Rapid Assessment of Avoidable Blindness (RAAB): Muchinga Province, Zambia

June 2017

Seeing is Believing

Sightsavers

Report compiled by Dr. Grace Chipalo Mutati.

Acknowledgements

Special thanks to Sightsavers for the initiation and logistical support for this study – and SIB for the financial support. Thank you to Muchinga Provincial Health Director (PHD) and the respective District Health Directors (DHDs) for the cooperation accorded to us during the groundwork in preparation for the study, for permission and access to the population and for according us the manpower during the fieldwork. To the cluster informers who did a wonderful job of communication to the clusters and the preparation of maps, which made it easy for us to find the clusters. To the investigating teams for their tireless efforts and vigilance in the recruitment of participants.

Thank you to the institutions that allowed the ophthalmologists, ophthalmic clinical officers and ophthalmic nurses to take time off to carry out the survey. Special thanks to the international certified trainers Dr. Kolawole Ogundimu and Dr. Alemayehu Woldeyes for taking time off to come and conduct training for the RAAB methodology, and for their support during data entry and the reporting phase. Many thanks to the international supervisor, Prof. Susan Lewallen, for the invaluable support given to the RAAB trainers.

Acronyms

ARMD	Age Related Macular Degeneration
CHW	Community Health Worker
CSC	Cataract Surgical Coverage
CSO	Central Statistics Office
DHD	District Health Directors
IAPB	International Agency for the Prevention of Blindness
IOV	Inter-Observer Variation
KCCO	Kilimanjaro Centre for Community Ophthalmology
OCO	Ophthalmic Clinical Officer
ONO	Ophthalmic Nursing Officer
PHD	Provincial Health Director
RAAB	Rapid Assessment of Avoidable Blindness
SCB	Standard Chartered Bank
SIB	Seeing is Believing
UTH	University Teaching Hospital
VA	Visual acuity
VI	Visual impairment
WHO	World Health Organisation

Executive Summary

Background

As part of the strategy to achieve the aim of VISION 2020 in Zambia, the government of the Republic of Zambia, in collaboration with Sightsavers, conducted a survey on causes of avoidable blindness in the four districts of Muchinga province. The four districts are located in the hard-to-reach rural area with inadequate eye health services. The aim was to estimate the magnitude and causes of blindness and severe VI in people aged 50 years and above in four districts in Muchinga province of Zambia.

Methods

A population-based survey was conducted in four districts (Isoka, Chinsali, Shiwang'andu and Chama) in Muchinga province of Zambia. Villages were selected by probability proportionate to population size within each district. Households within clusters were selected through compact segment sampling where eligible subjects were selected. The survey team moved from house to house in each cluster until they had examined 40 people over the age of 50 years. A total of 90 clusters were selected by cluster randomisation. Participants underwent a comprehensive ophthalmic examination in their homes. This included measurement of visual acuity (VA) with a tumbling-E chart and ocular examination by an ophthalmologist and the diagnosis of the principal cause of VI noted. Those who were visually impaired (VA<6/18 in the better eye with available correction) were assigned a main cause of visual loss. Information was obtained on those who had cataract surgery, and those who were visually impaired from cataract were asked why they had not gone for surgery.

Results

A total number of 3,600 persons aged 50 years and above were sampled; among these 3,502 (97.3%) were examined. The age and sex-adjusted prevalence of bilateral blindness (presenting VA < 3/60) was 4.1% (95% Confidence Interval [CI], 3.4-4.9%), and age and sex-adjusted prevalence of bilateral severe VI (VA of <6/60-3/60) was 3.1% (95% CI, 2.4-3.8%). Avoidable causes of blindness (i.e. cataract, glaucoma and non-trachoma corneal scarring etc) were responsible for 89.8% of bilateral blindness and 86.1% of bilateral severe VI.

Cataract was the major cause of blindness (53.0%); similarly, it was a major cause of severe VI (63.5%). The cataract surgical coverage in blind people adjusted for age and sex was low at 36.8% with significant gender difference of 45.8% for men and 27.6% for women. The main barrier for cataract surgery was inaccessibility of the service (49.1%); this was followed by lack of awareness of the available service (32.7%).

Conclusion

The prevalence of blindness and VI in persons aged 50 years and above was higher than estimated by WHO for Zambia. The majority of the causes were avoidable, with cataract accounting for over 50% of all cases of blindness. The data suggests that expansion of eye care programmes to address avoidable causes of blindness is necessary in this area of Zambia. The

study was funded by SIB, and co-implemented by Sightsavers and the Ministry of Health of Zambia.

Figure 1: Briefing before field training

Figure 2: Muchinga Escarpment from where the province takes its name

Figure 3: Taking the visual acuity of one of the patients

Contents

Acknowledgements 2
Acronyms 3
Executive Summary 4
Background 4
Methods 4
Results 4
Conclusion 4
List of tables and figures ..... **Error! Bookmark not defined.**
1.0 Introduction 10
1.1 Rationale 10
1.2 Main objective 10
2.0 Survey methodology 11
2.1 Setting 11
2.2 Study design 13
2.3 Inclusion and exclusion criteria 13
2.4 Sample size 14
2.5 Sampling frame 14
2.6 Training 15
2.7 Data collection methods 15
2.8 Ophthalmic examination 16
2.9 Ethical approval 17
3.0 Results 18
3.1 Prevalence of blindness and severe VI 18
3.2 Causes of blindness and visual impairment 19
3.3 Cataract and blindness 21
3.4 Cataract surgical coverage (CSC) 21
3.5 Cataract surgery outcome 22
3.6 Place of surgery 22
3.7 Reasons for not having surgery 23
4.0 Discussion 23
5.0 Conclusion 25
References 26

Appendices 27
Appendix I – Rapid Assessment of Avoidable Blindness Survey form 27
Appendix II - Participants and Local Leaders Information Sheet 29
Appendix III - Flow chart for the RAAB in Muchinga province 30
Appendix IV - Report of RAAB Training..... 31
Appendix V - RAAB survey team composition and their roles 33
Appendix VI – Inter-Observer Variability Test (IOV1) Report 36

Table 1: Distribution of population sampled compared to sample by age and gender 18
Table 2: Sample prevalence of blindness, severe (SVI), and moderate (MVI) visual impairment - bilateral presenting VA 19
Table 3: Extrapolated prevalence of blindness, severe (SVI), and moderate (MVI) visual impairment - bilateral presenting VA 19
Table 4: Age and sex-adjusted results for cataract and blindness, severe (SVI), and moderate (MVI) visual impairment - bilateral best corrected VA 21
Table 5: Age and sex-adjusted results for cataract surgical coverage 22
Table 6: VA in operated eyes obtained after cataract surgery 22
Table 7: Reasons for not having cataract surgery 23

Figure 1: Briefing before field training 5
Figure 2: Muchinga Escarpment from where the province takes its name 5
Figure 3: Taking the visual acuity of one of the patients 6
Figure 4. Map of Zambia and Neighbouring Countries 12
Figure 5. Shows the districts that make up Muchinga province and those used for the survey 13
Figure 6: Causes of moderate VI (presenting VA<6/18 - 6/60) 19
Figure 7: Causes of severe VI (presenting VA<6/60 - 3/60) 20
Figure 8: Causes of blindness VI (presenting VA<3/60) 20

1.0 Introduction

In 2015, the International Agency for the Prevention of Blindness (IAPB) estimated that 253 million people were visually impaired, 36 million of whom were blind (1). They estimated that 89% of visually impaired people lived in low and middle-income countries and that 55% of visually impaired people were women. Globally, avoidable blindness (preventable and treatable) accounted for 81.2% of blindness and VI, and among older people (aged 50 and above) cataracts and refractive error combined accounted for 55% of blindness and 77% of moderate or severe VI (2). Other major causes of avoidable blindness globally include glaucoma and other causes of moderate or severe VI, include age-related macular degeneration (ARMD), glaucoma and diabetic retinopathy.

The IAPB Vision Atlas estimates that Zambia has a prevalence of blindness of 1.1% in the general population and 2.8% in people aged 50 years and above (2). In Zambia, a Rapid Assessment of Avoidable Blindness (RAAB) was conducted in 2010 in parts of Southern and Lusaka provinces and reported 2.3% of people over the age of 50 to be blind, that severe VI was 1.7% and VI was 7.0% (3).The major cause of blindness was cataract (39.8%) with posterior segment disease being the next main cause (34.9%). However, the results of this study may not be comparable to other parts of the country since Southern Zambia has had functional eye services for several years and its population is a mix of urban and rural, while Muchinga province has no established eye services and its population is purely rural. In Muchinga province, trained eye care workers are limited to middle level ophthalmic staff. There is no ophthalmologist in Muchinga province, ophthalmic services are provided through outreach by a team from the Copperbelt province.

1.1 Rationale

Sightsavers Zambia is an international non-governmental organisation which is involved in eye care and has been in Zambia for over 30 years. As part of the strategy to achieve the aim of VISION 2020 in Zambia, the government of Zambia - in collaboration with Sightsavers and supported by the Standard Chartered Bank (SCB) - conducted a RAAB in 2017 to identify the magnitude and causes of avoidable blindness in Muchinga province. Four districts were selected (Chama, Chinsali, Isoka and Shiwangandu), based on the fact that these were regions which the Ministry of Health had identified as having inadequate eye health services. Hence it was important to establish baseline information before extending services to the area. The estimated total population of the region surveyed was 322,601, with the population for each district as follows: Chama 103,894, Chinsali 86,723, Isoka 72,189 and Shiwangandu 59,795 (4).

1.2 Main objective

The main objective was to estimate the magnitude and causes of blindness and VI in the Muchinga province of Zambia using the RAAB methodology.

