Rapid assessment of avoidable blindness (RAAB) and disability and equity survey

Nampula, Mozambique

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Contents

Executive summary

Visual impairment (VI) is a major global health problem with approximately 253 million people affected globally, of which 36 million are completely blind[1]. The majority of VI is found in low- and middle-income countries and avoidable causes such as cataract and refractive error are responsible for the majority of cases. Women are disproportionately affected and growing evidence suggests that other marginalised groups, such as poorer people and people with disabilities, may also carry a disproportionate burden.

Effective and relatively cheap interventions are available to treat causes of VI such as cataract and refractive errors, but they require an adequately resourced and functioning health system to deliver them. Up-to-date and accurate data are required to plan and monitor eye health services, including health service data and population level data. Data about the magnitude and causes of VI within the population and the coverage of services such as cataract surgery are vital for understanding the impact of existing services and whether they are having the desired effect.

The rapid assessment of avoidable blindness (RAAB) is a standardised survey methodology designed to measure the magnitude and causes of VI and the extent to which services are reaching different groups of people. The RAAB focuses on people aged over 50 years, as this is where the majority of VI is found. In 2018 we conducted a RAAB in Nampula province, Mozambique, to understand the current situation of eye health and how it has changed since the previous RAAB was undertaken in 2011. We collected some additional data about respondent wealth and disability status so that we could understand how eye health status and access to services differed across those groups.

We recruited 4,191 individuals aged 50+ years, of whom 4,015 were examined (95.8% response rate). After adjusting for age and sex, prevalence of blindness was 3.9%, reduced from 6.2% in 2011, with no differences observed between males and females.

Although the proportion of blindness due to cataract had reduced from 2011, it remained the major cause of blindness. Cataract was also the leading cause of severe VI. Cataract surgical coverage had increased to 31.5%, compared to 12.5% in 2011. Cataract surgical coverage among males remained higher than among females – 42% compared with 21%. Cataract surgical quality also appears to have improved, with an increase in ‘good’ visual outcomes and a decrease in ‘poor’ visual outcomes compared with the 2011 study.

Uncorrected refractive error was the major cause of moderate VI, and uncorrected presbyopia was high at 94%.

[1] Bourne RR, Flaxman SR, Braithwaite T, Cicinelli MV, Das A, Jonas JB, Keeffe J, Kempen JH, Leasher J, Limburg H, Naidoo K. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. The Lancet Global Health. 2017 Sep 1;5(9):e888-97.

Compared to 2011, posterior segment diseases (glaucoma, ARMD and others) appear to be growing in importance, increasing from 22% in 2011 to 33% in 2018.

Disability among the over 50s in Nampula appears relatively low compared with neighbouring countries, at just under 11%. People with non-visual disabilities have a higher prevalence of visual impairment than others, and they have a lower level of cataract surgical coverage.

The results of this study show that the Nampula eye health programme has been effective in reducing blindness over the past seven years. Successes in managing cataract in particular should be maintained and developed further to ensure women, people with disabilities and poorer people can access services. Other eye health services should be developed to address causes of VI such as refractive error and posterior segment diseases. In a resource-constrained environment, programme managers will need to set clear goals and test and identify cost-effective and sustainable approaches to achieve their goals over the next ten years, or until the next RAAB is conducted.

Introduction

Visual impairment is a major public health concern in many countries, with the World Health Organization (WHO) estimating that approximately 1.3 billion people live with some level of visual impairment globally[2]. Among these, it is estimated that 188.5 million people have mild vision impairment, 217 million have moderate to severe vision impairment, and 36 million people are blind. The major causes are cataract and refractive error, both of which are easily curable with high quality functioning health systems. The vast majority of these people live in low- and middle- income settings and are aged over 50 years. They are also disproportionately women.

In Mozambique the eye health system is relatively weak, with only 25 ophthalmologists in the country – less than one per million population and four times less than the recommended levels for Africa of four per million.[3] Up-to-date information about the magnitude and causes of visual impairment, as well as health seeking behaviour in the population, is important for planning services, but if collected regularly can also help evaluate the effectiveness of services provided in the past.

This report describes the results of an eye health and disability survey conducted in Nampula province of Mozambique in August and September 2018. It included a rapid assessment of avoidable blindness (RAAB) (Results 1), and a disability and wealth survey component (Results 2). We also examined the interaction between the two components to gain insight into additional personal characteristics of people aged over 50 years in rural Mozambique, and to better understand how individual characteristics may drive their health status and health seeking behaviour.

A third section (Results 3) describes the changes observed between this RAAB and one that was conducted in the same area in 2011. This makes Nampula one of the few locations where RAABs have been repeated to measure the change in prevalence of blindness and cataract surgical coverage.

[2] Bourne RRA, Flaxman SR, Braithwaite T, Cicinelli MV, Das A, Jonas JB, et al.; Vision Loss Expert Group. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. Lancet Glob Health. 2017 Sep;5(9):e888–97.

[3] The Vision Loss Expert Group. Global Vision Database Maps • IAPB Vision Atlas [homepage on the Internet]. 2018 [cited 2018 Nov 27]. Available from: http://atlas.iapb.org/global-action-plan/gap-indicators/

Eye health services in Nampula, 2011-2018

After the RAAB was conducted in 2011, programme managers identified and implemented new strategies and actions to respond to the findings of the survey.

- **Surgical quality** was improved through introducing optical biometry and a keratometer (2014) to calculate the correct power for the intraocular lens (IOL) for cataract surgeries.
- **Community knowledge** about eye health and available services was raised through training community leaders and community health workers, and broadcasting radio programmes.
- **Services were brought closer** to the communities by training and deploying ophthalmic technicians in primary and secondary health facilities and conducting outreach camps.
- **Cataract surgical rate (CSR: the number of surgeries per million population) increased** from 139 in 2011 to 529 in 2017.
- **Patient transport** from communities to health facilities (and back) for cataract surgeries, as identified as a major barrier in the 2011 study.

In 2016, further changes were made to the programme delivery strategy with a particular focus on increasing uptake among females and people with disabilities. Interventions included:

- **training women** as community health workers.
- **prioritising women** for screening and treatment.
- **emphasising women and girls** in sensitisation and mobilisation activities, as well as radio programmes.
- **sensitising all staff** on how important is to include people with disability in eye health activities and as a result, mobilisation and sensitisation activities emphasise the need for families to bring their relatives with disabilities.
- **transportation** provided to examinations for people with mobility difficulties.
- **surgical quality monitoring** using the WHO cataract monitoring tool to identify any poor results and implement improvements.

Methods

Study design

This was a cross-sectional survey comprised of two components among a sample of participants aged over 50 years in Nampula, Mozambique. The first component was a rapid assessment of avoidable blindness (RAAB), a standard methodology, and the second component focused on the disability and wealth status of the participants.

RAAB is a standardised methodology that is designed to determine the prevalence and causes of visual impairment in an area, as well as other information that can help with planning eye care services in the region. The RAAB collects data on visual acuity, lens condition, principal cause of visual impairment (if appropriate), information on cataract surgery (if appropriate), and reasons for not having accessed cataract surgery (if appropriate).

In addition to the standard RAAB questionnaire, an additional two sets of questions were administered to the participants to understand their disability and socio-economic status: the Washington Group Short Set of Questions on Disability (WGSS) and the Equity Tool (ET). Both tools are described in detail, below.

Study definitions

Blind (bilateral) is presenting visual acuity of worse than 3/60 in the better eye, unless otherwise stated.

Cataract, operable is the presence of a cataract alongside a level of visual acuity that would indicate the need for corrective surgery.

Cataract, operated is when, upon examination of the lens, the presence of an intraocular lens (pseudophakia) or an absent lens (aphakia) generally indicates a cataract operation has taken place.

Cataract surgical coverage is the proportion of people in the population who, having required a cataract operation, have been operated on. This can be expressed as $CSC = \frac{[x+y]}{[x+y+z]} \times 100\%$

Where

x = individuals with one operable cataract eye and one operated cataract eye

y = individuals with bilateral operated cataracts

z = individuals with bilateral operable cataracts

Disability is determined by responding as having a lot of difficulty or not being able to perform at all in one of the six functional domains of the WGSS.

Disability, non-visual is determined by responding as having a lot of difficulty or not being able to perform at all in one of the five functional domains (not including the seeing domain).

Effective cataract surgical coverage is the proportion of people in the population who having required a cataract operation, have been operated on and have a good visual outcome (VA≥6/18). This can be expressed as $CSC = \frac{[a+b]}{[x+y+z]} \times 100\%$

Where x, y, and z are described as above, and:

a = individuals with one operable cataract eye and one operated cataract eye which achieves VA≥6/18

b = individuals with bilateral operated cataracts achieving VA≥6/18 in at least one eye.

Functional low vision (FLV) is diagnosed when best-corrected visual acuity is less than 6/18 to PL+, but not caused by cataract, refractive error, uncorrected aphakia or pseudophakia with PCO.

Odds ratio (OR) is a measure of association between two variables. The OR describes the odds an outcome will occur given a particular exposure, compared to the odds the outcome will occur given a different exposure. An OR of 1 indicates no difference in the outcome according to the exposures.

P-value is a measure of the likelihood that a statistic did not happen by chance. A small p-value means we should have a lot of confidence in the statistic, whereas a large one (often considered >0.05 which represents a 1/20 chance) would imply the statistic may not be reliable.

Visual acuity (VA) is the level of vision measured for an individual, often using a Snellen chart. In the case of a RAAB, examiners use a simplified E optotype with 6/18 on one side and 6/60 on the other. VA can be expressed as presenting (with the individual wearing spectacles if they have them) or best corrected (using a pinhole occluder).

Visually impaired, moderately (MVI) is a VA of worse then 6/18 but 6/60 or better.

Visually impaired, severely (SVI) is a VA of worse than 6/60 but 3/60 or better.

Wealth quintile in this study is considered one of the five groups a household is allocated to according to a score based on the building characteristics and ownership of certain assets compared to the national profile.

Sample selection

Study population

The study population is people aged over 50 years ordinarily resident in Nampula. To be included people had to have been resident in the selected household for six months or more over the past year, sharing meals from the same kitchen. People excluded from the study included those who had not been resident in Nampula for the past six months; those who were unable, for any reason, to provide meaningful consent to the study; and those who refused for any reason.

Sample size

Based on the 2011 Nampula RAAB, the expected prevalence of blindness in adults aged over 50 years is conservatively estimated at 5.0%. Allowing for a confidence of 95%, a precision of 16% (i.e. worst acceptable result of 4.2%), with a design effect of 1.4 for clusters of 40, and 5% non-response, the required sample size was 4,200 people age 50 and above (RAAB 5 software). Clusters of size 40 were chosen due to dispersed villages in the study area and long travel distances. In total, 105 clusters of 40 adults aged over 50 years were required for this survey.

Sampling procedure

A simple random sample of all people aged over 50 years in Nampula province was not practical. Therefore, we used a two-stage cluster sampling methodology. A list of all *bairros* in Nampula province, with their populations, was obtained from the official 2007 Mozambican census[4] and used as the sampling frame. Large *bairros* were broken down in to *celulas* where such data existed. In cases where the population size of the unit was not available, the larger unit was split equally between the number of its known sub-divisions. This information was entered in the integrated RAAB software, which used a probability proportional to size approach to select 105 areas.

Within each area, we enrolled 40 people using a compact segment sampling approach, which was applied as follows:

- The cluster informer visited the area a few days before the team arrived and worked with the *bairro* leaders, who provided the names of the *celulas* within the village and the approximate number of households.

[4] Instituto Nacional de Estatistica - Moçambique. Indicadores Sócio Demográficos Província de Nampula 2007. http://www.ine.gov.mz/operacoes-estatisticas/censos/censo-2007/rgph-2007/indicadores-socio-demograficos-provincia-de-nampula-2007.pdf/view

- A simple map was produced and numbers assigned to each *celula*. Numbers were written on small bits of paper which were then drawn at random by the village leader to select the area of the *bairro* to be included in the study.
- All households in the selected *celula* were visited and all eligible people living there, whether present that day or not, were enumerated. Households were visited sequentially and people enumerated until 40 people aged 50+ years were recruited. If there were fewer than 40 people of age 50+ in this *povocao* then a neighboring area hamlet was visited and sampling continued until 40 eligible people were enumerated.

Data collection

Five teams collected the data; each team comprised of an ophthalmologist or experienced ophthalmic technician as an examiner, an ophthalmic technician, a disability/equity data collector, and a driver. At each village, a local guide joined the team to guide them and make household introductions. Teams underwent five-day training in Nampula Central Eye Hospital with two certified RAAB trainers, and all passed an IOV exam to show standardisation of clinical examination, the report of which is in Appendix 1.

In a selected area, the team moved from the edge of the selected segment closest to the main road to the nearest house. They continued systematically until 40 people aged 50 years and over had been enumerated and examined. If an individual was absent at the time of the visit they were enumerated and the house was revisited at the end of the day to carry out the examination. If they were still absent, information on their visual status was collected from their family or neighbour but was not included in the analysis.

Prior to examination, information regarding the survey was provided to the participants and consent was sought from each individual and the head of the household. All consenting participants underwent ophthalmic examination in their homes, including measurement of visual acuity (VA) in daylight with a tumbling-E chart and lens examination with a direct ophthalmoscope in a darkened house. Pupil dilation was only used if judged necessary by the examiner. For every individual examined the data collected was stored within the mRAAB app on an Android phone; the study used keyless, touch-screen mobile devices (encrypted and password-protected mobile units).

In addition, each participant enrolled onto the RAAB was asked to participate in the disability and wealth component, which asked individuals about functional difficulties and health seeking behavior, and heads of households were asked about the assets of the households.

This data was collected using keyless, touch-screen ultra-mobile devices (encrypted and password-protected smartphone units) with an application designed using

CommCare software. All data was backed up daily after data had been collected; the fieldworker manually transferred the records to the cloud. The technical advisor backed up the encrypted files on a password-protected external drive. This process ensured security and minimised loss of data should a field device be misplaced or broken. These devices offer a cost-effective alternative to paper-based data collection. To ensure data quality, algorithms were incorporated into the software and regular data reviews were conducted.

Data collection tools – disability and wealth component

The disability and wealth component was developed by combining two standardised tools, in addition to some extra socio-demographic information, into a single mobile application for administration following the RAAB survey component.

Wealth

We used two tools to measure economic status of participants: the Equity Tool (ET), which measures relative wealth, i.e. how an individual and their household compares to other individuals/households in the country in their wealth; and the Poverty Scorecard, which measures probability of an individual and their household to be below the poverty line.

The Equity Tool, maintained by Metrics for Management, is an internationally recognised tool designed to evaluate differences between social groups[5]. Economic status of participants is determined by categorising them into one of five asset-based wealth quintiles: those who are the poorest and often most marginalised fall into the bottom quintile, those who are the wealthiest are in the top quintile. The tool is based on the standard asset-based tool used in Demographic and Health Surveys (DHS) and has been adapted for specific countries, including Mozambique, to ensure it was appropriate for use within that specific context. The ET was only asked to heads of households and their answers applied to other members of their households.

The Simple Poverty Scorecard was developed by Mark Schreiner of Microfinance Risk Management LLC and has been adapted for different countries. It estimates a particular household's poverty likelihood – that is, the probability that a household is below a given poverty line. The poverty line for an individual is the money they need to achieve the minimum level of welfare to not be deemed 'poor', given their circumstances[6].

[5] Chakraborty, Nirali M, Kenzo Fry, Rasika Behl, and Kim Longfield. 2016. "Simplified Asset Indices to Measure Wealth and Equity in Health Programs: A Reliability and Validity Analysis Using Survey Data From 16 Countries." *Global Health: Science and Practice* 4 (1):141-54. doi: 10.9745/ghsp-d-15-00384.
[6] Ravallion, M., 2008. Which poverty line? A response to Reddy (No. 53).

Disability

We used the Washington Group Short Set (WGSS) of questions developed to easily measure people with disabilities in censuses and surveys.[7] These are a set of six questions designed to identify those who, because of difficulties doing certain universal basic actions, are at greater risk than the general population of limitations in participation. The Washington Group, which was formed by the United Nations Statistical Commission in 2001, was established to devise a common definition, concept, standards and methodology for measuring disability cross-nationally. The WGSS was designed to be applied and understood in all cultural settings following translation to the local language. The WGSS have been used in Mozambique previously, including the most recent census and the 2008 national survey on disability.

