fair amount of knowledge about common issues like cataract and refractive error but very limited knowledge about rarer conditions such as diabetic retinopathy, childhood blindness and government schemes for eye care. Differences between men and women were observed in the responses to these questions, however women were more likely to answer some questions correctly, and men others.

Table 13. Household head knowledge of eye health issues

		Agree		Partially agree		Disagree	
		N	%	N	%	N	%
Cataract is curable <i>P=0.001</i>	Total	1,696	87.1	164	8.4	88	4.5
	Male	1,203	87.6	123	9.0	47	3.4
	Female	493	85.7	41	7.1	41	7.1
Infants can be born with cataract <i>P<0.001</i>	Total	841	43.2	729	37.4	378	19.4
	Male	588	42.8	564	41.1	221	16.1
	Female	253	44.0	165	28.7	157	27.3
Government has a health insurance scheme <i>P=0.001</i>	Total	1,656	85.0	148	7.6	144	7.4
	Male	1,191	86.7	99	7.2	83	6.1
	Female	465	80.9	49	8.5	61	10.6
Government provides free cataract surgeries <i>P<0.001</i>	Total	1,573	80.8	221	11.3	154	7.9
	Male	1,128	82.2	162	11.8	83	6.1
	Female	445	77.4	59	10.3	71	12.4
Diabetes affects eyesight and can lead to gradual loss of vision <i>P<0.001</i>	Total	1,218	62.5	471	24.2	259	13.3
	Male	868	63.2	360	26.2	145	10.6
	Female	350	60.9	111	19.3	114	19.8
Spectacles can improve your eyesight <i>P=0.1</i>	Total	1,815	93.2	118	6.1	15	0.8
	Male	1,279	93.2	87	6.3	7	0.5
	Female	536	93.2	31	5.4	8	1.4
It is natural to lose your eyesight as you grow older and nothing can be done about it <i>P<0.001</i>	Total	1,628	83.6	306	15.7	14	0.7
	Male	1,117	81.4	246	17.9	10	0.7
	Female	511	88.9	60	10.4	4	0.7
You would visit an eye doctor if you were unable to see clearly <i>P=0.6</i>	Total	1,743	89.5	200	10.3	5	0.3
	Male	1,223	89.1	146	10.6	4	0.3
	Female	520	90.4	54	9.4	1	0.2
Home remedies can treat most eye diseases	Total	125	6.4	479	24.6	1,244	69.0
	Male	91	6.6	361	26.3	921	67.1

		Agree		Partially agree		Disagree	
		N	%	N	%	N	%
<i>P=0.02</i>	<i>Female</i>	34	5.9	118	20.5	423	73.6
Some eye problems in adults and children require surgery <i>P<0.001</i>	Total	1,481	76.0	425	21.8	42	2.2
	<i>Male</i>	1,017	74.1	332	24.2	24	1.8
	<i>Female</i>	464	80.7	93	16.2	18	3.1

Compared to the same questions asked at baseline, the proportion agreeing with the correct response increased among all questions except the question about it being natural and unavoidable to lose one’s sight as one grows older (Table 14). Generally, this indicates a good increase in eye knowledge among the community between the two studies.

Tables 14. Knowledge and perception on eye health among household heads at baseline and endline

Statements	Correct response	Baseline (%)	Endline (%)	Change
Cataract is curable	True	80.6	88.6	+9.9%
Spectacles can improve your eyesight	True	71.9	93.0	+29.3%
You would visit an eye doctor if you were unable to see clearly	True	44.3	90.1	+103.4%
Some eye problems in adults and children require surgery	True	44.2	75.7	+71.3%
Government provides free cataract surgeries	True	43.1	81.0	+87.9%
Government has a health insurance scheme	True	38.8	85.4	+120.1%
Home remedies can treat most eye diseases	False	31.8	69.6	+118.9%
Infants can be born with cataract	True	33.3	44.2	+13.9%
Diabetes affects eyesight and can lead to gradual loss of vision	True	20.4	64.3	+215.2%
It is natural to lose your eyesight as you grow older and nothing can be done about it	False	7.3	0.6	-91.8%

Disability among study participants

Disability prevalence was found to be 14.7% among study participants (Table 15). It was higher among women (16.5%) than men (12.9%) and increased with age: 4.3% in the 40-49 age group up to 70.8% in the 80+ age group. Disability was most likely among people with lower levels of education: 20.6% among illiterate participants, 17.1% among those who can read/write but didn’t attend school, 11.2% among those with primary education and between 6% and 8.3% in all other higher education groups. Disability was also highest among people who weren’t working or were retired (48.3%), responded ‘other’ to the occupation question (25.3%) or were homemakers (12.0%). Disability wasn’t found to be linked with household wealth or caste.

Non-visual disability (i.e. a measure of disability excluding people with only *visual* disability) was 11.1% among the whole population. Relationships with other variables followed a broadly similar pattern to those described above.

Data on disability was not collected at baseline.

Table 15. Associations of various characteristics with a) disability and b) disability excluding visual disability

		Disability			Non-visual disability		
		N	%	95%CI*	N	%	95% CI*
Total		502	14.7	12.5-17.3%	377	11.1	8.9-13.6%
Sex							
Sex	Male	212	12.9	10.8-15.2%	153	9.3	7.4-11.6%
	Female	290	16.5	13.6-19.8%	224	12.7	10.0-16.0%
Age							
Age	40-49	68	4.3	3.2-5.8%	47	3.0	2.0-4.4%
	50-59	104	12.0	9.3-15.3%	78	9.0	6.7-11.9%
	60-69	138	23.6	19.5-28.3%	997	16.6	12.7-21.5%
	70-79	112	40.9	33.6-48.5%	88	32.1	25.5-39.6%
	80+	80	70.8	61.0-78.9%	67	59.3	49.7-68.2%
Highest educational qualification							
Highest educational qualification	Cannot read or write	265	20.6	16.7-25.2%	199	15.5	11.9-20.0%
	Can read/write but did not attend school	51	17.1	13.0-22.1%	39	13.0	8.9-18.7%
	Primary	143	11.2	9.0-13.8%	110	8.6	6.6-11.1%
	Secondary	32	8.3	5.4-12.6%	22	5.7	3.4-9.6%
	Higher secondary	5	6.0	2.5-13.8%	3	3.6	1.2-10.5%
	Graduate	5	7.2	2.8-17.6%	4	5.8	1.8-17.5%
	Post-graduate	1	8.3	1.8-30.8%	0	0	-
Current occupation							
Current occupation	Housewife/home maker	155	12.0	9.3-15.3%	122	9.5	7.1-12.6%
	Agriculture	60	9.7	7.2-12.9%	38	6.1	4.3-8.7%
	Wage labourer	29	5.9	3.8-8.9%	18	3.6	2.0-6.6%
	Fishing	5	4.9	2.2-10.4%	3	2.9	1.1-7.7%
	Van driver	3	6.5	2.1-18.3%	3	6.5	2.1-18.3%
	Small business	16	7.3	4.6-11.4%	9	4.1	2.2-7.7%
	Government job	2	4.8	1.4-15.0%	0	0	-
	Retired/not working	170	48.3	41.3-55.4%	132	37.5	30.3-45.2%
	Other	62	25.3	19.1-32.7%	52	21.2	15.9-27.7%

