RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

Version 5
for Windows®

October 2012

RAAB 5

RAAB Version 5 for Windows® - October 2012

A package for entry and analysis of data from population based Rapid Assessments of Avoidable Blindness

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The RAAB package for Windows is programmed in Visual FoxPro version 9.0 ® and the reports are generated through Crystal Reports version 10 ®. Both programmes are runtime versions. Changes to the programme cannot be made by the user. The package can run on any computer with a Pentium II processor and Windows 2000 SP4, or higher specifications.

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Purpose of this manual

The purpose of this manual is to:

- explain the principles of the Rapid Assessment of Avoidable Blindness (RAAB);
- explain how to plan for a RAAB and provide a checklist of requirements for the survey;
- explain the survey methodology, such as how to calculate the sample size and how to select the clusters;
- provide guidelines for fieldwork;
- explain how to train examiners, including assessing the inter-observer variation;
- explain the ophthalmic examination procedure and how to fill in survey forms;
- explain the installation and use of the software programme;
- explain how to analyse survey data and how to generate reports.

Reports generated from this survey will produce the following indicators for people aged 50+:

- prevalence of blindness, severe and moderate visual impairment and low vision;
- prevalence of blindness, severe and moderate visual impairment from avoidable causes;
- prevalence of blindness, severe and moderate visual impairment from cataract;
- main causes of blindness, severe and moderate visual impairment;
- prevalence of aphakia and/or pseudophakia;
- cataract surgical coverage;
- visual outcome of cataract surgery;
- barriers to cataract surgery;
- cataract surgery service indicators like place, cost and type of surgery, cause of poor outcome.

Purpose of RAAB

Rapid assessment of avoidable blindness (RAAB) is a rapid methodology to conduct a population based survey of visual impairment and eye care services among people aged 50 years and over. The RAAB is intended to provide the prevalence of blindness and visual impairment, its main causes, the output and quality of eye care services, barriers, cataract surgical coverage and other indicators of eye care services in a specific geographical area. If done at the start of an intervention programme, this information will help eye health managers to develop a plan of action based on community needs. If conducted 5-8 years after the start of an intervention programme these results will help to monitor existing blindness control programmes and to adjust these programmes as and when required.

Requirements for RAAB

The entire survey can be completed with local ophthalmologists, ophthalmic assistants and support staff, e.g. ophthalmic nurses, optometrists, etc., using basic ophthalmic equipment. Since the data analysis and report generation is automated and incorporated in the software, no outside assistance is required for data analysis and report generation. Collected data and reports are standardised and results can easily be compared with those from other regions or countries.

TABLE OF CONTENTS

Abbreviations

ARMD	Age Related Macula Degeneration
BCVA	Best corrected visual acuity
Blind	VA<3/60 with available correction
CI	Confidence interval, usually with 95% probability
CNS	Central Nervous System
CRS	Cluster Random Sampling
CSC	Cataract Surgical Coverage
DEFF	Design Effect
DR	Diabetic Retinopathy
ICD10	International Classification of Disease – 10^{th} revision
IAPB	International Agency for the Prevention of Blindness
IOL	Intra-ocular lens
IOV	Inter-observer variation
MVI	Moderate visual impairment – presenting VA <6/18 – 6/60
PCO	Posterior capsular opacification
PinVA	Visual acuity with pinhole
PVA	Presenting Visual Acuity
RAAB	Rapid Assessment of Avoidable Blindness
RACSS	Rapid Assessment of Cataract Surgical Services
RBG	Random blood glucose
SE	Sampling error
SEcrs	Sampling error for cluster random sampling
SEsrs	Sampling error for simple random sampling
SRS	Simple random sampling
SVI	Severe visual impairment – presenting VA <6/60 – 3/60
VA	Visual Acuity
WHO	World Health Organization

Chapter 1

INTRODUCTION

1.1 Blindness and low vision in the world

In the International Classification of Disease – 10th revision (ICD10), the World Health Organization (WHO) defines blindness as visual acuity (VA) less than 3/60 in the better eye with best correction. Uncorrected refractive error was at that time not considered as a cause of blindness or visual impairment. In the past decade, however, more data became available demonstrating that uncorrected refractive errors indeed were an important cause of visual impairment and even blindness. Therefore the WHO has suggested to measure the prevalence of blindness both with the available correction as well as with best correction or pinhole. The definitions were subsequently revised as shown in Table 1.
Using the old definitions, the latest estimates suggest that in the year 2002 there were 37 million blind people and 124 million people with low vision in the world. [1] In total, 161 million people were visually impaired. This does not include the estimated 5 million blind and 135 million people with low vision due to refractive errors, who do not have any adequate optical correction.

Table 1. Definitions by the World Health Organization (WHO – ICD10)

Moderate visual impairment (MVI)	VA< 6/18 – 6/60 in better eye with available correction (PVA) or with best correction or pinhole (BCVA or PinVA)
Severe visual impairment (SVI)	VA< 6/60 – 3/60 in better eye with available correction (PVA) or with best correction or pinhole (BCVA or PinVA)
Blindness	VA< 3/60 in better eye with available correction (PVA) or with best correction or pinhole (BCVA or PinVA)
Visual impairment	VA< 6/18 in better eye with available correction (PVA) or with best correction or pinhole (BCVA or PinVA)
Low Vision	A person with low vision is one who has impairment of visual functioning even after treatment and/or standard refractive correction, and a visual acuity of less than 6/18 to light perception, or a visual field of less than 10 degree from the point of fixation, but who uses, or is potentially able to use, vision for planning and/or execution of a task.*

* Conditions of the visual field are not taken in consideration in this survey

Different systems are used to measure visual acuity. Table 2 shows the values used in these different systems and their relationship.

Table 2. Conversions between notations for visual acuity

Snellen 6m	Snellen 20ft	Decimal	Francophone	LogMar
6/6	20/20	1	10/10	0
6/9	20/32	0.63	6/10	0.2
6/12	20/40	0.50	5/10	0.3
6/18	20/60	0.33	3/10	0.5
6/24	20/80	0.25	2,5/10	0.6
6/36	20/120	0.17	1,7/10	0.8
6/60	20/200	0.10	1/10	1.0
3/60	20/400	0.05	1/20	1.3
1/60	20/1200	0.02	1/50	1.8
PL+	PL+	PL+	PL+	3
NPL	NPL	NPL	NPL	4

[1] Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, Mariotti S. Global data on visual impairment in the year 2002. Bull WHO 2004;82:844-851

Worldwide, more than 80% of all blindness occurs in people of 50 years and older. Cataract is the major cause of blindness (48%), followed by glaucoma (12.3%), Age-related Macula Degeneration or ARMD (8.7%) and corneal scarring (5.1%) (Table 3). Refractive errors and uncorrected aphakia are not included in these estimates, because the WHO definitions for blindness are used to measure visual acuity with best correction. Approximately 75%-80% of all blindness is avoidable. This means that it can either be treated (refractive error, cataract, and uncorrected aphakia) or prevented (trachoma, corneal scarring, childhood blindness, onchocerciasis, and to a certain extent glaucoma and diabetic retinopathy).

Table 3. Estimates of the number of blind people in the world by cause [1]

Cause of blindness	Number of blind (mill.)	%
Cataract	17.62	47.8%
Glaucoma	4.53	12.3%
Age-related Macula Degeneration	3.21	8.7%
Corneal scar	1.88	5.1%
Diabetic retinopathy	1.77	4.8%
Childhood blindness	1.44	3.9%
Trachoma	1.33	3.6%
Onchocerciasis	0.29	0.8%
Other causes	4.79	13.0%
Total	**36.86**	**100.0%**

There is a large variation in causes of blindness between individual countries. Even within a country the prevalence of blindness due to cataract may vary considerably and is mainly determined by the number of cataract operations conducted, the proportion of elderly people and the incidence of cataract. These factors mean that cataract blindness is more common in low- and middle-income countries. Blindness from trachoma, onchocerciasis, corneal opacities and childhood blindness are also more common in low-income countries. ARMD, glaucoma and diabetic retinopathy make up a greater proportion of blindness in high and middle-income countries.

1.2 VISION 2020 – The Right to Sight

VISION 2020 – the right to sight, is the joint initiative by WHO and IAPB (International Agency for the Prevention of Blindness) to eliminate avoidable blindness by the year 2020. The VISION 2020 strategy depends on the development of district-level plans for the prevention of avoidable blindness. With the current uptake of VISION 2020 programmes, many countries require baseline data at the district level to facilitate adequate planning. District level surveys are also needed to monitor eye care programmes and to measure achievements. This requires a simple survey methodology, including a basic eye examination with standardised, basic equipment, which can be implemented by locally available ophthalmic staff.

1.3 A simple and valid method for estimating the magnitude of avoidable blindness

Conventional blindness surveys are usually lengthy, costly and complicated exercises, requiring expert assistance from epidemiologists or statisticians to produce reports. Because of the high costs and expertise involved, surveys have been undertaken in few countries and most countries that had surveys in the past cannot repeat them after 8-10 years to assess the impact of intervention programmes. This means that such blindness surveys are often not appropriate for planning and monitoring VISION 2020 programmes, and cheaper and faster methodologies are required.

The RAAB survey is a rapid survey methodology that is undertaken at the district level. A sample of 2500-5000 people over the age of 50 years is selected (the exact number depending on the

expected prevalence of blindness). These people have their visual acuity (VA) measured. Those with VA<6/18 are examined by an ophthalmologist, to determine the cause of visual impairment. People who have undergone cataract surgery are asked about the time, place and costs of their surgery. People who need cataract surgery are asked why they have not reported for surgery. Using this standard RAAB Survey, a standardised software package can be used to produce automatic reports with the following indicators:

Table 4. Indicators produced by RAAB

Indicator	Description	Relevance
prevalence of blindness, severe visual impairment (SVI) and moderate visual impairment (MVI)	Shows burden of disease	Information needed to plan and monitor eye care services
prevalence of blindness, SVI and MVI due to avoidable causes		
prevalence of blindness, SVI and MVI from cataract		
main causes of blindness, SVI and MVI		
uncorrected refractive errors and uncorrected presbyopia		
prevalence of aphakia and/or pseudophakia	Shows uptake of cataract surgical services	Information needed to plan and monitor eye care services
cataract surgical coverage		
visual outcome of cataract surgery	Shows quality of surgery	Information needed to maintain high quality surgery
cause of poor outcome after surgery		
barriers to cataract surgery	Shows barriers to surgery	Information needed to maintain high cataract surgical coverage
Cataract surgical services	Provides more information about cataract services	Information needed to plan cataract surgical services

1.4 What makes RAAB a rapid methodology?

a) RAAB only includes people aged 50 years and above

More than 80% of all blindness occurs in people of 50 years and older, and so the prevalence of blindness in people ≥50 years is much higher than in the entire population. This means that a smaller sample size is required for a survey covering people aged 50 years and above only. The sample size may be one third to one sixth of that needed for a survey covering all age groups, depending upon the proportion of people aged 50 and older in the survey area. A RAAB covering 2500 to 5000 people can provide an accurate estimate on blindness and low vision in a defined population.

Table 5 demonstrates, with data from India, that the prevalence of cataract blindness in people aged 50 years and older is nearly 68% higher than the prevalence in people aged 40 years and older. The sample size required to achieve an estimate with the same precision in the 40+ age group will be around 70% higher than the sample size required if only the people aged 50 years

and over were surveyed. The number of cases of cataract blindness in the people aged 40 years and older is only 5% greater than the total number of cases in the people aged 50 years and over. By limiting the survey to people of 50 years and older the total sample size will be reduced by 70%, and this will only under-estimate the actual number of cases in the survey area by around 5%.