Disability is determined by participants' responses to six questions relating to different functional domains: seeing, hearing, walking, communication, self-care and remembering or concentrating. They are introduced using the context of difficulties faced due to health issues, rather than using the word 'disability', to avoid stigmatising the respondent and biasing responses. The response categories are non-binary to help capture a range of disability severity. The Washington Group recommends participants who respond "a lot of difficulty" or "cannot do at all" to at least one of the six domains (seeing, hearing, walking, remembering, self-care or communication) should be considered as disabled.

Health seeking behaviour

Additionally, several questions around health information and health seeking behaviour were asked of participants to understand practices and norms among older people in Nampula.

Statistical analysis

Although the RAAB was analysed using its bespoke software, the data was extracted and joined with the disability and wealth component for combined analysis in Stata version 15.

Data was joined using a unique ID that was generated by the RAAB application on data entry. The disability and wealth component enumerator copied the ID into their own data entry device at that stage, and both recorded some identifying information such as age and sex for matching verification at analysis.

Data was reviewed and examined for inconsistencies or illogical entries. Age recorded over 100 was recoded to 99. Descriptive statistics were compiled by

[7] Madans, Jennifer H, Mitchell E Loeb, and Barbara M Altman. 2011. Measuring disability and monitoring the UN Convention on the Rights of Persons with Disabilities: the work of the Washington Group on Disability Statistics. Paper presented at the BMC Public Health.

looking at the number and percentages among categorical variables and means, variations and ranges among continuous variables. Univariate analyses were conducted between selected outcome variables (having a disability; being bilaterally blind; needing a cataract operation; having had a cataract operation) and the dependent variables, using chi-squared tests and logistic regression where necessary. Multivariate models were developed using a forward step-wise approach where more than one dependent variable showed a univariate relationship with the outcome variable (assuming a p-value of 5% as a guide to which indicators to include). Factors were added to the model one at a time according to strength of univariate association and retained if they showed independent association within the model.

Age and sex adjusted estimates were calculated and extrapolated to calculate actual numbers using the 2007 Mozambique census data[4] for both 2011 and 2018 studies. This has two major implications on the results that should be accounted for in reading the report:

- The 2011 age and sex adjusted results reported in section three are slightly different from the report generated at the time, which used unverifiable population data. However, there is minor difference in the results generated.
- The assumed population increase of approximately 50% between 2007 and 2017 is not accounted for in the population projections.

Ethical considerations

This study was conducted in line with the highest standard of ethical conduct. Participants were given oral information about the study and provided with an opportunity to ask questions. It was stressed that participation was entirely voluntary, and written consent was taken with adaptations for those who were illiterate or had other impairments preventing them from signing their own name. Participants examined and found to have ocular morbidities were either treated on site, given referral to the nearest health facility with required services, or asked for permission to share their name with the team recorder to ensure they would be transported to Nampula Central Eye Hospital at the next available time.

Ethical clearance was obtained from the Mozambique National Bioethics Committee prior to the study.

Results: Rapid assessment of avoidable blindness 2018

Sample characteristics

Overall, 4,191 individuals aged 50+ years were enrolled and 4,015 individuals were examined (95.8% response rate) (Table 1). Of those not examined, the majority were either not available or refused to participate, with a small proportion (25, 0.6%) deemed incapable.

Table 1: Examination status of enrolled participants

	Examined		Not available		Refused		Not capable		Total	
	n	%	n	%	n	%	n	%	n	%
Males	1,819	95.4%	50	2.6%	29	1.5%	8	0.4%	**1,906**	**100.0%**
Females	2,196	96.1%	42	1.8%	30	1.3%	17	0.7%	**2,285**	**100.0%**
Total	**4,015**	**95.8%**	**92**	**2.2%**	**59**	**1.4%**	**25**	**0.6%**	**4,191**	**100.0%**

There were more females than males among those examined in the study (54.7%). Compared to the population of the area as per the 2007 census, younger people – particularly men – were underrepresented in our sample, and older people were overrepresented (Figures 1 and 2, Tables 2 and 3). This means the sample results may overstate the magnitude of age-related visual impairment, and age and sex adjusted results are important for understanding the true extent of visual impairment in this population.

Table 2: Age and sex distribution of people examined in the sample

	Males		Females		Total	
	n	%	n	%	n	%
50 – 59 years	800	44.0%	1,082	49.3%	**1,882**	**46.9%**
60 – 69 years	536	29.5%	627	28.6%	**1,163**	**29.0%**
70 – 79 years	332	18.3%	325	14.8%	**657**	**16.4%**
80 – 99 years	151	8.3%	162	7.4%	**313**	**7.8%**
Total	**1,819**	**100.0%**	**2,196**	**100.0%**	**4,015**	**100.0%**

Table 3: Total number of people aged 50+ in survey area

	Males		Females		Total	
	n	%	n	%	n	%
50 – 59 years	88,291	49.7%	87,587	54.3%	**175,878**	**51.9%**
60 – 69 years	53,307	30.0%	47,032	29.2%	**100,339**	**29.6%**
70 – 79 years	25,315	14.3%	19,047	11.8%	**44,362**	**13.1%**
80 – 99 years	10,564	6.0%	7,543	4.7%	**18,107**	**5.3%**
Total	**177,477**	**100.0%**	**161,209**	**100.0%**	**338,686**	**100.0%**

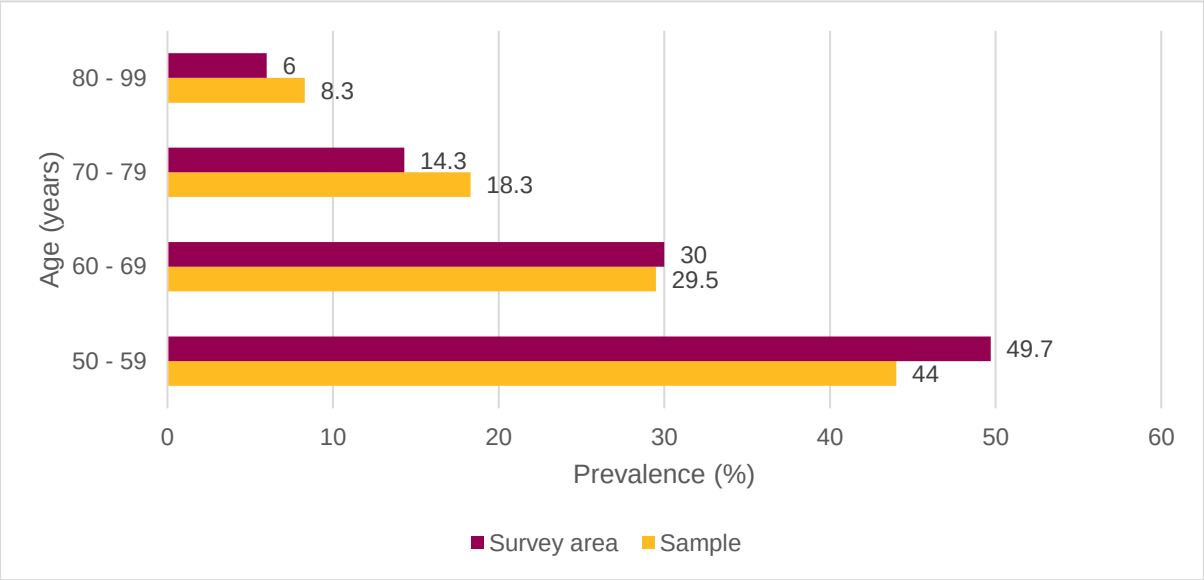

Figure 1: Proportion of males in total survey area and in sample

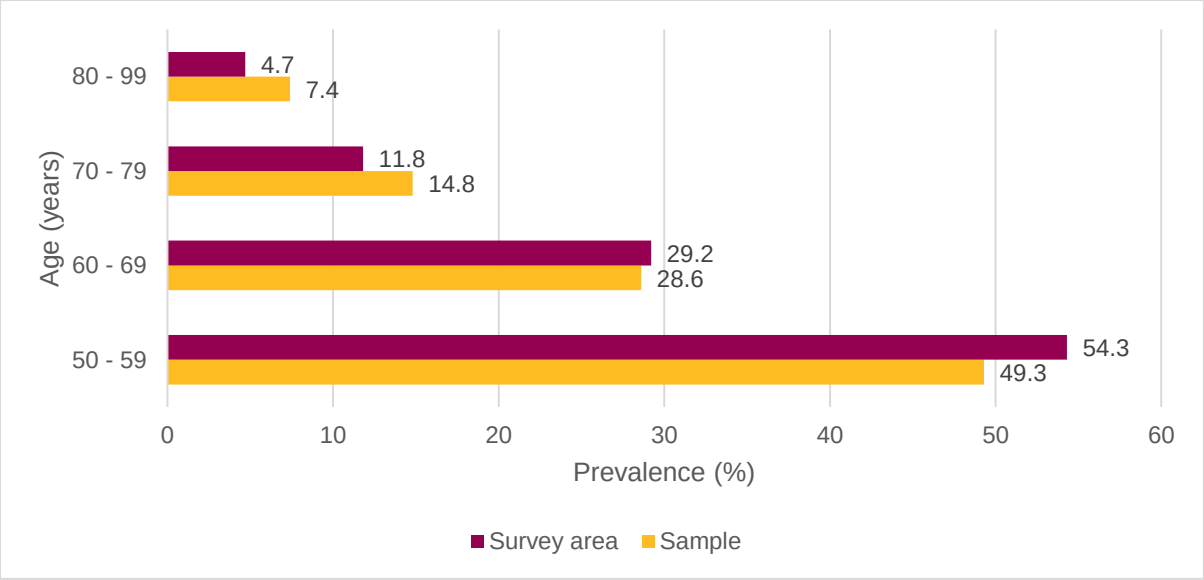

Figure 2: Proportion of females in total survey area and in sample

Prevalence of blindness and visual impairment

Among the participants examined, 187 people were bilaterally blind. This is equivalent to 4.7% of the study population, although the 95% confidence interval indicates this could vary from between 3.8% to 5.5% (Table 4).

When a pinhole was used to understand how access to corrective devices might affect VA, 174 people, or 4.3% of people (95%CI 3.5-5.2), were bilaterally blind.

Severe visual impairment (SVI) affected 114 or 2.8% of participants, and moderate visual impairment (MVI) was present in 454 or 11.3% of participants.

Blindness and SVI appeared to affect more women than men, while MVI affects more men than women, although in all cases the 95% confidence intervals overlapped indicating statistical uncertainty around those estimates.

Table 4: Prevalence of blindness, SVI and MVI – all causes

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Blindness – VA <3/60 in the better eye with best correction or pinhole						
All bilateral blindness	70	3.9% (2.9-4.7)	104	4.7% (3.6-5.9)	**174**	**4.3% (3.5-5.2)**
All blind eyes	284	7.8% (6.6-9.0)	344	7.8% (6.6-9.1)	**628**	**7.8% (6.8-8.8)**
Blindness – VA <3/60 in the better eye with available correction (presenting VA)						
All bilateral blindness	76	4.2% (3.2-5.1)	111	5.1% (3.9-6.2)	**187**	**4.7% (3.8-5.5)**
All blind eyes	299	8.2% (7.0-9.4)	374	8.5% (7.3-9.8)	**673**	**8.4% (7.4-9.4)**
Severe visual impairment (SVI) – VA <6/60 – 3/60 in the better eye with available correction						
All bilateral Severe VI	46	2.5% (1.7-3.3)	68	3.1% (2.4-3.8)	**114**	**2.8% (2.3-3.4)**
All Severe VI eyes	137	3.8% (2.9-4.6)	192	4.4% (3.6-5.1)	**329**	**4.1% (3.5-4.7)**
Moderate visual impairment (MVI) – VA <6/18 – 6/60 in the better eye with available correction						
All bilateral MVI	210	11.5% (10.1-13.0)	244	11.1% (9.4-12.8)	**454**	**11.3% (10.1-12.5)**
All Moderate VI eyes	463	12.7% (11.3-14.2)	523	11.9% (10.3-13.5)	**986**	**12.3% (11.1-13.4)**

Prevalence of blindness was associated with age, increasing in each 10-year age group as presented in Table 5. People in the oldest group, 80+ years, were 10 times more likely to be bilaterally blind than those aged 50-60 years.

Table 5: Blindness prevalence (PVA<3/60 in better eye) by age group

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
50 – 59 years	10	1.3 (0.5 - 2.0)	17	1.6 (0.8 - 2.3)	**27**	**1.4 (0.9 - 2.0)**
60 – 69 years	17	3.2 (1.5 - 4.8)	20	3.2 (1.8 - 4.6)	**37**	**3.2 (2.2 - 4.2)**
70 – 79 years	27	8.1 (5.4 - 10.9)	36	11.1 (7.1 - 15.1)	**63**	**9.6 (6.9 - 12.3)**
80+ years	22	14.6 (9.1 - 20.0)	38	23.5 (16.5 - 30.5)	**60**	**19.2 (14.5 - 23.8)**
All 50+ years	76	4.2 (3.2 - 5.1)	111	5.1 (3.9 - 6.2)	**187**	**4.7 (3.8 - 5.5)**

As stated above, older people were overrepresented in our sample and, following adjustments for age and sex, the prevalence of VI at all levels reduced slightly (Table 6). Adjusted prevalence of presenting bilateral blindness was 3.9% (3.6% among men and 4.2% among women), SVI was 2.5% (2.3% men and 2.6% women) and MVI was 10.1% (10.2% men and 10% women).

The prevalence of blindness translates to approximately 13,148 people aged 50+ years with bilateral blindness in Nampula province; based on the confidence intervals the estimated number of bilaterally blind in Nampula is between 10,969 and 15,743. Similarly, 8,298 people are living with SVI (6,710 to 10,247) and 34,310 are living with MVI (30,738 to 38,243).

Table 6: Age and sex adjusted results for all causes of blindness, SVI and MVI

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Blindness – VA <3/60 in the better eye with best correction or pinhole						
All bilateral cases	5,837	3.3 (2.3-4.2)	6,324	3.9 (2.8-5.1)	**12,161**	**3.6 (2.8-4.4)**
All eyes	24,692	7.0 (5.8-8.1)	21,979	6.8 (5.6-8.0)	**46,671**	**6.9 (5.9-7.9)**
Blindness – VA <3/60 in the better eye with available correction (presenting VA)						
All bilateral cases	6,393	3.6 (2.6-4.6)	6,755	4.2 (3.0-5.3)	**13,148**	**3.9 (3.0-4.7)**
All eyes	26,043	7.3 (6.1-8.6)	23,916	7.4 (6.2-8.7)	**49,959**	**7.4 (6.4-8.4)**
Severe visual impairment (SVI) – VA <6/60 – 3/60 in the better eye with available correction						
All bilateral cases	4,052	2.3 (1.5-3.1)	4,246	2.6 (1.9-3.4)	**8,298**	**2.5 (1.9-3.0)**
All eyes	12,109	3.4 (2.6-4.3)	12,359	3.8 (3.1-4.6)	**24,468**	**3.6 (3.0-4.2)**
Moderate visual impairment (MVI) – VA <6/18 – 6/60 in the better eye with available correction						
All bilateral cases	18,131	10.2 (8.8-11.7)	16,179	10.0 (8.4-11.7)	**34,310**	**10.1 (8.9-11.3)**
All eyes	40,857	11.5 (10.1-12.9)	35,277	10.9 (9.4-12.5)	**76,134**	**11.2 (10.1-12.4)**

Causes of bilateral visual impairment

The leading cause of blindness was cataract (55.6%), followed by glaucoma (20.3%), and other posterior segment disease (11.8%) (Figure 3).