		Disability			Non-visual disability		
		N	%	95%CI*	N	%	95% CI*
HH wealth	Poorest	0			0		-
	Second	2	13.1%	8.5-19.5%	1	11.5	7.1-17.9%
	Third	38	15.1%	12.3-18.4%	31	11.0	8.6-14.0%
	Fourth	198	15.2%	12.3-18.6%	148	11.2	8.5-14.5%
	Richest	264	13.5%	10.0-18.1%	197	10.2	6.9-14.9%
Caste	Scheduled Caste	229	14.6	11.4-18.5%	176	11.3	8.3-15.2%
	Scheduled Tribe	1	7.9	5.5-11.3%	7	5.6	3.6-8.5%
	Other backward Caste	51	17.3	12.3-23.7%	41	13.9	9.1-20.7%
	General	212	14.9	12.0-18.3%	153	10.7	8.1-14.1%
<i>*Standard errors used to calculate CIs adjusted for clustering</i>							

Eye Health Results

Age distribution of study participants

The mean age of participants who were examined was 53.1 and the median age was 50 (Table 16). This was broadly similar to those who were unavailable for examination, but a little younger than those who refused and older than those who were incapable, although the numbers of people in these latter two groups were very small. Women who were examined appeared slightly younger than males, but women who were unavailable were slightly older than males who were unavailable. One possible explanation for the difference in availability was that the younger males were at work, but the differences are very small. The age profile of study participants is very similar to those enrolled and examined in the baseline study.

Table 16. Average age of sample population by examination status and sex

Mean (median)	Examined	Not available	Refused	Not capable	Total
Males	54.2 (51)	52.7 (50)	64.6 (60)	52.7 (47)	54.0 (50)
Females	52.1 (49)	55.6 (55)	71 (71)	54.8 (51)	52.4 (50)
Total	53.1 (50)	53.6 (50)	66 (65)	53.3 (47)	53.2 (50)

Table 17 shows how the age and sex distribution of enumerated subjects compared with the underlying population as measured in the 2011 national census. The age and sex distribution of the endline study participants is roughly similar to those enumerated in the baseline study and is again broadly in line with the underlying population enumerated in the 2011 census.

Table 17. Age and sex distribution of the total study sample aged >40 years compared to the total population in the study area (North and South 24 Parganas)

Age group	Male		Female		Total	
	Sample	Population*	Sample	Population*	Sample	Population*
40-49	41.8	42.2%	50.0	42.0%	46.1	42.1%
50-59	26.9	28.8%	24.1	26.9%	25.5	27.9%
60-69	18.5	17.4%	15.9	17.8%	17.1	17.7%
70-79	9.8	8.0%	6.4	8.7%	8.0	8.4%
80+	3.5	2.9%	3.6	4.5%	3.3	4.0%
TOTAL	48.3	52.3	51.7	47.7	-	-

*West Bengal, 2011 National Census of India. Ministry of Home Affairs, Government of India.
http://www.censusindia.gov.in/2011census/population_enumeration.aspx [accessed 16/09/2014]

Prevalence of blindness in the sample

24 people are bilaterally blind (presenting vision <3/60), or 0.7% of the total population (Table 18). Prevalence of SVI is 2.9% and prevalence of MVI is 8.5%. Females have a higher prevalence of blindness than males (0.9% of females are blind compared with 0.5% of males) but males have a higher prevalence of SVI and MVI: (2.4% of females are SVI compared with 3.3% of males; and 8.0% of females are MVI compared with 9.1% of males).

All levels of VI were higher among the older age group: prevalence of blindness was ten times greater among people aged over 50 than those aged 40-49 years.

Since the baseline study among the sample, prevalence of blindness has decreased from 1.9% to 0.7% in the sample. Prevalence of SVI has decreased from 4.8% to 2.9% and prevalence of MVI has decreased from 12.3% to 8.5%.

Among the over 50s, prevalence of blindness is 1.3%, SVI is 5.2% and MVI is 14.4%.

Table 18. Prevalence of blindness, severe visual impairment (SVI) and visual impairment (VI) – all causes among total sample

Level of visual acuity	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Blindness – VA<3/60 in the better eye with best correction, or pinhole (WHO definition)									
All bilateral blindness	- (-)	8 (0.8)	8 (0.5)	- (-)	15 (1.7)	15 (0.9)	- (-)	23 (1.3)	23 (0.7)
All blind eyes	4 (0.3)	50 (2.6)	54 (1.6)	7 (0.4)	73 (4.1)	80 (2.3)	11 (0.4)	123 (3.3)	134 (2.0)
Blindness – VA<3/60 in the better eye with available correction (presenting VA)									
All bilateral blindness	- (-)	8 (0.8)	8 (0.5)	- (-)	16 (1.8)	16 (0.9)	- (-)	24 (1.3)	24 (0.7)
All blind eyes	4 (0.3)	59 (3.1)	63 (1.9)	7 (0.4)	76 (4.3)	83 (2.4)	11(0.4)	135 (3.7)	146 (2.1)

Level of visual acuity	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Severe Visual Impairment (SVI) – VA <6/60-3/60 in better eye with available correction									
All bilateral SVI	1 (0.2)	54 (5.6)	55 (3.3)	1 (0.1)	42 (4.8)	43 (2.4)	2 (0.1)	96 (5.2)	98 (2.9)
All SVI eyes	5 (0.4)	123 (6.4)	128 (3.9)	3 (0.2)	115 (6.5)	118 (3.4)	8 (0.3)	238 (6.5)	246 (3.6)
Moderate Visual Impairment (MVI) - VA<6/18-6/60 in the better eye with available correction									
All bilateral VI	14 (2.0)	135 (14.1)	149 (9.1)	11 (1.3)	130 (14.8)	141 (8.0)	25 (1.6)	265 (14.4)	290 (8.5)
All VI eyes	46 (3.3)	331 (17.3)	377 (11.5)	44 (2.5)	309 (17.5)	353 (10.0)	90 (2.9)	640 (17.4)	730 (10.7)

Age and sex-adjusted prevalence of (presenting) blindness is 0.8% (95%CI 0.5-1.2%) (Table 19). Among people aged over 50 years it is 1.4% (95%CI 0.9-2.0%). Prevalence is over twice as high among women compared with men: 1.1% compared with 0.5%, although the confidence intervals overlap indicating no statistical difference. There is less gender discrepancy between individuals with severe visual impairment (3.1% overall; 3.0% among women and 3.1% among men) and moderate visual impairment (8.8% overall; 9.3% among women and 8.4% among men).

Since the baseline survey, age and sex-adjusted prevalence of blindness has decreased from **2.0% (95%CI 1.5-2.8%) to 0.8%, representing a 60% decrease**. Since the confidence intervals do not overlap, it appears this decrease may represent a true decrease in prevalence over the time period.

Extrapolating these results to the whole population of the North 24 Parganas and South 24 Parganas, we can estimate there are 690,129 people with bilateral visual impairment or 1,879,587 eyes with visual impairment. 42,932 people are estimated to be blind, of whom 29,690 (69.2%) are female. 166,563 people are estimated to have severe visual impairment, of whom 78,643 (47.2%) are female, and 480,634 people are estimated to have a moderate visual impairment of whom 240,837 (50.1%) are female.