Blindness in children and in people aged 15-49 is not covered in the RAAB survey. The prevalence of blindness in people below the age of 50 is very low and so extremely large sample sizes would be required to provide accurate estimates of the prevalence of blindness in these two groups. Special rapid assessments have been developed to assess childhood blindness[2] and also for trachoma and vitamin A deficiency, eye diseases which are more common in younger age groups.

Table 5. Prevalence of cataract blindness in different age groups in India [3]

Age group	Population (million)	Prevalence cataract blindness VA<3/60	Cases with cataract blindness VA<3/60	Sample size *
40-49	70.9	0.31 %	222,000	
50-59	48.8	1.95 %	952,000	
60-69	29.8	5.94 %	1,767,000	
70+	13.7	9.39 %	1,290,000	
Total 40+	**163.3**	**2.59 %**	**4,231,000**	**5,733**
Total 50+	**92.3**	**4.34 %**	**4,010,000**	**3,371**

*Variation 20% around estimate, Confidence interval 95%, Design effect 1.6 for cluster size 50

b) Ophthalmic examination in RAAB uses basic ophthalmic equipment

The examination is relatively rapid because visual acuity in RAAB is measured with a simplified tumbling Snellen E chart of size 60 and size 18 and a pinhole. Examination of the fundus and the lens is conducted with a torch and a direct ophthalmoscope and sometimes with a portable slit lamp. Visual fields and intraocular pressure are not measured. The most important causes of avoidable blindness can be diagnosed using this equipment (i.e. refractive error, cataract, uncorrected aphakia, trachoma, onchocerciasis, corneal scarring and vitamin A deficiency). Other diseases, such as glaucoma, diabetic retinopathy, and ARMD (which are often rare in low income settings) can be diagnosed with a direct ophthalmoscope or handheld slitlamp. These may require more diagnostic skills and sophisticated equipment, which are difficult to use in a door-to-door survey and so are not the focus of the RAAB.

c) RAAB has automated software for data entry and data analysis

The software provides modules to calculate the sample size, to select the required number of clusters from a sampling frame, to calculate the inter-observer variation, and to check the entered data on consistency. It is possible to select the language of the screens of the software (English, Dutch, French, Spanish, Chinese). After cleaning the data, reports of results, both sample data as well as age and sex adjusted data, can be produced automatically through a menu system. The software will also calculate sampling error, design effect and confidence intervals.

d) RAAB uses locally available staff

The entire process, from planning to the collection of field data, data analysis and report writing, can be conducted by local staff, using the guidelines of this manual, the training materials and the software package. Using local staff will keep the costs low and increases the sense of ownership and motivation of the staff involved. If three or four teams with transport can be mobilised, they could cover 50 to 60 clusters (corresponding to the usual required sample size) in a period of 3-4 weeks. The collection of data can be done by local ophthalmologists, residents in ophthalmology,

[2] Muhit MA, Shah SP, Gilbert CE, Hartley SD, Foster A. The key informant method: a novel means of ascertaining blind children in Bangladesh. Br J Ophthalmol. 2007;91:995–9

[3] Madan Mohan, Survey of Blindness – India, Summary & Results, New Delhi 1989

or experienced ophthalmic assistants. Local staff can enter the data directly into the software package. Alternatively, professional data entry services can be hired.

1.5 What RAAB is not

The RAAB is not a case-finding exercise: it will not provide a list of names and addresses of all people who are blind due to cataract in a geographic area. Survey staff should not be looking for patients with eye problems only, but make the utmost attempt to give a correct representation of the actual situation in the survey area.

The RAAB is not a detailed blindness survey, but rather a door-to-door survey with diagnostic ophthalmic equipment limited to a direct ophthalmoscope and a portable slit lamp at best. The sample size of the RAAB is usually large enough to provide a reasonable accurate estimate of the prevalence of avoidable blindness, but since most specific causes of blindness have a lower prevalence, they would require larger samples to give equally accurate estimates (e.g. of the prevalence of blindness due to glaucoma).

Chapter 2

PREPARING FOR THE SURVEY

2.1 Appointment of a Survey Coordinator

All RAAB activities will be carried out under responsibility and guidance of a Survey Coordinator.

The work of the Survey Coordinator starts before the actual field survey and includes the following responsibilities:

- *Develop a sampling frame*
  - selection of the survey area
  - collection of the latest population data by 5-year age group and by sex for the survey area
  - creation of the sampling frame
- *Baseline needs assessment*
  - review of available information on cataract surgical services
  - review of available data on prevalence of blindness
- *Selection of clusters*
  - development of the sample design
  - selection of the clusters
- *Selection of survey personnel*
  - Identify and recruit appropriate personnel
- *Arrange logistics*
  - arrangement of survey equipment and transport
  - arrangement of survey schedule (date and team for each cluster)
- *Training*
  - organisation of the training programme for the field staff
  - standardisation of ophthalmic examination procedures
  - assessment of the inter-observer variation
- *Data management*
  - daily collection of survey records from survey teams
  - training and supervision of data entry and validation of data entry (consistency checks and double data entry)
- *Data analysis and report writing*
  - analysis of data and report generation
  - report writing

Attitudes and skills required for the Survey Coordinator:

- commitment and perseverance;
- time commitment;
- willingness to learn from local people and to use local resources;
- a careful listener;
- awareness and sensitivity;
- using common sense in analysing the information;
- experience in public health, population-based surveys and epidemiology is an advantage;
- training as an ophthalmologist is an advantage.

2.2 Selection of the survey area

The survey area for the RAAB can be an entire country or part of a country (province or districts). In general, the total population in the survey area should be between 0.5 and 5 million people. If the total population is smaller then the effort and the resources will be too high for a survey that will only be relevant to a small population. If the total population is more than 5 million, there can be

large differences in the availability and affordability of eye care services within the survey area, causing larger variations in prevalence across the survey area.

The indicators obtained from the RAAB are used to plan and monitor blindness programmes. For that reason, the survey area should preferably be the management area for eye care services, which can be the country, the province or the district. If the entire management area is too large, it is advisable to divide it into smaller sub-areas. Several areas with smaller populations can be combined into one larger survey area of adequate size.

Another important aspect is the availability of staff for the survey teams. There should be enough qualified examiners, ophthalmologists, residents in ophthalmology and experienced ophthalmic assistants, to form two to five teams, without disabling regular ophthalmic services during the period of fieldwork. If sufficient examiners cannot be made available, consider carefully whether a RAAB should be conducted at all. Alternatively, additional staff may be mobilised from elsewhere for this exercise. Besides ophthalmic staff, there should also be an office for the RAAB, and enough vehicles and money for fuel, allowances, food for field staff, batteries, torches, printing of survey questionnaires, wages for data entry staff, etc.

The survey area should be safe and accessible. Do not plan a RAAB in an area where the safety of your field staff cannot be guaranteed. Do not expose them to unnecessary risks when travelling.

2.3 Collection of population data and creation of a sampling frame

In most countries a national population census is conducted every 10 years. Normally, this will provide population data by sex and by 5 or 10-year age groups.

The Survey Coordinator should obtain a copy of the most recent census data for the survey area, preferably on electronic media that can be read by a computer. Two sets of data are required:

1. **a list of all population units in the survey area**, which will be used as the sampling frame (list), from which clusters will be selected. People in one cluster (50 residents of that area aged 50 years or older) will be selected from one population unit. This is usually a list of all enumeration areas in the survey area from the national census. Enumeration areas are geographical areas created by the census office to be covered by their census enumerators. In a rural area, several small villages may be combined in one enumeration area, while a larger town is usually sub-divided in a number of enumeration areas. The census office uses detailed maps to demarcate the various enumeration areas. Census data are collected for each enumeration area and therefore the population data for each enumeration area is known. Enumeration areas are best suited for a sampling frame.

   Occasionally these data will not be available or else are out-of-date (ideally they should not be more than 5 years old). In these instances other population units, such as a list of all settlements in the survey area with the population of each settlement, can be used to make a sampling frame. In order to be useful these lists must be complete and must show the population size for all settlements in the survey area. In one country, where all inhabitants are registered with a general practitioner, we used the list of all general practitioners and the number of people registered with each of them, as a sampling frame for RAAB. In a different country, we used a recent list of polling stations, with the number of voters registered at each polling station. In yet another country, the immunization programme maintained detailed population data from each village, which could be used.

2. **a table with the composition of the population of the entire survey area by sex and by 5-year age groups**. This second list is used to compare the age and sex composition of the sample that is enumerated in the survey with that of the actual population in the survey area. In case of any differences, the survey data will be adjusted automatically. These data are usually obtained from the national census data.

The code number, name (location) and number of people per population unit should be entered into a standard file, which is generated automatically when a new database is opened in RAAB. (Figure 1) The total list of all population units in the survey area is called the sampling frame. From this sampling frame, the required number of population units are selected by systematic sampling with a probability proportional to size. The sampling frame data should be provided in this format only, otherwise the automatic selection of population units may not be possible. This file is located in directory C:\ \RAAB5\Data\<name of database>\Samplingframe.xls. (See chapter 4.9.2 page 55)

Figure 1. Format file Samplingframe.xls

	A	B	C
1	**Data entry for sampling frame**		
2			
3	Enter the code	Enter the name of the population unit (settlement,enumeration	Enter the population
4	of the settlement,	area, neighbourhood, other population unit.	in this entire population
5	enumeration area		unit.
6	or other population		
7	unit.		
8			
9	**Code**	**Unit name**	**Population**
10			
11			

2.4 Calculation of the sample size

The exact prevalence of avoidable blindness in a survey area can only be measured by examining all persons in a defined area. However this will take too much time and will be too expensive. The second option is to only examine samples from the total population and from this calculate what the prevalence in the entire population would be. In this case we have to decide how to select these samples and how many people to examine in total.

The Survey Coordinator should review written reports to collect existing data on the expected prevalence of blindness and avoidable blindness in the survey area. The Survey Coordinator should also consult key informers, such as local ophthalmologists, epidemiologists and officials from the health department. Based on this information, an estimate has to be made of the expected prevalence of avoidable blindness (VA<3/60 in the better eye with available correction) in the survey area. To decide on the design of a population-based survey is always a compromise between accuracy and feasibility. A larger sample size will improve the precision of the prevalence estimate, but places high demands on funds and manpower. A smaller sample size may require fewer resources, but the precision of the prevalence estimate will be lower.

The approximate sample size depends on the following:

1. The **expected prevalence of bilateral blindness** (VA<3/60 with best correction) in the area. The expected prevalence may be estimated from previous reports, if available, or from anecdotal information from key informers. If there are no previous reports, comparisons could be made with countries with a known prevalence and similar socio-economic conditions, similar eye health infrastructure and similar cataract surgical rate. Alternatively, the estimates for the various WHO regions in Table 6 could be used. The higher the prevalence, the lower the sample size required.

2. The **precision of the estimate** required. Precision can be measured in absolute terms (e.g. prevalence ±1%) or in relative terms (e.g. precision of ±20% of the prevalence). For instance, if the estimated prevalence is 4% then a precision ±1% means that the acceptable prevalence estimate is between 3 and 5%. A precision of 20% around the estimate (4%) means that the acceptable prevalence estimate is between 3.2 and 4.8%. A precision of 20% around the likely prevalence is commonly accepted. The higher the desired precision, the larger the sample size required.