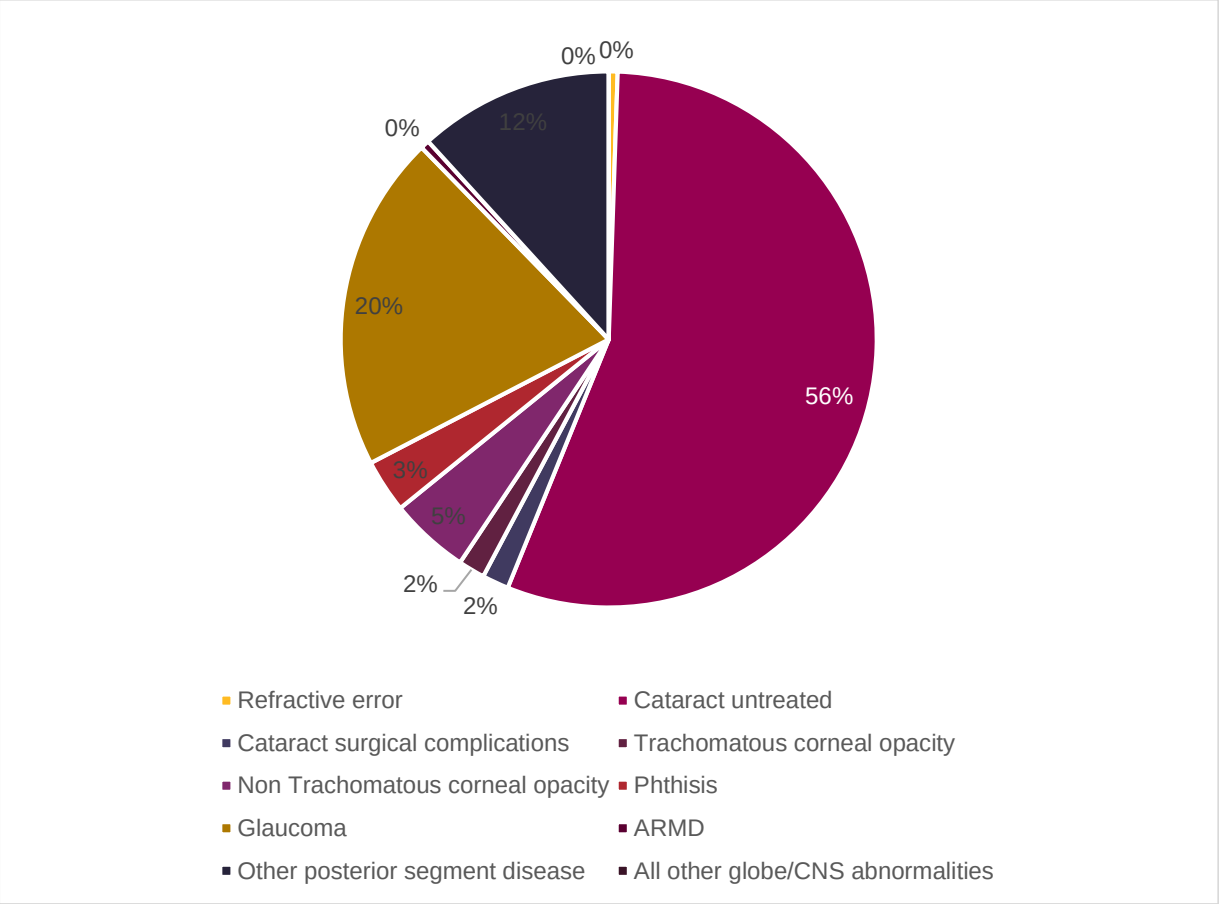

Figure 3: Principal cause of blindness in persons: VA<3/60 in better eye with available correction

The main cause of SVI was unoperated cataract (68.4%), followed by refractive error (16.7%), and glaucoma (7.0%) (Figure 4).

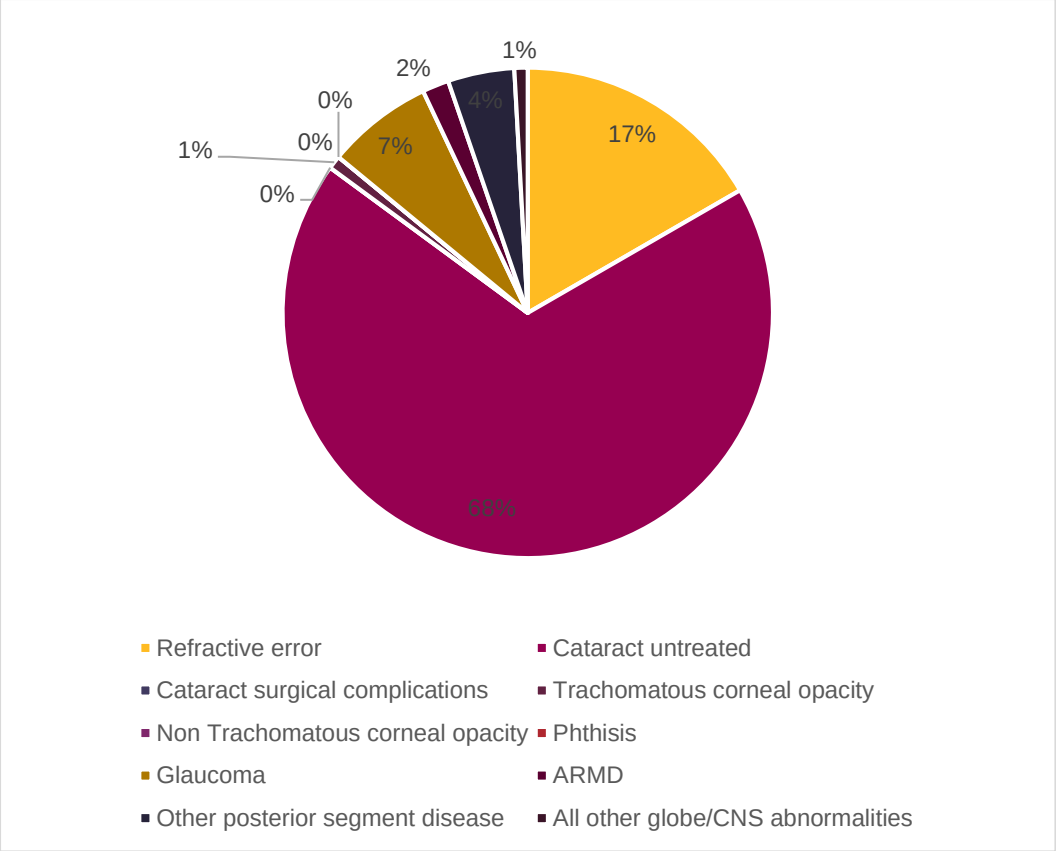

Figure 4: Principal cause of SVI in persons: VA<6/60 – 3/60 in better eye with available correction

The main cause of MVI was uncorrected refractive error (46.3%), followed by unoperated cataract (43.2%) and other posterior segment disease (5.9%) (Figure 5).

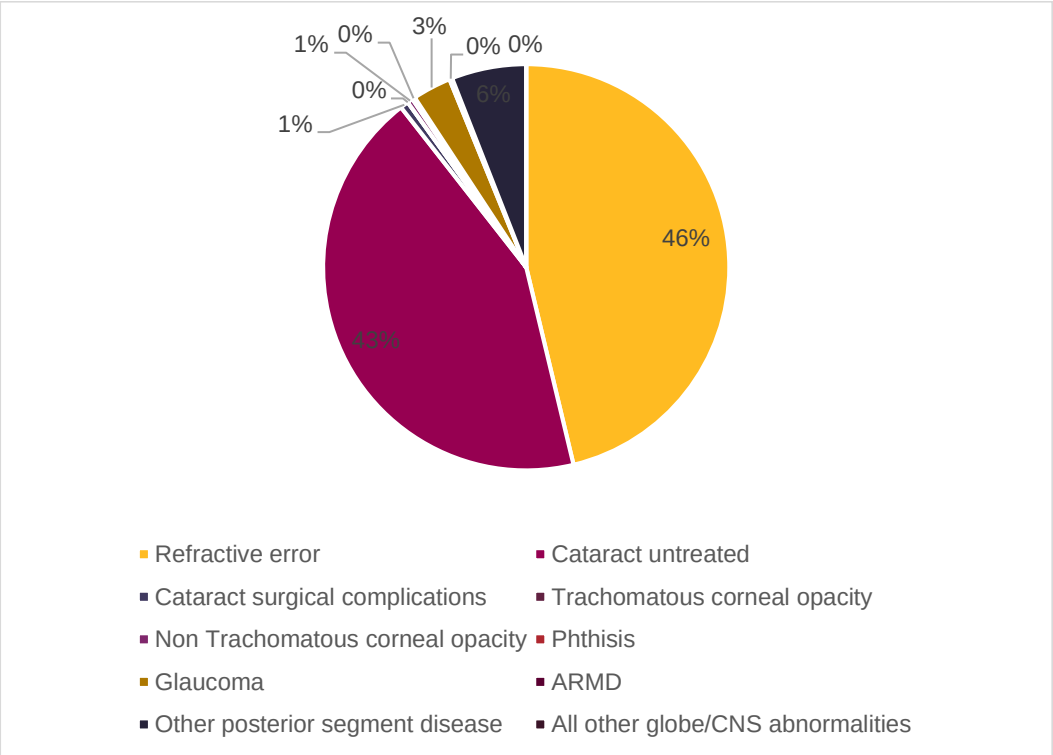

Figure 5: Principal cause of MVI in persons: VA<6/60 – 6/18 in better eye with available correction

Cataract related blindness and visual impairment

Table 7 shows the prevalence of cataract by the level of VA of the individual, although it should be noted that cataract may not be the cause of the observed level of VA. Within the sample, 91 people (2.3%; 95%CI 1.7-2.8%) were bilaterally blind with cataracts. 137 people (3.4%; 95%CI 2.7-4.1%) were SVI or blind with cataracts, and 357 people (8.9%; 95%CI 7.5-10.3%) were MVI, SVI or blind with cataracts. In total, 950 eyes (11.5%) observed in the sample had a cataract.

Prevalence appears higher among women than men at all levels, although the 95% CIs overlap and indicate no statistical difference by sex.

Table 7: Prevalence of cataract with VA<3/60, VA<6/60 and VA<6/18 – best corrected VA

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Cataract and VA <3/60 with best correction or pinhole						
Bilateral cataract	33	1.8% (1.2-2.4)	58	2.6% (1.9-3.4)	**91**	**2.3% (1.7-2.8)**
Unilateral cataract	75	4.1% (3.1-5.2)	84	3.8% (2.9-4.7)	**159**	**4.0% (3.2-4.7)**
Cataract eyes	141	3.9% (3.1-4.6)	200	4.6% (3.7-5.4)	**341**	**4.3% (3.6-4.9)**
Cataract and VA <6/60 with best correction or pinhole						
Bilateral cataract	52	2.9% (2.0-3.7)	85	3.9% (3.0-4.8)	**137**	**3.4% (2.7-4.1)**
Unilateral cataract	92	5.1% (5.9-8.5)	114	5.2% (6.9-9.7)	**206**	**5.1% (6.7-8.9)**
Cataract eyes	196	5.4% (4.3-6.5)	284	6.5% (5.4-7.5)	**480**	**6.0% (5.1-6.8)**
Cataract and VA <6/18 with best correction or pinhole						
Bilateral cataract	132	7.3% (5.6-8.9)	225	10.3% (8.6-11.9)	**357**	**8.9% (7.5-10.3)**
Unilateral cataract	125	6.9% (5.5-8.2)	111	5.1% (4.1-6.0)	**236**	**5.9% (5.0-6.7)**
Cataract eyes	389	10.7% (9.0-12.4)	561	12.8% (11.0-14.5)	**950**	**11.8% (10.4-13.3)**

Following adjustment for age and sex, prevalence of bilateral blindness with cataract is 1.7%: 2.1% among women and 1.4% among men (Table 8). Prevalence of SVI and blindness due to cataract is 2.7%: 3.1% among women and 2.3% among men.

Prevalence of MVI, SVI and blindness due to cataract is 7.2%: 8.5% among women and 6.0% among men.

This translates to an estimated 24,330 people aged over 50 years with some level of bilateral VI and cataract in Nampula, of whom 56.4% are female. There are a further 25,012 people with some level of unilateral VI and cataract. In total, 67,154 eyes are estimated to have some level of VI and cataract, of which 51.8% are female.

Table 8: Age and sex adjusted results for cataract and VA< 3/60, 6/60, and 6/18 with best correction

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Cataract and VA <3/60 with best correction or pinhole						
Bilateral cataract	2,518	1.4 (0.8-2.0)	3,353	2.1 (1.3-2.8)	**5,871**	**1.7 (1.2-2.3)**
Unilateral cataract	6,542	3.7 (2.6-4.7)	5,302	3.3 (2.4-4.2)	**11,844**	**3.5 (2.8-4.2)**
Cataract eyes	11,581	3.3 (2.5-4.0)	12,008	3.7 (2.9-4.6)	**23,589**	**3.5 (2.9-4.1)**
Cataract and VA <6/60 with best correction or pinhole						
Bilateral cataract	4,047	2.3 (1.5-3.1)	4,960	3.1 (2.4-3.9)	**9,007**	**2.7 (2.0-3.3)**
Unilateral cataract	8,408	4.7 (3.5-6.0)	8,105	5.0 (3.6-6.4)	**16,513**	**4.9 (3.9-5.8)**
Cataract eyes	16,098	4.5 (3.5-5.6)	17,179	5.3 (4.3-6.4)	**33,277**	**4.9 (4.1-5.7)**
Cataract and VA <6/18 with best correction or pinhole						
Bilateral cataract	10,597	6.0 (4.7-7.2)	13,733	8.5 (7.2-9.9)	**24,330**	**7.2 (6.1-8.2)**
Unilateral cataract	13,779	7.8 (5.8-9.7)	11,233	7.0 (4.9-9.0)	**25,012**	**7.4 (5.9-8.9)**
Cataract eyes	32,375	9.1 (7.4-10.8)	34,779	10.8 (9.0-12.6)	**67,154**	**9.9 (8.5-11.4)**

Cataract surgical coverage

Cataract surgical coverage (CSC) is the service coverage indicator that measures the proportion of people (or eyes) who, having developed a cataract, have been operated on for it. CSC of eyes at 3/60 in this study was 22.3%; 14.9% among females and 30.9% among men (Table 9). For people, CSC at 3/60 was 28.4%; 19.4% among women, and twice as high at 40.0% among men.

Table 9: Cataract surgical coverage of eyes and persons in sample

	Males	Females	Total
Cataract surgical coverage (eyes) – percentage			
VA < 3/60	30.9	14.9	**22.3**
VA < 6/60	24.3	11.0	**17.0**
VA < 6/18	13.9	5.9	**9.4**
Cataract surgical coverage (persons) – percentage			
VA < 3/60	40.0	19.4	**28.4**
VA < 6/60	30.7	14.1	**21.3**
VA < 6/18	19.5	7.0	**12.1**

Table 10 shows CSC following adjustment for age and sex, which is very slightly different from the sample estimates. CSC for eyes at the 3/60 level is 24.5% overall. Among people at 3/60, CSC is 31.5%. CSC among males is twice as high as among females for both eyes and persons.

Table 10: Age and sex adjusted cataract surgical coverage

	Males	Females	Total
Cataract surgical coverage (eyes) – percentage			
VA < 3/60	31.7	15.9	**24.5**
VA < 6/60	25.0	11.6	**18.7**
VA < 6/18	14.2	6.1	**10.2**
Cataract surgical coverage (persons) – percentage			
VA < 3/60	41.7	21.0	**31.5**
VA < 6/60	32.0	15.3	**23.7**
VA < 6/18	20.3	7.6	**13.6**

Visual outcomes and effective cataract surgical coverage

Among the eyes observed as having been operated for cataract, 58.2% had good presenting vision (6/18 or better), raising to 72.4% with best correction (Tables 11 and 12). 19.4% were observed to have borderline presenting vision, decreasing to 11.2% with best correction, and 22.4% were observed to have poor presenting vision, decreasing to 16.3% with best correction.

The vast majority of eyes were operated with an IOL, with only three (3.1%) with no IOL implanted. All three eyes with no IOL had poor outcomes that did not improve with best correction.

Table 11: VA in operated eyes in sample with available correction (presenting)

	Non-IOL		IOL		Total	
	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	0	0.0	57	60.0	**57**	**58.2**
Borderline: can see 6/60	0	0.0	19	20.0	**19**	**19.4**
Poor: cannot see 6/60	3	100.0	19	20.0	**22**	**22.4**
Total	3	100.0	95	100.0	**98**	**100.0**

Table 12: VA in operated eyes in sample with best correction (pinhole)

	Non-IOL		IOL		Total	
	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	0	0.0	71	74.7	**71**	**72.4**
Borderline: can see 6/60	0	0.0	11	11.6	**11**	**11.2**
Poor: cannot see 6/60	3	100.0	13	13.7	**16**	**16.3**
Total	3	100.0	95	100.0	**98**	**100.0**

Effective cataract surgical coverage (eCSC) is a combination of CSC and good visual outcomes. It represents the proportion of people within the sample who were in need of cataract surgery, received it, and now have good visual outcomes (Table

13). ECSC among persons is 18.9% in total, although much lower among women (11.1%) than men (29.1%).

Table 13: Effective cataract surgical coverage (persons)

Persons	Males	Females	Total
VA<3/60	29.1%	11.1%	18.9%
VA<6/60	22.7%	8.1%	14.4%
VA<6/18	12.2%	4.1%	7.4%

Figure 6 shows eCSC among persons with VA<6/60 as a proportion of CSC. Although the numbers are small, the proportion of surgeries among males with good outcomes are higher than among females (71% vs 53%).