Level of visual acuity	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)
Blindness – VA<3/60 in the better eye with best correction, or pinhole (WHO definition)									
All bilateral blindness	-	13,242 (0.8%; 0.4-1.6%)	13,242 (0.5%; (0.2 – 0.9%)	-	27,615 (1.8%; 1.1 – 3.0%)	27,615 (1.1%; 0.6 – 1.7%)	-	40,856 (1.3%; 0.9-2.0%)	40,856 (0.7%; 0.5 – 1.1%)
All blind eyes	6,799 (0.3%; 0.1-0.7%)	82,106 (2.5%; 1.7-2.5%)	88,905 (1.6%; 1.1-2.2%)	10,493 (0.5%; 0.2-1.0%)	134,101 (4.4%; 3.2-6.1%)	144,594 (2.8%; 2.1-3.7%)	17,293 (0.4%; 0.2-0.7%)	216,207 (3.4%; 2.7-4.3%)	233,500 (2.1%; 1.7-2.7%)
Blindness – VA<3/60 in the better eye with available correction (presenting VA)									
All bilateral blindness	-	13,242 (0.8%; 0.4-1.6%)	13,242 (0.5%; (0.2 – 0.9%)	-	29,690 (2.0%; 1.2-3.2%)	29,690 (1.1%; 0.7-1.8%)	-	42,932 (1.4%; 0.9-2.0%)	42,932 (0.8%; 0.5-1.2%)
All blind eyes	6,799 (0.3%; 0.1-0.7%)	96,043 (2.9%; 2.1-4.0%)	102,842 (1.8%; 1.3-2.5%)	10,493 (0.5%; 0.2-1.0%)	139,657 (4.6%; 3.4-6.2%)	150,151 (2.9%; 2.2-3.8%)	17,293 (0.4%; 0.2-0.7%)	235,700 (3.7%; 3.0-4.6%)	252,993 (2.3%; 1.9-2.9%)
Severe Visual Impairment (SVI) – VA <6/60-3/60 in better eye with available correction									
All bilateral SVI	1,650 (0.1%; 0-1.0%)	86,270 (5.2%; 3.8-7.2%)	87,920 (3.1%; 2.2-4.3%)	1,045 (0.1%; 0-0.7%)	77,598 (5.1%; 3.9-6.8%)	78,643 (3.0%; 2.3-4.0%)	2,695 (0.1%; 0-0.5%)	163,868 (5.2%; 4.1-6.5%)	166,563 (3.1%; 2.5-3.8%)
All SVI eyes	8,648 (0.4%; 0.2-0.8%)	196,841 (6.0%; 4.6-7.8%)	205,489 (3.6%; 2.8-4.6%)	4,195 (0.2%; 0.1-0.6%)	206,622 (6.8%; 5.5-8.4%)	210,816 (4.1%; 3.3-5.0%)	12,843 (0.3%; 0.1-0.5%)	403,463 (6.4%; 5.3-7.7%)	416,306 (3.8%; 3.2-4.5%)
Moderate Visual Impairment (MVI) - VA<6/18-6/60 in the better eye with available correction									
All bilateral VI	23,897 (2.0%; 1.1-3.5%)	215,900 (13.1%; 10.7-15.9%)	239,797 (8.4%; 6.8-10.3%)	13,614 (1.2%; 0.7-2.3%)	227,222 (15.1%; 12.1-18.6%)	240,837 (9.3%; 7.5-11.4%)	37,512 (1.6%; 1.0-2.5%)	443,123 (14.0%; 11.9-16.5%)	480,634 (8.8%; 7.5-10.4%)
All VI eyes	77,893 (3.2%; 2.1-4.8%)	536,181 (16.3%; 13.6-19.4%)	614,073 (10.8%; 8.9-12.9%)	57,635 (2.6%; 1.8-3.9%)	538,579 (17.8%; 14.7-21.5%)	596,215 (11.5%; 9.5-13.8%)	135,528 (2.9%; 2.1-4.0%)	1,074,759 (17.0%; 14.5-19.8%)	1,210,288 (11.1%; 9.5-13.0%)

Compared with the age and sex-adjusted results from the baseline study (Appendix 1), presenting visual acuity had reduced at each level of visual acuity (Figure 4).

Figure 4. Change in age and sex prevalence of visual impairment between baseline and endline studies

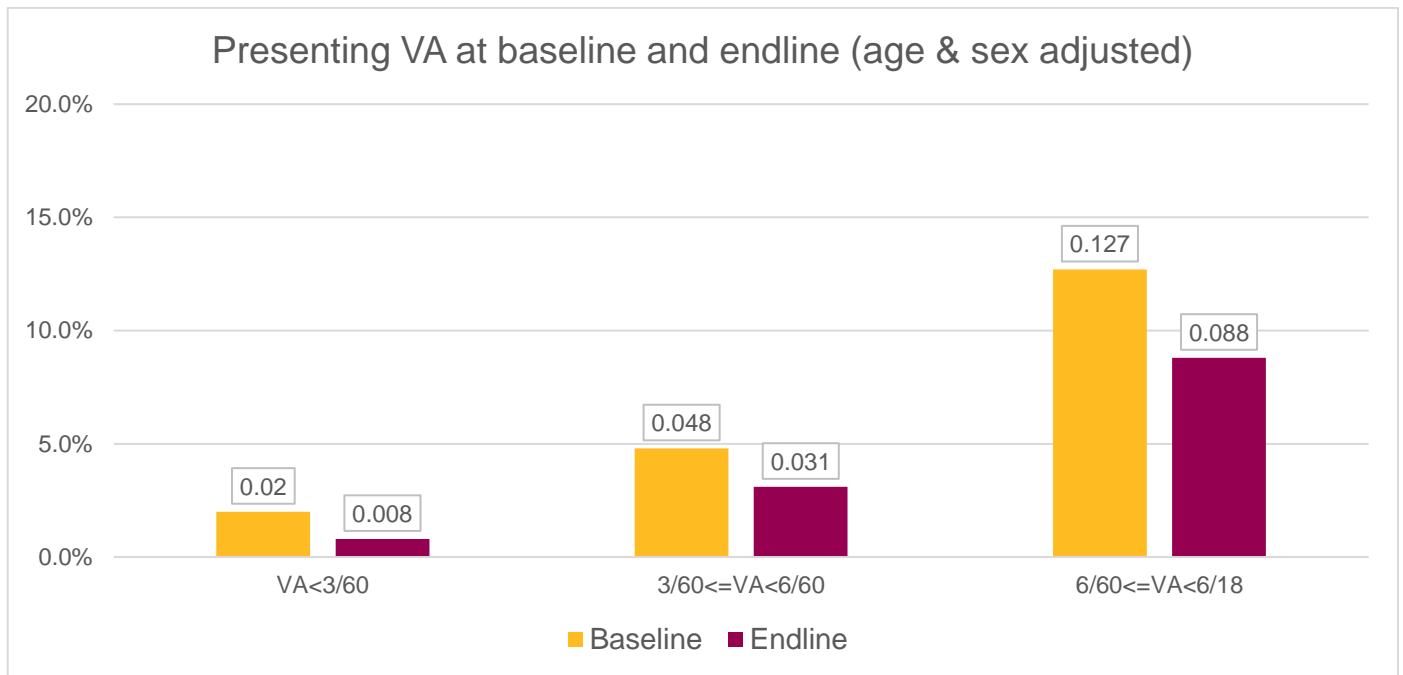


Table 20 shows the distribution of visual impairment by wealth and (non-visual) disability. Although household wealth does not appear to be linked with visual impairment, non-visual disability is associated with visual impairment, with people with visual impairments more likely to experience other, non-visual disabilities.