1.2.1 Specific objectives

To determine:

- Prevalence of blindness and VI in people aged 50 years and above
- The causes of blindness and VI
- Cataract surgical coverage
- Outcomes of cataract surgery
- Barriers to cataract surgery

2.0 Survey methodology

2.1 Setting

Zambia is a landlocked Sub-Saharan country sharing boundaries with Malawi, Mozambique, Zimbabwe, Botswana, Namibia, Angola, Democratic Republic of Congo and Tanzania. It has a total surface area of about 752,614 km², with a population of 13,092,666 according to the 2010 census; this was projected to be a population of 15.8 million in 2015, comprised of approximately 49% male and 51% female.

The administrative structure is such that the smallest unit is the household, then the ward and the district and finally the province - the largest sub-division. Administratively, the country is divided into ten provinces, namely Central, Copperbelt, Eastern, Luapula, Lusaka, Muchinga, North-Western, Northern, Southern and Western provinces. These provinces are further sub-divided into districts. There are 105 districts. Lusaka city is the capital of Zambia.

The country's Gross Domestic Product (GDP) stands at US$27.07 billion and has a Gross National Income (GNI) of US$1,721.61 per capita (World Bank, 2014).

Zambia has a tropical climate, an annual average temperature of 20C and a relative humidity average of 61.5% per annum with a range from 34% to 86% (5).

Zambia has a number of rivers that are the main sources of water - the Zambezi, Kafue, Luangwa, Chambeshi and Luapula. The country also has a number of lakes such as Tanganyika, Mweru, Bangweulu, and the man-made Lake Kariba.

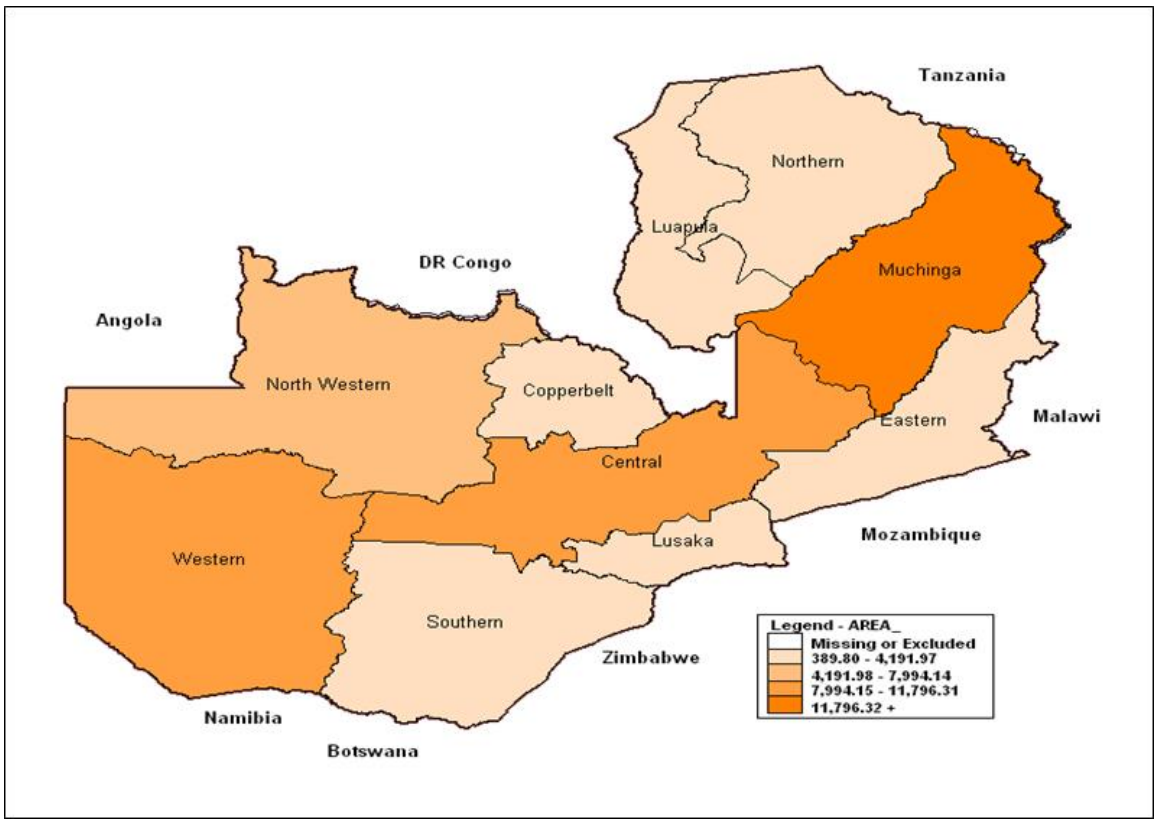


Figure 4. Map of Zambia and Neighbouring Countries

2.1.1 Muchinga province

Muchinga Province is located in the north-east of the country and borders with Tanzania in the north, Malawi in the east, and Eastern and Central Provinces in the south. The province is located on both sides of the Muchinga mountains (Muchinga Escarpment), which serve as a divide between the drainage basins of the Zambezi River (Indian Ocean) and the Congo River (Atlantic Ocean), making it geographically a hard-to-reach area. It is one of the most sparsely populated provinces in the country, with a population density of 8.1 persons per square kilometre and a population of 711,657, according to 2010 statistics.

The main rivers of the province are the Luangwa River, a major left tributary of the Zambezi, the Chambeshi River, and a tributary of Lake Bangweulu in the drainage basin of the Congo. The northern part of the country receives the highest rainfall, with an annual average ranging from 1,100 mm to over 1,400 mm.

The main economic activity for the province is agriculture, with livestock farming and the growing of cereals, cassava and beans at subsistence level (6).

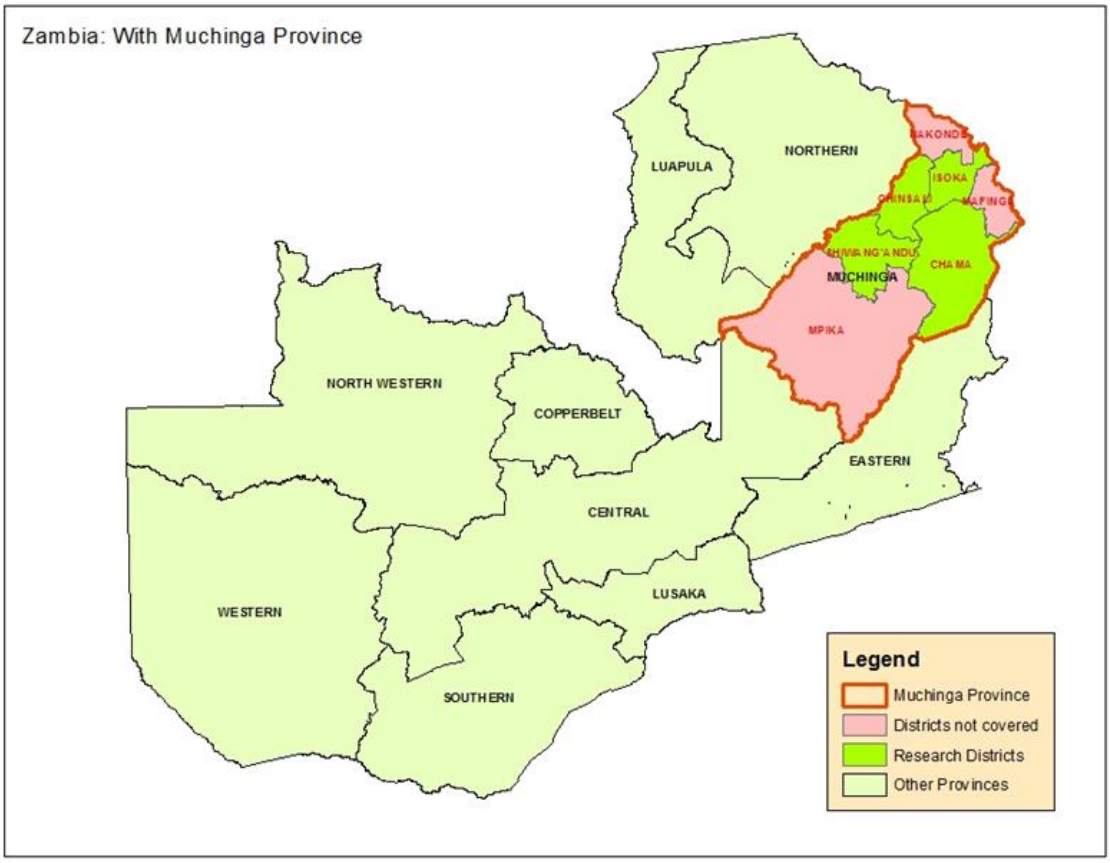


Figure 5. Shows the districts that make up Muchinga province and those used for the survey

2.2 Study design

RAAB is a standardised survey methodology that was developed and piloted with the objective of measuring the magnitude and causes of visual impairment in a relatively cheap and quick way, compared to large-scale surveys of blindness (7). It aims to utilise locally available resources to conduct a house-to-house survey of people aged over 50 years, among whom a simplified visual acuity (VA) test and lens examination is conducted, and basic information about cataract surgical history taken. The study focuses on people aged over 50 years as this is where over 80% of VI is found; focusing on this age group allows the sample size to remain between 3,000-4,000 people which helps to keep costs down. Participants found to have best corrected VA<6/18 where the main cause cannot be attributed to cataract are also asked to consent to undergo pupil dilation and further examination of the posterior segment with a direct ophthalmoscope to allow for better attribution of cause of VI. RAAB methodology is supported by a mobile data collection application and software to enable quick and accurate sample size calculation, cluster selection and data analysis and table production. RAABs are designed to be used for planning and monitoring eye health services in districts of between 500,000 and five million.