Table 6. Estimates of prevalence of blindness in 2002 in people age 50+ by WHO sub-region

WHO subregion	Country	Prevalence of blindness in people aged 50+(%)
Afr-D	Algeria, Angola, Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Comoros, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Madagascar, Mali, Mauritania, Mauritius, Niger, Nigeria, Soa Tome and Principe, Senegal, Seychelles, Sierra Leone, Togo	9.0
Afr-E	Botswana, Burundi, Central African Republic, Congo, Cote d'Ivoire, Democratic Republic of Congo, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, Uganda, Tanzania, Zambia, Zimbabwe	9.0
Amr-A	Canada, Cuba, USA	0.4
Amr-B	Argentina, Bahamas, Belize, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, El Salvador, Grenada, Guyana, Honduras, Jamaica, Mexico, Panama, Paraguay, Suriname, Uruguay, Venezuela	1.3
Amr-D	Bolivia, Equador, Guatemala, Haiti, Nicaragua, Peru	2.6
Emr-B	Bahrain, Iran, Jordan, Kuwait, Lebanon, Libya, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates	5.6
Emr-D	Afghanistan, Djibouti, Egypt, Iraq, Morocco, Pakistan, Somalia, Sudan, Yemen	7.0
Eur-A	Andorra, Austria, Belgium, Croatia, Cyprus, Czech republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, United Kingdom	0.5
Eur-B1	Albania, Bosnia and Herzegovina, Bulgaria, Georgia, Poland, Romania, Serbia and Montenegro, Slovakia, Macedonia, Turkey	1.2
Eur-B2	Armenia, Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	1.3
Eur-C	Belarus, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Moldova, Russian Federation, Ukraine	1.2
Sear-B	Indonesia, Sri Lanka, Thailand	6.3
Sear-D	Bangladesh, Bhutan, North Korea, India, Maldives, Nepal, East Timor	3.4
Wpr-A	Australia, Brunei, Japan, New Zealand, Singapore	0.6
Wpr-B1	China, Mongolia,	2.3
Wpr-B2	Cambodia, Laos, Malaysia, Myanmar, Philippines, South Korea, Vietnam	5.6
Wpr-B3	Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia, Tonga, Tuvalu, Vanatua, Nauru, Papua New Guinea, Samoa, Solomon Islands	2.2
World		**0.57**

Resnikoff S, et al. Global data on visual impairment in the year 2002. Bull WHO 2004;82:844-851

3. The **confidence** you want to place in the precision, i.e., what is the probability that the actual prevalence is within the specified precision and not caused by chance alone. This is indicated by $(1 - \alpha)$, where α indicates the error. Generally, a confidence level of $(1 - \alpha) = 95\%$ is considered adequate. If the precision = 20% around the likely prevalence, and $(1 - \alpha) = 95\%$,

means that we are 95% sure that the actual prevalence is within one-fifth (20%) of the prevalence found in the survey. The higher the confidence required, e.g. (1 – α) = 99%, the larger is the required sample size.

4. The **method of sampling**. The question of sample size and the method of sampling are inter-related. In Simple Random Sampling (SRS) each subject must have an equal chance of being selected and has to be selected at random from the entire population, in our case, from all people aged 50+ in the entire survey area. This would require all people aged 50+ to be registered, so that this list can be used to select subjects at random. Most countries do not have such lists and so Simple Random Sampling is not feasible. Even with such a list, Simple Random Sampling will make the survey cumbersome and expensive since selected subjects may live far apart and much travelling will be needed.

   A better way to conduct a survey is to select a group of subjects living together, called a cluster, through Cluster Random Sampling. For RAAB the cluster size is usually 50, since one cluster of 50 subjects can be examined in one day by one team. Each cluster must be selected at random from the entire population of the survey area. Since people living close together (in one cluster) are more likely to share certain characteristics than randomly selected individuals, a correction factor (called the design effect: DEFF) has to be introduced to compensate for the decrease in variation caused by the cluster sampling. If the condition under examination is evenly distributed among the different clusters, DEFF will be small (close to 1.0). If the distribution varies strongly between the clusters, the DEFF will be larger (it can go up to a factor 5 or more). DEFF can only be calculated from actual survey data, but the expected DEFF can be estimated on the basis of earlier experience. DEFF usually increases with the cluster size, so that the required sample size increases as cluster size increases. The expected DEFF for RAAB are 1.4 for cluster-size 40, 1.5 for cluster-size 50 and 1.6 for cluster-size 60.

   The RAAB uses a multistage cluster sampling methodology. The first stage is to select at random as many population units as there are clusters from a list that includes all population units in the survey area (sampling frame). A population unit is preferably an enumeration area, but can also be another clearly demarcated group of people. The second stage is to select at random 50 eligible persons in the selected population unit.

5. Decide on the **cluster-size and the number of clusters**.
   It is advisable to select a cluster size of 50 people aged 50+ to be examined per team per day. Experience shows that this is achievable by one team in one day. In exceptional circumstances clusters between 40 and 60 people can be used. It is not advisable to use a cluster size larger than 60 as the DEFF will increase steeply and a very large sample size will be required. All clusters must be of exactly the same size; otherwise the statistical inferences are not valid.

When you have decided upon the five parameters above, which determine the sample design, you can start to calculate the sample size. The RAAB software has a special module for this. Go to the main menu, click on ‘Utilities’, and click on ‘Sample size calculation’. This will open the Sample size calculation menu. The use of this module is explained in Chapter .4.9.1, page 54.

2.5 First stage sampling: selection of population units

Once the sample size and the cluster size have been determined you can select the clusters for the survey from a list of all population units in the survey area. This list is called the sampling frame. The menu ‘Utilities | Select clusters’ provides a quick and reliable way to select the required number of population units through systematic sampling from the sampling frame. The use of this module is explained in Chapter 4.9.2 on page 55 and a spreadsheet to demonstrate systematic sampling is provided on the installation CD. The population units are selected from the sampling frame with a probability according to their population size. This procedure is known to be self-

weighing and also ensures that the selection of clusters is evenly spread over the entire population.

In a small population unit there may not be enough people aged 50 years and older to complete one cluster. In such a case you should continue the examination in the next geographically nearest population unit to complete the cluster.

2.6 Second stage sampling: selection of eligible persons

In most cases, there will be more than 50 people aged 50 years and older in the selected population unit, and so people will need to be sampled within the population unit (e.g. enumeration area, village or urban area). In such cases, **compact segment sampling** should be used to select households.[4]

The population unit (enumeration area, village or urban area) from which the cluster will be taken is visited two to five days before the survey by the cluster informer to inform them of the survey. The village leaders are asked if a map of the village is available, and if not, if they could produce a sketch map of the village showing major landmarks and the approximate distribution of neighbourhoods and households.

From the census data we can estimate the proportion of the population that is 50 years and older. As an example, imagine that the village has 2000 people and that 20% of the population (400 people) is 50 +. That means that we require a segment of 250 people in order to find 50 people aged 50+. On the day of the survey, using the map the village is then divided into 8 segments of approximately equal population size and with well-demarcated boundaries, so that each segment includes the desired cluster size of 50 people aged 50 years and older. It should be clear to which segment each house in the village belongs. Each segment is given a number, and these numbers are written on a piece of paper. The pieces of paper are folded, shaken, and one is selected at random. This segment is thus randomly selected to select the cluster from and all households in this segment are visited door-to-door, until 50 people aged > 50 years are identified. If there are fewer than 50 people of age 50+ in this segment then a second segment is chosen at random and sampling continues until person number 50 has been examined.

If the population unit is too small to provide 50 people aged 50+ then all households in this unit should examined first and the remaining subjects should be examined from the next nearest population unit.

Other surveys and also the previous Rapid Assessment of Cataract Surgical Services (RACSS) survey have used the ‘random walk’ method to select households within villages. The random walk method is more complicated than the compact segment method, is less objective and has a higher risk of bias (preferential inclusion of blind people) and has statistically poorer properties. Therefore compact segment sampling should be used in RAAB.

Eligible subjects: In each household all persons of 50 years and older, residing in the household for six months or more over the past year, are examined and interviewed. ‘Residing in the household’ has to be defined clearly for the entire survey area (e.g. sharing meals from the same kitchen with the other members of the household for at least 6 months in a year). Exclude any visitors. For each of the people aged 50+ identified one RAAB Survey Record has to be completed. Always check whether there are any other eligible people residing in the household that are not present at the time of your visit. If so, complete a RAAB survey record for them and arrange to revisit at an appropriate time. Do NOT complete a record for any person above 50 years who is a guest or a visitor from another house or area, although you may check their eyes as a

[4] Turner AG, Magnani RJ, Shuaib M. A not quite as quick but much cleaner alternative to the Expanded Programme on Immunization (EPI) Cluster Survey design. *Int J Epidemiol* 1996:25:198-203.

courtesy. In case you come across a locked house, check with the neighbours whether any people of 50 years and above live there. If so, complete a RAAB Survey Record for each person and make sure you visit the house again after making proper arrangements. If the inhabitants are away for a longer period (more than one night), go to the next house. Continue the survey with a systematic route until you have visited all the houses in that area or until 50 people aged 50+ have been included.

Subjects not examined: People may agree to be examined, or else they may be away (not available), refuse to be examined or unable to communicate (e.g. deaf, dementia or psychiatric illness). It is tempting to continue and find a replacement subject for those not examined. However, because people with poor vision are more likely to be at home, compared with people with good vision, using replacements may lead to over-sampling of people with impaired vision and an over-estimation of visual impairment in the survey area. To avoid such a bias, absenteeism and refusals of eligible subject must be kept to a minimum and definitely be less than 10%. Good publicity and strict adherence to the timetable are essential to achieve good response rates. If someone is away, you should return at least twice during the day to try to find and examine him or her. You should also make an effort to persuade refusers to be examined. If the person is not available for examination despite repeat visit(s), try to get the correct estimate of age by interviewing a close relative or a neighbour.

2.7 Selection of survey teams

Ideally, three to five teams should be formed for the fieldwork.
Each team should at least consist of:

- 1 person to undertake eye examinations and to diagnose the cause of visual impairment. This is usually an ophthalmologist, although a resident in ophthalmology or experienced ophthalmic clinical officer may be appropriate.
- 1 person to undertake visual acuity examinations. This is often an ophthalmic assistant, ophthalmic nurse or optometrist.
- For each cluster, 1 local health worker or community worker (or village elder), who knows the people in the population unit.
- 1 driver

In addition there should be a cluster informer who is responsible for informing each selected population unit (e.g. village leaders or health centres) of the survey and to collect or ask for maps of the area for compact segment sampling.

There should be sufficient staff to form three to five teams, without disabling regular ophthalmic services during the period of fieldwork. If sufficient examiners cannot be made available, consider carefully whether a RAAB should be conducted at all at this time. Alternatively, additional staff may be mobilised from elsewhere for this exercise. It is important to select motivated, dedicated and reliable staff for the survey teams.
Each field day the survey team will be accompanied by a local health worker or community worker. He or she will introduce the survey team to the community. During the fieldwork, they can move slightly ahead of the investigating team to explain the purpose of the survey and to prepare the elderly persons for examination. They can mark those houses where one or more eligible people live with a chalk or a sticker on the door. This will save the examiners a lot of time. The local health worker can also provide treatment for minor ailments as and when encountered. This may help strengthen the position of the local worker.
The fieldwork can be conducted as a project with fully committed staff. If fieldwork has to be combined with regular clinical work, it may be better to spread it out over a longer period. Each team can then go out 1 to 3 days in a week. Alternatively, if they have to visit a number of population units far away from their basis, they may stay away for a week and camp in the region. Field work can be tiring and regular breaks have to be provided. If a team has to conduct fieldwork for too long on a stretch they may loose interest and the quality of their examinations will go down.