Table 20. Prevalence of bilateral blindness, severe visual impairment and visual impairment by wealth quintile, sex and disability

		VA < 3/60		VA < 6/60-3/60		VA < 6/18-6/60	
		In better eye		In better eye		In better eye	
		Available correction		Available correction		Available correction	
		N	% (95%CI)	N	%	N	%
Household wealth quintile All: P=0.3	Poorest	-	-	-	-	-	-
	Second	1	0.2 (0.-1.7)	6	1.4 (0.6-2.9)	30	6.8 (4.5-9.9)
	Third	9	0.9 (0.4-1.8)	37	3.7 (2.8-4.9)	86	8.6 (6.9-10.7)
	Fourth	12	0.7 (0.4-1.4)	44	2.7 (2.0-3.7)	147	9.2 (7.5-11.2)
	Richest	2	0.6 (0.1-2.2)	11	3.0 (1.9-4.9)	27	7.5 (4.5-12.1)
Males p=0.6	Poorest	-	-	-	-	-	-
	Second	-	-	3	1.4 (0.5-4.0)	17	7.9 (5.0-12.2)
	Third	5	1.0 (0.4-2.4)	19	3.9 (2.3-6.5)	44	9.1 (6.7-12.2)
	Fourth	3	0.4 (0.1-1.2)	27	3.5 (2.3-5.2)	77	9.9 (7.6-13.0)

		VA<3/60		VA<6/60-3/60		VA<6/18-6/60	
		In better eye Available correction		In better eye Available correction		In better eye Available correction	
		N	% (95%CI)	N	%	N	%
	Richest	-	-	6	3.4 (1.6-7.4)	11	6.3 (3.2-12.0)
Females p=0.6	Poorest	-	-	-	-	-	-
	Second	1	0.4 (0.1-3.3)	3	1.3 (0.4-4.2)	13	5.7 (2.9-10.8)
	Third	4	0.8 (0.3-2.1)	18	3.5 (2.3-5.2)	42	8.1 (6.0-11.0)
	Fourth	9	1.1 (0.5-2.2)	17	2.0 (1.3-3.2)	70	8.4 (6.6-10.8)
	Richest	2	1.1 (0.3-4.2)	5	2.7 (1.3-5.6)	16	8.5 (4.6-15.1)
Disability All: P<0.001	Non-visual disability	21	4.2 (2.7-6.4)	69	13.7 (10.3-18.1)	103	20.5 (17.2-24.3)
	No disability	3	0.1 (0.0-0.3)	29	1.0 (0.7-1.4)	187	6.4 (5.3-7.8)
Males P<0.001	Non-visual disability	7	3.3 (1.6-6.5)	36	17 (11.1-25.1)	43	20.3 (14.7-27.2)
	No disability	1	0.1 (0.0-0.5)	19	1.3 (0.8-23.1)	106	7.4 (5.8-9.4)
Females P<0.001	Non-visual disability	14	4.8 (2.9-8.0)	33	11.4 (8.2-15.5)	60	20.7 (16.2-26.0)
	No disability	2	0.1 (0.5-0.5)	10	0.7 (0.4-1.3)	81	5.5 (4.2-7.1)

Main causes of visual impairment

Cataract is the main cause of blindness (83.3%), followed by 'others' (12.5%) (Table 21). A similar pattern is seen for SVI (cataracts responsible for 92.9% of SVI) although refractive errors is the main cause of MVI (58.3%), followed by cataract (33.8%). Although numbers are small, there does not appear to be any difference between males or females. Numbers of people affected by visual impairment in the 40-49 group are much smaller than those in the 50+ group, however they are proportionately more affected by refractive error than their older counterparts.

Table 21. The main causes of VI at different visual acuity levels

Cause			Blind	SVI	MVI	Total
			N (%)	N (%)	N (%)	N (%)
Refractive error	Total		0 (-)	1 (1.0)	169 (58.3)	170 (41.3)
	Sex	Male	0 (-)	1(1.8)	89 (59.7)	90 (42.5)
		Female	0 (-)	0 (-)	80 (56.7)	80 (40.0)
	Age	40-49	0 (-)	0 (-)	21 (84.0)	21 (77.8)
		50+	0 (-)	1 (1.0)	148 (55.9)	149 (38.7)
Cataract (untreated)	Total		20 (83.3)	91 (92.9)	98 (33.8)	209 (50.7)
	Sex	Male	7 (87.5)	51 (92.7)	47 (31.5)	105 (49.5)
		Female	13 (81.3)	40 (93.0)	51 (36.2)	104 (52.0)
	Age	40-49	0 (-)	0 (-)	2 (8.0)	2 (7.4)
		50+	20 (83.3)	91 (94.8)	96 (36.2)	207 (53.8)
Corneal scar	Total		1 (4.2)	0 (-)	2 (0.7)	3 (0.7)
	Sex	Male	0 (-)	0 (-)	2 (1.3)	2 (0.9)
		Female	1 (6.3)	0 (-)	0 (-)	1 (0.5)
	Age	40-49	0 (-)	0 (-)	0 (-)	0 (-)
		50+	1 (4.2)	0 (-)	2 (0.8)	3 (0.8)
Others	Total		3 (12.5)	6 (12.1)	21 (7.2)	30 (7.3)
	Sex	Male	1 (12.5)	3 (5.5)	11 (7.4)	15 (7.1)
		Female	2 (12.5)	3 (7.0)	10 (7.1)	15 (7.5)
	Age	40-49	0 (-)	2 (100.0)	2 (8.0)	4 (14.8)
		50+	3 (12.5)	4 (4.2)	19 (7.2)	26 (6.8)
TOTAL	Total		24	98	290	412
	Sex	Male	8	55	149	212
		Female	16	43	141	200
	Age	40-49	0	22	25	27
		50+	24	96	265	385

The patterns observed here are similar to those seen in the baseline survey, where 87% of blindness and 82% of SVI were attributable to cataract. 48% of MVI was due to refractive error and 47% was due to cataract.

Cataract and visual impairment

Table 22 shows the prevalence of visual impairment co-existing with cataract. It should be noted the cause of the VI is not necessarily the cataract, although it is likely. No difference is observed between males and females.