2.3 Inclusion and exclusion criteria

All people aged 50 years and above who had been resident in the sample area for the past three months prior to the survey were eligible for inclusion.

2.4 Sample size

A sample size adequate to demonstrate a prevalence of blindness of 4.0% ±0.8% with 95% confidence was calculated. This was increased for non-participation (10%) and design effect (1.5) resulting in a size of 3,563 or 90 clusters of 40 participants each (3,600 in total). The team decided on clusters of size 40 rather than 50 due to the long distances between homes in the villages and the difficulties envisaged in moving between the homes and enrolling enough participants each day.

2.5 Sampling frame

The last national census conducted in Zambia for 2010 was used as the sampling frame for this survey with a projected growth pattern of 3.9% per annum. A list of all the villages and their populations in the respective wards was collected from the various districts and sent to the trainers who then used this to select the clusters. The sampling procedure embedded in the RAAB software uses probability proportional to the size of the population methodology to randomly select villages automatically.

The second stage of sample selection was that of selecting households within clusters, and it was done through compact segment sampling. This involves choosing a start point within the village and moving from house to house, enumerating all eligible residents (whether at home at the time of visit or absent) until 40 eligible participants are enrolled. If any eligible participants were away from home at the time of the visit, the survey team would return to the house at the end of the day to meet with them. If they were still absent, a neighbour or friend would be asked for details on the individual's visual status.

In order to facilitate the survey team's work, the selected village was visited a day or two beforehand by the cluster informer. They worked with village leaders to produce a sketch map of the ward showing major landmarks and the approximate distribution of households in the village. The cluster informer requested that local leaders inform the residents of the visit of the survey team and requested that residents of 50 years and above stay around their homes on the day of the survey. The village leader also appointed a guide to work with the survey team on the day of their visit to introduce them to residents.

Large villages were split into segments where each segment would include approximately 40 people aged 50 years and above. For instance, if a village had 240 people aged 50 years and above, then it would be divided into six segments. One of the segments was chosen at random in collaboration with the village leaders by drawing lots and all households within the segment were included in the sample sequentially, until 40 people aged 50 years and above were identified, examined, and their data entered on the data collection programme on the smartphone. If the segment had fewer than 40 people aged 50 years and above, then another segment was chosen at random and sampling continued. The sampling started at the edge of the village and all the households were sampled sequentially until 40 people aged 50 years and above had been examined.

If the village had fewer than 40 people aged 50 years and above, there was no need for segmentation and all the people of that age group were examined. In such cases, the cluster informer would inform the next village leader of the possibility of the RAAB team including his area in the survey.

2.6 Training

The teams were trained for one week by certified RAAB trainers from the Kilimanjaro Centre for Community Ophthalmology (KCCO) and Sightsavers. They included Prof. Susan Lewallen who was the lead RAAB trainer, while others were Dr. Kolawole Ogundimu and Dr. Alemayehu Woldeyes. The Principal Investigator was Dr. Grace Chipalo Mutati, Consultant Ophthalmologist and the coordinator was Dr Willard Mumbi, Consultant Ophthalmologist.

There were five survey teams, each consisting of an ophthalmologist and an ophthalmic nurse or ophthalmic clinical officer, as well as a driver and a cluster informer who would work independently of the survey teams to prepare the clusters for their visit (teams listed in appendix V). Inter-observer agreement for measurement of VA, lens examination and cause of blindness was assessed between the teams to ensure that it was of an acceptable standard (i.e. kappa ≥ 0.60), results described in Appendix VI. The detailed training report is given in Appendix V.

The field training was conducted in Chisamba district on 30th May 2017, using the RAAB data collection form in order to get a feel of the actual work to be done, and was supervised by Dr. Alemayehu Woldeyes. The team of Dr. Simon Chisi was taken as the gold standard. The form is shown in Appendix I. Information provided to communities is in Appendix II.

2.7 Data collection methods

The survey team and village guide moved into the community to identify and examine the participants. All people aged 50 years and above who met the inclusion criteria and consented to be examined were enrolled for the study. All people who refused were recorded as refused. Those who were unable to consent for participation or communicate were noted as not able to communicate. Those who were not available were enrolled and the team would make two attempts to return to the household; if not found, the history of their visual status was obtained from family members or neighbours.

At each household, following the introduction of the team and consent from the eligible participants, the presenting vision was assessed in daylight using the tumbling E at a distance of six metres which was measured using a premeasured rope. Pinhole vision was assessed for all eyes with VA <6/18. The ophthalmologist examined the participants and the ophthalmic clinical officer entered the results on the mRAAB data collection application on a mobile phone. All participants were examined for lens opacity, aphakia/pseudophakia. All eyes with VA less than 6/18 not improving with pinhole (cause: refractive error) and without obvious lens opacity (cause: cataract) were further examined (fundoscopy with a dilated pupil) to determine the cause of VI. The WHO guideline was used to determine the cause of the VI. For people with multiple causes, the cause assigned was that which was considered easiest to treat.

Persons with cataract were asked why they hadn't had cataract surgery, while those who had the surgery information was gathered on where the surgery was done, the cost and the outcomes were recorded. Appropriate referrals/counselling were done for the various conditions identified. The village guide compiled a list of people who had been referred for follow-up once the services had been instituted.

At the end of the day, the survey used the mRAAB app to generate a file of the results collected and emailed it to the survey coordinator who received the file, checked it for completeness and uploaded to the RAAB software along with the other results. The RAAB software automatically generates results in pre-defined tables. If any errors or incompleteness was noticed by the survey coordinator as part of their review, the survey teams were immediately notified so they could rectify the problem as soon as possible.

The survey was carried out from the 1st June to 7th July 2017.

Information was entered on a mobile phone and reports were automatically generated using the RAAB software to give the composition of the sample by:

- Sex and by examination status
- Sample prevalence of blindness
- Severe VI and VI
- Prevalence of cataract and pseudophakia or aphakia
- Cataract surgical coverage
- Other causes of low vision
- Barriers to cataract surgery
- Outcome of cataract surgery
- Sex- and age-adjusted prevalence, estimated numbers of cases of avoidable blindness in the survey area
- 95% confidence intervals, sampling error and design effect for the sample were also generated

Data was presented in frequency tables, graphs, and as summary statistics.

2.8 Ophthalmic examination

A standardised examination protocol was used for the RAAB. A survey record was filled for each eligible person on the smartphone which included seven sections: general information; vision and pinhole examination; lens examination; principal cause of vision impairment. If not examined, the participants' visual history was taken from the neighbours or members of the family who knew their visual status. If cataract operation had not been done, reasons why the surgery had not been carried out were recorded and if it had been done, details about cataract operation - where and when it was done as well as the costs involved - were recorded.

Blindness was defined as VA<3/60 in the better eye, while severe VI as VA≥3/60 but <6/60 and moderate VI was defined as VA≥6/60 but <6/18, all with available correction.

Presenting VA was measured with a tumbling "E" chart using optotype size 6/18 (20/60) on one side and size 6/60 (20/200) on the other side at six- or three-metre distance. All measurements

were taken in full daylight with available correction. If the VA was <6/18 in either eye, then pinhole vision was also measured. If the vision improved to >6/18, then the condition was entered into the data as refractive error.

The participant was then moved to a dark location - this was usually in their homes, where the lens was assessed for cataract formation. If there was no cataract and the vision was still <6/18, the participants' pupils were dilated with a short-acting mydriatic for direct fundoscopy. The fundus was then examined and the cause for vision loss recorded on the mRAAB application.

2.9 Ethical approval

Ethical approval for this study was granted by the University of Zambia Research and Ethics Committee and cleared by the Ministry of Health. Permission to conduct the study was obtained from the Provincial Medical Office and the respective district medical offices.

When the team reached the area informed, (verbal) consent was obtained from the participants after providing information on the purpose, procedure and the possible benefits of the study. Participants were informed that participation was voluntary, and that all discussions and data collected from the study would be kept confidential, and that findings will be anonymously reported. Appropriate counselling, treatment or referral for eye problems was provided to study participants.

3.0 Results

The total number of people examined was 3,600 giving a response rate of 97.3%, of which 80 individuals (2.2%) were unavailable, 11 (0.3%) refused and 7 (0.2%) were not capable of taking part in the survey.

Table 2 shows the total population by age and gender of the survey area compared to the sample. The distribution of the population sampled is generally similar to the population of the survey area. Almost half of the people surveyed belonged to the 50-59 years age group in both survey area and sample and 1,921 (54.9%) participants were women compared to 51.9% in the survey area (aged over 50 years).

Age Distribution	Male		Female		Total	
	Sample	Survey Area	Sample	Survey Area	Sample	Survey Area
50-59 years	47.3%	44.9%	41.2%	43.3%	44.0%	44.1%
60-69 years	22.7%	28.6%	26.9%	33.1%	25.0%	30.9%
70-79 years	19.5%	18.8%	21.8%	17.3%	20.8%	18.0%
80-89 years	10.4%	7.7%	10.1%	6.3%	10.3%	7.0%

Table 1: Distribution of population sampled compared to sample by age and gender

3.1 Prevalence of blindness and severe VI

Of 166 people in the sample, 4.7% (95%CI4.0-5.5%), were found to be bilaterally blind (defined as VA worse than 3/60 in the better eye with available correction - see Table 3). The prevalence was similar between males and females, 4.6% and 4.8% respectively. Adjusting for differences in age and sex between the sample and survey area produced a prevalence of blindness of 4.1% (95%CI3.3-4.9% - see Table 4). Extrapolating this to the total population of the survey areas means that an estimated 2,315 people were blind, of whom 1,179 are women (50.1% female).