2.8 Training of field staff

All field staff must be thoroughly trained so that they uniformly follow the same procedure to identify eligible subjects, to assess visual acuity and examine the lens, and to record the data. The inter-observer variability must be minimised and this has to be checked during the training. Each team should be given standardised instructions on definitions, method of selection of the subjects, examination protocol, method to obtain and record the data, etc. A set of 'Instructions for Examiners' is provided on page 29. This procedure has been thoroughly tested and to retain comparability it is advisable not to modify the instructions. All team leaders have to ensure that the instructions are followed carefully.

Before the actual training starts, the following arrangements should be made:

- list of enumeration areas and their population for the entire survey area. These are usually available from the National Census Office.
- table with total population of survey area, subdivided by 5–years age groups and by sex.
- electronic or paper maps. In case paper maps have to be purchased it is better to wait until the list of selected population units is known.
- a room large enough to accommodate all participants and to conduct vision testing (6 metres).
- a computer and an LCD projector.
- survey equipment.
- a copy of the survey form, guidelines for examiners and coding instructions for each of the participants. The survey form is available in English, French and Spanish. The RAAB manual is at present available in English and Spanish. These documents can be translated, if required.

A standard training programme is shown below. The sequence may vary slightly, depending upon the local situation. When translation is needed a duration of 5 days is recommended.

Day 1: survey design and planning, selection of clusters

Participants: organisers, survey coordinator, data entry clerks, team leaders of survey teams

Morning

- background and principles of RAAB
- quick overview of survey methodology
- principles of the software package

Afternoon

- proposal of sample design
- selection of clusters
- selection of cluster for field practice (inform local leaders)
- planning for inter-observer variation assessment

Day 2: training of field staff

Participants: survey coordinator, data entry clerks, all members of survey teams

Morning

- how to complete the survey form
- protocol for examination of subjects
- exercise: visual acuity screening and examination

Afternoon

- how to conduct the survey in the villages
- preparations for inter-observer variation assessment
- installation of RAAB software and training of data entry clerk
- instructions on the use of the RAAB software (data entry clerk)

Day 3: training of field staff, inter-observer variation

Participants: survey coordinator, data entry clerks, all members of survey teams

Morning

- inter-observer variation assessment
- data entry of inter-observer variation records

Afternoon

- analysis of results
- discussion of findings with all the teams
- how to conduct the survey in the villages
- informed consent

Day 4: field practice

Participants: survey coordinator, all members of survey teams

Morning

- practical exercise in one of the selected population units. If all goes well then this becomes the first completed cluster.

Afternoon

- after field exercise the entire group meets again for 1-2 hours to discuss experiences from the survey work
- data entry of survey records (data entry clerks)
- create consistency report
- practical exercise on use of RAAB software (consistency checks, creation of reports)

When the training has to be conducted in another language and translation during the training is required, the training period should be extended with another day.

2.9 Standardise ophthalmic examination and calculate the inter-observer variation

Setting up an inter-observer variation study

Before undertaking the RAAB survey, it is important to know whether all examiners agree on the assessment of visual acuity, pinhole vision, lens status and cause of visual impairment. To measure this, the findings of each examiner are compared with the findings of the most experienced examiner, the so-called 'Gold Standard'. It is assumed that the findings of the Gold Standard are the correct findings. The RAAB package has a module to calculate the inter-observer agreement (IOV), which is expressed in the Kappa coefficient (see page 16 for more details). It is advisable to assess the inter-observer variation of each team as it will operate during the fieldwork. Any team scoring a Kappa of less than 0.60 should be retrained before it is allowed to participate in the fieldwork.

Each team, including a 'Gold standard' examiner (the most experienced ophthalmologist), should participate in the reliability study.
The procedure is as follows:

1. The senior examiner should select a group of 40-50 people, all aged 50 years and above. These could be patients from the outpatient department and their companions, or in-patients from other departments. The group should include at least 20 people with impaired vision and cataract or (pseudo)aphakia. Each person in this group should be given an identification number, beginning with 01, which must be shown to all examiners. The number can be written on a piece of paper and the patient must show this to each examiner. When the team has completed the examination of this patient, they should write their team number on this piece of paper.

The findings on nine examinations will be compared:

- assessment of visual acuity in each eye;
- assessment of visual acuity with pinhole in each eye;
- examination of the lens in each eye;
- assessment of the main cause of VA<6/18 in each eye and in person

2. Each team should have enough **Inter-Observer Variation Test forms** (see Figure 2) for all subjects. An example of this form is shown below. The team number should be entered at the top of each form, together with the number the patient is carrying. One form should be used for each person examined by each examiner. This format is exactly the same as the examination part of the RAAB survey form.

   The IOV format is available on the installation CD in English, French and Spanish, with the VA measurement system commonly used in these countries. It may be necessary to translate the labels of this format into other languages.

Figure 2. Format for Inter-Observer Variation Test

ASSESSMENT OF INTER-OBSERVER VARIATION - RAAB

Examiner _____ **Patient ID** ☐☐

B. VISION

Using distance glasses: **No:** O (1) **Yes:** O (2)
Using reading glasses: **No:** O (1) **Yes:** O (2)

Presenting vision	Right eye	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)

Pinhole vision	Right eye	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)

C. LENS EXAMINATION

	Right eye	Left eye
Normal lens / minimal lens opacity:	O (1)	O (1)
Obvious lens opacity:	O (2)	O (2)
Lens absent (aphakia):	O (3)	O (3)
Pseudophakia without PCO:	O (4)	O (4)
Pseudophakia with PCO:	O (5)	O (5)
No view of lens:	O (6)	O (6)

D. MAIN CAUSE OF PRESENTING VA<6/18
(Mark only one cause for each eye)

	Right eye	Left eye	Principal cause in person
Refractive error:	O (1)	O (1)	O (1)
Aphakia, uncorrected:	O (2)	O (2)	O (2)
Cataract, untreated	O (3)	O (3)	O (3)
Surgical complications:	O (4)	O (4)	O (4)
Trachoma corneal opacity:	O (5)	O (5)	O (5)
Other corneal opacity:	O (6)	O (6)	O (6)
Phthisis:	O (7)	O (7)	O (7)
Onchocerciasis:	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)
Other posterior segment:	O (12)	O (12)	O (12)
All globe/CNS abnormalities:	O (13)	O (13)	O (13)
Not examined (can see 6/18)	O (14)	O (14)	O (14)

3. Each person is examined by each team, in turn. Each team fills in a form with the number of the team and the individual's number, 01, and then proceeds to the visual acuity assessment, pinhole examination, lens examination and the assessment of the main cause of a presenting vision <6/18. The person then moves on to the next team. There need not be a consistent order in which the people are examined by each team. There should be two supervisors ensuring that there is a smooth flow of people between the teams and to check that each patient is seen by all teams. The teams should not share their findings with the other examiners. The examiners should write their team number on the numbered paper of the person to mark that their team has completed the examination.
   At the end of this exercise, each team will have a pile of forms, equal to the number of persons examined. Each team has to check all forms for completeness and whether all patients have been seen by all examiners.

4. All forms are then entered into the RAAB software package by the data entry clerk. Details of opening a new data file and entry of IOV data are given in Chapter 4.8.2.

5. When all IOV records have been entered the data file has to be 'cleaned' first. The first step is to check whether each person in the IOV assessment has been seen by each team. The second step is to check the IOV data file for empty fields or invalid entries. (see Chapter 4.8.2) The inter-observer variation should only be calculated after the data file has been cleaned.

   It is good practice to compare the findings of the different teams. This can be done by asking one team at a time to read out their findings of a number of patients so that the others can make comments. No changes should be made to the forms during these discussions. This exercise will make the teams more aware of the importance of a good examination and accurate data recording. To make this review easy, all records in the IOV data file can be shown as an Excel file, sorted on patient ID and examiner. Click on 'Utilities | Review IOV data file' and this Excel file will appear.

Calculation of inter-observer variation
Go to the main menu, click on 'Reports' and click on 'Calculate inter-observer variation'. A small screen opens where you have to select the most experienced examiner ('Gold Standard'). The report will automatically compare the findings of the 'Gold Standard' will all other examiners and produce a report with the Kappa coefficient for all indicators of the eye examination.

What do the results mean?
For the purpose of this survey, the Kappa coefficient is the most appropriate measure of agreement. A Kappa of 1.00 indicates perfect agreement between examiners; A Kappa of 0 indicates no agreement other than what can be attributed to chance, and a negative value indicates less than chance agreement. The following guidelines for the Kappa value can be used:

0.81 - 1.00	very good agreement
0.61 - 0.80	good agreement
0.41 - 0.60	moderate
0.21 - 0.40	fair
0.20 or less	poor agreement

Only examiners that have an agreement higher than 0.60 should be allowed to conduct eye examinations in the survey. If their agreement is less, they should be replaced by examiners with a good agreement, or undergo additional training until their Kappa coefficient is higher than 0.60.

2.10 Training tools and survey equipment

All equipment used during the survey work should be available during the training sessions and for the IOV assessment. In addition, the survey records, Coding Instructions and Instructions for Examiners should be available, if necessary translated into the local language.
The survey records are provided on the RAAB CD-ROM in English, French and Spanish. For each language the user can also choose between the Snellen 6 metres, Snellen 10 feet, decimal and LogMar visual acuity measuring system. The Coding Instructions and Instructions for Examiners are at present available in English and in Spanish.

The following equipment and supplies are required for each team conducting fieldwork:
- Forms
  - Timetable listing all population units and the dates they will be visited by which team.
  - Maps of the entire survey area with all selected population units marked. If available, maps with roads and geographical details of each population unit should be provided.

- Set of RAAB Survey Records. Staple exactly as many forms as the total number of persons 50+ to be examined per cluster together to form one bundle for each cluster. Put a blank sheet of paper on top, on which you write the name of the survey area, the number and the name of the population area, the date of examination and the name and signature of the team leader (see example). In this way forms are less likely to be lost.
- One set of Coding Instructions and a set of Instructions for Examiners.
- Referral slips for hospital.
- Map of population unit to be divided in segments.
- Referral slips and basic medicines to treat common minor ailments.

- Equipment
  - A pencil + eraser + sharpener for each team member;
  - Clipboard to keep the Survey Records and to facilitate data recording.
  - Simplified vision-testing card. The card can be made from strong white cardboard, of a size of 15 x 15 cm (6 x 6 inch). On one side it should have one optotype 'E' of size 60, on the other side one optotype conform to size 18. Alternatively, the optotype 'E' could be replaced by optotype 'C' of similar sizes. Each team should have at least 3 cards in case any is lost or damaged (Figure 3);
  - One tape or rope of 6 metres (20 feet) with a knot or ring in the middle at 3 metres (10 feet);
  - Torch with focussed light and spare batteries;
  - Direct ophthalmoscope with spare batteries;
  - Occluder with pinhole, preferably with multiple holes (Figure 4);
  - Shoulder bag to carry all materials;
  - Identity card;
  - Portable slit lamp with short-acting mydriatic (optional);
  - Binocular head loupe (2-3x magnification) (optional).

The Survey Coordinator has to ensure that each survey team has a full set of the equipment at the time of training and practical exercises.