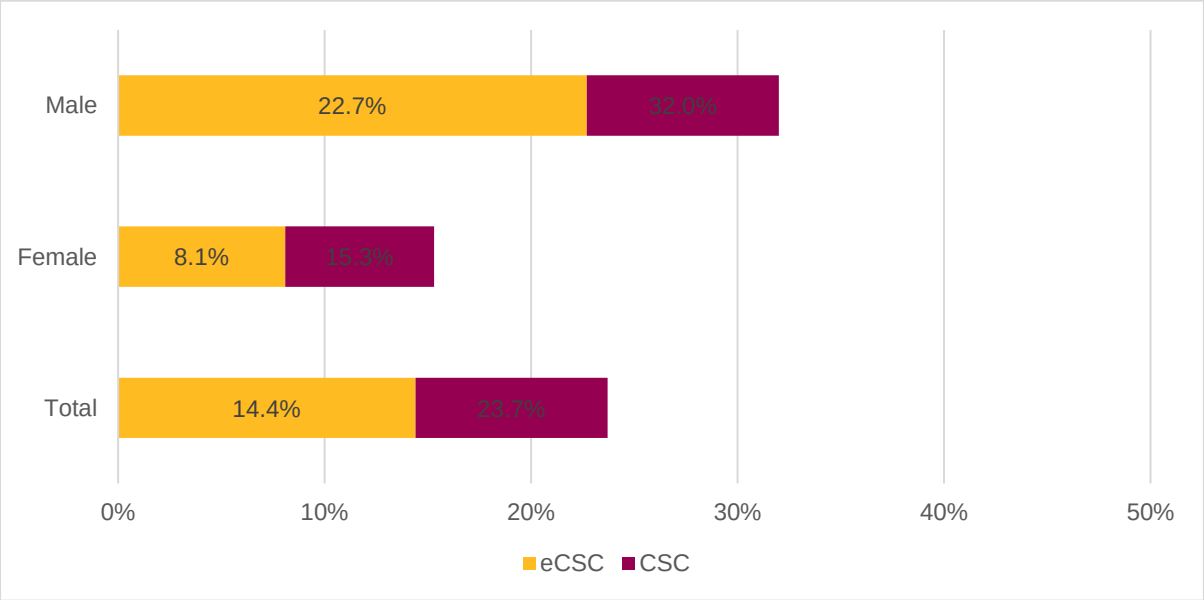

Figure 6: Cataract surgical coverage and effective cataract surgical coverage at VA< 6/60 among persons in sample

All cataract surgeries observed took place at government hospitals, although specific locations weren't identified. Table 14 shows that the majority of operated eyes (69/98; 70.4%) were operated in the past four years, since the optical biometry and keratometer were introduced in the hospital. 74% of these had good visual outcomes compared with only 40% of those operated five or more years ago.

Table 14: Presenting VA in operated eyes in sample by years after surgery

	≤ 4 yrs postop		5+ yrs postop		Total	
	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	51	73.9%	6	40.0%	**57**	**58.2**
Borderline: can see 6/60	16	23.2%	3	20.0%	**19**	**19.4**
Poor: cannot see 6/60	12	17.4%	10	40.0%	**22**	**22.4**
Total	**69**	**100.0**	**15**	**100.0**	**98**	**100.0**

The reasons observed by examiners for poor or borderline visual outcomes were lack of available correction (34%); surgical complications (29%); long-term sequelae (22%); and pre-existing contraindications to surgery (15%) (Table 15).

Table 15: Post-op presenting VA and causes of borderline and poor outcomes (n=41)

	Selection		Surgery		Spectacles		Sequelae		Total	
	Eyes	%	Eyes	%	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	0	0.0	0	0.0	0	0.0	**0**	**0.0**	**57**	**58.2**
Borderline: can see 6/60	3	50.0	4	33.3	10	71.4	**2**	**22.2**	**19**	**19.4**
Poor: cannot see 6/60	3	50.0	8	66.7	4	28.6	**7**	**77.8**	**22**	**22.4**
Total	**6**	**100.0**	**12**	**100.0**	**14**	**100.0**	**9**	**100.0**	**98**	**100.0**

Barriers to cataract surgery

Participants with operable cataracts were asked the reasons why they had not received the operation (Table 16). Half reported being unable to access treatment; 20% each reported being unaware treatment was an option and not feeling a need for surgery. Around 5% each reported being afraid to have surgery and being denied treatment by the provider. Only one person reported cost as a factor.

Table 16: Barriers to cataract surgery in sample (bilateral and unilateral BCVA<6/60 due to cataract)

	Males		Females		Total	
	n	%	n	%	n	%
Cannot access treatment	80	46.5	122	53.0	**202**	**50.2**
Unaware treatment is available	36	20.9	46	20.0	**82**	**20.4**
Need not felt	38	22.1	39	17.0	**77**	**19.2**
Treatment denied by provider	13	7.6	9	3.9	**22**	**5.5**
Fear	5	2.9	13	5.7	**18**	**4.5**
Cost	0	0.0	1	0.4	**1**	**0.2**
Total	172	100.0	230	100.0	**402**	**100.0**

Refractive errors

The prevalence of refractive errors (RE) was found to be 6.6%, 86% of which are uncorrected (Table 17). Prevalence of RE was slightly higher among men than women (7.3% vs 6.2%), however the proportion of uncorrected RE was similar among both (86%). This does not include uncorrected presbyopia, which is very high at 94.4%; 90.8% among men and 97.4% among women.

Table 17: Uncorrected refractive error and presbyopia

	Males		Females		Total	
	n	%	n	%	n	%
Total refractive errors	130	7.2%	136	6.2%	**266**	**6.6%**
Uncorrected refractive errors	112	6.2%	118	5.4%	**230**	**5.7%**
Uncorrected presbyopia	1,651	90.8%	2,139	97.4%	**3,790**	**94.4%**

Functional low vision requiring low vision services

The age and sex adjusted prevalence of functional low vision (FLV) and requiring low vision services is 2.6% in Nampula (Table 18). There are an estimated 8,738 people aged 50+ requiring low vision services: 4,975 males (2.8%) and 3,763 females (2.3%). The prevalence of FLV increases steadily with age and is 6.7% in people aged 80+. (Tables 18 and 19)

Table 18: Extrapolated magnitude of functional low vision – bilateral presenting vision

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Functional low vision	4,975	2.8 (2.1-3.5)	3,763	2.3 (1.5-3.1)	**8,738**	**2.6 (2.0-3.2)**

Table 19: Persons with functional low vision: best corrected VA <6/18-PL+ in the better eye (incurable)

	Males		Females		Total	
	n	%	n	%	n	%
50 – 59	14	1.8%	15	1.4%	**29**	**1.5%**
60 – 69	19	3.5%	18	2.9%	**37**	**3.2%**
70 – 79	13	3.9%	10	3.1%	**23**	**3.5%**
80+	8	5.3%	13	8.0%	**21**	**6.7%**
Total	54	3.0%	56	2.6%	**110**	**2.7%**

The most common causes for FLV are other posterior segment disease (42.7%) and glaucoma (41.8%), non-trachomatous corneal opacity (7.3%), ARMD (3.6%), trachoma corneal opacity (2.7%), and cataract surgical complications (1.8%). No single case of diabetic retinopathy was reported here (Table 20).

Table 20: Principal cause of functional low vision in persons: best corrected VA <6/18-PL+ in the better eye (incurable)

	Males		Females		Total	
	n	%	n	%	n	%
Cataract surgical complications	0	0.0%	2	3.6%	**2**	**1.8%**
Trachomatous corneal opacity	1	1.9%	2	3.6%	**3**	**2.7%**
Non-trachomatous corneal opacity	3	5.6%	5	8.9%	**8**	**7.3%**
Glaucoma	27	50.0%	19	33.9%	**46**	**41.8%**
ARMD	1	1.9%	3	5.4%	**4**	**3.6%**
Other posterior segment disease	22	40.7%	25	44.6%	**47**	**42.7%**
Total	**54**	**100.0%**	**56**	**100.0%**	**110**	**100.0%**

Results: Eye health, wealth and disability: 2018

Participant characteristics

Of the 4,190 respondents enrolled, 4,002 (95.5%) consented and provided responses to the disability and wealth component (Table 21). Of the 189 who did not answer the questions, the majority (92.6%) had not answered the RAAB questions, but 7.4% had.

Table 21: Table comparing respondents of the two study components

RAAB component	Disability and wealth component			
		Interviewed	**Not available, refused or incapable**	**Total**
	Examined	4,001 (98.98)	14 (7.4)	4,014 (95.8)
	Not available	1 (0.02)	91 (48.1)	92 (2.2)
	Refused	0	59 (31.2)	59 (1.4)
	Not capable	0	25 (13.2%)	25 (0.6)
	Total	4,002 (95.5)	189 (4.5)	4,191

Sample prevalence of disability

Among the respondents to the disability and wealth component, prevalence of disability was 11.9% (95%CI 11.0-13.0%) (Table 22). It was slightly higher among women (12.5%) than men (11.3%), although the confidence intervals did not indicate a statistical difference. Prevalence increased steadily with age from 4.7% among people aged 50-59 up to 41.1% among people aged over 80 years.

Prevalence of non-visual disability was 5.7% (95%CI 5.0-6.5%) among the whole sample, following similar patterns with respect to age and sex as all disability.

Table 22: Prevalence of disability and non-visual disability among study sample (n=4,002)

	Disability			Non-visual disability		
	Male N (%, 95%CI)	**Female N (%, 95%CI)**	**Total N (%, 95%CI)**	**Male N (%, 95%CI)**	**Female N (%, 95%CI)**	**Total N (%, 95%CI)**
Total	205 (11.3%; 9.9-12.8%)	273 (12.5%; 11.1-13.9%)	478 (11.9%; 11.0-13.0%)	95 (5.2%; 4.3-6.4%)	134 (6.1%; 5.2-7.2%)	229 (5.7%; 5.0-6.5%)
50-59	38 (4.8%; 3.4-6.6%)	51 (4.7%; 3.5-6.1%)	89 (4.7%; 3.8-5.8%)	22 (2.8%; 1.8-4.2%)	17 (1.6%; 0.9-2.5%)	39 (2.1%; 1.5-2.8%)
60-69	53 (9.7%; 7.4-12.5%)	70 (11.3%; 8.9-14.1%)	123 (10.6%; 8.9-12.5%)	17 (3.1%; 1.8-4.9%)	34 (5.5%; 3.8-7.6%)	51 (4.4%; 3.3-5.7%)
70-79	64 (19.3%; 15.2-23.9%)	76 (23.5%; 19.0-28.5%)	140 (21.4%; 35.5-46.8%)	25 (7.5%; 4.9-10.9%)	32 (9.9%; 6.9-13.7%)	57 (8.7%; 6.7-11.1%)
80+	50 (34.0%; 26.4-42.3%)	74 (47.7%; 39.7-55.9%)	124 (41.1%; 6.8-93.2%)	31 (21.1%; 14.8-28.6%)	49 (31.6%; 24.4-39.6%)	80 (26.5%; 6.8-9.3%)

Age and sex adjusted prevalence of disability

As described in the RAAB results above, younger men were disproportionately underrepresented in the sample, and so sex and age adjusted results were calculated to understand the real magnitude of disability in the population. Following adjustment, the prevalence of disability is estimated to be 10.6%, or just over 37,000 people aged over 50 years in Nampula province (Table 23). The prevalence of non-visual disability is 4.8%, or just over 16,000 people aged over 50 years in Nampula province.

Table 23: Age and sex adjusted prevalence of disability among people aged over 50 years in Nampula province

	Male N (%, 95%CI)	**Female N (%, 95%CI)**	**Total N (%, 95%CI)**
Disability	18,834 10.6 (9.1-12.3%)	17,718 11.0 (9.5-12.7%)	37,031 10.8 (9.5-12.2%)
Non-visual disability	8,253 4.7 (3.8-5.7%)	8,164 5.1 (4.0-6.4%)	16,421 4.8% (4.1-5.8%)

Severe functional difficulties were most commonly reported in the visual (325, 8.1%), lower-body (176, 4.4%), and upper-body domains (79, 2.4%).

Table 24: Description of Washington Group variables (n=4,002)

	No difficulties	Some difficulties	A lot of difficulties	Cannot do at all
	N %	N %	N %	N %
Seeing	2,697 67.4%	980 24.5%	297 7.4%	28 0.7%
Hearing	3,512 87.8%	457 11.4%	30 0.8%	3 0.1%
Walking/ lower-body	2,937 73.4%	889 22.2%	168 4.2%	8 0.2%
Remember/ concentrate	3,486 87.1%	481 12.0%	35 0.9%	0
Self-care/upper-body	3,486 87.1%	437 0.9	77 1.9%	2 0.5%
Communicate	3,920 98.0%	71 1.8%	11 0.3%	0

Nearly ninety percent (87.7%) of respondents reported no severe difficulties at all (Table 25). 9.6% reported severe difficulties in one domain, 1.9% in two domains, 0.6% in three, and 0.1% in four, five and six domains each.

Table 25: Number of domains in which severe difficulties are reported by sample (n=4,002).

	Cannot do at all		A lot of difficulties or cannot do at all	
Number of difficulties	**N**	**%**	**N**	**%**
0	3,964	99.1	3,509	87.7
1	35	09	384	9.6
2	3	0.1	75	1.9
3	0	0	22	0.6
4	0	0	5	0.1
5	0	0	3	0.1
6	0	0	4	0.1

Household wealth

Nearly three quarters (2,907/4,004; 72.6%) of respondents answered questions on behalf of their household about their household asset ownership, which were used to calculate two measures of household economic status.

Table 26 shows respondents' wealth relative to national standards. 12.9% of households were among the poorest 20% in the country, 33.6% in the second poorest, 22.0% in the middle quintile, 18.7% in the second wealthiest, and 12.8% in the wealthiest quintile. Households where a male responded to the questions were relatively wealthier than those where a female responded to the questions ($p<0.001$).

In absolute terms, 60.8% of households surveyed were likely to fall below the poverty line. Households with a male respondent were less likely than households with a female respondent to fall below this poverty line (58.8% vs 63.6%, p<0.001).

Table 26: Household wealth status by sex of household respondent

	Male		Female		Total	
	N	%	N	%	N	%
Wealth quintile						
Poorest quintile	172	10.2	204	16.8	376	12.9
2nd	533	31.6	445	36.5	978	33.6
3rd	374	22.1	264	21.7	638	22.0
4th	358	21.2	185	15.2	543	18.7
Richest quintile	252	14.9	120	9.9	372	12.8

Eye health and wealth and disability

Table 27 shows the age and sex sample prevalence of VI by people with non-visual disabilities, and those without. Prevalence of bilateral blindness and SVI are statistically significantly higher among people with non-visual disabilities compared with other respondents.

Table 27: Sample prevalence of bilateral visual impairment, but non-visual disability status

	Non-visual disability		No non-visual disability		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Blindness – VA <3/60 in the better eye with available correction (presenting VA)						
All bilateral cases	48	21.0 (15.6-27.6)	138	3.7 (3.0-4.5)	**186**	**4.6 (3.9-5.6)**
Severe visual impairment (SVI) – VA <6/60 – 3/60 in the better eye with available correction						
All bilateral cases	18	7.9 (5.2-11.8)	95	2.5 (2.0-3.1)	**113**	**2.8 (2.3-3.5)**
Moderate visual impairment (MVI) – VA <6/18 – 6/60 in the better eye with available correction						
All bilateral cases	38	16.6 (11.9-22.7)	415	11.0 (9.8-12.3)	**453**	**11.3 (10.2-12.6)**

Age and non-visual disability were associated with being bilaterally blind or SVI (Table 28). Sex did not appear to be associated with this outcome.

Older people and those with non-visual disabilities were also more likely to have one or two unoperated cataracts. Sex did not appear to be associated with not having been operated.

Table 28: Table describing univariate associations of 1) being bilaterally blind or SVI, and 2) of having an unoperated cataract

		1) Bilaterally blind or severely VI		2) Any unoperated cataract	
		N (%)	**OR (p-value)**	**N (%)**	**OR (p-value)**
Sex	Male	121 (6.7)	-	250 (13.8)	-
	Female	178 (8.1)	1.2 (0.08)	325 (14.9)	1.09 (0.3)
Age groups	50-59	42 (2.2)	-	69 (3.7)	-
	60-69	72 (6.2)	2.9 (<0.001)	157 (13.5)	4.1 (<0.001)
	70-79	98 (15.0)	7.7 (<0.001)	206 (31.5)	1.8 (<0.001)
	80+	86 (28.5)	17.4 (<0.001)	141 (46.7)	3.9 (<0.001)
Non-visual disability	No	235 (6.2)	-	505 (13.3)	-
	Yes	66 (28.8)	6.1 (<0.001)	73 (31.9)	3.0 (<0.001)

Looking at all these factors together by mutually adjusting, age and non-visual disability remain independently associated with being bilaterally blind or SVI, although the strength of the effect of non-visual disability is reduced (Table 29). Additionally, sex is now associated with the outcome, perhaps its effect being mediated previously through non-visual disability.