Sample prevalence of severe VI (presenting VA<6/60-3/60 in better eye) was 3.3% (95% CI2.6-4.0%), and 3.1% (95%CI 2.4-3.8%) after adjustment for age and sex. Adjusted prevalence of SVI was 3.3% among males and 2.9% among females, which means an estimated 895 males and 837 females with bilateral severe VI in the survey area.

Sample prevalence of moderate VI (presenting VA<6/18-6/60 in better eye) was 10.2% (95%CI 8.8-11.5%) and 9.6% (95%CI 8.3-11.0%) after adjustment for age and sex. Adjusted prevalence of MVI was 9.9% among males and 9.4% among females which means an estimated 2,678 males and 2,733 females in the survey area (50.5% female). *I) visual impairment – bilateral presenting VA*

	Males		Females		Total	
	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)
Blindness	73	4.6 (3.5-5.7)	93	4.8 (3.9-5.8)	166	4.7 (4.0-5.5)
Severe VI	53	3.4 (2.4-4.3)	62	3.2 (2.4-4.0)	115	3.3 (2.6-4.0)
Moderate VI	160	10.1 (8.5-11.7)	194	10.3 (8.6-11.8)	357	10.2 (8.8-11.5)

Table 2: Sample prevalence of blindness, severe (SVI), and moderate (MVI) visual impairment - bilateral presenting VA

	Males		Females		Total	
	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)
Blindness	1,147	4.2 (3.1-5.4)	1,179	4.0 (3.1-5.0)	2,315	4.1 (3.4-4.9)
Severe VI	895	3.3 (2.4-4.2)	837	2.9 (2.0-3.7)	1,729	3.1 (2.4-3.8)
Moderate VI	2,678	9.9 (8.3-11.5)	2,733	9.4 (7.7-11.0)	5,414	9.6 (8.3-11.0)

Table 3: Extrapolated prevalence of blindness, severe (SVI), and moderate (MVI) visual impairment - bilateral presenting VA

3.2 Causes of blindness and visual impairment

Cataract was the primary cause of bilateral blindness (53.0%), and bilateral severe VI (63.5%), and also a major contributor to moderate VI (36.4%). Of the remainder of blindness, glaucoma accounted for 14.5%, non-trachomatous cornea opacity was 10.2%, other posterior segment disease 7.2%, trachoma corneal opacity 6.0%, pthisis 3.0%, other globe/CNS abnormalities 3.0% and cataract surgical complications 3.0%.

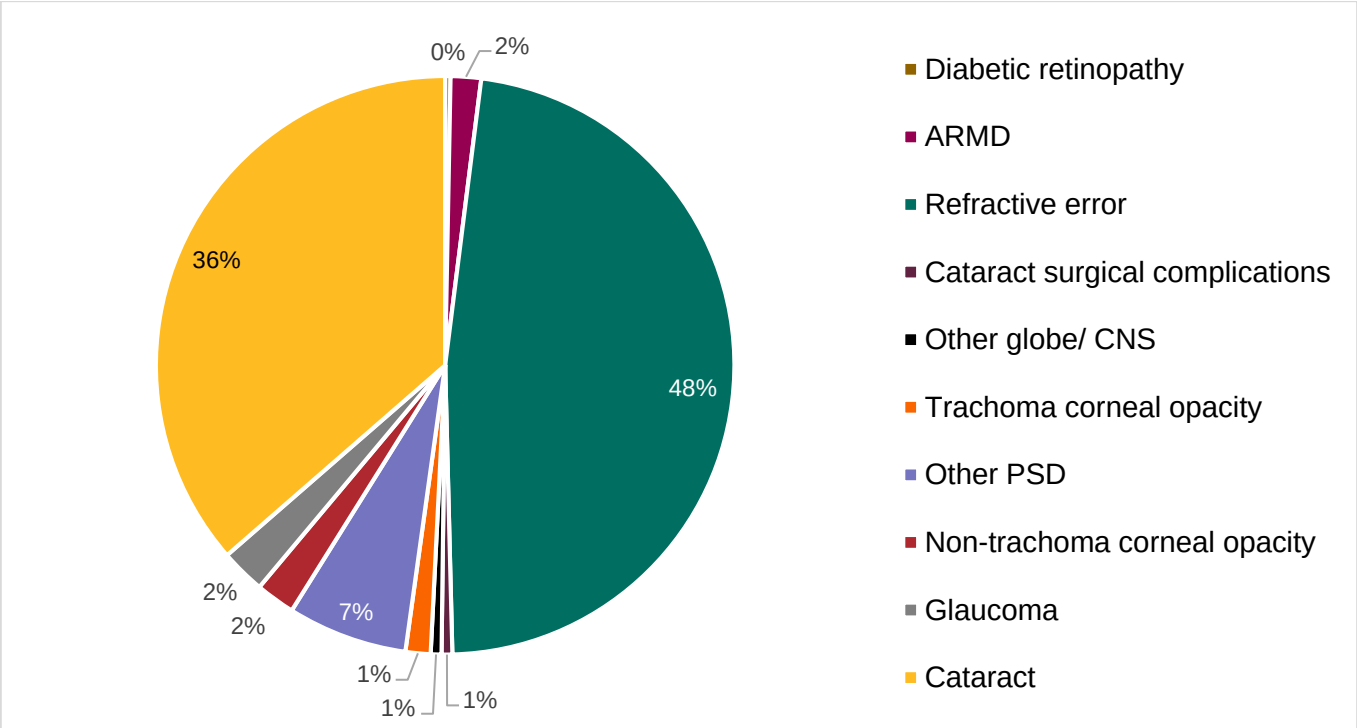


Figure 6: Causes of moderate VI (presenting VA<6/18 - 6/60)

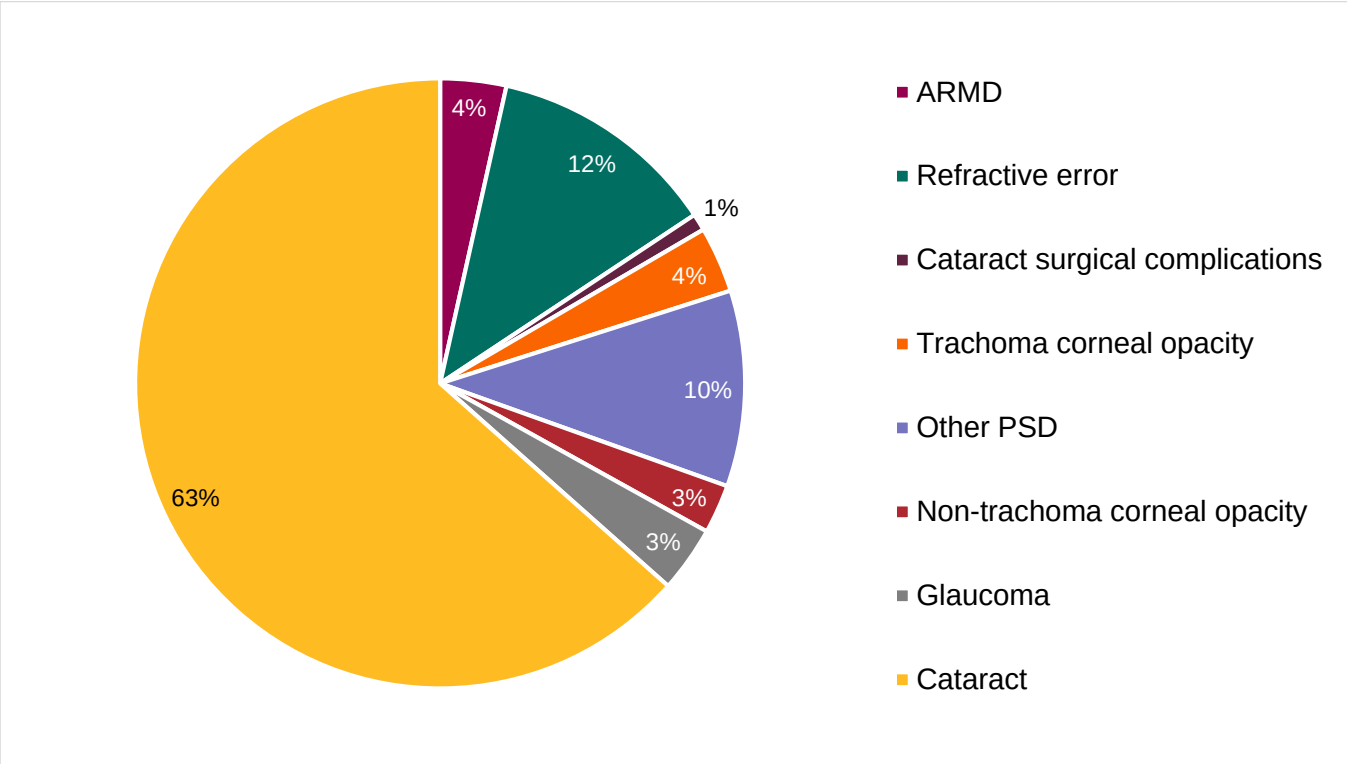


Figure 7: Causes of severe VI (presenting VA<6/60 - 3/60)