Figure 3. Simplified vision-testing card

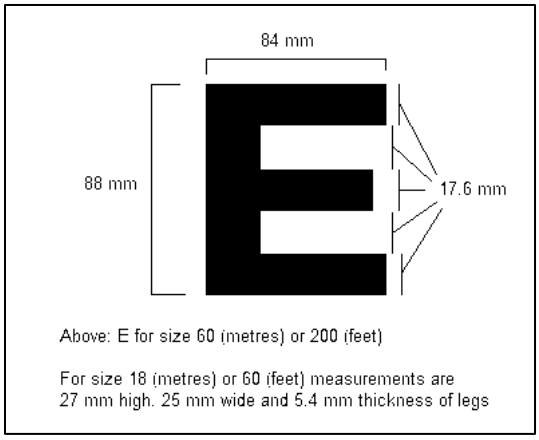


Figure 4. Occluder with pinhole

The following training materials are provided on the RAAB CD:
- the manual (English and Spanish version only)
- a training slide set specially prepared for a trainer to teach all aspects of the RAAB
- accompanying text for each slide of the training slide set
- a slide set on the RAAB survey form, to be used together with the Coding Instructions

2.11 Arrangement of logistics

A detailed timetable with which team will visit which population area on a particular date has to be made. This timetable has to be shared in time with the local authorities of the population unit that will be examined. Ideally a population unit should be informed 3-5 days ahead of the visit by the 'cluster informer' The cluster informer should inform the local leaders about the purpose of the survey, that they will only be examining 50 people aged 50 years and older and that examinations will take place in the household. The village leaders should be requested to inform the population.

If maps have been arranged centrally the cluster informer should ask the local leaders about the distribution of the population on this map. If the cluster informer was not given a map by the survey coordinator, he should ask village leaders if a map of the village is available. If not they should work with members of the village to produce a sketch map of the village showing major landmarks and the approximate distribution of neighbourhoods and households. This should be ready in time for the survey team visit.

The cluster informer also has to make arrangements with a local health worker or community worker to participate in the fieldwork.

A second option is to train the cluster informer in the principles of the compact sampling method. He can then divide the population unit in equal segments of adequate size and select one segment at random to sample the cluster from and an extra one as back-up. The advantage is that he can advise all residents of 50 years and older in these two segments to stay at home on the day the survey team comes. In case of a small population unit, when there will not be enough eligible people to complete the cluster, the cluster informer has to determine in which population unit the survey team should continue their examinations. This has to be the next nearest population unit. He should inform the authorities in this population unit as well and, if necessary, select a segment where the survey team should go.

In rural areas, people are usually not far away from home. In urban population areas people are usually away for work on weekdays and it may be advisable to do the examinations on Saturdays, Sundays or public holidays.

Good publicity is very important to get a good coverage. If the publicity is poor, many eligible persons may not be around during the survey work. That means they have to be visited again at a later time, which takes a lot of extra time and may not always be possible. If too many people are absent, the accuracy and reliability of the results are seriously affected.

The schedule has to be arranged in such a way that transport facilities are utilised optimally. In remote areas, the survey teams may have to spent the night in the field and continue to the next population area the following day. They should lose as little time as possible on travelling. It is very important to follow the schedule and not to change dates frequently. Do not cancel a visit on the last moment. People may be very disappointed and may not be cooperative anymore.

Despite all attempts to make RAAB as simple and as quick as possible, the time and efforts required to complete a RAAB should not be under-estimated. In most cases, the sample size will lie between 2500 to 5000 people of 50 years and older, consisting of 50-100 clusters of size 50. One cluster can be completed within one working day. That means 50-100 working days for the fieldwork with one team, 25-50 with two teams or 13-25 with four teams. Extra days have to be added for travelling to and from remote clusters.

2.12 Budget

The RAAB methodology makes optimal use of local available ophthalmic manpower and resources to keep the costs down. Only the trainer may come from elsewhere. By focussing on people aged 50 years and older the sample size remains low. Data cleaning, data analysis and creation of reports has been built into the software and requires no external expertise.

The costs of a RAAB are normally between US$ 20,000 and 30,000. The costs can be divided into the following categories:

1. preparations and coordination, e.g. staff, survey equipment, printing of forms, computer, etc.
2. training: costs of external trainer, e.g. honorarium, travel, accommodation, etc.
3. training: costs for local staff, e.g. travel, boarding and lodging, allowances, training venue, etc.
4. fieldwork, e.g. allowances, transport, fuel.
5. data analysis and report writing.

On the RAAB installation CD a special Excel spreadsheet is provided to help with calculating the expenditure.

2.13 Common mistakes

- underestimating the work

Although RAAB is a 'rapid assessment' it still requires a lot of hard work. People participating in this work have to be relieved from other duties for the duration of the fieldwork. Do not start a RAAB if you do not have enough human resources.

- no reliable census data (or an alternative sampling frame) available

Make sure good census data are available before you start planning a RAAB. Without reliable census data it becomes difficult to set up a good sampling frame. Without a good sampling frame clusters cannot be selected at random and with a probability proportionate to size. This means that the enumerated population may not represent the target population. Also, without good population data the age and sex adjusted prevalence cannot be calculated.

- poor publicity

When publicity is poor, many eligible people will be absent. That reduces the sample size and thereby the accuracy of the estimate. It also causes additional work for the survey teams, because they have to revisit the same house again later on the day, or even return on a different day.

- no spare equipment provided

When equipment brakes down and there is no spare available a whole day's work may be lost. Make sure each team always has a spare ophthalmoscope and spare batteries.

- survey procedures change

Initially, examination procedures are usually followed well, but after some time other routines may come in, like examination of the lens in broad daylight, rather than inside the house in semi-dark condition. When slit lamp examination is included, it is more frequently used in the initial cluster than in the later ones. Examination procedures should be conducted according to the standards, and be the same for all subjects, otherwise the findings are no longer comparable.

Chapter 3

EXECUTION OF FIELD WORK

3.1 Examination protocol and coding instructions for survey record

A copy of the RAAB Survey Record is given in Annex 2. Electronic copies of the survey record for the different visual acuity measurement systems (See Table 2) in English, French and Spanish are also available from the RAAB installation CD-ROM. If required, the form can be translated in any other local language. If the form is translated, ensure that only the text labels are translated literally. The RAAB Survey Record is a modification from the format used for the Rapid Assessments for Cataract Surgical Services (RACSS-WHO/PBL/01.84), which was developed for the Prevention of Blindness and Deafness Unit of the WHO.

Do not change the sequence of the options or the numbers in brackets behind each option, as this will make all the programmed analysis of the software invalid.

The purpose of the RAAB Survey Record is to collect essential information that will provide estimates of the following indicators:

- prevalence of blindness, severe visual impairment and visual impairment;
- prevalence of blindness, severe visual impairment and visual impairment from avoidable causes;
- prevalence of blindness, severe visual impairment and visual impairment from cataract
- main causes of blindness, severe visual impairment and visual impairment;
- prevalence of aphakia and/or pseudophakia;
- cataract surgical coverage;
- visual outcome of cataract surgery;
- barriers to cataract surgery;
- uncorrected refractive errors and uncorrected presbyopia;
- cataract surgery service indicators (age at time of surgery, place, costs and type of surgery, cause of visual impairment after cataract surgery).

All indicators are subdivided by sex and in many cases also by age group. The indicators thus obtained can be used as baseline information for the formulation of eye care programmes and for regular monitoring of ongoing cataract intervention programmes.

The RAAB Survey Record contains seven different sections:

A General Information
B Vision – presenting vision and pinhole vision
C Lens Examination
D Principle cause of presenting vision < 6/18
E History, if not examined
F Why cataract operation was not done
G Details about cataract operation

The RAAB Survey Record focuses on the avoidable causes of blindness in people of 50 years and older. Cataract is a major curable cause of visual impairment and gets much emphasis. Posterior segment eye disease (e.g. glaucoma, ARMD and diabetic retinopathy) is usually more difficult to diagnose with the limited diagnostic facilities used in this rapid assessment.

The RAAB Survey Record has been designed for use by ophthalmologists, residents in ophthalmology and experienced paramedical ophthalmic staff. The examinations for all sections, except Section D (cause of VA<6/18), can be completed by auxiliary personnel, such as nurses or ophthalmic assistants, adequately trained for this purpose. Examinations for section D must be

completed by the ophthalmologist or ophthalmic clinical officer. It is important that the examinations are conducted following the same procedures and by using the same equipment for all persons. When experienced staff and portable slit lamps are available, a detailed lens examination with portable slit lamp and mydriasis is recommended for all eyes with a presenting VA less than 6/18, not improving with pinhole.

Coding instructions should be provided to all field staff participating in the survey before starting data collection and will serve as a permanent reference throughout the survey. Standard slides or photographic materials are recommended for training purposes to illustrate the definitions provided in these instructions and to facilitate standardisation of findings to be recorded on the forms.

Instructions for completing forms

Boxes need to be filled with a number, circles have to be tick marked or made black and on lines, a text has to be written. Always use a pencil to fill the records and write clearly. It is important that the form is clearly marked so that the data entry person does not get confused. If an error is made, use an eraser to remove the wrong entry.

Section A: general information

The selection of clusters is discussed on page 11. For each eligible person, a RAAB Survey Record has to be completed, whether the person is examined, is absent, refused examination or was unable to communicate.

Section A - General Information	
Item	**Instructions**
Year	Enter year of examination. Also write this on the cover page.
Month	Enter month of examination. Also write this on the cover page.
Survey area	A defined geographical or administrative area, such as a district, a group of districts, a province, or an entire country, from where the clusters are selected. Write the name and a two-digit ID code number.
Survey area code	Write a one or two-digit code number. In the case of stratified sampling, use a different area code for each stratum.
Cluster No.	Write the number of the cluster as it appears in the list of the sample design. Write name and number of the cluster area also on the cover page.
Individual No.	Sequential number of eligible persons in a cluster.
Name	Person name, to be written in local language, as appropriate. This item will not be included in the data processing, but may be useful to trace people for follow up (if needed).
Sex	Mark the appropriate circle: male (1) or female (2).
Age	Record age in years; estimated, if no official certificate available. For ages of 50 to 98, use the age in years; for ages of 99 or higher, write 99. The software will not accept any age below 50.
Optional 1 and 2	These fields may be used for collection of additional information, such as ethnic group, occupation, literacy, insurance cover, etc. Survey staff should be provided with appropriate codes for these items. There is no automatic analysis for these two fields. When these options are used the original data file can be sub-divided on the basis of the optional codes and each of the new files can be analysed independently to compare results.

Examination Status	Mark • 'Examined' (1) when a subject can be examined. • 'Absent' (2) if a resident is not present during the survey period, even after repeated visits. • 'Refused' (3) when a resident refuses to be examined. • 'Unable to communicate' (4) when a resident is profoundly deaf, has dementia or psychiatric illness and is not able to complete the test.
Always ask: "Did you ever have any problems with your eyes?"	Mark • Yes: O (1) • No: O (2)

Section B: vision

In section B fill in the presenting and pinhole visual acuity for each eye separately.

Equipment needed: simplified 'E' chart, pinhole occluder and rope to measure distance

Method: VA is tested using the simplified tumbling `E' chart with available correction. Visual acuity is measured with a chart with an 'E' optotype of size 18 of the Snellen chart on one side and an 'E' optotype of size 60 on the other side at 6 or 3 metres distance with available correction. This is best done in full daylight, in the courtyard or on the street. Distance is measured with a special tape of 6-metre length, with a ring/knot at both ends and one in the middle (3 meters). The examiner puts one ring around a finger and keeps that hand against the chest; the examinee does the same with the ring at the other end of the tape. First the right eye is examined, while the left eye is covered with the palm of a hand or an occluder, either by the examinee, or by a helper. The examinee should stand in the shade or with his or her back to the sun, while the E chart is kept up in clear daylight. Vision is tested separately for each eye. If a patient usually wears distance glasses, these should be worn during visual acuity measurement.