Tables 22. Prevalence of cataract with VA<3/60, VA<6/60 and VA<6/18 – best corrected VA or pinhole, among total sample

Level of visual acuity	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Cataract blindness with VA<3/60 with best correction or pinhole									
Bilateral cataract blind	0 (-)	6 (0.6)	6 (0.4)	0 (-)	12 (1.4)	12 (0.7)	0 (-)	18 (1.0)	18 (0.5)
Unilateral cataract blind	1 (0.1)	26 (2.9)	27 (1.6)	3 (0.3)	34 (3.9)	37 (2.1)	4 (0.2)	60 (3.4)	64 (1.9)
Cataract blind eyes	1 (0.07)	38 (2.2)	39 (1.2)	3 (0.2)	58 (3.3)	61 (1.7)	4 (0.1)	96 (2.7)	100 (1.5)
Cataract with VA<6/60 with best correction or pinhole									
Bilateral cataract	0 (-)	35 (3.7)	35 (2.1)	0 (-)	40 (4.5)	40 (2.3)	0 (-)	75 (4.1)	75 (2.2)
Cataract eyes	2 (0.1)	113 (5.9)	115 (3.5)	3 (0.2)	130 (7.4)	133 (3.8)	5 (0.2)	243 (6.9)	248 (3.6)
Cataract with VA<6/18 with best correction or pinhole									
Bilateral cataract	1 (0.2)	94 (9.8)	95 (5.8)	1 (0.1)	92 (10.4)	93 (5.3)	2 (0.1)	186 (10.1)	188 (5.5)
Cataract eyes	6 (0.4)	241 (12.6)	247 (7.5)	9 (0.5)	253 (14.4)	262 (7.4)	15 (0.5)	494 (14.0)	509 (7.5)

NB. This table lists people and eyes with cataract and different levels of visual impairment. However, the primary cause of the visual impairment could be other than cataract.

Table 23 shows that the age and sex-adjusted prevalence of bilateral blindness (presenting vision) and cataract is 0.5%: it is slightly higher among women (0.7%) than men (0.4%). At the SVI and MVI levels, bilateral prevalence is slightly higher among males than females.

Table 23. Age and sex adjusted prevalence of cataract with VA

Level of visual acuity	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)
Cataract blindness with VA<3/60 with best correction or pinhole									
Bilateral cataract blind	-	9,571 (0.6; 0.3-1.3%)	9,571 (0.3; 0.1-0.8%)	-	22,121 (1.5; 0.8-2.6%)	22,121 (0.9; 0.5-1.5%)	-	31,692 (1.0; 0.6-1.6%)	31,692 (0.6; 0.4-0.9%)
Cataract blind eyes	-	77,940 (2.4; 1.5-3.7%)	77,940 (1.4; 0.9-2.2%)	3,150 (0.1; 0.0-1.0%)	128,860 (4.3; 2.9-6.2%)	132,010 (2.5; 1.7-3.7%)	3,150 (0.1; 0.0-0.5%)	206,801 (3.3; 2.4-4.4%)	209,914 (1.9; 1.4-2.6%)

Level of visual acuity	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N	N	N	N	N	N	N	N	N
	(%; 95%CI)	(%; 95%CI)	(%; 95%CI)	(%; 95%CI)	(%; 95%CI)	(%; 95%CI)	(%; 95%CI)	(%; 95%CI)	(%; 95%CI)
Cataract with VA<6/60 with best correction or pinhole									
Bilateral cataract	-	56,648 (3.4; 2.5-4.8%)	56,648 (2.0; 1.4-2.8%)	-	75,291 (5.0; 3.8-6.6%)	75,291 (2.9; 2.2-3.8%)	-	131,939 (4.2; 3.3-5.3%)	131,939 (2.4; 1.9-3.0%)
Cataract eyes	3,300 (0.1; 0.0-1.0%)	201,198 (6.1; 4.5-8.2%)	204,498 (3.6; 2.7-4.8%)	3,150 (0.1; 0.0-1.0%)	261,861 (8.7; 6.9-10.8%)	265,011 (5.1; 4.1-6.3%)	6,450 (0.1; 0.0-0.6%)	463,059 (7.3; 6.0-8.9%)	469,473 (4.3; 3.6-5.2%)
Cataract with VA<6/18 with best correction or pinhole									
Bilateral cataract	1,650 (0.1; 0.0-1.0%)	147,712 (9.0; 7.1-11.3%)	149,362 (5.2; 4.1-6.6%)	1,045 (0.1; 0.0-0.7%)	166,657 (11.0; 9.1-13.3%)	167,702 (6.4; 5.3-7.8%)	2,695 (0.1; 0.0-0.5%)	314,369 (10.0; 8.6-11.5%)	317,064 (5.8; 5.0-6.7%)
Cataract eyes	6,600 (0.3; 0.0-1.1%)	364,427 (11.1; 8.9-13.6%)	371,026 (6.5; 3.8-8.0%)	13,629 (0.6; 0.2-1.7%)	482,623 (16.0; 13.5-18.9%)	496,253 (9.5; 8.0-11.3%)	20,229 (0.4; 0.2-1.0%)	847,051 (13.4; 11.7-15.3%)	867,243 (7.9; 6.9-9.1%)

Operated cataract

The sample prevalence of operated eyes is 4.9% (Table 24). 3.3% of people have both eyes operated and 3.2% have just one eye operated. The differences between males and females are not large: bilateral operations are 3.5% among men and 3.1% among women. Unilateral operations are 2.8% among men and 3.3% among women.

These findings are very similar to those seen at baseline where 4.7% of eyes had been operated on: 3.2% of people being bilaterally (pseudo) aphakic and 3.2% being unilaterally (pseudo) aphakic. Differences between males and females were a little different: bilateral operations were 2.7% among men and 3.8% among women, and unilateral operations were 2.9% among men and 3.6% among women.

Table 24. Sample prevalence of (pseudo) aphakia, among total sample

	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Bilateral (pseudo) aphakia	2 (0.3)	55 (5.7)	57 (3.5)	1 (0.1)	53 (6.0)	54 (3.1)	3 (0.2)	108 (5.9)	111 (3.3)

Unilateral (pseudo) aphakia	3 (0.4)	44 (4.6)	47 (2.9)	3 (0.3)	60 (6.8)	63 (3.6)	6 (0.4)	104 (5.7)	110 (3.2)
(Pseudo) aphakic eyes	7 (0.5)	154 (8.7)	161 (4.9)	5 (0.3)	166 (9.4)	171 (4.8)	12 (0.4)	320 (9.1)	332 (4.9)

Table 25 shows the age and sex-adjusted prevalence of operated eyes. It also shows the estimated number of people in the study area who are pseudo aphakic. It is estimated that more than 560,000 eyes have been operated on, over 300,000 of which are female eyes and nearly 260,000 of which are male eyes.

Table 25. Age and sex adjusted prevalence of (pseudo) aphakia

	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N (% ±95%CI)	N (% ±95%CI)	N (% ±95%CI)	N (% ±95%CI)	N (% ±95%CI)	N (% ±95%CI)	N (% ±95%CI)	N (% ±95%CI)	N (% ±95%CI)
Bilateral (pseudo) aphakia	3,300 (0.3; 0.1-1.1%)	87,289 (5.3; 4.1-6.9%)	90,589 (3.2; 2.4-4.1)	1,575 (0.1; 0.0-1.0%)	95,273 (6.3; 4.7-8.4%)	96,848 (3.7; 2.8-5.1)	4,875 (0.1; 0.7%)	182,562 (5.8%; 4.7-7.1%)	187,437 (3.4; 2.8-4.3)
Unilateral (pseudo) aphakia	5,149 (0.4; 0.1-1.3%)	71,613 (4.3; 3.3-5.8%)	76,762 (2.7; 2.0-3.6)	4,195 (0.4; 0.1-1.2%)	104,775 (6.9; 5.2-9.3%)	108,970 (4.2; 3.1-5.7)	9,344 (0.4; 0.2-0.9%)	176,388 (5.6; 4.6-6.8%)	185,731 (3.4; 2.8-4.2)
(Pseudo) aphakic eyes	11,749 (0.5; 0.2-1.4%)	246,191 (7.5; 6.1-9.1%)	257,940 (4.5; 3.7-5.5)	7,344 (0.3; 0.1-1.0%)	295,321 (9.8; 7.8-12.2%)	302,666 (5.8; 4.6-7.4)	19,093 (0.4-0.9%)	541,512 (8.6; 7.2-10.2%)	560,606 (5.1; 4.3-6.1)

Cataract surgical coverage

Table 26 shows cataract surgical coverage among the sample. The proportion of operated eyes among people with cataract and cannot see 3/60 is 76.9% - a small increase from 74.2% from baseline. At better levels of VA, CSC in eyes is 57.2% at 6/60 (up from 46.6% at baseline), and 39.5% at 6/18 (up from 30.4% at baseline). The difference between males and females is very small.