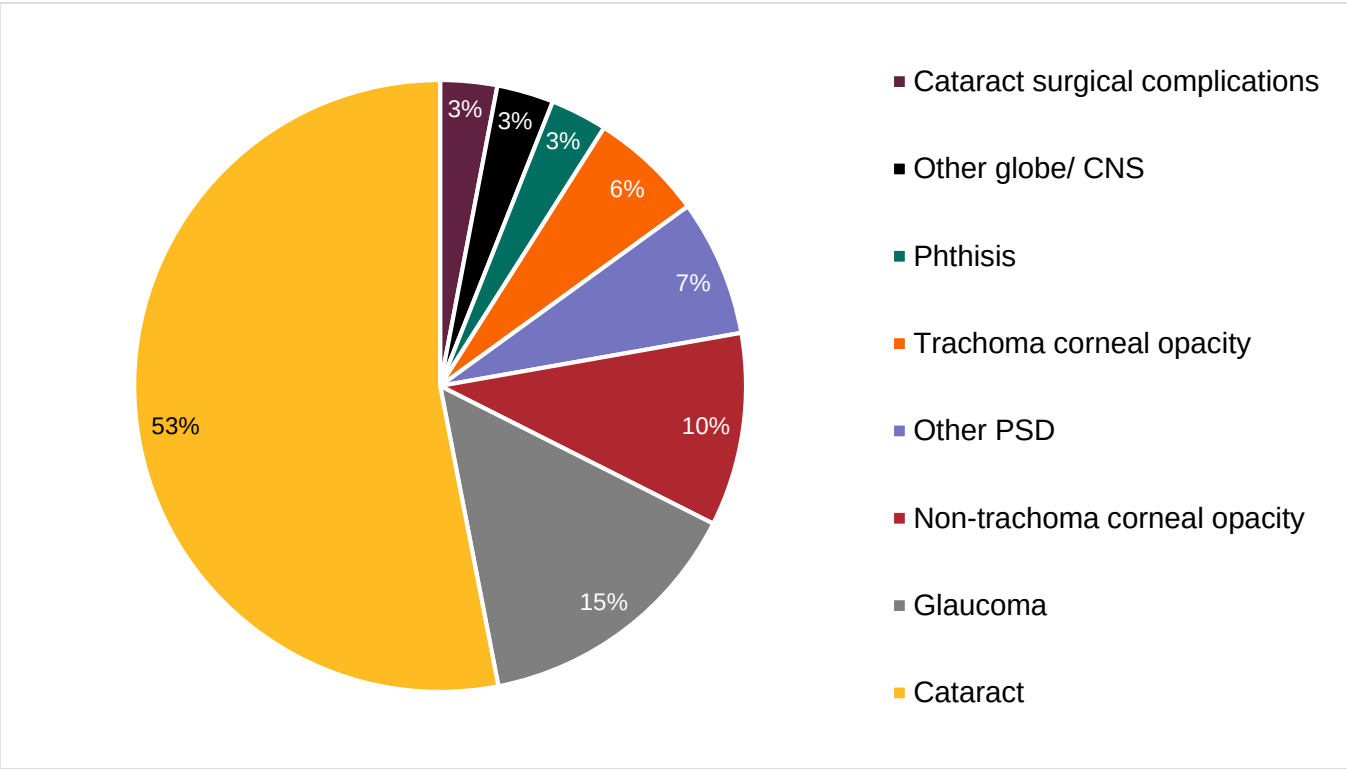


Figure 8: Causes of blindness VI (presenting VA<3/60)

3.3 Cataract and blindness

After adjustment for age and sex, it was estimated that 3.6% (95%CI 2.9-4.3%) of eyes (approx. 4,059) were blind with a cataract (cataract may not be the major cause of blindness). 983 people (1.7%, 95%CI 1.2-2.3) in the survey area were estimated to be bilaterally blind with cataract and 2,092 (3.7%, 95%CI 3.0-4.4) were estimated to have one cataract blind eye. No major differences were observed between males and females.

	Males		Females		Total	
	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)
Cataract and Blindness - VA<3/60 with best correction						
Bilateral cataract	425	1.6 (0.8-2.3)	558	1.9 (1.2-2.6)	983	1.7 (1.2-2.3)
Unilateral cataract	1,069	3.9 (3.0-4.9)	1,023	3.5 (2.4-4.6)	2,092	3.7 (3.0-4.4)
Cataract eyes	1,919	3.5 (2.7 – 4.4)	2,140	3.7 (2.8-4.5)	4,059	3.6 (2.9-4.3)
Cataract and Severe VI – VA<6/60-3/60 with best correction						
Bilateral cataract	289	1.1 (0.7-1.4)	341	1.2 (0.8-1.5)	630	1.1 (0.9-1.4)
Unilateral cataract	472	1.7 (1.0-2.5)	359	1.2 (0.5-2.0)	831	1.5 (0.9-2.0)
Cataract eyes	862	1.6 (1.1-2.1)	881	1.5 (1.0-2.1)	1,743	1.5 (1.1-2.0)
Cataract and Moderate VI – VA<6/18-6/60 with best correction						
Bilateral cataract	612	2.3 (1.6-2.9)	963	3.3 (2.6-4.0)	1,575	2.8 (2.3-3.3)
Unilateral cataract	722	2.7 (1.4-3.9)	565	1.9 (1.0-2.9)	1,287	2.3 (1.5-3.1)
Cataract eyes	1,679	3.1 (2.2-4.0)	2,070	3.5 (2.7-4.4)	3,749	3.3 (2.6-4.0)

Table 4: Age and sex-adjusted results for cataract and blindness, severe (SVI), and moderate (MVI) visual impairment - bilateral best corrected VA

3.4 Cataract surgical coverage (CSC)

92 eyes (1.3%, 95%CI 1.0-1.6) examined in the survey were found to be aphakic or pseudoaphakic. Age and sex adjustment means this extrapolated to 1,360 eyes in the survey population (1.2%, 95%CI 0.9-1.5%).

Following adjustment for age and sex, 37% of people with VA<3/60 who required surgery were found to have received it. Men were more likely to have received surgery than women (45.8% vs 27.6%). 28% of people with VA<6/60 who required surgery were found to have received it, with men more likely than women (36.7% vs 19.1%). 17.7% of people with VA<6/18 who required surgery were found to have received it with men more likely to have received it than women (24.3% vs 12.2%).

	Males	Females	Total
Cataract surgical coverage (eyes) – percentage			
VA<3/60	32.6	16.8	25.1
VA<6/60	25.0	12.5	19.0
VA<6/18	17.2	7.8	12.5
Cataract surgical coverage (persons) - percentage			
VA<3/60	45.8	27.6	36.8
VA<6/60	36.7	19.1	28.0
VA<6/18	24.3	12.2	17.7

Table 5: Age and sex-adjusted results for cataract surgical coverage

3.5 Cataract surgery outcome

Cataract surgical outcomes with available correction was relatively poor (Table 5). Exactly half of the eyes (50.0%) had a good outcome (can see 6/18), 17.0% had borderline outcome (can see 6/60) and 33.0% had poor outcome (cannot see 6/60). Among eyes operated on in the past three years, 58.1% of outcomes were good and 29.0% were poor. With best correction. the proportion of good outcomes could rise to 63.8%, borderline outcomes to 9.6% and poor outcomes would be 26.6%.

Over half (61.3%) of the poor outcomes were conducted in the government hospital. Of the 94 eyes that received cataract surgery, all except three had an intraocular lens (IOL) inserted.

	No IOL Eyes (n=3)	IOL Eyes (n=85)	All Eyes (n=94)
Available correction			
Good : Can see 6/18	0 (0.0)	47 (51.6%)	47 (50.0%)
Borderline: Can see 6/60	1 (33.3%)	15 (16.5%)	16 (17.0%)
Poor: Cannot see 6/60	2 (66.7%)	29 (31.9%)	31 (33.0%)
Best correction			
Good: Can see 6/18	1 (33.3%)	59 (64.8%)	60 (63.8%)
Borderline: Can see 6/60	0 (0.0)	9 (9.9%)	9 (9.6%)
Poor: Cannot see 6/60	2 (66.7%)	23 (25.3%)	25 (26.6%)

Table 6: VA in operated eyes obtained after cataract surgery

3.6 Place of surgery

More than half of the surgeries were conducted in government hospitals (56.4%), the remainder were conducted in eye camps (23.4%), private hospitals (10.6%) and voluntary/charitable hospital

(9.6%). The surgeries were mostly conducted by visiting ophthalmologists from the Copperbelt and Lusaka Province. Eye camps were also conducted in the area in various settings. All surgeries under private hospitals were conducted outside Muchinga province.

3.7 Reasons for not having surgery

Table 6 summarises the reasons given by those blind from cataract for not having cataract surgery. Almost half (49.6%) reported they could not access the treatment. And an equally good proportion (29.1%) reported they were unaware treatment was possible.

	Bilaterally blind from cataract		Unilaterally blind from cataract		TOTAL	
	n	%	n	%	n	%
Cannot access treatment	88	49.7	116	48.9	204	49.3
Unaware treatment is possible	56	31.6	66	27.8	122	29.5
Need not felt	14	7.9	25	10.5	39	9.4
Cost	13	7.3	13	5.5	26	6.3
Treatment denied by provider	3	1.7	11	4.6	14	3.4
Fear	3	1.7	6	2.5	9	2.2
TOTAL	**177**	**100**	**237**	**100**	**414**	**100**

Table 7: Reasons for not having cataract surgery

4.0 Discussion

This study was conducted to create baseline information on the prevalence and causes of blindness in Muchinga region. These districts were selected because they were regions with inadequate eye health service before interventions were implemented. The response rate was 97.2% which can be considered very high. Although the cluster informers working with local leaders knew the village boundaries and residents well, the response rate could have probably been higher had the survey not been conducted during harvest time. Normally because of the mountainous terrain, villagers would camp at the farms away from the village until harvesting was complete. A proportion (0.3%) refused examination and the scope of the study did not provide an explanation for the reasons for refusal of the clinical examination.