First the 'E' chart is shown from nearby, the procedure is explained and the examinee is instructed to point in the direction of the open ends of the 'E'. Then the 'E' optotype of size 6/60 is shown first at a distance of 6 metres. It is advisable to start with the larger E to test if the patient understands the procedure. If they can see the E size 60 at 6 metres (6/60), change to the E size 18 at 6 metres distance (6/18). If they cannot see the E size 60 at 6 metres, change to size 60 at 3 metres (3/60). If the 'E' of size 60 cannot be seen at 1 metre distance, check with a torch in semi-dark condition (inside the house) whether the person has perception of light (PL+) or not (PL-).

The optotype is rotated before each reading to change the direction of the open ends. This rotation should be in varying directions to avoid memorising. The criteria for vision at a certain level are 4 correct consecutive showings, or 4 correct out of 5 showings.

An eye with a presenting VA better than 6/18 does not need to be examined with pinhole - just mark code 1 for pinhole vision. Any eye with a presenting VA less than 6/18 has to be examined for acuity with a pinhole as well. Mark the VA obtained with the pinhole. If the person wears spectacles, place the pinhole in front of the spectacles. In some cases, the available correction is not the optimal correction. Vision with pinhole correction cannot be worse than presenting vision.

The classification of visual impairment used in this package is in accordance with the International Classification of Diseases (ICD-10), 1992 (see also Table 1):

- Visual acuity of 6/18 or better is considered as normal vision
- 'Moderate Visual impairment' refers to visual acuity less than 6/18 but at least 6/60.
- 'Severe visual impairment' refers to visual acuity less than 6/60 but at least 3/60.
- 'Blind' refers to visual acuity less than 3/60.

Section B. Vision	
Item	**Instructions**
Distance glasses / reading glasses	Mark the appropriate circle for distance and for reading glasses separately. When using bifocal or multifocal glasses both options should be marked as 'Yes'. During vision testing distance glasses should be used.
Presenting vision in right and left eye	Mark the appropriate circle for each eye. Only one entry is allowed.
Pinhole vision in right and left eye	If presenting vision is 6/18 or better, then pinhole vision is the same. All eyes with VA<6/18 should be also tested with pinhole. If vision was tested with distance glasses, these should be used here as well. Place the pinhole in front of the patient's glasses.

A sample of the simplified optotypes (Snellen E) is shown in Figure 3. There is also a sample in electronic format on the CD-ROM, which can be printed. Set the paper size on your printer to A4 to get the right measurements. Check the measurements with a ruler before using the chart.

Section C: lens examination
a) Standard lens examination
In Section C, only one circle must be marked for each eye. If the lens in both eyes is normal, the circle left of code (1) of each eye must be marked.

Equipment needed: direct ophthalmoscope and torch

Method : The examinee is taken inside the house, where you find or create a shaded or dark area. There, the lens status is assessed by torch and by distant direct ophthalmoscopy at 20-30 cm distance in semi-dark condition, without dilatation of the pupil. Examine the lens in each eye and mark your observations in Section C: normal lens or minimal lens opacity; obvious lens opacity present, lens absent (aphakia), IOL implanted without posterior capsule opacification or IOL implanted and posterior capsule opacification present. If you cannot see the lens because of corneal scarring, Phthisis bulbi or other causes, mark 'No view of lens'.

Section C. Lens Examination	
Item	**Instructions**
Normal lens, minimal lens opacity	Crystal clear lens or minimal lens opacity, unlikely to cause reduction of visual acuity. Clear or minimal dark shading of the red reflex.
Obvious lens opacity	A pupil that clearly appears grey or white when examined with oblique light in a shaded or darkened area. With distant direct ophthalmoscopy an obvious dark shading of the red reflex is visible. Note: This item refers to a major opacification of the lens, leading to low vision or blindness. Section F has to be filled in when there is an obvious lens opacity and a pinhole VA <6/18 in one or both eyes.
Lens absent (aphakia)	Absence of lens from the central pupil. May be judged to be present when there is a reliable history of cataract extraction and/or if other evidence of absence of the lens from the central pupillary area, such as iris tremulousness. A completely dislocated lens, as occurs with couching or trauma, should also be recorded as aphakia.

Item	Instructions
Pseudophakia without PCO	As aphakia, but with Intra-Ocular Lens (IOL) inserted. No Posterior Capsule Opacification (PCO) to be seen with the unaided eye.
Pseudophakia with PCO	As aphakia, but with Intra-Ocular Lens (IOL) inserted. Obvious Posterior Capsule Opacification (PCO) to be seen with the unaided eye.
No view of lens	Mark if the lens cannot be seen because of dense corneal opacity, Phthisis, or for other reasons.

b) Detailed lens examination

This manual provides a simplified procedure with minimal equipment for the examination of eyes, particularly for the presence or absence of cataract. Whenever/wherever trained manpower and additional equipment can be made available, an additional as well as a detailed examination could be carried out. This is particularly important in detecting PCO and diseases of the retina and the optical nerve.

Equipment needed: hand-held slit lamp and short acting mydriatic

Method: When the examined eye does not improve to 6/18 or better with pinhole examination, the pupil is dilated with a short-acting mydriatic (tropicamide 0.5%) eye drop. Two drops five minutes apart should be applied. In the following conditions, the pupil should not be dilated:

- Very shallow anterior chamber, where an angle-closure glaucoma attack could be precipitated.
- Presence of obvious white cataract where the fundus would not be visible even after dilatation.
- Presence of large corneal opacity, or occlusio pupillae.

Once dilated, the lens (intraocular lens if present), the posterior capsule and the anterior vitreous are examined with the slit lamp in a semi-dark room. The record form is filled in as follows:

Section C - Detailed Lens Examination	
Item	**Instructions**
Normal lens, minimal lens opacity	Crystal clear lens or minimal lens opacity, unlikely to cause reduction of visual acuity.
Obvious lens opacity	Lens with cortical/nuclear/posterior subcapsular opacity (opacities). When not fully opaque during distant direct ophthalmoscopy, a faint red glow is present.
Lens absent (aphakia)	Lens not present in the pupillary area. A dislocated or couched lens should also be recorded as aphakia.
Pseudophakia without PCO	Presence of intraocular lens, but no opacification of posterior capsule, which could lead to visual impairment.
Pseudophakia with PCO	Presence of intraocular lens with significant PCO, which has led to visual impairment or blindness.
No view of lens	Lens not visible because of dense corneal opacity, occlusio pupillae or any other reason.

Section D: main and principal cause of presenting vision less than 6/18
This section is completed for all eyes with a PVA<6/18. The abnormality causing low vision or blindness should be marked. Examination with illuminated loupe as well as direct ophthalmoscope is recommended; this should be consistently used or consistently not used throughout the survey. This also applies when a handheld slit lamp and mydriasis is used.

The completion of this section can be divided into two activities: (1) for each eye, assess and mark one principal disorder that is responsible for visual loss in that eye; (2) mark one principal disorder responsible for or contributing to visual loss in the person. If the VA was 6/18 or better in the eye then mark 'not examined – can see 6/18' (code 14).

Mark the principal disorder responsible for visual loss in each eye as well as in the individual (better eye) after considering disorders in either eye, which are most amenable to treatment or prevention. When there are two disorders, one of which is secondary to the other, the primary is to be selected as the principal disorder. For example, if the patient has cataract secondary to glaucoma, glaucoma is the principal disorder. When there are co-existing primary disorders in the same or different eyes, mark as the principal disorder that which is most readily curable or, if not curable, that which is most easily preventable. The following is a recommended ranking of the disorders with respect to these criteria:

1. Refractive error
2. Aphakia, uncorrected
3. Cataract, untreated
4. Cataract surgical complications
5. Preventable corneal opacities and phthisis
6. (Primary) glaucoma
7. Other posterior segment disorders.

The ranking may be modified to suit particular local circumstances. If this is done, the same modification should be applied consistently throughout the survey by all examiners involved, as well as in all other surveys in the same country. Once the disorders and underlying causes have been marked for each eye, an assessment is made of the principal cause of low vision in the person.

Equipment needed: direct ophthalmoscope and handheld slit lamp (optional)

***Method*:** When the examined eye does not improve to 6/18 or better with pinhole examination, the eye is examined in detail by the ophthalmologist, in a shaded or dark area, using a direct ophthalmoscope or handheld slit lamp.

Section D - Principal Cause of Vision <6/18 with available correction	
Item	**Instructions**
Refractive error	Phakic eyes with VA< 6/18, improving with pinhole or optical correction to 6/18 or better.
Aphakia, uncorrected	Aphakia (absence of lens from the central pupil), improving with correction or pinhole to 6/60 or better. For aphakia where VA does not improve with proper correction, other causes of visual loss should be determined and recorded appropriately, while uncorrected aphakia should not be marked. If there is clear evidence that a surgical procedure has led to a blinding condition, e.g. secondary glaucoma, then 'surgical complication' should be marked as an underlying cause.

Item	Instructions
Cataract, untreated	Obvious lens opacity, obscuring a clear red reflex, which is likely to affect vision. Do not mark this option in cases of minor opacities, unlikely to affect vision.
Surgical complications	If there is evidence that a surgical procedure has led to a blinding condition, e.g., secondary glaucoma, then this box should be marked. Uncorrected aphakia must be recorded as above.
Trachoma corneal opacity	Central corneal scarring in the presence of at least one of the following signs of trachoma: • trichiasis / entropion; • conjunctival scarring; • pannus, or; • Herbert's pits.
Other corneal opacity	Leucoma, staphyloma, or other easily visible corneal opacity present over the pupil (no signs of trachoma).
Phthisis	Small shrunken globe due to trauma or severe infection.
Onchocerciasis	In the presence of dermatological signs of onchocerciasis there is either: • sclerosing keratitis; • chronic iridocyclitis; • chorioretinal atrophy; or, • optic atrophy.
Glaucoma	Mark if any of the following suggested criteria apply: • the eye is stone hard on digital palpation; • an afferent pupil defect and corneal oedema; • the vertical cup-disk ratio is 0.8 or greater. This is <u>not</u> a complete diagnosis for glaucoma, but only used for the purpose of this survey, since tonometry and testing of visual fields is not practical under field conditions and glaucoma is not the focus of this survey.
Diabetic retinopathy	This diagnosis applies only for persons with confirmed diabetes. The retina shows either: • proliferative retinopathy (growth of new blood vessels with or without haemorrhages), or; • diabetic macular oedema (extensive swelling of the central retina).
Age-Related Macular Degeneration (ARMD)	ARMD refers to obvious or severe pigment disturbances at the macula from what is considered 'normal' in the absence of other known causes. Check if any of the following suggested criteria apply: • the pigment epithelium is disturbed by atrophy, or proliferation (mottling); • drusen (yellow colloid-like dots); • swelling or oedema of the central retina; • circinate exudates; • Haemorrhage; • Macula hole.

Item	Instructions
Other posterior segment disorder:	If the VA<6/18 cannot be attributed to any of the above mentioned causes, but a specific cause can be identified then use this diagnosis.
Globe or CNS abnormality	Microphthalmos, anophthalmos, enucleated eye, amblyopia.
Not examined (can see 6/18)	Mark if the patient has vision of 6/18 or better in this eye and there was no indication to examine.

Once the disorders and underlying causes have been marked for each eye, an assessment is made of the principal cause of low vision in the person.