After mutual adjustment, age remains independently associated with having any unoperated cataract and sex becomes an associated factor, with women more likely to be affected than men. However, the effect of non-visual disability disappeared, with the effect apparently mediated through age or sex.

The odds of being bilaterally blind or SVI or having an unoperated cataract increase progressively with age – and are higher for women. Additionally, the odds of being bilaterally blind or SVI are an additional three times higher for people with non-visual disabilities.

Table 29: Table describing multivariate associations of 1) being bilaterally blind or SVI, and 2) of having an unoperated cataract.

		1) Bilaterally blind or severely VI	2) Any unoperated cataract
		OR (p-value)	**OR (p-value)**
Sex	Male	-	-
	Female	1.4 (0.02)	1.3 (0.01)
Age groups	50-59	-	-
	60-69	2.8 (<0.001)	4.1 (<0.001)
	70-79	7.2 (<0.001)	12.2 (<0.001)
	80+	13.3 (<0.001)	22.4 (<0.001)
Non-visual disability	No	-	-
	Yes	2.9 (<0.001)	1.2 (0.2)

Cataract surgical coverage was around one-third higher among people in the sample who didn't report any non-visual disabilities than among those who did report non-visual disabilities.

Effective cataract surgical coverage, however, was around twice as high among people in the sample who didn't report any non-visual disabilities than among those who did report non-visual disabilities.

Table 30: Cataract surgical coverage (persons) at different levels of visual acuity

		VA<3/60	VA<6/60	VA<6/18
Cataract surgical coverage	Non-disabled (no non-visual disability)	30.2%	22.6%	12.2%
	Disabled (non-visual disability)	22.6%	17.1%	11.5%
Effective cataract surgical coverage	Non-disabled (no non-visual disability)	21.9%	16.5%	7.8%
	Disabled (non-visual disability)	9.7%	7.3%	4.9%

Health seeking behaviour

When asked about general health information, the vast majority of respondents named community leaders as their most accessed (70%) and most trustworthy (59%) source of health information, followed by community health workers (29% and 22% respectively) (Tables 31-34). These were followed by friends, radio and family. Television, professional health workers and newspapers were not mentioned as important sources by many, potentially reflecting their scarcity in the area.

Women were more likely to report getting information from friends (14% vs males 11%) and family (16% vs males 7%), and men were more likely to report getting it from the radio (19% vs females 13%).

People with (all) disabilities were more likely to access information from their families than other people in the community (18% vs 11%), and less likely to access information from health workers (community or professional), radio or television.

Table 31: Questions: Where do men and women get most of their information about health issues from?

(multiple responses allowed)	Males		Females		Total		Difference
	N	%	N	%	N	%	p-value
Community leaders (religious or secular)	1,270	70.0	1,526	69.7	2,796	69.9	0.9
Community health workers	553	30.5	607	27.7	1,160	29.0	0.6
Friends/ neighbours	203	11.2	300	13.7	503	12.6	0.02
Radio	343	18.9	276	12.6	619	15.5	<0.001
Family	121	6.7	358	16.4	479	12.0	<0.001
Television	76	4.2	75	3.4	151	3.8	0.2
Professional health workers	55	3.0	39	1.8	94	2.4	0.009
Newspapers/ magazines	4	0.2	3	0.1	7	0.2	0.5
Other	11	0.6	5	0.2	16	0.4	0.06

Table 32: Questions: Where do people with and without disabilities get most of their information about health issues from?

(multiple responses allowed)	People with disabilities		People without disabilities		Total		Difference
	N	%	N	%	N	%	p-value
Community leaders (religious or secular)	357	72.4	2,439	69.5	2,796	69.9	0.2
Community health workers	107	21.7	1,053	30.0	1,160	29.0	<0.001
Friends/ neighbours	68	13.8	435	12.4	503	12.6	0.4
Radio	41	8.3	578	16.5	619	15.5	<0.001
Family	88	17.9	391	11.1	479	12.0	<0.001
Television	8	1.6	143	4.1	151	3.8	0.007
Professional health workers	5	1.0	89	2.5	94	2.4	0.04
Newspapers/ magazines	0	0	7	0.2	7	0.2	0.3
Other	2	0.4	14	0.4	16	0.4	0.9

Table 33: Question: Which is the most trustworthy source of information about health according to men and women? (p<0.001)

	Males		Females		Total	
	N	%	N	%	N	%
Community leaders (religious or secular)	1,077	59.4	1,287	58.8	2,364	59.1
Community health workers	427	23.5	468	21.4	895	22.4
Friends/ neighbours	40	2.2	84	3.8	124	3.1
Radio	151	8.3	98	4.5	249	6.2
Family	47	2.6	185	8.5	232	5.8
Television	30	1.7	43	2.0	73	1.8
Professional health workers	40	2.2	23	1.1	63	1.6
Newspapers/ magazines	2	0.1	0	0	2	0.1

Table 34: Question: Which is the most trustworthy source of information about health according to people with and without disabilities? (p<0.001)

	People with disabilities		People without disabilities		Total	
	N	%	N	%	N	%
Community leaders (religious or secular)	300	60.9	2,064	58.8	2,364	59.1
Community health workers	81	16.4	814	23.2	895	22.4
Friends/ neighbours	25	5.1	99	2.8	124	3.1
Radio	21	4.3	228	6.5	249	6.2
Family	58	1.8	174	5.0	232	5.8
Television	5	1.0	68	1.9	73	1.8
Professional health workers	3	0.6	60	1.7	63	1.6
Newspapers/ magazines	0	0	2	0.1	2	0.1

When asked specifically about the nearest reliable place to get eye health services, 55% of respondents mentioned their local community health workers, 27% mentioned the district or provincial level government health facility, and a further 13% mentioned the local government health facility. Less than 5% in total mentioned family members or local traditional healers as the nearest reliable source, and less than 1% mentioned private facilities.

Men and women had different responses, with men more likely to mention local government health facilities and women more likely to mention family members. Similarly, people with disabilities were less likely to mention community health workers and more likely to mention family members and local government health facilities.

Table 35: Question: Where is the nearest reliable place for men and women to get eye health services? (p<0.001)

	Males		Females		Total	
	N	%	N	%	N	%
Local community health worker	1,007	55.5	1,187	54.3	2,194	54.8
Government health facility at district of province level	481	26.5	578	26.4	1,059	26.5
Government health facility nearby	279	15.4	247	11.3	526	13.1
Family member	30	1.7	142	6.5	172	4.3
Traditional healer	3	0.2	17	0.8	20	0.5
Private health facility nearby	6	0.3	10	0.5	16	0.4
Private health facility at district of province level	5	0.3	5	0.2	10	0.3
Other	3	0.2	2	0.1	5	0.1

Table 36: Question: Where is the nearest reliable place for people with and without disabilities to get eye health services? (p<0.001)

	People with disabilities		People without disabilities		Total	
	N	%	N	%	N	%
Local community health worker	227	46.0	1,967	56.1	2,194	54.8
Government health facility at district of province level	143	29.0	916	26.1	1,059	26.5
Government health facility nearby	74	15.0	452	12.9	526	13.1
Family member	37	7.5	135	3.9	172	4.3
Traditional healer	6	1.2	14	0.4	20	0.5
Private health facility nearby	2	0.4	14	0.4	16	0.4
Private health facility at district of province level	2	0.4	8	0.2	10	0.3
Other	2	0.4	3	0.1	5	0.1

Respondents were also asked their opinion about reasons why people in their community may not seek care when they have serious eye health problems. Nearly 89% of respondents felt that few barriers exist and that everyone goes when they need care, with men (90%) slightly more likely to report this than women (87%). However, 6% of people felt that hospital fees were unaffordable, and around 3% each felt that lack of family support, lack of knowledge, inability to leave farms/work, and lack of perceived importance were barriers to seeking care.

Women were more likely than men to mention lack of family support (3.8% vs 1.5%) and not knowing where to get care (3.0% vs 1.9%).

Table 37: Question: In the OPINION of men and women, what are the main barriers stopping people in this community going to the hospital when they have a serious eye problem?

(multiple responses allowed)	Males		Females		Total		Difference
	N	%	N	%	N	%	p-value
There are no barriers: everyone goes when needed	1,640	90.4	1,900	86.8	3,540	88.5	<0.001
People in this community cannot afford hospital fees	103	5.7	144	6.6	247	6.2	0.2
People in this community cannot go to the hospital because their families do not allow them or will not help them	27	1.5	82	3.8	109	2.7	<0.001
Eye problems are not very important to people in this community	43	2.4	61	2.8	104	2.6	0.4
People in this community cannot afford to spend time away from their homes, farms or work	42	2.3	62	2.8	104	2.6	0.3
People in this community do not know where to go when they have serious eye health problems	35	1.9	66	3.0	101	2.5	0.03
People in this community are afraid to go to the hospital when they have serious eye problems	44	2.4	60	2.7	104	2.6	0.5

People with disabilities were significantly less likely to report that there were no barriers to seeking care (80% vs 90%), although the proportion was still relatively high. They were more likely than others in the community to report against all the other barriers to seeking care.

Table 38: Question: In the OPINION of people with and without disabilities, what are the main barriers stopping people in this community going to the hospital when they have a serious eye problem?

(multiple responses allowed)	People with disabilities		People without disabilities		Total		Difference
	N	%	N	%	N	%	p-value
There are no barriers: everyone goes when needed	394	79.9	3,146	90.0	3,540	88.5	<0.001
People in this community cannot afford hospital fees	51	10.3	196	5.6	247	6.2	<0.001
People in this community cannot go to the hospital because their families do not allow them or will not help them	47	9.5	62	1.8	109	2.7	<0.001
Eye problems are not very important to people in this community	19	3.9	85	2.4	104	2.6	0.06
People in this community cannot afford to spend time away from their homes, farms or work	27	5.5	77	2.2	104	2.6	<0.001
People in this community do not know where to go when they have serious eye health problems	25	5.1	76	2.2	101	2.5	<0.001
People in this community are afraid to go to the hospital when they have serious eye problems	24	4.9	80	2.3	104	2.6	0.001

Results: Changes in Nampula eye health from 2011 to 2018

The RAAB undertaken in 2011 aimed to enrol 3,050 people and achieved an enrolment rate of 96.9% (2,954 people). Compared with the 2007 census data, men and younger people were underrepresented in the study sample – similar to the 2018 RAAB. It is important therefore to compare the age and sex standardised results of the two studies to ensure differences due to sampling are accounted for.

Table 39: 2011: Eligible persons, coverage, absentees and refusals in survey

	Examined		Not available		Refused		Not capable		Total	
	n	%	n	%	n	%	n	%	n	%
Males	1,347	97.0%	13	0.9%	14	1.0%	14	1.0%	1,388	100.0%
Females	1,607	96.7%	6	0.4%	27	1.6%	22	1.3%	1,662	100.0%
Total	**2,954**	**96.9%**	**19**	**0.6%**	**41**	**1.3%**	**36**	**1.2%**	**3,050**	**100.0%**

Table 40: 2011: Age and sex distribution of people examined in the sample and in survey area

	Males				Females				Total			
	Sample		Area		Sample		Area		Sample		Area	
	n	%	n	%	n	%	n	%	n	%	n	%
50 – 59 years	577	42.8%	88,291	49.7%	706	43.9%	87,587	54.3%	**1,283**	**43.4%**	**175,878**	**51.9%**
60 – 69 years	415	30.8%	53,307	30.0%	537	33.4%	47,032	29.2%	**952**	**32.2%**	**100,339**	**29.6%**
70 – 79 years	279	20.7%	25,315	14.3%	278	17.3%	19,047	11.8%	**557**	**18.9%**	**44,362**	**13.1%**
80 – 99 years	76	5.6%	10,564	6.0%	86	5.4%	7,543	4.7%	**162**	**5.5%**	**18,107**	**5.3%**
Total	**1,347**	**100.0%**	**177,477**	**100.0%**	**1,607**	**100.0%**	**161,209**	**100.0%**	**2,954**	**100.0%**	**338,686**	**100.0%**

Prevalence of visual impairment

In 2011, the prevalence of bilateral blindness in the sample was 7.1% (95%CI 5.8-8.5%). Using a pinhole, this reduced slightly to 7.0% (95%CI 5.7-8.3%). Bilateral SVI affected 90 people or 3.1% (95%CI 2.4-3.7%) and MVI affected 193 people or 6.5% (5.5-7.6%).

Table 41: 2011: Prevalence of blindness, SVI and MVI – all causes

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Blindness – VA <3/60 in the better eye with best correction or pinhole						
All bilateral blindness	91	6.8% (5.2-8.3)	116	7.2% (5.5-8.9)	**207**	**7.0% (5.7-8.3)**
All blind eyes	291	10.8% (9.2-12.4)	319	9.9% (8.1-11.8)	**610**	**10.3% (8.9-11.7)**
Blindness – VA <3/60 in the better eye with available correction (presenting VA)						
All bilateral blindness	92	6.8% (5.2-8.4)	119	7.4% (5.6-9.2)	**211**	**7.1% (5.8-8.5)**
All blind eyes	298	11.1% (9.5-12.7)	328	10.2% (8.3-12.1)	**626**	**10.6% (9.2-12.0)**
Severe visual impairment (SVI) – VA <6/60 – 3/60 in the better eye with available correction						
All bilateral Severe VI	47	3.5% (2.4-4.5)	43	2.7% (1.9-3.5)	**90**	**3.1% (2.4-3.7)**
All Severe VI eyes	109	4.1% (3.0-5.1)	115	3.6% (2.9-4.3)	**224**	**3.8% (3.2-4.4)**
Moderate visual impairment (MVI) – VA <6/18 – 6/60 in the better eye with available correction						
All bilateral MVI	90	6.7% (5.1-8.2)	103	6.4% (5.2-7.6)	**193**	**6.5% (5.5-7.6)**
All Moderate VI eyes	203	7.5% (6.0-9.1)	241	7.5% (6.3-8.7)	**444**	**7.5% (6.4-8.6)**

Adjusting for age and sex to allow for differences in representation of certain groups within the sample, bilateral blindness was 6.2% (95%CI 4.8-7.5%), SVI was 2.6% (95%CI 1.9-3.3%) and MVI was 2.9% (95%CI 4.8-6.9%).

Table 42: 2011: Age and sex adjusted results for all causes of blindness, SVI and MVI

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Blindness – VA <3/60 in the better eye with best correction or pinhole						
All bilateral cases	10,801	6.1 (4.5-7.7)	9,805	6.1 (4.4-7.8)	**20,606**	**6.1 (4.7-7.4)**
All eyes	35,056	9.9 (8.3-11.4)	27,851	8.6 (6.8-10.5)	**62,907**	**9.3 (7.9-10.7)**
Blindness – VA <3/60 in the better eye with available correction (presenting VA)						
All bilateral cases	10,892	6.1 (4.5-7.7)	10,085	6.3 (4.5-8.0)	**20,977**	**6.2 (4.8-7.5)**
All eyes	35,791	10.1 (8.5-11.7)	28,654	8.9 (7.0-10.8)	**64,445**	**9.5 (8.1-10.9)**
Severe visual impairment (SVI) – VA <6/60 – 3/60 in the better eye with available correction						
All bilateral cases	5,168	2.9 (1.9-4.0)	3,589	2.2 (1.4-3.0)	**8,757**	**2.6 (1.9-3.3)**
All eyes	12,473	3.5 (2.5-4.5)	9,859	3.1 (2.3-3.8)	**22,332**	**3.3 (2.7-3.9)**
Moderate visual impairment (MVI) – VA <6/18 – 6/60 in the better eye with available correction						
All bilateral cases	11,140	6.3 (4.7-7.8)	8,787	5.5 (4.3-6.6)	**19,927**	**5.9 (4.8-6.9)**
All eyes	25,609	7.2 (5.7-8.7)	21,258	6.6 (5.4-7.7)	**46,867**	**6.9 (5.8-8.0)**

Therefore, between 2011 and 2018, bilateral blindness reduced by approximately 2.3% among people aged over 50 years in Nampula. The 95% confidence intervals of the two prevalence estimates do not overlap, indicating a statistically significant difference. Assuming a static population, this is equivalent to approximately 6,000 fewer people being bilaterally blind in the province in 2018 compared to 2011.