The survey found a high prevalence of blindness (4.1%, 95%CI 3.4-4.9) compared to that obtained in Southern Zambia (2.3%) (3). Results from other RAAB surveys done in Malawi (8), Rwanda (9) and Tanzania (10) ranged from 1.8-3.3% (unadjusted) which was lower than what was found in the study area. The prevalence of blindness in Muchinga was possibly higher than that of Southern Zambia due to a number of reasons: Southern Zambia's demographic is an urban rural setting with the presence of active eye health services. The extrapolated number of blind people in the four districts of Muchinga was 2,315. The proportion of blind people was higher for females than males,

a finding common to other RAAB studies in the region, except in a RAAB conducted in South Malawi where the prevalence of blindness was higher in men than women.

The main causes of blindness in Muchinga were cataract, glaucoma and non-trachomatous cornea opacities. Similar causes have been observed in other RAAB surveys in the southern province of Zambia and Malawi. This result is consistent with the current trend that cataract is the most common cause of blindness worldwide. Our study found that unoperated cataract is also the major cause of severe VI and that uncorrected refractive error is the primary cause of moderate VI. The finding of refractive error as the most common cause of VI could be due to the myopic shift induced by age-related nuclear sclerosis as reported by researchers for RAAB in Kwazulu Natal (11). In this study, avoidable causes were responsible for 89.8% of blindness. The finding that the majority of causes of blindness are avoidable justifies the initiative to address blindness in this area. The prevention of blindness initiative in this area should include the correction of refractive errors, which contributed to 48% of moderate VI.

The age and sex-adjusted cataract surgical coverage was low (37%) compared to studies from Malawi (44.6% unadjusted) (8), Kenya (78%) (12), Tanzania (68.9%) (10) and Rwanda (47%) (9). Muchinga province has always depended on sporadic eye camps conducted by ophthalmologists from outside the province, with the support of cooperating partners. The low CSC could be due to the absence of a dedicated ophthalmic unit headed by an ophthalmologist. The finding of a low cataract surgical coverage for females (25.5%) has also been noted in other areas of Sub Saharan Africa (13).

WHO recommended that the grades of outcome for cataract surgery with an IOL are: good outcome VA >6/18 at 90%, borderline VA >6/60 at less than 5% and poor outcome of VA<6/60 at less than 5%. The high proportion of poor outcomes after cataract surgery in this survey could be due to a combination of factors, for instance there is no ophthalmologist to follow up patients and therefore manage any complications. In this study, the majority were attributed to poor patient selection and surgical complications. Most surgeries, although conducted in a hospital environment, have a setting similar to that of an eye camp where the screening of patients preoperatively is inadequate; for instance conditions like glaucoma may be missed as most patients present with dense cataract that obscures fundus view, and may not have had any examination before the development of cataract. Secondly, biometry is not conducted pre-operatively and patients are offered a standard lens which may not be appropriate for the patient.

In our study, half of those that had not accessed surgery for cataract reported that they were not able to access the service. Studies have reported that major reasons for low cataract surgical rates include the following: low demand because of fear of surgery, low demand from poor people because of high cost of surgery, low demand because of poor visual results, lack of eye surgeons (particularly in Africa), old age, no available services close to the community, and lack of awareness of available surgical services (14). In our study, subjects with blindness owing to bilateral cataracts (32.5%) did not seek intervention because they were ‘unaware of treatment.’

5.0 Conclusion

The prevalence of blindness in Muchinga province of 4.1%. Although lower than the WHO projected for Africa, it still remains higher than that obtained in the region. Cataract is the commonest cause of blindness in Muchinga with refractive errors being the main cause of VI. Eye health services are severely inadequate and inaccessible.

Cataract surgical coverage is low and there is an obvious gender imbalance in the accessibility of cataract service. Information/sensitisation on the availability of services is also low. The quality of cataract surgeries performed in the area is below the WHO recommendation.

It is therefore evident that eye health services are not available in Muchinga province and the result of this survey justifies Sightsavers extending the services to Muchinga province.

References

1. Bourne RR, Flaxman SR, Braithwaite T, Cicinelli MV, Das A, Jonas JB, et al. 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;5(9):e888-e97.
2. Flaxman SR, Bourne RR, Resnikoff S, Ackland P, Braithwaite T, Cicinelli MV, et al. Global causes of blindness and distance vision impairment 1990–2020: a systematic review and meta-analysis. The Lancet Global Health. 2017;5(12):e1221-e34.
3. Lindfield R, Griffiths U, Bozzani F, Mumba M, Munsanje J. A Rapid Assessment of Avoidable Blindness in Southern Zambia. PLOS ONE. 2012;7(6):e38483.
4. Central Statistical Office of Zambia. 2010 CENSUS OF POPULATION AND HOUSING Population and Demographic Projections 2011 - 2035.; 2013.
5. Mulenga BP, Wineman A, Sitko NJ. Climate trends and farmers' perceptions of climate change in Zambia. Environmental management. 2017;59(2):291-306.
6. Central Statistical Office of Zambia. Agriculture Analytical Report for the 2000 Census of Population and Housing. . 2003.
7. Kuper H, Polack S, Limburg H. Rapid assessment of avoidable blindness. CEHJ. 2006;19(60):68-9.
8. Kalua K, Lindfield R, Mtupanyama M, Mtumodzi D, Msiska V. Findings from a rapid assessment of avoidable blindness (RAAB) in Southern Malawi. PLoS One. 2011;6(4):e19226.
9. Mathenge W, Nkurikiye J, Limburg H, Kuper H. Rapid assessment of avoidable blindness in Western Rwanda: blindness in a postconflict setting. PLoS medicine. 2007;4(7):e217.
10. Habiyakire C, Kabona G, Courtright P, Lewallen S. Rapid assessment of avoidable blindness and cataract surgical services in Kilimanjaro region, Tanzania. Ophthalmic epidemiology. 2010;17(2):90-4.
11. Govender P, Ramson P, Visser L, Naidoo KS. Rapid assessment of avoidable blindness in the northern eThekwini district of KwaZulu-Natal Province, South Africa. African Vision and Eye Health. 2015;74(1):7 pages.
12. Mathenge W, Kuper H, Limburg H, Polack S, Onyango O, Nyaga G, et al. Rapid assessment of avoidable blindness in Nakuru district, Kenya. Ophthalmology. 2007;114(3):599-605.
13. Lewallen S, Mousa A, Bassett K, Courtright P. Cataract surgical coverage remains lower in women. British Journal of Ophthalmology. 2009;93(3):295-8.
14. Foster A. Vision 2020: the cataract challenge. Community eye health. 2000;13(34):17-9.

Appendices

Appendix I – Rapid Assessment of Avoidable Blindness Survey form

RAPID ASSESSMENT FOR AVOIDABLE BLINDNESS SURVEY RECORD

A. General Information — Year – Month: ☐☐☐☐-☐☐

Survey _____ ☐☐ Cluster no. ☐☐☐ Individual no. ☐☐

Nam _____ Sex: Male O(1) Age (years) ☐☐

Female O(2) Exam O(1) (go to B)

Optional 1 ☐☐ Not available: O(2) (go to E)

Examination status: Refused: O(3) (go to E)

Optional 2 ☐☐ Not able to communicate: O(3) (go to E)

B. Vision – Presenting Vision

Glasse without glasses: O(1)

with available distance glasses: O(2)

	Right	Left eye
Can see 6/18	O(1)	O(1)
Cannot see 6/18, but can see 6/60	O(2)	O(2)
Cannot see 6/60 but can see 3/60	O(3)	O(3)
Cannot see 3/60 but can see 1/60	O(4)	O(4)
Light perception (PL+)	O(5)	O(5)
No light perception (PL-)	O(6)	O(6)

Best Vision – with best correction or

	Right	Left eye
Can see 6/18	O(1)	O(1)
Cannot see 6/18, but can see 6/60	O(2)	O(2)
Cannot see 6/60, but can see 3/60	O(3)	O(3)
Cannot see 3/60		

C. Lens examination

	Right	Left eye	
Normal lens/minimal lens	O(	O(	(go to D)
Visually impairing lens opacity	O(	O(	(go to D &
Lens absent (aphakia)	O(	O(	(go to D &
Pseudophakia without PCO	O(	O(	(go to D &
Pseudophakia with PCO	O(	O(	(go to D &
No view of Lens	O(	O(	(go to D)

D. Main cause presenting VA<6/18 (mark only one cause for each eye)

	Right eye	Left eye	Mark princip disorde
Refractive error	O(1)	O(1)	O(1)
Cataract, untreated	O(2)	O(2)	O(2)
Aphakia, uncorrected	O(3)	O(3)	O(3)
Surgical complications	O(4)	O(4)	O(4)
Trachoma	O(5)	O(5)	O(5)
Phthisis	O(6)	O(6)	O(6)
Other corneal scar	O(7)	O(7)	O(7)
Globe abnormality	O(8)	O(8)	O(8)
Glaucoma	O(9)	O(9)	O(9)
Diabetic retinopathy	O(10	O(10)	O(10)
ARMD	O(11	O(11)	O(11)

but can see 1/60	O(4)	O(4)	Onchocerciasis	O(12	O(12)	O(12)
Light perception (PL+)	O(5)	O(5)	Post. segment / CNS	O(13	O(13)	O(13)
No light perception (PL-)	O(6)	O(6)	Not examined – can see	O(14	O(14)	O(14)

E. History, if not examined
(From relative or

	Right	Left eye
Believed		
Not blind	O(1)	O(1)
Blind due to cataract	O(2)	O(2)
Blind due to other causes	O(3)	O(3)
Operated for cataract	O(4)	O(4)