Section E: history, if not examined

Whenever an eligible person in the cluster is found absent, refuses to be examined, even after repeated visits or is unable to communicate (profound deaf, dementia or psychiatric disease) (status=2, status=3 or status=4), section E has to be completed. This may seem extra work and it is tempting to continue and find a replacement subject. However, because people with poor vision are more likely to be at home, compared with people with good vision, using replacements may lead to over-sampling of people with impaired vision and an over-estimation of visual impairment in the survey area. To avoid such a bias, absenteeism and refusals of eligible subject must be kept to a minimum and definitely be less than 10%. Good publicity and strict adherence to the timetable are essential to a good attendance and compliance.

Section E - History, if not examined	
Item	**Instructions**
Believed not blind	Vision in either eye allows subject to move around freely and to participate in social life.
Believed blind due to cataract	Visual impairment limits social interaction. Use the local name for cataract to assess whether blindness is attributed to cataract.
Believed blind due to other causes	Visual impairment limits social interaction. Blindness is not attributed to cataract (use local name).
Believed operated for cataract	Visual impairment inhibited social interaction in the past. Subject was operated, reportedly for cataract.

Section F: why cataract operation has not been done

Section F of the RAAB Survey Record shows a list of the most common barriers to cataract surgery. This section is only filled in for people who have an obvious lens opacity and visual impairment or blindness (VA<6/18 in one or both eyes with pinhole).

Not all patients who are blind due to cataract will present themselves for operation. Many patients are not operated for a variety of reasons. These can be poor accessibility, costs, fear of operation, etc. Knowing these barriers makes it possible to address them effectively and thereby increase the utilisation of cataract surgical services.

Study this list carefully before you start the fieldwork. Ask people with obvious lens opacity and visual impairment or blindness (VA<6/18 in one or both eyes with pinhole) the standard question: “Why have you not been operated for cataract?” Match the answer of the patient with the barriers

mentioned in the list and the answer closest to the patient's answer should be marked. Mark at least one and a maximum of two barriers.

Section F – Why cataract operation was not done	
Code	**Barrier**
1	Need not felt
2	Fear for surgery or poor result
3	Cannot afford operation
4	Treatment denied by provider
5	Unaware that treatment is possible
6	No access to treatment
7	Local reason (optional)

Section G: details about cataract operation
This section is only filled in for people who have undergone cataract surgery.

Ask operated patients about their age at the time of cataract surgery. Ask them where the operation was conducted: in a government, charitable or private hospital, in an 'eye camp' (surgery performed by qualified ophthalmic staff in an improvised operation theatre) or in a 'traditional setting' (surgery performed at home or in the premises of a traditional healer or 'coucher').

Mark 'Non IOL' if the patient did not get an IOL implanted at the time of surgery. Mark 'IOL implant' for PC-IOL and for AC-IOL, also when these IOL's are dislocated. Mark 'Couching' if there is evidence of dislocation of the lens and iris tremulousness, or if couching is ascertained during interview. Ask operated patients whether they paid anything for the cost of surgery, whether the operation was free, partially free or paid. Costs on transportation, food or accommodation should not be counted.

If the VA is less than 6/18 after cataract surgery, try to assess the cause of this result. If the patient did not regain full sight after an uncomplicated surgery because another eye disorder in the same eye caused loss of vision as well, then mark 'Ocular comorbidity (Selection)'. If the borderline or poor outcome is due to complications during cataract surgery, mark 'Operative complications'. If the vision after cataract surgery can be improved with pinhole, then mark 'Refractive error'. Uncorrected aphakia should also be marked as refractive error for this question. Finally, in case of initial good outcome and subsequent vision loss due to post-operative capsule opacification or retinal detachment, mark 'Long term complications'.
If the VA is 6/18 or better, or if the loss of vision after surgery is caused by another condition than cataract surgery, mark 'Not applicable, can see 6/18'.

3.2 Instructions for examiners

These instructions assume that the subject to be examined is a person of 50 years or older, the area of the survey is a district, a cluster sampling procedure is applied with 60 clusters of 50 people aged 50+ each and the RAAB Survey Record is used.

You are now part of a team that will survey the population in your district to estimate the number of people blind or visually impaired, and the main causes of this visual loss. This survey is scientifically designed and tested for its methodology and validity. In order to achieve reliable and comparable results, it is important that each investigator understands these instructions well, follows them carefully, and uses the tools provided properly for every subject under investigation. A set of instructions is given below for your reference and use.

Preparation for fieldwork

1. You are given a booklet containing 50 single sheet RAAB Survey Records, a 6 meter tape with 3 rings, two tumbling 'E' cards with 'E's' conform to size 18 and 60 of the standard Snellen chart, a binocular magnifying head loupe, an occluder with a pinhole, a pencil, eraser, sharpener, a time table with a list of population areas to be surveyed, a direct ophthalmoscope, and a torch with spare cells. In special situations, you may have a portable slit lamp and a short-acting mydiatic as well. Each booklet with survey forms shall be used for one cluster only. For every new cluster, the supervisor will provide a new booklet. Use one page for one eligible person only.

2. Transport should be arranged in order to reach the selected village/town/area as early as possible, ideally by 8:00 a.m. on the day of survey. This will help in contacting most of the persons eligible for examination. Do not plan surveys on public holidays, market days or on festivals. In urban areas, it may be better to plan the survey days in the weekends or in the evenings.

3. Read the RAAB Survey Record and its coding instructions carefully before starting the survey work. Make sure you understand all the sections and the method to complete the record. When in doubt, contact the team leader or the Survey Coordinator for any clarifications regarding the record, the methodology of the eye examination or any other aspect of the survey.

   The questionnaire has seven sections

   A. General Information
   B. Vision, presenting and pinhole vision
   C. Lens examination
   D. Main and principal cause of vision < 6/18
   E. History, if not examined
   F. Why cataract operation was not done
   G. Details about cataract operation

   Some sections are compulsory and some are conditional.

   - Section A must be filled for all persons above 50 years of age who are residing in the household.
   - Section B, C and D are compulsory for all persons above 50 years who are available and have agreed to the eye examination at the time of visit.
   - Section E is for eligible persons who are not available at the time of visit, refused examination or are unable to communicate.
   - Section F is for examined persons, who have a pinhole visual acuity less than <6/18, in combination with an obvious opacity in the lens of one or both eyes.
   - Section G is for all persons with (pseudo)aphakia in one or both eyes.

Sampling of subjects

4. The village or geographical area, in which the population area is located, is informed three to five days before the visit of the survey team. When detailed maps are available of the selected enumeration area then an advance visit may not be required. If detailed maps are not available, it is advisable to send an advance team to map out the population unit from which the cluster is to be taken. The advance team can use a local sketch map or, If such a map is not available they will produce a sketch map of the village, together with the village leaders, showing major landmarks and the approximate distribution of neighbourhoods and households

   For compact segment sampling, the population unit has to be divided into segments of approximately equal population size and with well-demarcated boundaries and each segment should have enough people (usually 50) aged 50 years and older to complete one cluster. The number of segments per village is equal to the size of the village population aged > 50 years, divided by the desired cluster size (i.e. 50 people aged >50 years).

For instance, if a village has an estimated 3000 inhabitants, and 15% of them are aged 50+ then there are 450 people aged 50+ in that village (3000 x 15% = 450). The village is then divided into 9 segments with equal population size (average 50 people aged 50+ in each segment). Then one segment has to be selected at random and a second one in case the first segment does not have enough eligible persons to complete the cluster. Each segment is given a number. The numbers 1 to 9 are written on a piece of paper, folded, shaken, and one of the wraps is selected.

This segment is thus randomly selected and all households in this segment are included in the sample. The team visits every household and examines all eligible persons (resident of the segment; age 50 years or older) until 50 people aged > 50 years have been registered. If all households in the selected segment are examined and less than 50 eligible persons were recorded, then, a second segment is selected at random and the remaining persons will be examined from that second segment, until the cluster is completed.
Only these two selected segments have to be informed about the coming visit. In case the entire village is too small to complete one cluster, the next nearest settlement has to be identified where the remaining eligible persons have to be sampled from.

It will save the survey teams a lot of time if the creation of the sketch map and the selection of the segment has been done by the 'cluster informer'. However, this task can only be entrusted to a senior and experienced person. It is essential that each cluster must have an equal chance of being selected.

5. Instructions should be given that all persons of age 50 and above in the selected segment should stay at home on the day of the examination. If any local health workers are available in the village or neighbourhood, they should accompany the survey team. It saves a lot of time for the survey team if the local health worker can move ahead of the examiners to announce the team and explain the purpose of the survey and the examination. The local health worker can mark those houses where residents eligible for examination are living with a sticker or chalk on the doorpost. The local health worker can also provide medication to those in need of treatment and make appointments for people who require eye surgery.

6. A word of caution: many health workers are used to tracing people with eye problems in the community. They may be tempted to guide the team to the houses of people with eye problems, as they may not understand the importance of examining healthy people as well. It is essential to realise that this survey is intended to find the actual prevalence of blindness and low vision in the community. It is not a case-finding exercise.

7. Good publicity is essential to achieve a high coverage. Poor publicity will result in many people being absent and a lot of extra work and time spent on revisiting the absentees. The more absentees, the lower the coverage and accuracy of the survey and the greater the risk of biased estimates.

8. With the compact segment procedure, one must always start at one edge of the segment (arbitrarily selected) and continue systematically door-to-door until all households in the segment have been visited or 50 people aged 50+ have been enumerated. If all households in the selected segment are examined and less than 50 eligible persons were recorded, then, a second segment is selected at random and the remaining persons will be examined from that second segment, until the cluster is completed.

9. Ask for all persons of 50 years and older residing in the household. If there is no person of age 50+ in a household, go to the next house. Include only those who actually live in the household at least 6 months every year and who take meals from the same kitchen. Always check whether there are any other eligible people residing in the household that are not present at the time of your visit. If so, complete a RAAB survey record for them and arrange to revisit at an appropriate time. Exclude any visitors. For each of the elderly thus identified, one RAAB

Survey Record has to be completed. Do NOT complete a record for any person above 50 years who is a guest or a visitor from another house or area, although you may check their eyes as a courtesy. In case you come across a locked house, check with the neighbours whether any persons of 50 years and above live there. If so, fill in a form for each eligible subject and make sure you visit the house again after making proper arrangements. If the inhabitants are away for a longer period (more than one night), go to the next house without filling in a form. Continue the survey with a systematic route until you have visited all the houses in that area.

10. You may find only the female members of the household at home while the males might have gone to the field for work. Make arrangements to examine the males later in the day. This will avoid gender bias in data collection. In rural areas, people are often not far away from their houses. In urban areas people are usually out for work and it may be better to schedule the visits on Saturdays and Sundays or in the late afternoon.

11. If the person is not available for examination despite repeat visit(s), try to get the correct estimate of age by interviewing a close relative or a neighbour. If they are sure that the missing person's age is 50+, you can complete the appropriate columns in `A' and `E'. Try at least one more time through a visit at a time when he/she is expected to be available.

12. You may come across persons with eye problems who do not qualify to be part of the survey (younger than 50 years; visitors, not residing in the household) but do need medical attention. You can examine, advise, refer and treat such patients, but do not include them in the survey data. Do not fill in a survey record for such persons.

Examination of subject

13. Insist on seeing all people aged 50+ yourself. For each person, try to get the most accurate estimate of age of the individual. You may use a list of historic events to assess the age. Only those individuals aged 50+ should be examined and included in the survey.

14. Before examination, ensure that you have explained the examination procedure and obtained verbal consent from the participant. Participation is voluntary.