SVI remained relatively static, however MVI saw an increase from 5.9% to 10.1%, meaning approximately 14,000 more people are affected in the province.

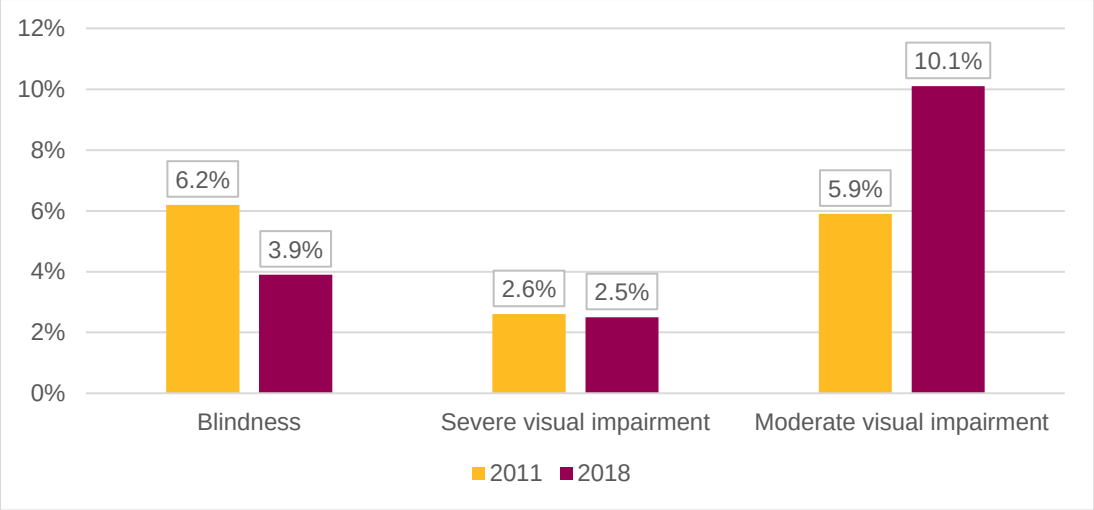

Figure 7: Changes in the prevalence of visual impairment between 2011 and 2018

Causes of visual impairment

In 2011, 73% of bilateral blindness was attributed to unoperated cataract, 11.8% was attributed to other posterior segment diseases, and 9.0% was attributed to glaucoma. By 2018, the proportion of blindness attributed to unoperated cataract had reduced to 56%, the proportion attributed to glaucoma increased to 20.3%, and the proportion attributed to other posterior segment diseases remained static at 11.8%. Blindness due to causes such as surgical complications and refractive error was relatively minimal in both surveys. Corneal opacities (trachoma and non-trachoma) were also relatively minor causes of blindness in both studies. In 2011 they were responsible for blindness in nine people (4.3%) or 55 eyes (8.8%), and in 2018 this was slightly higher at 12 people (6.4%) or 82 eyes (12.2%).

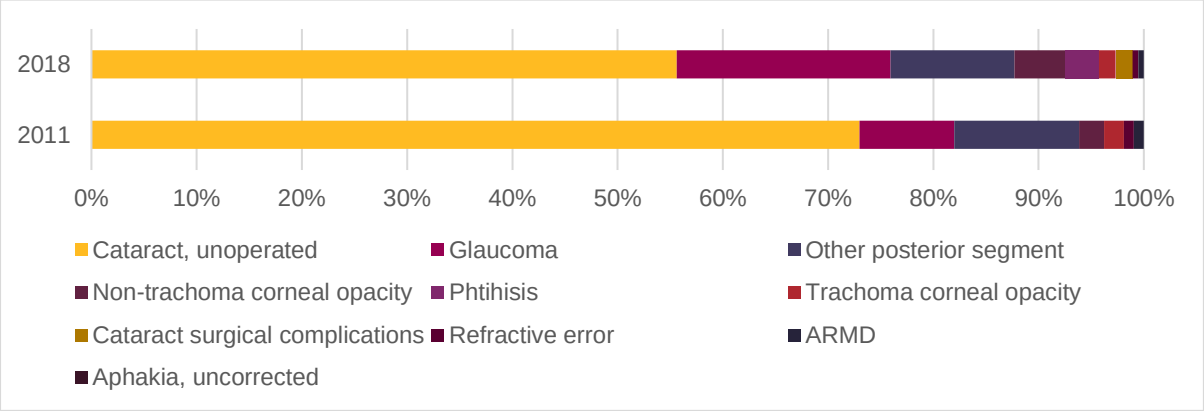

Figure 8: Causes of bilateral blindness in 2011 and 2018 surveys: shown as a proportion of the total

The two main causes of SVI were unoperated cataract and refractive error in both surveys. The proportions these causes were responsible for remained similar: cataract in 2011 was 68.9% and in 2018 was 68.4%; refractive error in 2011 was 15.6% and in 2018 was 16.7%. Glaucoma and other posterior segment diseases were the other important causes identified in both surveys, responsible respectively for 2.2% and 12.2% (total 14.4%) in 2011, and 7.0% and 4.4% (total 11.4%) in 2018.

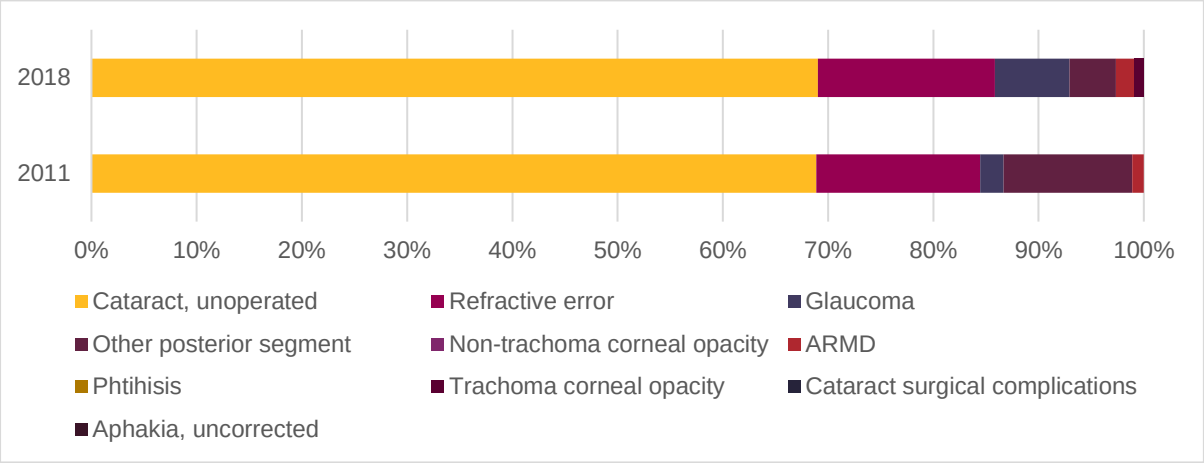

Figure 9: Causes of bilateral SVI in 2011 and 2018 surveys: shown as a proportion of the total

Refractive error was the major cause of MVI in 2011 (43.5%) and 2018 (46.3%), followed by unoperated cataract (2011: 36.3%; 2018: 43.2%) and other posterior segment disease (2011: 14.5%; 2018: 5.9%). Other causes, including glaucoma and corneal opacities, were responsible only for small numbers of cases in both surveys.

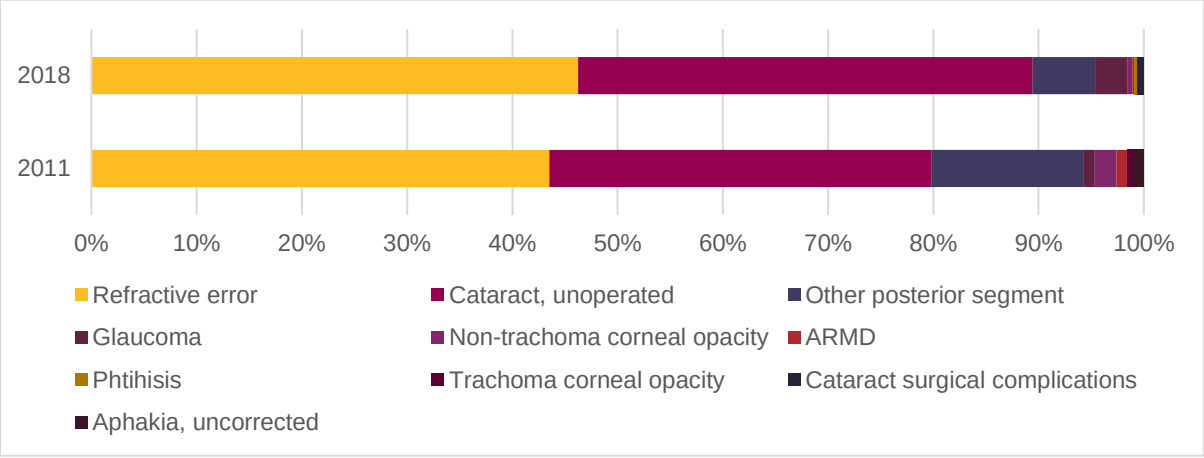

Figure 10: Causes of bilateral MVI in 2011 and 2018 surveys: shown as a proportion of the total

Cataract surgical coverage

Age and sex adjusted CSC among persons increased nearly three-fold at all levels of visual acuity between 2011 and 2018. Males in need were approximately twice as likely as females to have received surgery in both surveys, indicating no change in the gender differential in successfully seeking care between the two time points.

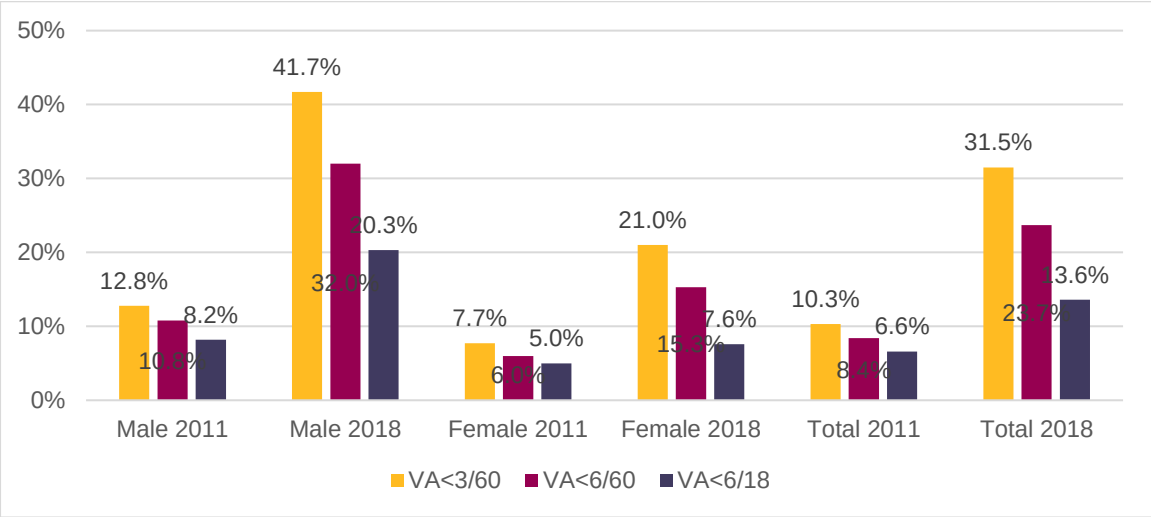

Figure 11: Age and sex adjusted cataract surgical coverage in 2011 and 2018, by sex and level of visual acuity

Quality of visual outcomes

The quality of visual outcomes observed among participants who had received cataract surgery appeared to improve between 2011 and 2018. Despite small numbers in the 2011 survey, the proportion of good presenting vision (can see 6/18) increased from 35% to 58%, and the proportion of good best corrected vision (can see 6/18 with pinhole) increased from 58% to 72%. The proportion of poor presenting vision (cannot see 6/60) decreased from 27% to 22%, and the proportion of poor best corrected vision decreased from 23% to 16%.

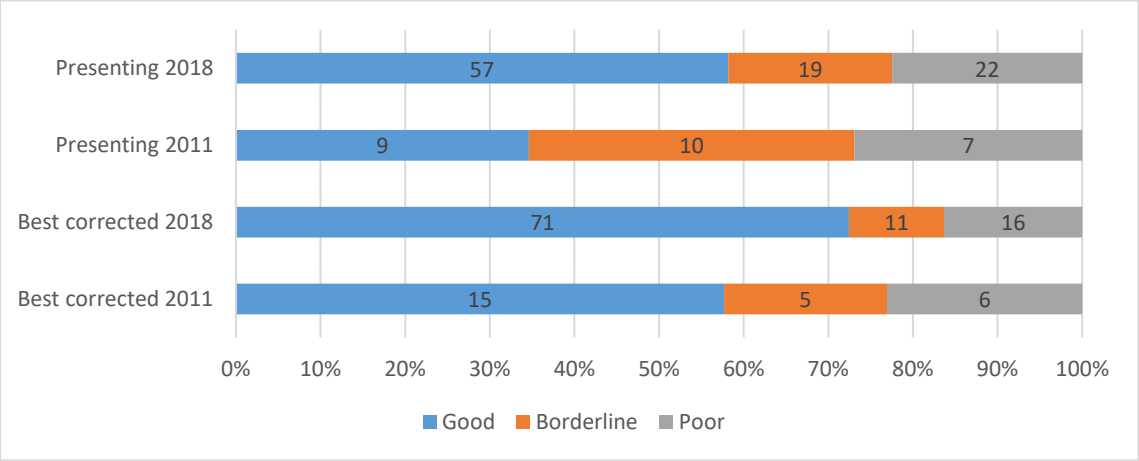

Figure 12: Quality of visual outcomes in 2011 and 2018

Discussion

In the past seven years the eye health programme in Nampula has made significant progress towards reducing avoidable blindness, showing a decrease in prevalence of bilateral blindness among people aged 50+ years from 6.2% (95% CI 4.8%-7.5%) in 2011 to 3.9% (95% CI 3.0%-4.7%) in 2018. If the population remained static, this would mean approximately 7,800 cases of blindness had been avoided in this province, however a significant increase in the population between 2011 and 2018 means this is likely to be much higher.

This decrease in prevalence of blindness is likely to be attributed to the three-fold increase in cataract surgical coverage, from 10.3% in 2011 to 31.5% in 2018.

Despite these evident successes, the programme has many challenges and the province is far from the elimination of avoidable visual impairment or universal coverage with essential eye health services. About 3.9% of people aged over 50 years in Nampula, or approximately 13,000 people, continue to live bilaterally blind. Around 6,000 of them are blind with cataract. Cataract surgical coverage continues to be relatively low, with less than a third since 2011 of people with operable cataract having access to surgery.

There are also gender disparities in access to cataract services, with the cataract surgical coverage among women being only half of the coverage among men (21% vs 41%). Some progress has been made in the past seven years, as the cataract coverage among men increased 2.5 times from 17.5% to 41.7% and three times among women, from 7.1% to 21%.

Cataract surgical coverage decreases further when quality of post-surgery visual outcomes are taken into account; only one in five people with operable cataract currently have access to the surgery, which fully restores their sight. Women are even more disadvantaged, as only one in ten women with operable cataract has access to surgery. It is however important to note that the quality of post-operative outcomes in the province has undoubtedly improved in the past few years – 74% of surgeries taken in the past four years had good visual outcomes, compared to only 40% of the surgeries taken 5+ years ago. Poor visual outcomes were recorded in 40% of surgeries conducted 5+ years ago, and 17% of surgeries conducted four years ago or less. Highly skilled surgeons and an investment in biometry will undoubtedly have contributed towards this. In addition, the reasons for poor visual outcomes can be multiple, including other co-morbidities present in patients with cataract.

Furthermore, the study found no change in the prevalence of SVI, and there was an increase in the prevalence of MVI from 5.1% in 2011 to 10.1% in 2018. This is likely to indicate people are not accessing treatment at the early stages of visual impairment, which is not surprising given that the capacity of the system to address

the needs of those who are currently blind is limited, leaving almost no space for those who have less severe levels of impairments. More than half of survey respondents with operable cataracts reported not being able to access treatment, indicating perceived barriers within the community.

The study results suggest there are around 24,330 people in Nampula with bilateral cataract, and a further 25,012 with unilateral cataract. While men are approximately 23% more likely to have unilateral cataracts, women are approximately 30% more likely to suffer bilaterally.

There are also nearly 9,000 people in Nampula who have functional low vision and are in need of low vision services, and there are over 19,000 people aged 50+ years who have uncorrected refractive error.

Although visually impairing glaucoma has been identified in the study, it is worth noting that glaucoma only affects visual acuity at the very end stage and, therefore, much glaucoma will go unidentified by this study. To understand the full extent of glaucoma in Nampula, a specific study would be required with very different clinical examination procedures.