F. Why cataract operation was not done
(mark 1 or 2 responses, if VA<6/18, not improving pinhole, with visually impairing lens opacity in one

Unaware that treatment is possible	O(1)
Believes it to be destiny / God's Will	O(2)
Told to wait for cataract to mature	O(3)
Surgical services not available or very	O(4)
Don't know how to get surgery	O(5)
Cannot afford operation	O(6)
No one to accompany	O(7)
No time available / other priorities	O(8)
Old age and need not felt	O(9)
One eye adequate vision / need not felt	O(10)
Fear of operation	O(11)
Fear of losing eyesight	O(12)
Other disease contra-indicating	O(13)

G. Details about cataract operation

	Right eye	Left
Age at operation (years)	☐☐	☐☐
Place of operation		
Government hospital	O(1)	O(1)
Voluntary / charitable	O(2)	O(2)
Private hospital	O(3)	O(3)
Eye camp / improvised	O(4)	O(4)
Traditional setting	O(5)	O(5)
Type of surgery		
Non IOL	O(1)	O(1)
IOL implant	O(2)	O(2)
Couching	O(3)	O(3)
Cost of surgery		
Totally free	O(1)	O(1)
Partially paid	O(2)	O(2)
Totally paid	O(3)	O(3)
Cause of VA<6/18 after cataract surgery		
Ocular co-morbidity	O(1)	O(1)
Operative complications	O(2)	O(2)
Refractive error (Spectacles)	O(3)	O(3)
Late complications	O(4)	O(4)
Does not apply / no relation	O(5)	O(5)
Are you satisfied with results of cataract		
Very satisfied	O(1)	O(1)
Partially satisfied	O(2)	O(2)
Indifferent	O(3)	O(3)
Partially dissatisfied	O(4)	O(4)
Very dissatisfied	O(5)	O(5)

Appendix II - Participants and Local Leaders Information Sheet

Introduction

The prevalence of blindness worldwide is estimated to be 1%. This increases with age - people aged 50 years and above contribute to 80% of the blindness.

The causes are mainly cataracts, trachoma, refractive errors, glaucoma, childhood blindness and vitamin A deficiency.

It is important to know the main causes of blindness in a given area to be able to adequately and efficiently plan for the available resources to combat blindness.

Survey

The survey will assist in knowing the prevalence of blindness in persons aged 50 years and above. It will assist us in knowing what the causes of blindness are in this age group.

A RAAB survey record will be filled in during the interview of the participant. Ocular examination of the participants will be carried out and findings recorded on the same record sheet. In some cases, further examination of the eye for proper diagnosis of a condition will be required; in this case some medication will be applied in the eyes of participants. This will cause some vision blurring for about six hours and after that the original sight will be restored.

Participation in the study is voluntary and consent is verbal.

The identity of the person is confidential.

The survey team will wear name tags for proper identification.

Approval

The University of Zambia Biomedical Research Ethics Committee (UNZABREC) has approved the study.

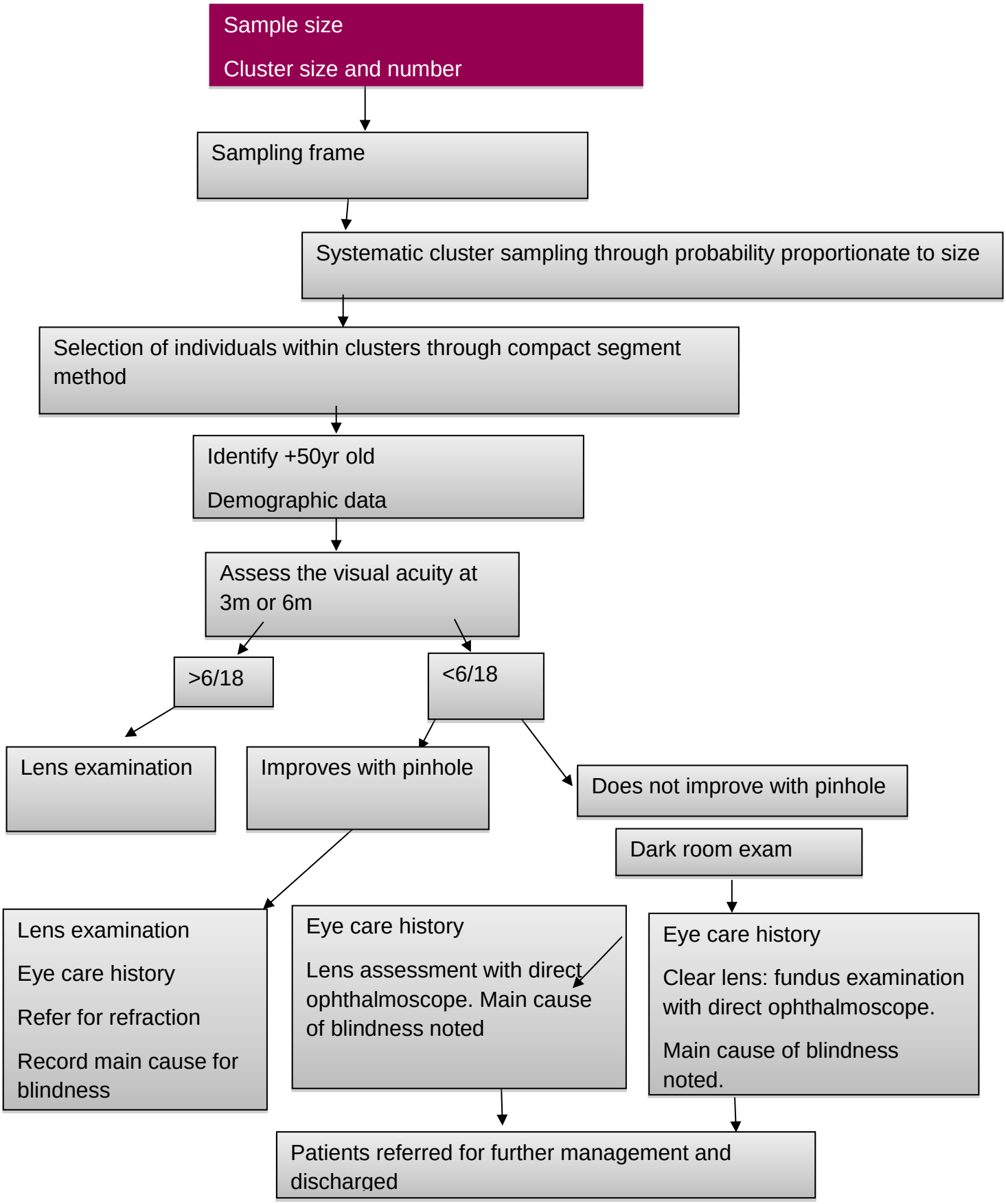
Thank you for your participation

For any queries, please contact the persons below

Dr. Grace Chipalo Mutati Tel: +260977345944

Dr. Willard Bwalya Mumbi Tel: +260977810542

Appendix III - Flow chart for the RAAB in Muchinga province



Appendix IV - Report of RAAB Training

Groote Schuur Hospital
Dept. Ophthalmology, H-53
University of Cape Town
Tel: +27 763741476
slewallen@kcco.net
www.kcco.net

Report of RAAB training in Muchinga, Zambia

March 20-23 and May 30-31, 2017

Prepared by Alemayehu Woldeyes and Kolawole Ogundimu

Essential Details of Training

This training was undertaken to equip a team to conduct a RAAB survey to collect baseline data on blindness and VI in Muchinga, Zambia, with total projected population size of 814,847 and the three selected districts (Chinsali, Chama and Isoka) with a total projected population around 369,378.

Pre-training work, accomplished by email communication, included a sample size calculation and study of the census information to group some small villages together for cluster sampling. The three districts (Chinsali, Chama and Isoka) were selected from Muchinga province since the project work in these areas.

The participants in the training are shown below. Each examination team (ophthalmologists and ophthalmic clinical officers) will have their own cluster informer, all of whom attended training. Two cluster informers were excluded for medical reasons that can affect their field work. This became known just before retraining and the start of the field work, hence no replacement was done for the two. Appendix A.

Sample size and selection of clusters

A sample size adequate to demonstrate a prevalence of blindness of 4.0% ±0.8% with 95% confidence was calculated. This was increased for non-participation (10%) and design effect (1.5) resulting in a size of 3,563or 90 clusters of 40 each. The list of selected clusters is attached as Appendix B.

Classroom training on the principles of RAAB (March 20-21/2017)

Training included all aspects of the standard training for RAAB, using the PP training provided by S Lewallen for training with the smartphone app. All training was carried out by Kolawole Ogundimu and Alemayehu Woldeyes with Susan Lewallen observing.

1. Principles and aims of RAAB including
2. Purpose of RAAB; output and limitations
3. Sample size
4. Sampling technique used in RAAB (two stages)
5. Basic structure of RAAB
6. Details of who is enrolled (enumerated)
7. Demonstrating proficiency in the techniques of taking and recording VA
8. Detailed instruction on lens exam and diagnostic definitions of the 13 clinical diagnoses allowed in RAAB
9. Details of completing sections on previous cataract surgery and barriers: Deciding on meaningful options for “place of surgery” and “reason for no surgery”
10. Use of the app; practice in entering simulated participants
11. Sending data importing into software and comparing reports from each team
12. More details and practice of cluster informer tasks
13. Role play for exam teams
14. Review of responsibilities of all team member
15. Discussion of IOV and use of IOV paper form

The options for place of surgery will be:

- Government hospital
- Private hospital
- Voluntary/charitable hospital
- Eye camp/improvised setting
- Hospital outside Zambia

The local meaning of cost will be:

- Completely free – includes hospital, transport, food and other auxiliary costs paid or cost up to 5 USD.
- Partially paid – anything in-between Completely Free and Completely Paid. Cost 5-50 USD.
- Completely Paid – Hospital fee over approx. USD50 and all ancillary costs met by the patient.
- The local option for barriers was decision by family members, husband, wife or children.