Among persons, CSC at 3/60 level is 86.3%, increased from 75.0% at baseline. At 6/60 CSC is 65.5%, up from 49.6%, and at 6/18 it is 48.5%, up from 35.0%.

Difference in CSC by sex is again negligible. Similarly, it wasn't possible to detect a difference in CSC according to household wealth. However, non-visual disability was associated with CSC with people reporting non-visual disabilities experiencing a lower CSC at all VA levels than their counterparts.

Table 26. Cataract surgical coverage (CSC) in sample

CSC (eyes)		VA<3/60	VA<6/60	VA<6/18
	Total	76.9%	57.2%	39.5%
Sex	Male	80.5%	58.3%	39.5%
	Female	73.7%	56.3%	39.5%
CSC (persons)				
	Total	86.3%	65.5%	48.5%
Sex	Male	87.5%	64.8%	46.7%
	Female	85.2%	66.1%	50.3%
Disability	No disability	91.8%	70.1%	51.7%
	Non-visual disability	76.8%	57.3%	43.0%
Wealth	Poorest	-	-	-
	Second	91.7%	75.0%	50.0%
	Third	90.2%	65.8%	50.4%
	Fourth	81.9%	61.3%	44.9%
	Richest	88.9%	75.0%	56.8%

Following adjustment for age and sex, CSC in eyes is slightly lower than in the sample and CSC in persons is slightly higher, perhaps reflecting the greater likelihood of women to have had only one operation and their over-representation in the sample as compared to the underlying population.

Table 27. Age and sex-adjusted cataract surgical coverage

		VA<3/60	VA<6/60	VA<6/18
CSC (eyes)	Total	72.8%	54.4%	39.3%
	Male	76.8%	55.8%	41.0%
	Female	69.6%	53.3%	37.9%
CSC (persons)	Total	89.4%	74.1%	61.6%
	Male	93.1%	76.3%	61.6%
	Female	86.3%	72.1%	61.5%

Cataract surgical outcome

Cataract surgical outcomes overserved as good are very high at 80%, with only 8.7% being considered poor (Table 28). With correction, 83.1% of operated eyes can see 6/18, close to the WHO recommended threshold of 85%.

These figures are slightly improved on the baseline survey where 75% of outcomes were 'good' and 7% 'poor'.

Table 28. VA in operated eyes with available correction (PVA)

	IOL		Non-IOL		Total	
	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	266	81.2%	0	-	266	80.1%
Borderline: can see 6/60	37	11.4%	0	-	37	11.1%
Poor: cannot see 6/60	22	6.8%	7	100%	29	8.7%
	325		7		332	100%

After correction, 7.2% of eyes remain with a poor outcome, not far from the WHO suggested level of 5% (Table 29).

Table 29. VA in operated eyes with best correction (BVA)

	IOL		Non-IOL		Total	
	Eyes	%	Eyes	%	Eyes	%
Good can see 6/18	276	84.9%	0	-	276	83.1%
Borderline: can see 6/60	32	9.8%	0	-	32	9.6%
Poor: cannot see 6/60	17	5.2%	7	100%	24	7.2%
	325		7		332	100%

Details of cataract surgery

The most common place of operation is the private hospital (57.7%), followed by the eye camp (17.0%), government hospital (16.1%) and voluntary/charitable hospital (9.2%). This differs from baseline where 38.5% were undertaken in a voluntary/charitable hospital, 34.5% in a private hospital, 15.5% at a government hospital and 11.5% at an eye camp.

The majority of people were satisfied with the service they received (88.7%), fewer than 1% were indifferent and 10.4% were dissatisfied. This is an improvement from baseline where 80.7% were satisfied, 8.2% were indifferent and 11.2% were dissatisfied.

Table 30. Details of cataract surgery from operated sample of eyes

	Male		Female		Total	
	N/ mean	%/ standard deviation	N/ mean	%/ standard deviation	N/ mean	%/ standard deviation
Place of operation:						
Government hospital	31	18.8	23	13.4	54	16.1
Voluntary/charitable hospital	15	9.1	16	9.4	31	9.2
Private hospital	90	54.5	104	60.8	194	57.7

Eye camp/improvised setting	29	17.6	28	16.4	57	17.0
Average price of surgery (INR)	1,918	0	2,046	0	1,983	0
Satisfaction with cataract surgery						
Satisfied	146	88.5	152	88.9	298	88.7
Indifferent	0	-	3	1.8	3	0.9
Dissatisfied	19	11.5	16	9.4	35	10.4

Effective cataract surgical coverage

Effective cataract surgical coverage (eCSC) is a measure of cataract surgical coverage that also reflects the quality of cataract surgical outcomes. Since such a high proportion of operated eyes have good outcomes, eCSC here is very similar to CSC. Three quarters of people with operable cataracts have been operated on and have good surgical outcomes.

Table 31. Percentage of effective cataract surgical coverage (person)

	Male	Female	Total
VA<3/60	76.4%	74.1%	75.2%
VA<6/60	56.5%	58.5%	57.5%
VA<6/18	39.7%	43.3%	41.5%

Reason for not accessing cataract surgery

The major reason given for not having accessed cataract surgery was not being able to afford it (40.2%), closely followed by not feeling a need to have surgery (37.2%). This differed from the baseline study when although 39.8% also did not feel a need, only 16.3% said they could not afford surgery.

Table 32. Reasons for not having cataract surgery by gender (no differences observed)

	Male		Female		Total	
	N	%	N	%	N	%
Need not felt (old age, one eye or other priorities)	58	38.2	61	36.1	119	37.1
Cannot afford	67	44.1	62	36.7	129	40.2
Unaware of services or told to wait	17	11.2	21	12.4	38	11.8
Fear or feeling of destiny	37	24.3	34	20.1	71	22.1
No time or person to accompany	9	5.9	20	11.8	29	9.0
No services	13	8.6	8	4.7	21	6.5
Medical contraindication	5	3.3	11	6.5	16	5.0
Other	4	2.6	12	7.1	16	5.0

Prevalence of presbyopia

Without spectacles, 42% of the sample were unable to read N8 unaided. Among those people, 60% had spectacles and among those people, 95.6% were able to read N8 when wearing the glasses.

There was no observed difference between males and females in terms of presbyopia, access to near glasses or ability to read N8 with glasses.

At baseline, 75.2% of the sample were unable to read N8, however only 46.2% of these had access to spectacles. Among those with spectacles, 87.3% were able to read N8 when wearing them.