Similarly, although no single case of diabetic retinopathy was identified in the study, we are aware that the examination methods used in RAAB are not designed to identify diabetic retinopathy. Cases could have been missed, or otherwise classified as ‘other posterior segment’. As with glaucoma, we would need to conduct a specific study to measure the magnitude of diabetic retinopathy in Nampula.

Prevalence of disability was found to be 10.8% among the over 50s in Nampula, and prevalence of non-visual disability was 4.8%. Given the age group this seems quite low, but may reflect the relatively young age structure in Nampula; only a small proportion of the over 50s are aged over 70. A large proportion of the people reporting visual disabilities are visually impaired due to avoidable causes, and many others may require low vision services. Given the high reliance of many older people with disabilities on their families for health information as well as access to services, services should focus on ensuring the general population is aware of the importance of health care for people with disabilities and support that may be available for them.

Table 43 shows results of this study in comparison with other RAABs conducted by Sightsavers in sub-Saharan Africa in the past three years. The level of bilateral blindness in Mozambique is similar to the levels in Singida, Tanzania and Muchinga, Zambia; slightly lower than in Yaoundé, Cameroon and Karamoja, Uganda, but much lower than in Worno health zone in Sokoto, Nigeria. The comparative results are similar for other levels of visual impairment. The cataract surgical coverage is lower than in many other places apart from in Zambia, where the coverage is comparable. The gender disparities in cataract surgical coverage are similar to other places in Africa; the post-surgery visual outcomes are one of the best among the studies compared with the proportion of good visual outcomes being higher than in many other places and proportion of poor outcomes being the lowest among the studies.

Table 43: Results of the RAABs conducted by Sightsavers in sub-Saharan Africa in 2015-2018

	Nampula Mozambique, 2018	Singida Tanzania, 2017	Muchinga province Zambia, 2017	Yaounde, Cameroon, 2016	Karamoja, Uganda, 2015	Worno health zone, Sokoto Nigeria, 2016
Blindness	3.9 (3.0-4.7)	3.8 (3.00-4.7)	4.1% (3.1-5.0)	2.6 (2.1-3.2)*	3.1 (2.3-3.9)	6.8 (5.6-8.0)
SVI	2.5% (1.9-3.0)	2.1 (1.5-2.7)	3.1 (2.4-3.8)	0.7 (0.4-1.0)	1.5(0.8-2.1)	4.3 (3.5-5.1)
MVI	10.1% (8.9-11.3)	7.4 (6.4-8.4)	9.6 (8.3-11.0)	5.1 (4.3-6.0)	6.9 (5.6-8.2)	11.4 (9.8-13.1)
FLV	2.6%	1.2%		2.2 (1.7-2.7)	2.6 (1.6-3.5)	3.8(2.8-4.8)
CSC (at VA 3/60)	31.5%	50.6% (m 67.8%; f. 40.4%)	36.8% (m 45.8; f 27.6)	59.1% (m 69.8%; f. 52.8%)	43.1% (m 48.5; f 39.5)	69.6% (m 78.1; f. 63.2)
eCSC	18.9% (m 29.1%; f 11.1%)					
Good outcomes (with available correction)	58.2 (last 3y 63.8%)	54.7% (last 3y 66.3%)	50% (last 3 y 58.1%)	45.3%	43.1%	31.3%
Poor outcomes (with available correction)	22.4% (last 3y 13.0%)	26.1% (last 3y 22.8%)	33% (last 3y 29%)	33.9%	39.1%	51.4%
RE	6.6%	3.7%		14.3%		
URE	5.7%	2.8%		3.8%		
Uncorrected presbyopia	94.4%	96.5%		63.1%		
Disability	10.3% (non-VI 4.8%)	21.2% (non-VI 13.3%)				

*Used unadjusted but the difference was very minor, as the sample was highly representative of the population

This study was subject to a number of limitations. Standard RAAB limitations are well documented elsewhere[8]. In addition to these, a major limitation of the study is the use throughout of population data from the 2007 national census. Both the 2011 and 2018 studies used this data for their sampling frame and extrapolating results to the population. Official population projections from the National Institute of Statistics suggest that the Nampula population would have increased from 2007 levels by 11% in 2011 and 32% by 2018[9], and preliminary results from the 2017 census suggest that these projections are conservative. Therefore, extrapolated results presented in this report should be interpreted with this limitation in mind.

25 people enrolled were not examined in the study due to their 'inability to communicate'. Although undocumented, it is likely this inability is due to a severe communication disability and prevalence of disability may therefore be underestimated by approximately 0.6%, meaning true sample prevalence would be 12.5%.

In conclusion, the survey demonstrated that the Nampula province and its eye health programme have made significant progress in reducing avoidable visual impairment in the past seven years. The cataract coverage has significantly increased, and the quality of post-surgery visual outcomes has dramatically improved.

However, there remains considerable work to be done to scale up services and to make them available to all who need them. Evidence suggests that while outreach may be more effective at reaching marginalised groups such as women, the outcomes may not be as high quality as those seen in a base hospital. Although the prevalence of moderate visual impairment as well as non-cataract related visual impairment are on the rise, the efforts of the programme should continue focusing on cataract. Thousands of people in the province continue living bilaterally blind from the condition, which can be effectively treated. Specific efforts need to be made to increase uptake of cataract surgery by women and to ensure the programme deploys effective strategies to recruit women through outreach.

Given a high number of people in need of spectacles, particularly presbyopic spectacles, effective market-based approaches need to be deployed. However, given the high levels of poverty in this population, the approaches should prioritise the availability of affordable (low cost) spectacles as well as cross-subsidy models where the poorest of the poor also have access to services.

[8] Kuper, H., Polack, S. and Limburg, H., 2006. Rapid assessment of avoidable blindness. Community Eye Health, 19(60), p.68.
[9] http://www.ine.gov.mz/estatisticas/estatisticas-demograficas-e-indicadores-sociais/projeccoes-da-populacao/populacao-projectada-por-distritos-nampula-2007_2040.xls/view

Appendices

Appendix 1: Training report

Report of data collector training for study:

Rapid Assessment of Avoidable Blindness, Nampula, Mozambique

13–17 August 2018

Prepared by Emma Jolley and Kola Ogundimu

Overview of training

This training was undertaken to prepare a team to conduct a survey to collect end line data for evaluating an eye health programme in Nampula province, Mozambique, where the 2017 census estimated the total population to be 6,102,867 (2,941,344 males and 3,161,423 females)[10]. A baseline RAAB was conducted in August 2012.

In addition to the standard RAAB, a number of additional survey tools were added to capture data on examinee economic status, disability and health seeking behaviour (Appendix 2). The economic tools are validated in Mozambique and have been used in surveys such as DHS and MICS and are the Equity Tool[11] to measure relative asset-based wealth and the Simple Poverty Scorecard[12] to measure absolute asset-based wealth. The disability tool was the Washington Group Short Set of questions[13] internationally validated and accepted measure of inclusion in mainstream surveys. In the absence of existing, validated measures, the health seeking behaviour questions were designed specifically for this survey.

An additional 'social' data collector was added to each team to not overburden the RAAB team, and a specially designed survey tool was designed in an app form using CommCare software[14]. In all other respects the survey followed standard RAAB protocol.

Training and IOV were conducted at Nampula Central Hospital Ophthalmology Department. The participants in the training are shown below. The five examination teams are comprised of a team leader (ophthalmologist or ophthalmic technician), an

[10] Aprersentacao de Resultados Preliminares
[11] Chakraborty NM, Fry K, Behl R, Longfield K. Simplified Asset Indices to Measure Wealth and Equity in Health Programs: A Reliability and Validity Analysis Using Survey Data From 16 Countries. GHSP. 2016;4(1):141-154.
[12] Schreiner, M., 2013. Simple Poverty Scorecard Poverty-Assessment Tool Mozambique. Swiss Development Corporation/Microfinance Risk Management, LLC, p.127.
[13] Madans JH, Loeb ME, Altman BM. Measuring disability and monitoring the UN Convention on the Rights of Persons with Disabilities: the work of the Washington Group on Disability Statistics. BMC Public Health. 2011;11(4):S4.
[14] www.commcarehq.org

assistant (ophthalmic technician) (both of whom attended every day of the training) and a social data collector (who attended days 1, 3, and 5 of the training). In addition, each team had a driver, although they did not attend the majority of the training. The cluster informers also attended the first and third days of the training.

Sightsavers staff attending included Mércia Cumaio, Programme Manager, Abrão Banqueiro Chale, Programme Officer, and Emma Jolley and Kola Ogundimu, certified RAAB trainers.

Table 1: RAAB team members

Team #	Name	Position	Team role
1	Anselmo Vilanculos	Ophthalmologist	Team leader and principal investigator
	Manita Matos	Ophthalmic Technician	Assistant
	Veronica Hunguana		Social data collector
2	Dantew Terrefe	Ophthalmologist	Team leader
	Gita Sanito	Ophthalmic Technician	Assistant
	Ivete Mungoi		Social data collector
3	Gretel Alvarez Miror	Ophthalmologist	Team leader
	Guilherme Aleluia	Ophthalmic Technician	Assistant
	Kaleid Amorim		Social data collector
4	Sérgio Mosse	Ophthalmic Technician	Team leader
	Bento Francisco	Ophthalmic Technician	Assistant
	Teresa Carlos Vascono		Social data collector
5	Geremias Mandela	Ophthalmic Technician	Team leader
	Mai-mai José Linha	Ophthalmic Technician	Assistant
	Nelson João Calima		Social data collector
	Cassamo Remane		Cluster informer
	Carlos B. Elias		Cluster informer

Sample size and cluster selection

Survey sample size was calculated and clusters selected prior to the training. 2007 census data was used for sampling purposes as detailed data from 2017 census was not yet available (projected: October 2018). In some cases, where bairros were very large, they were sub-divided in to a lower administrative unit. Population size data was mostly unavailable at this lower unit so sub-divisions of equal size were assumed for the purposes of sampling.

The sample size is calculated based on the following assumptions: the prevalence of blindness in the age group aged >50 years is estimated at 5%; the desired precision estimate is ±0.8% around the prevalence estimate (±16% of the prevalence) with a 95% confidence level; and the design effect associated with the clustering design is 1.4. We expect 5% of selected people to be non-responders. This gives a sample size of 4,199 people aged >50 years. This will be achieved through enumerating 40 people from each of 105 clusters. Clusters of size 40 were chosen following discussion between the survey coordinator and PI, both of whom have experience with RAAB and trachoma surveys in the area and didn't consider it feasible to enrol 50 people per day due to difficult terrain and spread out villages.

Clusters were identified by compiling a list of all villages from the 2007 census data (2017 data was not yet available to such a level of detail) and selecting 105 through probability proportional to size (PPS) sampling. One cluster selected was identified as being impractical to visit due to being an island with infrequent/unsafe boat connections and was replaced by another cluster on the mainland in the same district of similar population size. The final list of clusters can be found in Appendix 2.

Classroom training 13–15 August

Training included all aspects of the survey methodology using a Powerpoint presentation developed by Emma Jolley as a guide. Various parts of the training were carried out by Emma Jolley, Dr Kola Ogundimu, and Mércia Cumaio. The Powerpoint and training was translated into Portuguese by a professional translator with experience with eye health, surveys and RAABs who also attended the classroom training.

1. Objectives and aims of the study
2. Survey structure
3. Sampling and sample size
4. Enrolment
5. Purpose of RAAB
6. Visual acuity screening methodology and practice
7. Lens exam and diagnostic definitions of the five clinical diagnoses
8. Equity Tool: what is it and practice
9. Disability questions: what are they and practice
10. Practical introduction to the study app; practice in entering simulated participants
11. Discussion of IOV
12. Discussion of fieldwork details

The options for place of surgery will be:

- Government hospital
- Voluntary/charitable hospital
- Government hospital outside of Nampula
- Eye camp/improvised setting

The local meaning of cost will be:

- Completely free – includes hospital, transport, food and other auxiliary costs paid.
- Partially paid – anything in-between completely free and completely paid.
- Completely paid – hospital fee over approx. USD400 / MZN 30,000 and all ancillary costs met by the patient.

There will be no local option for barriers.

Major issues encountered included the use of the English language mRAAB app which some ophthalmic assistants found difficult due to their lack of knowledge of English. A translation guide was developed prior to the training to assist with this and extra time spent to ensure their confident use of the app. These assistants were also placed with team leaders with English language skills and who were confident in use of the app. The social data app was developed in English, Portuguese and eMakhua and such issues were not encountered.

Survey coordinator responsibilities will be split. Mércia and Abrão will oversee fieldwork logistics and top-level supervision. Emma Jolley will receive, check and feedback on data quality.

IOV 16 August

42 patients were enrolled however only 39 patients were observed by all five teams. The team chosen as gold standard was the one observed by the trainers to be performing best throughout the training. Kappa scores of 0.6 or above were observed in 35 of the 36 areas with one score of 0.58 observed (IOV reports available on request). The trainers identified the major issues encountered to be linked to use of the pinhole and several hours were spent subsequent to the IOV test discussing the issues and how to ensure consistency when using the pinhole. It was decided that if teams could demonstrate consistent use of the pinhole during the fieldwork that the IOV would not need to be repeated.

Field work pilot 17 August

All study team members including drivers participated in a field training day. Permission was sought from local authorities to visit a community in the suburbs of Nampula, Murrapaniua, and teams met at the hospital and travelled together in

vehicles to reach the site by 9am. Initially the teams met with a community leader and discussed the community size and sub-divisions. As the community was large, for the purposes of the exercise we purposively selected a cluster to visit that was in easy reach. A local guide, Ronaldinho Rodrigues, was assigned to work with the teams and teams took it in turns to approach households, enumerate eligible participants and conduct examinations. After a short period, the team split in to two groups to allow for more practice for each team. After several hours, the team returned to the hospital to reflect on the experience and discuss issues that arose.

Several examinees had required pinhole examination and the trainers felt that all teams were now operating the same and felt confident to allow fieldwork to proceed. Other issues highlighted included the need to practice remembering all the introductory information for households (study objectives, consent, etc), sequencing between ophthalmic and social data collection, and the need for hand hygiene – extra alcohol was procured for each team.

Final fieldwork arrangements were discussed and the training was wrapped up.

Appendix 1: Social data tool (Excel version)

Número da equipe [ ] Insira o ID do cluster de hoje [ ][ ][ ] Que dia é hoje? _____

Nome de cluster _____ Número do agregado familiar [ ][ ] Nr. de identifição do participante no aplicativo do RAAB? [ ][ ]

Sexo: Homem [ ] / Mulher [ ] Anos [ ][ ] Podes examinar a pessoa agora?
- Sim, Eles concordam e agora podem participar [ ]
- Não, não disponível [ ]
- Não, recusa [ ]
- Não, incapaz de se comunicar [ ]

O participante está respondendo como chefe da familia? Se ele é a unica pessoa elegivel na sua casa voce DEVE responder sim
- Sim [ ] → A
- Não [ ] → B

A **Proxima sessão de perguntas precisam ser respondidas UMA VEZ por cada casa**

W1 Quantos membros do agregado famíliar têm entre 0 e 15 anos de idade?

0	1	2	3	4	5+

W2 O chefe do agregado/cônjuge masculino sabe ler e escrever?

Não	Sim	Não há chefe masculino/cônjuge masculino

		Sim	Não
W3	O seu agregado familiar possui geleira?		
W4	O seu agregado familiar possui electricidade?		
W5	O seu agregado familiar possui telefone Celular?		
W6	O seu agregado familiar possui televisor?		
W7	O agregado familiar tem um ferro de engomar a carvão ou eléctrico que esteja em funcionamento?		
W8	O agregado familiar tem uma mesa que esteja em funcionamento?		

W9 Quantas camas e beliches possui o agregado familiar que estejam em funcionamento?

0/1	2	3+

W10 Que tipo de casa de banho os membros do seu agregado familiar, geralmente, usam?