The survey coordinator responsibilities will be given to Dr Mumbi. Francis Kalusa will handle logistics in Zambia (money and transport). All data will be emailed to Alemayehu Woldeyes and Grace Mutati for back up and importing into RAAB software on a daily basis. He will contact Dr. Mumbi and Francis if data does not arrive.

Inter-observer variability testing (IOV1) (March 22)

IOV testing was organized with 51 patients who were examined by all teams and 2 more examined by 2 teams. Most of Kappa coefficients ranged from 0.60 to 1.00; 2 of the 36 scores were = 0.48 so the decision was made to go ahead with the pilot on the 23rd since 26 out of 36 (72.2%) were more than 0.75.

Pilot survey (May 31)

The initial attempt to carry out the pilot survey was thwarted by persistent and unseasonal rainfall. As the rains would also affect the survey proper, we made the decision to postpone further action until the rains stopped.

Provide date or retraining. One-day retraining and briefing was given before the field work since the initial training was given a month back. All the team members participated well. Two of the cluster informers were excluded from the study for medical reasons (accidents sustained). Any questions raised were answered by the trainer (Alemayehu Woldeyes) who supervised the field practice.

One of the clusters was chosen from a rural village 85km from Lusaka for the pilot survey. It had been prepared for a pilot survey by the cluster informers. All teams went to the cluster for examination. Since we went to the field on a second appointment, some people were away for a funeral and at the market place, making it impossible to reach all participants. The houses were very far apart, requiring long walks to reach the next house. The experience was useful in highlighting a number of issues in enrolment at the cluster level, and the logistical challenges demonstrated the rigour expected in a population-based survey. The five teams moved together, taking turns to examine patients, with the trainers observing and commenting. Several misconceptions about enrolment were corrected (e.g. passing by houses because “no one was home”). We only enrolled people during the pilot, so a team had to return to the cluster later, starting enrolment at the selected house and moving to the next nearest until 40 people were enrolled. At some households, the team preferred waiting for pupillary dilation since the distance to the next house was very far.

The cluster informers were given some guidance to prepare and match the 90 paper maps collected from Central Statistics Authority (CSA) for each selected cluster using during the field

Appendix V - RAAB survey team composition and their roles

NAME	POSITION AND PLACE OF WORK	RAAB ROLE
Dr. Grace Chipalo Mutati	Consultant Ophthalmologist, Senior Medical Superintendent UTH Eye Hospital, National Coordination. Lecturer school of Medicine	Principal investigator

NAME	POSITION AND PLACE OF WORK	RAAB ROLE
Dr. Willard Mumbi	Senior Registrar Ophthalmology – Kabwe General Hospital	Survey coordinator
Dr. Felida Mwacalimba	Senior Registrar Ophthalmology – University Teaching Hospital (UTH) .	Team leader: D
Jessie Nyalazi	Ophthalmic nurse, UTH	Assistant: D
Dr. Simon Chisi	Medical Superintendent, Consultant Ophthalmologist – St. Francis Mission Hospital.	Team leader: E
Josias Ndhlovu	Ophthalmic nurse, St. Francis Mission Hospital.	Assistant :E
Dr. Kayulachansa	Senior Registrar Ophthalmology –. Solwezi General Hospital	Team leader: B
Elias Mashilipa	Ophthalmic clinical officer, Solwezi General Hospital	Assistant : B
Dr. Chisanga Chelu	Senior Registrar Ophthalmology – Mansa General Hospital	Team leader: A
Foster Maambo	Senior Ophthalmic clinical officer, Kabwe General Hospital	Assistant :A
Dr Mboni Chileshe	Senior Registrar Ophthalmology – Kitwe central Hospital.	Team leader : C
Patricia Mulenga	Ophthalmic nurse, Kitwe central Hospital	Assistant : C
Chansa Chipili	Ophthalmic Clinical Officer, Chainama College of Health Sci.	Cluster informer
MoonoHampango	Ophthalmic Clinical Officer, Levy Mwanawasa General Hospital	Cluster informer
Timothy Kangwa	Ophthalmic Nurse, UTH	Cluster informer

	NAME	TEAM NUMBER	INSTITUTION	TITLE
OPHTHALMOLOGISTS				
1	Dr Willard Mumbi	RAAB Coordinator	Kabwe General Hospital	Ophthalmologist
2	Dr FelidaMwacalimba	4	UTH	Ophthalmologist
3	Dr Simon Chisi	5	St Francis Hospital	Ophthalmologist
4	Dr KayulaChansa	2	Solwezi General Hospital	Ophthalmologist

NAME	POSITION AND PLACE OF WORK			RAAB ROLE
5	Dr Chisanga Chelu	1	Mansa General Hospital	Ophthalmologist
6	Dr MboniChileshe	3	Kitwe Central Hospital	Ophthalmologist
OCO/ONs				
1	Jessie Nyalazi	4	UTH	Ophthalmic Nurse
2	Patricia Mulenga	3	Kitwe Central Hospital	Ophthalmic Nurse
3	Foster Maambo	1	Kabwe General Hospital	Senior Ophthalmic Clinical Officer
4	Elias Mashilipa	2	Solwezi General Hospital	Ophthalmic Clinical Officer
5	Josias Ndhlovu	5	St Francis Hospital	Ophthalmic Nurse
CLUSTER INFORMERS				
1	ChansaChipili		Chainama College of Health Sciences	Ophthalmic Clinical Officer
2	MoonoHampango		Levy Mwanawasa General Hospital	Ophthalmic Clinical Officer
3	Timothy Kangwa		UTH	Ophthalmic Nurse

Appendix VI – Inter-Observer Variability Test (IOV1) Report

CALCULATION OF INTER-OBSERVER VARIATION (RAAB)

Date and time of report: 06/06/2017 13:44:32
This report is for the survey area:
Gold Standard A

This report compares the findings of the most experienced examiner, the 'Gold Standard', which are considered to be correct, with the findings of a second examiner.
Kappa coefficient calculations according to Altman D.G. Practical Statistics for Medical Research, 1999

Value of Kappa	Strength of agreement
<0.20	Poor
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61 - 0.80	Good

Comparing the 'Gold Standard' with examiner: B

1. Inter-observer variation on presenting VA in the right eye:

A \ B	1	2	3	4	5	6	Total
1	42						42
2		2					2
3	1		2				3
4				1			1
5					4		4
6						1	1
Total	43	2	2	1	4	1	53

Kappa Coefficient: 0.95
CI95% of Kappa: (0.84 - 1.05)

2. Inter-observer variation on presenting VA in the left eye:

A \ B	1	2	3	4	5	6	Total
1	45	1					46
2							0
3							0
4							0
5	1				4		5
6						2	2
Total	46	1	0	0	4	2	53

Kappa Coefficient: 0.84
CI95% of Kappa: (0.63 - 1.06)

Page 1 of 24

Comparing the 'Gold Standard' with examiner: C

1. Inter-observer variation on presenting VA in the right eye:

A \ C	1	2	3	4	5	6	Total
1	40						40
2		2					2
3			1				1
4				1			1
5					4		4
6						1	1
Total	40	2	1	1	4	1	49

Kappa Coefficient: 1.00

CI95% of Kappa: (1.00 - 1.00)

2. Inter-observer variation on presenting VA in the left eye:

A \ C	1	2	3	4	5	6	Total
1	43	1					44
2							0
3							0
4							0
5					3		3
6					1	1	2
Total	43	1	0	0	4	1	49

Kappa Coefficient: 0.80

CI95% of Kappa: (0.53 - 1.07)

Comparing the 'Gold Standard' with examiner: D

1. Inter-observer variation on presenting VA in the right eye:

A \ D	1	2	3	4	5	6	Total
1	42						42
2		2					2
3		1					1
4			1				1
5					3	1	4
6						1	1
Total	42	3	1	0	3	2	51

Kappa Coefficient: 0.81

CI95% of Kappa: (0.61 - 1.02)

2. Inter-observer variation on presenting VA in the left eye:

A \ D	1	2	3	4	5	6	Total
1	44	2					46
2							0
3							0
4							0
5					3		3
6					1	1	2
Total	44	2	0	0	4	1	51

Kappa Coefficient: 0.73

CI95% of Kappa: (0.43 - 1.03)

Comparing the 'Gold Standard' with examiner: E

1. Inter-observer variation on presenting VA in the right eye:

A \ E	1	2	3	4	5	6	Total
1	42						42
2		2					2
3			1				1
4				1			1
5					3	1	4
6						1	1
Total	42	2	1	1	3	2	51

Kappa Coefficient: 0.94

CI95% of Kappa: (0.82 - 1.06)

2. Inter-observer variation on presenting VA in the left eye:

A \ E	1	2	3	4	5	6	Total
1	44	2					46
2							0
3							0
4							0
5					3		3
6						2	2
Total	44	2	0	0	3	2	51

Kappa Coefficient: 0.82

CI95% of Kappa: (0.57 - 1.06)

We work with partners in low and middle income countries to eliminate avoidable blindness and promote equal opportunities for people with disabilities

www.sightsavers.org

Visit our research centre:
www.research.sightsavers.org

Share SightsaversUK

Follow @Sightsavers @Sightsavers_Pol

Watch SightsaversTV

Bumpers Way
Bumpers Farm
Chippenham
SN14 6NG
UK

+44 (0)1444 446 600

info@sightsavers.org

Sightsavers

Registered charity numbers 207544 and SC038110