Table 33. Presbyopia prevalence by sex (no difference by sex)

	Male		Female		Total	
	N	%; 95%CI*	N	%; 95%CI*	N	%; 95%CI*
Unable to read N/8 (without glasses)	668	40.6; 34.2-47.3	765	43.4; 37.6-49.3	1,433	42.0; 36.2-48.1
Access to near glasses	401	60.0; 54.1-65.7	463	60.5; 55.1-65.7	864	60.3; 55.1-65.2
Unable to read N/8 with available glasses	18	4.5; 2.7-7.3	20	4.3; 2.7-6.7	38	4.4; 3.1-6.3

* Adjusted for clustering

Extrapolating these results to the population, we can estimate that there are approximately 2,347,232 presbyopes aged over 40 in the study area. Among these, 40% (1.4 million) may not have glasses, and 62,199 of those who do have glasses may have an incorrect prescription of additional ocular problem preventing them from seeing N8.

Table 34. Age and sex adjusted prevalence of presbyopia by sex

	Male		Female		Total	
	N	%; 95%CI	N	%; 95%CI	N	%; 95%CI
Unable to read N/8 (without glasses)	1,137,884	39.9; 33.5-46.6	1,209,348	46.5; 40.4-52.6	2,347,232	43.0; 37.0-49.2
Access to near glasses	684,936	60.2; 54.2-65.9	724,615	59.9; 54.4-65.2	1,409,550	60.1; 54.9-65.0
Unable to read N/8 with available glasses	28,511	4.2; 2.5-6.8	33,687	4.6; 2.9-7.3	62,199	4.4; 3.1-6.3

Reasons for not using glasses among the sample who require them

Among the 610 subject participants who require near spectacles, one-third were aware that they required them (Table 35).

Table 35. Awareness on glasses, use and willingness to pay for refractive error services (no sex association unless stated)

	Male		Female		Total	
	N	%	N	%	N	%
Aware of need for glasses (n=610)	93	32.0	111	34.8	204	33.4
If yes, reasons for not attending a check-up for glasses (n=204) (p=0.2)						
Problem is recent	14	15.1	24	21.6	38	18.6
Financial reasons	38	40.9	52	46.9	90	44.1
Need not felt	28	30.1	16	14.4	44	21.6
Did not know where to go	2	2.2	4	3.6	6	2.9
Getting other treatment (naturopathy etc)	2	2.2	0	-	2	1.0
Personal reasons	5	5.4	7	6.3	12	5.9
No time	2	2.2	3	2.7	5	2.5
Not a priority	0	-	1	0.9	1	0.5
Others	2	2.2	4	3.6	6	2.9
Prescribed glasses (N=204, P=0.01)						
21	22.6	43	38.7	64	31.4	
Reasons for not filling prescription (n=64) (p=0.9)						
Can work without glasses	5	23.8	10	23.3	15	23.4
Financial reasons	12	57.1	27	62.8	39	60.9
Fear of people making fun	0	-	1	2.3	1	1.6
Personal reasons	3	14.3	3	7.0	6	9.4
Others	1	4.8	2	4.7	3	4.7
Reasons for not wearing available glasses (n=64)						
Glasses broken	2	9.5	8	18.6	10	15.6
Glasses lost	1	4.8	1	2.3	2	3.1
Don't need them now	2	9.5	8	18.6	10	15.6
Uncomfortable	2	9.5	7	16.3	9	14.1
No improvement in vision	3	14.3	3	7.0	6	9.4
Poor quality glasses	2	9.5	3	7.0	5	7.8
Using contact lenses	-	-	-	-	-	-
Using yoga, naturopathy, etc	1	4.80	-	-	1	1.6
People made fun	0	-	1	2.3	1	1.6
Other	8	38.1	12	27.9	20	31.3
Median amount willing to pay for an eye check-up? (INR)	120		100		100	
Median amount willing to pay for glasses (INR)?	200		150		200	

Spectacles use by study participants

On average, participants with spectacles have had them for 53.2 years – for women a slightly shorter time at 4.7 years. The majority of people (37.5%) obtained their prescriptions from an NGO hospital, vision centre of eye camp and a slightly smaller proportion (34.1%) obtained them from a private provider. A similar pattern was observed around where spectacles were obtained. This is a slight shift compared with baseline where private providers were the most common source of prescriptions (37.5%) but NGO hospitals, vision centres and eye camps remained the most popular source of spectacles.

The proportion of people with spectacles voicing satisfaction increased from 79.1% at baseline to 88.5% at endline.

Table 36. Spectacle use among individuals with spectacles (near or distance)

	Male		Female		Total	
	N	%	N	%	N	%
Average duration of having glasses (years) (mean/median)	5.9	4	4.7	3	5.2	4
Obtained prescription from:						
Government hospital/health centre	81	15.1	94	16.2	175	15.7
Private hospital/health centre	182	34.0	199	34.3	381	34.1
NGO hospital, vision centre or eye camp	194	36.2	225	38.7	419	37.5
Spectacle shop	45	8.4	38	6.5	83	7.4
Other	34	6.3	25	4.3	59	5.3
Obtained glasses from:						
Government hospital/health centre	37	6.9	46	7.9	83	7.4
Private hospital/health centre	158	29.5	177	30.5	335	30.0
NGO hospital, vision centre or eye camp	159	29.7	211	36.3	370	33.1
Spectacle shop	166	31.0	133	22.9	299	26.8
Other	16	3.0	14	2.4	30	2.7
Cost of glasses:						
Totally free	64	11.9	82	14.1	146	13.1
Partially free	41	7.7	37	6.4	78	7.0
Fully paid	431	80.4	462	79.5	893	80.0
Median INR paid (IQR)	400		350		350	
Satisfied with glasses?						
Satisfied	469	87.5	520	89.5	989	88.5
Indifferent	15	2.8	9	1.6	24	2.2
Dissatisfied	52	9.7	52	9.0	104	9.3

Health seeking behaviour

Table 37 shows that 11.1% of study participants had an eye problem in the six months preceding the survey. Among those people, 20.5% sought care for that problem. This contrasts with 34.6% of baseline survey participants reporting problems in the six months preceding that survey, although a similar percentage (21.2%) reported seeking care for those problems.

The major reason for not seeking care (60.6%) among people with eye problems in the past six months was financial. This is an increase from 36.6% at baseline.

Among those people who sought care for an eye problem in the preceding six months, around two-thirds expressed satisfaction with the accessibility (66.7%), affordability (68.0%) and quality (70.5%) of the facility they attended. This indicates an increase from the baseline survey where the proportion satisfied with facilities was closer to half those who sought care (accessibility: 51.2%; affordability: 47.4%; quality: 54.6%).