Não tem casa de banho/ mato/ campo	Outro

W11 Qual é a principal fonte de energia ou combustível que o seu agregado usa para cozinhar?
- Lenha [ ]
- Carvão [ ]
- Outro [ ]

W12 Qual é a principal fonte de energía ou combustivel que o agregado familiar usa para iluminação?
- Lenha, vela, petroleo/parafina/querosene, gás, ou outro [ ]
- Electricidade, gerador, placa solar, bateria, ou pilha [ ]

W13 Qual é o principal material de que é feito o telhado do seu agregado? (Inquiridor: Observar por conta própria e perguntar ao inquirido apenas se não for óbvio)
- Chapa de ferro [ ]
- Capim/ colmo/ lama [ ]
- Outro [ ]

W14 Qual é o principal material de que são feitas as paredes do seu agregado? (Inquiridor: Observar por conta própria e perguntar ao inquirido apenas se não for óbvio)
- Bloco de cimento [ ]
- Outro [ ]

W15 Qual é o principal material de que é feito o piso do seu agregado? (Inquiridor: Observar por conta própria e perguntar ao inquirido apenas se não for óbvio)
- Cimento [ ]
- Adobe, tile/marble, parquet, or sawed wood [ ]
- Outro [ ]

W16 Qual é a principal fonte de água usada pelos membros do seu agregado para beber?
- Água canalizada para dentro do quintal/ terreno [ ]
- Poço não protegido [ ]
- Outro [ ]

B	As seguintes perguntas incidem sobre dificuldades que poderá experimentar ao realizar determinadas atividades devido a um PROBLEMA DE SAÚDE.	1. Não – nenhuma	2. Sim – alguma	3. Sim – muita	4. Não consigo de forma
WG1	Tem dificuldade em ver, mesmo usando óculos?				
WG2	Tem dificuldade em ouvir, mesmo usando um aparelho auditivo?				
WG3	Tem alguma dificuldade em andar ou subir escadas?				
WG4	Tem alguma dificuldade em recordar-se de algo ou em concentrar-se?				
WG5	Tem alguma dificuldade (nos cuidados pessoais, por exemplo) em tomar banho ou vestir-se sozinho?				
WG6	Usando a sua linguagem habitual (que costuma usar), tem alguma dificuldade em comunicar, por exemplo, em compreender ou ser compreendido?				

C Comportamento de procura de saúde

HS1	Onde você obtém a maior parte de suas informações sobre problemas de saúde?? (Escolha duas)	Família	
		Amigos ou vizinhos	
		Líder comunitário (religioso ou secular)	
		Agente comunitário de saúde	
		Profissional de saúde	
		Jornais / outras revistas	
		Rádio	
		Televisão	
		De outros	
HS2	Qual é a fonte mais confiável de informações sobre saúde? (Escolha um)	Família	
		Amigos ou vizinhos	
		Líder comunitário (religioso ou secular)	
		Agente comunitário de saúde	
		Profissional de saúde	
		Jornais / outras revistas	
		Rádio	
		Televisão	
		De outros	
HS3	Onde é o local mais confiável para você obter serviços de saúde ocular? (Escolha um)	Membro da família	
		Curandeiro tradicional	
		Agente comunitário de saúde nesta aldeia	
		Instalação governamental nesta ou nas proximidades	
		Instalação privada nesta aldeia ou nas proximidades	
		Instalação governamental no distrito ou província	
		Instalação privada a nível distrital ou estadual	
		De outros	
HS4	Na sua OPINIÃO, quais são as principais barreiras que impedem as pessoas desta comunidade de irem ao hospital quando têm um sério problema ocular? (Escolha dois)	Não há barreiras: todo mundo vai quando necessário.	
		Problemas oculares não são muito importantes para as pessoas nesta comunidade	
		As pessoas nesta comunidade não podem ficar muito tempo longe de suas casas, machambas ou trabalho	
		As pessoas nesta comunidade não podem pagar as taxas hospitalares	
		As pessoas nesta comunidade não sabem para onde ir quando têm sérios problemas de saúde ocular	
		As pessoas nesta comunidade têm medo de ir ao hospital quando têm sérios problemas oculares	
		As pessoas desta comunidade não podem ir ao hospital porque as suas famílias não as permitem ou não as ajudam	
		De outros	

Appendix 2: Randomly selected units for study area

Cluster No.	District	Posto Administrativo	Localidae	Bairro	Sub-Bairro (if necessary)	Population
49	ANGOCHE	AUBE	Aube Sede	BAIRRO Aube Sede		22,390
1	ANGOCHE	BOILA - NAMETORIA	BOILA - SEDE	BAIRRO BOILA - SEDE	Naiculo-sede	2,923
2	ANGOCHE	BOILA - NAMETORIA	NABRUMA	BAIRRO NABRUMA	Naheje 2	2,788
50	ANGOCHE	CIDADE DE ANGOCHE	BAIRRO PARAPATO	BAIRRO Praia Velha		2,573
51	ANGOCHE	CIDADE DE ANGOCHE	INGURI	BAIRRO Inguri - sede		11,709
52	ANGOCHE	CIDADE DE ANGOCHE	SANGAGE	BAIRRO Muelane		1,522
3	ANGOCHE	NAMAPONDA	NAMAPONDA - SEDE	BAIRRO NAMAPONDA - SEDE	Zoro	967
4	CIDADE DE NAMPULA	MUATALA	MUATALA	BAIRRO MUATALA	Litine	4,974
6	CIDADE DE NAMPULA	MUATALA	MUATALA	BAIRRO MUTAUANHA	Namuato B	5,667
5	CIDADE DE NAMPULA	MUATALA	MUATALA	BAIRRO MUTAUANHA	Samora Machel	5,667
7	CIDADE DE NAMPULA	MUHALA	MUHALA	BAIRRO MUAHIVIRE	7 de Setembro	3,492
9	CIDADE DE NAMPULA	MUHALA	MUHALA	BAIRRO MUHALA - SEDE	1º de Maio	8,316
8	CIDADE DE NAMPULA	MUHALA	MUHALA	BAIRRO MUHALA - SEDE	Josina Machel	8,316
10	CIDADE DE NAMPULA	MUHALA	MUHALA	BAIRRO NAMUTEQUELIUA	Amilcar Cabral	7,364
11	CIDADE DE NAMPULA	NAMICOPO	NAMICOPO	BAIRRO NAMICOPO - SEDE	Mutava sede	2,617
12	CIDADE DE NAMPULA	NAPIPINE	NAPIPINE	BAIRRO CARRUPEIA	25 de Setembro	2,988
13	CIDADE DE NAMPULA	NAPIPINE	NAPIPINE	BAIRRO NAPIPINE	8 de Março	2,561
53	CIDADE DE NAMPULA	NATIKIRE	NATIKIRE	BAIRRO MARERE		5,180
14	CIDADE DE NAMPULA	NATIKIRE	NATIKIRE	BAIRRO MURAPANIVA	Mutivacocha "B"	1,710

54	CIDADE DE NAMPULA	URBANO CENTRAL	URBANO CENTRAL	BAIRRO MILITAR		7,660
55	CIDADE ILHA DE MOCAMBIQUE	LUMBO	LUMBO	BAIRRO AMPAPA		17,181
56	de MECONTA	7 DE ABRIL	NACOMA	BAIRRO NACOMA		5,275
57	de MECONTA	CORRANE	MECUA 1	BAIRRO MECUA 1		13,130
58	de MECONTA	de MECONTA	de VILA DE MECONTA	BAIRRO TETERENE		664
59	de MECONTA	NAMIALO	VILA DE NAMIALO	BAIRRO MULAPANE		2,958
15	LALAUA	LALAUA - SEDE	LALAUA - SEDE	BAIRRO LALAUA - SEDE	Muinana	1,629
60	LALAUA	METI	NAQUESSA	BAIRRO NAQUESSA		6,870
61	MALEMA	MALEMA/CANHUNHA	MALEMA - SEDE	BAIRRO MALEMA - SEDE		12,178
62	MALEMA	MALEMA/CANHUNHA	VILA DE MALEMA	BAIRRO MUTIVAZE - B		2,251
63	MALEMA	MUTUALI	VILA DE MUTUALI	BAIRRO CAPEIA		293
64	MALEMA	MUTUALI	VILA DE MUTUALI	BAIRRO PEQUERE		701
65	MECUBURI	MECUBURI	ISSIPE	BAIRRO ISSIPE		8,735
16	MECUBURI	MECUBURI	MECUBURI - SEDE	BAIRRO MECUBURI - SEDE	Inticuane	2,845
66	MECUBURI	MUITE	MUITE - SEDE	BAIRRO MUITE - SEDE		12,427
67	MECUBURI	NAMINA	NAMINA - SEDE	BAIRRO NAMINA - SEDE		23,134
17	MEMBA	CHIPENE	CHIPENE - SEDE	BAIRRO CHIPENE - SEDE	Nipheise	404
68	MEMBA	MAZUE	CAVA	BAIRRO CAVA		16,158
18	MEMBA	MAZUE	MAZUE - SEDE	BAIRRO MAZUE - SEDE	Molojo	950
19	MEMBA	MEMBA	MEMBA - SEDE	BAIRRO MEMBA - SEDE	Mahulupa	831
69	MEMBA	MEMBA	TROPENE	BAIRRO TROPENE		19,933
20	MOGINCUAL	LIUPO	LIUPO - SEDE	BAIRRO LIUPO - SEDE	Muerate	1,112
21	MOGINCUAL	NAMINGE	NAMINGE - SEDE	BAIRRO NAMINGE - SEDE	Namichir	1,454

22	MOGINCUAL	QUINGA	QUINGA - SEDE	BAIRRO QUINGA - SEDE	Mecage	1,988
70	MOGINCUAL	QUIXAXE	QUIXAXE - SEDE	BAIRRO QUIXAXE - SEDE		17,969
71	MOGOVOLAS	CALIPO	CALIPO SEDE	BAIRRO CALIPO SEDE		18,977
23	MOGOVOLAS	ILUTE	ILUTE - SEDE	BAIRRO ILUTE - SEDE	Namaluco (Naholoco/Iuluti)	766
72	MOGOVOLAS	ILUTE	MPUTO	BAIRRO MPUTO		13,447
73	MOGOVOLAS	MUATUA	MUATUA - SEDE	BAIRRO MUATUA - SEDE		18,343
74	MOGOVOLAS	NAMETIL - SEDE	VILA DE NAMETIL	BAIRRO Mucororo		4,228
75	MOGOVOLAS	NAMETIL - SEDE	VILA DE NAMETIL	Nacupio		564
24	MOGOVOLAS	NANHUPO	NANHUPO RIO	BAIRRO NANHUPO RIO	Nantoro	1,192
25	MOMA	MACONE - SEDE	JACOMA	BAIRRO JACOMA	Piriqueia	795
26	MOMA	MACONE - SEDE	MPACO	BAIRRO MPACO	Carepa	946
76	MOMA	MACONE - SEDE	NAICOLE	BAIRRO NAICOLE		16,563
77	MOMA	MACONE - SEDE	VILA DE MOMA	BAIRRO NATOMATO		3,646
27	MOMA	CHALAUA	CHALAUA - SEDE	BAIRRO CHALAUA - SEDE	Nacuzupa	1,197
28	MOMA	CHALAUA	PIQUEIRA	BAIRRO PIQUEIRA	Mieva	2,801
29	MOMA	LARDE	LARDE - SEDE	BAIRRO LARDE - SEDE	Maganha	1,555
78	MOMA	LARDE	TOPITO	BAIRRO TOPITO		8,401
79	MOMA	MUCUALI	NAJACA	BAIRRO NAJACA		12,356
30	MONAPO	ITOCULO	ITOCULO - SEDE	BAIRRO ITOCULO - SEDE	talane rio	2,300
31	MONAPO	MONAPO - SEDE	CANACUE	BAIRRO CANACUE	namacula	6,168
32	MONAPO	MONAPO - SEDE	MONAPO - SEDE	BAIRRO MONAPO - SEDE	malema	1,827
80	MONAPO	MONAPO - SEDE	MUNICÍPIO DE MONAPO	BAIRRO MULOTINE B		1,170
81	MONAPO	MONAPO - SEDE	MUNICÍPIO DE MONAPO	BAIRRO ZONA ALTA		415

33	MONAPO	NETIA	NACULUE	BAIRRO NACULUE	25 de setembro	1,991
34	MONAPO	NETIA	NETIA - SEDE	BAIRRO NETIA - SEDE	muthepua	3,220
82	MOSSURIL	LUNGA	VIDA NOVA	BAIRRO VIDA NOVA		11,308
83	MOSSURIL	MATIBANE	NACUCHA	BAIRRO NACUCHA		20,652
35	MOSSURIL	MOSSURIL - SEDE	NAMITATARI	BAIRRO NAMITATARI	Muanona-1	3,617
84	MUECATE	IMALA	GRACIO	BAIRRO GRACIO		16,025
85	MUECATE	MUCOLUANE	MUCOLUANE - SEDE	BAIRRO MUCOLUANE - SEDE		6,564
36	MUECATE	MUECATE	MUECATE - SEDE	BAIRRO MUECATE - SEDE	Mucoro	2,640
86	MURRUPULA	MURRUPULA	KAZUZU	BAIRRO KAZUZU		18,897
37	MURRUPULA	MURRUPULA	MURRUPULA SEDE	BAIRRO MURRUPULA SEDE	Migonhane	2,248
38	MURRUPULA	MURRUPULA	MURRUPULA SEDE	BAIRRO MURRUPULA SEDE	Muaprato	2,248
87	MURRUPULA	MURRUPULA	VILA DE MURRUPULA	BAIRRO ROVUMA_1 / 2		6,779
88	NACALA-PORTO	MAIAIA/MUTIVA	MAIAIA/MUTIVA	BAIRRO BLOCO 1		8,499
39	NACALA-PORTO	MAIAIA/MUTIVA	MAIAIA/MUTIVA	BAIRRO MOCONE		26,437
89	NACALA-PORTO	MAIAIA/MUTIVA	MAIAIA/MUTIVA	BAIRRO NAUAIA		9,554
90	NACALA-PORTO	MAIAIA/MUTIVA	MAIAIA/MUTIVA	BAIRRO RIBAWE		12,179
91	NACALA-PORTO	MUANONA	MUANONA	BAIRRO NAMISSICA		1,986
92	NACALA-VELHA	COVO	COVO - SEDE	BAIRRO COVO - SEDE		22,141
40	NACALA-VELHA	NACALA-VELHA	NACALA - VELHA -SEDE	BAIRRO NACALA - VELHA -SEDE	Catava	1,256
41	NACALA-VELHA	NACALA-VELHA	NACALA - VELHA -SEDE	BAIRRO NACALA - VELHA -SEDE	Ponte	744
93	NACAROA	INTETE	NOVANE	BAIRRO NOVANE		4,063
94	NACAROA	SAUA-SAUA	SAUA-SAUA - SEDE	BAIRRO SAUA-SAUA - SEDE		7,291
42	NAMAPA-ERATI	ALUA	ALUA - SEDE	BAIRRO ALUA - SEDE	Alua Sede	2,928

43	NAMAPA-ERATI	ALUA	ALUA - SEDE	BAIRRO ALUA - SEDE	Melege	2,928
44	NAMAPA-ERATI	NAMAPA-ERATI	ODINEPA	BAIRRO ODINEPA	Central	1,732
95	NAMAPA-ERATI	NAMAPA-ERATI	VILA DE NAMAPA	BAIRRO ANTONIO VIOLA		10,406
45	NAMAPA-ERATI	NAMAPA-ERATI	NAMAPA - SEDE	BAIRRO NAMAPA - SEDE	Munhacuco	1,402
46	NAMAPA-ERATI	NAMAPA-ERATI	NAMAPA - SEDE	BAIRRO NAMAPA - SEDE	Namulima	1,402
96	NAMAPA-ERATI	NAMIROA	MUANONA	BAIRRO MUANONA		24,163
47	NAMAPA-ERATI	NAMIROA	NAMIROA - SEDE	BAIRRO NAMIROA - SEDE	Mucuacuache	1,650
48	NAMPULA	ANCHILO	ANCHILO - SEDE	BAIRRO ANCHILO - SEDE	Moloa	2,090
97	NAMPULA	ANCHILO	SAUA - SAUA	BAIRRO SAUA - SAUA		7,998
98	NAMPULA	MUTIVAZE	NACUCA	BAIRRO NACUCA		7,907
99	NAMPULA	NAMAITA	POENE	BAIRRO POENE		7,050
100	NAMPULA	RAPALE	NACUIA	BAIRRO NACUIA		6,591
101	RIBAUE	CUNLE	ROIEQUE	BAIRRO ROIEQUE		3,019
102	RIBAUE	IAPALA	MATHARYA	BAIRRO MATHARYA		10,452
103	RIBAUE	IAPALA	VILA DE IAPALA	BAIRRO MURAPALA		409
104	RIBAUE	RIBAUE	CHICA	BAIRRO CHICA		15,859
105	RIBAUE	RIBAUE	MUNÍCIPIO DE RIBAUE	BAIRRO VARANCHA		1,090

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Bumpers Way
Bumpers Farm
Chippenham
SN14 6NG
UK

+44 (0)1444 446 600

info@sightsavers.org

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