Table 37. Eye health seeking behaviour among survey participants by sex

	Male		Female		Total	
	N	%	N	%	N	%
People reporting eye problems in the past six months	184	11.2	196	11.1	380	11.1
Proportion reporting seeking treatment for those problems	38	20.7	40	20.4	78	20.5
Reasons for not seeking care among those reporting problems (p=0.3)						
Not a serious problem	33	22.6	27	17.3	60	19.9
Did not know where to go	1	0.7	0	-	1	0.3
Financial reasons	82	56.2	101	64.7	183	60.6
No one to accompany	6	4.1	8	5.1	14	4.6
Fear	7	4.8	7	4.5	14	4.6
No time	10	6.9	3	1.9	13	4.3
Not a priority	-	-	-	-	-	-
Services too far	3	2.1	4	2.6	7	2.3
Other	4	2.7	6	3.9	10	3.3
Satisfaction with accessibility of facility						
Dissatisfied	9	23.7	12	30.0	21	26.9
Indifferent	3	7.9	2	5.0	5	6.4
Satisfied	26	68.4	26	65.0	52	66.7
Satisfaction with affordability of facility						
Dissatisfied	11	29.0	8	20.0	19	24.4
Indifferent	4	10.5	2	5.0	6	7.7
Satisfied	23	60.5	30	75.0	53	68.0

	Male		Female		Total	
	N	%	N	%	N	%
Satisfaction with quality of facility						
Dissatisfied	9	23.7	7	17.5	16	20.5
Indifferent	4	10.5	3	7.5	7	9.0
Satisfied	25	65.8	30	75.0	55	70.5

Conclusions

This endline study allowed us to measure key changes in project indicators compared with the baseline study. Prevalence of visual impairment at all levels decreased, and coverage and quality of cataract and refractive error services increased. Generally, knowledge of eye health issues increased among household heads, as did their satisfaction with the accessibility, affordability and quality of services they access.

Overall, results indicated few, small differences between males and females indicating relatively good levels of gender equity in terms of access to eye health services. Increases in cataract surgical coverage appear greater in the lower levels of visual acuity, indicating people examined at endline are accessing surgery earlier than those at baseline. This could be attributed to better knowledge or access to health care. People with non-visual disabilities had a lower CSC than their non-disabled counterparts at all levels of VA, indicating possible equity issues with how people with functional limitations access eye health services.

Cataract surgical outcomes were very good, and a slight improvement on those at baseline. Effective cataract surgical coverage was therefore high, indicating good coverage and quality of services among males and females who require it. Reported locations of cataract operations were different in this study than at baseline with a greater proportion of individuals reporting private services and a smaller proportion reporting charitable or NGO hospitals. We cannot definitively say why this may be, but it may be due to several reasons. For example, it is possible that a) a different profile of participants were included in the two studies b) there was a difference in the understanding of the terms 'private' and 'charitable/NGO' between participants in the two studies or c) there was a true increase in the number of participants accessing services through private means in the last five years. The proportion of respondents who need but have not yet received cataract surgery saying it was due to financial reasons more than doubled between the study periods. When examined where participants were accessing surgery at endline, it is possible that the endline study sampled people living closer to more private facilities than at baseline.

Fewer participants in the endline survey were presbyopic, although a greater proportion of people who needed glasses had them and were able to read with them, indicating an increase in coverage and quality of spectacle services.

The study was subject to several limitations: the disproportionate absence of younger males meant that the prevalence of visual impairment may have been underestimated in the sample, although the age and sex-adjusted results should have compensated for that. It appears that the data around age at cataract operation has problems since several people appear to have reported the number of years since their operation, rather than their age. Although the Indian equity tool is a more valid measurement of asset-based wealth than the tool used in the baseline study, the lack of comparability between the wealth datasets is problematic and limits analysis of changes according to wealth of respondents.

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Appendix 1: Baseline age & sex adjusted results

Level of visual acuity	Male			Female			Total		
	40-49	50+	All	40-49	50+	All	40-49	50+	All
	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)	N (%; 95%CI)
Blindness – VA<3/60 in the better eye with best correction, or pinhole (WHO definition)									
All bilateral blindness	-	33,347 (2.0; 1.2-3.4%)	33,284 (1.2; 0.7-2.0%)	5,705 (0.5; 0.2-1.6%)	42,591 (2.8; 1.7-4.6%)	48,296 (1.9; 1.2-2.9%)	5,705 (0.2; 0.1-0.8%)	75,966 (2.4; 1.6-3.7%)	81,604 (1.5; 1.0-2.2%)
All blind eyes	4,014 (0.2; 0.0-0.7%)	102,881 (3.1; 2.1-4.6%)	106,710 (1.9; 1.3-2.7%)	15,181 (0.7; 0.3-1.7%)	119,994 (4.0; 2.7-5.9%)	135,175 (2.6; 1.8-3.7%)	19,195 (0.4; 0.2-0.9%)	222,935 (3.5; 2.6-4.8%)	241,936 (2.2; 1.6-3.0%)
Blindness – VA<3/60 in the better eye with available correction (presenting VA)									
All bilateral blindness	-	35,761 (2.2; 1.3-3.5%)	35,693 (1.3; 0.8-2.1%)	7,542 (0.7; 0.3-1.8%)	65,011 (4.3; 2.9-6.3%)	72,553 (2.8; 1.9-4.0%)	7,542 (0.3; 0.1-0.9%)	100,847 (3.2; 2.3-4.4%)	108,301 (2.0; 1.5-2.7%)
All blind eyes	4,014 (0.2; 0.0-0.7%)	117,098 (3.6; 2.5-5.0%)	120,900 (2.1; 1.5-2.9%)	18,859 (0.9; 0.4-1.9%)	185,432 (6.1; 4.5-3%)	204,288 (3.9; 3.0-5.2%)	22,869 (0.2; 0.0-0.7%)	302,712 (4.8; 3.7-6.2%)	325,314 (3.0; 2.4-3.8%)
Severe visual impairment – 3/60 ≤ VA <6/60 in the better eye with available correction									
All bilateral SVI	4,137 (0.3; 0.1-1.5%)	121,797 (7.4; 5.6-9.8%)	125,713 (4.4; 3.3-5.8%)	5,802 (0.5; 0.2-1.6%)	130,111 (8.6; 7.0-10.5%)	135,913 (5.2; 4.2-6.5%)	9,939 (0.4; 0.2-1.0%)	251,951 (8.0; 6.8-9.4%)	261,655 (4.8; 4.0-5.7%)
All SVI eyes	8,274 (0.3; 0.1-1.5%)	267,865 (8.1; 6.3-10.4%)	275,097 (4.8; 3.7-6.2%)	17,212 (0.8; 0.3-2.0%)	290,376 (9.6; 8.0-11.6%)	307,588 (5.9; 4.8-7.2%)	25,486 (0.6; 0.3-1.2%)	557,790 (8.8; 7.6-10.3%)	582,761 (5.3; 4.5-6.3%)
Moderate visual impairment – 6/60 ≤ VA <6/18 in the better eye with available correction									
All bilateral VI	36,999 (3.1; 1.7-5.3%)	284,322 (17.3; 13.9-21.3%)	320,878 (11.2; 9.1-13.8%)	77,452 (7.1; 4.5-11.1%)	294,699 (19.5; 16.1-23.5%)	372,151 (14.3; 11.8-17.3%)	114,451 (5.0; 3.4-7.3%)	579,102 (18.3; 15.3-21.9%)	693,137 (12.7; 10.6-15.1%)
All VI eyes	90,804 (3.8; 2.3-6.1%)	571,327 (17.3; 14.1-21.1%)	661,055 (11.6; 9.5-14.1%)	156,645 (7.2; 4.6-11.0%)	594,192 (19.7; 16.2-23.7%)	750,837 (14.4; 11.9-17.4%)	247,448 (5.4; 3.7-7.7%)	1,165,684 (18.5; 15.5-21.9%)	1,412,319 (12.9; 10.9-15.3%)