15. Write the name and enter the code number of the survey area, in this case the district (provided to each team leader), the cluster number (as given in the list of the selected units) and the individual number (serially in the book of survey records) clearly.

16. In case of a line, write a name; in case of a box, enter a number in each box; in case of a circle, make the circle black or put a tick (✓) mark or a cross (X) on the circle. The numbers between brackets behind the circles indicate the codes that are to be entered into the computer software package. All other circles in that field should be left blank. No question should have more than one correct response, with the exception of section F: 'Why cataract operation was not done'. All entries must be made with a pencil only. If you happen to put a tick-mark in a wrong circle or write something wrong, do not strike through or overwrite. Erase the wrong entry and make the new entry. Do not tear, waste or discard any record in your book of survey records. Remember that the data entry clerk does not see the patient and should not get confused.

Visual acuity testing of subject

17. If the subject is available for examination, test his/her vision using the simplified `E' chart. If the person is wearing distance glasses, test his/her vision first with available glasses (presenting vision).Visual acuity is measured with a chart with an 'E' optotype of size 18 of the Snellen chart on one side and an 'E' optotype of size 60 on the other side at 6 or 3 metres distance with available correction. This is best done in full daylight, outside of the house. Distance is measured with a special rope of 6-metre length, with a ring at both ends and one in the middle.

The examiner puts one ring around a finger and keeps that hand against the chest; the examinee does the same with the ring at the other end of the rope. First the right eye is examined, while the left eye is covered with the palm of a hand or an occluder, either by the examinee, or by a helper. The examinee should stand in the shade or with his or her back to the sun, while the E chart is kept up in clear daylight.

First the 'E' chart is shown from nearby, the procedure is explained and the examinee is instructed to point in the direction of the open ends of the 'E'. Then the 'E' optotype of size 6/60 is shown first at a distance of 6 metres. It is advisable to start with the larger E to test if the patient understands the procedure. If the patient can see the E size 60 at 6 metres (6/60), change to the E size 18 at 6 metres distance (6/18). Else, change to size 60 at 3 metres (3/60). If the 'E' of size 60 cannot be seen at a distance of 1 metre, check with a torch in semi-dark condition (inside the house) whether the person has perception of light (PL+) or not (PL-). The optotype is rotated before each reading to change the direction of the open ends. This rotation should be in varying directions to avoid memorising. The criteria for vision at a certain level are 4 correct consecutive showings, or 4 correct out of 5 showings.

An eye with VA better than 6/18 does not need to be examined with pinhole - just mark code 1 for pinhole vision. Any eye with a VA less than 6/18 has to be examined for acuity with a pinhole as well. Mark the VA obtained with the pinhole. If the person wears spectacles, place the pinhole in front of the spectacles. In some cases, the available correction is not the optimal correction.

Lens examination of subject

18. After measuring the visual acuity, the examinee is taken inside the house, where you find or create a shaded or dark area. There, the lens status is assessed by torch and binocular loupe and by distant direct ophthalmoscopy at 20-30 cm distance in semi-dark condition, without dilatation of the pupil. Examine the lens in each eye and mark your observations in Section C: normal lens or minimal lens opacity; obvious lens opacity present, lens absent (aphakia), IOL implanted without posterior capsule opacification or IOL implanted and posterior capsule opacification present. If you cannot see the lens because of corneal scarring, phthisis bulbi or other causes, mark 'No view of lens'.

19. It is possible to modify the protocol and to include dilatation of the pupil and examination by portable slit lamp for every person with VA<6/18 with pinhole, if there is no mature white cataract, shallow anterior chamber or large corneal opacity. If applied, this protocol must then be followed for all persons in all clusters. Patients do not always appreciate the dilatation and this may reduce compliance and ultimately coverage of the survey. Slit lamp examination may cause operational problems in door-to-door surveys because it takes extra time. Conducting all detailed examinations in a central place may introduce bias and is not recommended, as disabled eligible persons may not be willing or able to go there, while non-eligible persons may use the opportunity to be examined.

Ophthalmic examination of subject

20. In case the visual acuity of any or both eyes is less than 6/18 with available correction, the eye(s) have to be examined to find the cause of the low vision or blindness. Examination of the posterior segment by direct ophthalmoscopy may be necessary. Mark the principal disorder responsible for visual loss in each eye as well as in the individual (better eye) after considering disorders in either eye, which are most amenable to treatment or prevention. When there are two disorders, one of which is secondary to the other, the primary is to be selected as the principal disorder. For example, if the patient has cataract secondary to glaucoma, glaucoma is the principal disorder. When there are more co-existing primary disorders in the same or different eyes, mark as the principal disorder that cause which is most readily curable or, if not curable, that which is most easily preventable.

The following is a recommended ranking of the disorders with respect to these criteria:

1. Refractive error (includes uncorrected aphakia)
2. Cataract
3. Surgery related complications
4. Preventable corneal opacities and Phthisis
5. (Primary) glaucoma
6. Diabetic retinopathy
7. Posterior segment disorders.

21. An eye with visual acuity less than 3/60, not improving with pinhole, with an obvious opacity in the lens, is classified as blind due to cataract. When both eyes meet these criteria, the person is classified as blind due to cataract. A presenting visual acuity less than 6/60 and equal or better than 3/60 is classified as severe visual impairment and a VA less than 6/18 and equal or better than 6/60 as moderate visual impairment. Some patients have more than one cause of blindness in the same eye, e.g. cataract and diabetic retinopathy, or cataract and glaucoma. In such cases, a clinical judgement has to be made which disease process the primary cause and contributing most to the visual impairment. A more difficult problem arises when each eye has a different cause of blindness. What is then the cause in the individual? The convention adopted by the WHO 'Simplified methodology for the assessment of blindness and its main causes' is that in such cases the cause in the individual is the one most easily preventable or curable.

22. All people with a treatable eye condition must be referred for appropriate treatment. Arrangement for this should be made and each team should carry referral slips.

Assessing barriers to surgery

23. If there is an obvious lens opacity in either or both eyes in combination with VA<6/18, not improving with pinhole, the person has to be asked why the operation for cataract was not done (Section F). This should be an open question. The reasons mentioned by the person should be compared with the barriers listed under F. Mark those barriers that come closest to the reasons mentioned by the patient. In no case should a possible answer be prompted. You can mark a maximum of two responses.

Assessing details of cataract surgery

24. If the person is operated in one or both eyes, all details given under Section G of the form must be entered. If a person is blind due to cataract in one eye, while the other eye is aphakic, section F has to be completed for the cataract blind eye and section G has to be completed for the operated eye.

People not available, refused or unable to communicate

25. In a survey like this, there are always some subjects who are not available or refuse to co-operate. Two or three attempts to contact them again are desirable. If still not available or refusing examination, you have to interview a neighbour or a relative regarding the subject's vision status. In this case, the examination of the vision, the lens and the assessment of the cause of visual acuity less than 6/18, if applicable, cannot be done and the actual visual acuity level will not be known. The subject can only be categorised as 'believed' blind or not blind depending upon the response of the neighbour or relative in Section E. Other general information such as age and sex can also be obtained from the neighbour or a relative.

    It is very tempting just to continue and find a replacement subject. However, because people with poor vision are more likely to be at home, compared with people with good vision, using replacements may lead to over-sampling of people with impaired vision and an over-estimation of visual impairment in the survey area. To avoid such a bias, absenteeism and refusals of

eligible subject must be kept to a minimum and definitely be less than 10%. (5 or less in cluster of 50) Good publicity and strict adherence to the timetable are essential to a good attendance and compliance.

Checking forms

26. Check whether you have filled up all the relevant sections on the record form before going to the next individual. Each form must be filled in completely.

27. Once the entire procedure, including filling of the survey record, is complete, go to the next eligible individual or household and repeat the same procedure.

28. The team leader must check all entries on all RAAB Survey Records on the day of the examination itself for correctness and completeness. Corrections must be made before passing on the records for data entry.

29. Send all record forms from one cluster as soon as possible to the computer staff for data entry. They will enter the records into the RAAB software the same day or, at the latest, the next day and run the consistency checks to identify possible errors. In case there are questions about a certain record, they will contact the team that examined that cluster. If there is too much time between the examination and the consistency check, the examiners may not recall their findings anymore and it will be very difficult to correct these errors. The data entry persons is not allowed to make any changes to the data on his or her own, because they have not seen the examined person.

3.3 Definition of some relevant terms

Aphakics or pseudophakics	Persons who have undergone cataract surgery in one or both eyes. A person is aphakic when the entire lens has been removed and pseudophakic when an artificial lens has been placed inside the eye.
Blindness	Blindness is defined as a Visual Acuity <3/60 in the better eye with available correction (= presenting vision: PVA) and with pinhole (PinVA). The restriction of the visual field is not part of the definition because this cannot be implemented under field conditions.
Severe visual impairment	Severe visual impairment is defined as a Visual Acuity <6/60 but at least 3/60 in the better eye with available correction (= presenting vision: PVA) and with pinhole (PinVA).
Moderate visual impairment	Visual impairment is defined as Visual Acuity <6/18 but can see 6/60 in the better eye with available correction (= presenting vision: PVA) and with pinhole (PinVA).
Avoidable blindness	Avoidable blindness is blindness that can be treated or could have been prevented when appropriate action was taken in time.
Cataract blindness	An eye is considered cataract blind if the vision is less than 3/60, not improving on pinhole examination, with an obvious opacity present in the lens. A person is called cataract blind if both eyes meet these criteria.
Confidence interval	The confidence interval (CI) is the range within which the actual prevalence is likely to lie with specified probability. Common practice is 95% probability.

Cataract Surgical Coverage

Aphakia or pseudophakia can be in one or both eyes. The Cataract Surgical Coverage can be computed for eyes or for persons, and for a specified level of vision. It is also calculated for males and for females.

$$\textbf{Cataract Surgical Coverage Eyes (\%)} = \frac{a}{a+b} \times 100$$

where:
a = all (pseudo)aphakic eyes
b = all eyes with operable cataract (PinVA<3/60, <6/60 or <6/18)
It measures the proportions of eyes, blind or visually impaired due to cataract, which have been operated so far in the survey area.

$$\textbf{Cataract Surgical Coverage Persons (\%)} = \frac{x+y}{x+y+z} \times 100$$

where
x = persons with one operated and one visually impaired eye
y = persons with bilateral (pseudo)aphakia
z = persons bilaterally visually impaired by cataract (PinVA<3/60, <6/60, <6/18)
It measures the proportion of people, blind or visually impaired due to cataract, which have been operated in one or both eyes in the survey area.

Design effect (DEFF)

When a design other than simple random sampling (SRS) is used the sampling error changes. The ratio

$$\textbf{DEFF} = \frac{SE^2\,(p) \text{ for cluster sampling}}{SE^2(p) \text{ for simple random sampling}}$$

is called the design effect (DEFF). In case of cluster random sampling (CRS), the variance of p generally increases and DEFF is more than 1, because of the tendency of subjects within a cluster to have similar characteristics. The sample size for a simple random sampling procedure (SRS, see below) has to be multiplied with DEFF to achieve the same precision using a cluster sampling procedure. Conditions that are evenly spread in a community have a low DEFF, while conditions that cluster in families or certain socio-economic groups have higher DEFF. The exact DEFF can only be calculated on the basis of the actual survey data and an estimate of the DEFF is used to calculate the sample size for CRS. Recent surveys on cataract blindness indicated a DEFF =1.4 for cluster size 40, DEFF =1.5 for size 50 and DEFF =1.6 for size 60.

Non-response

Inability to obtain information on a subject in sample is called non-response. This is due to the non-availability of the subject (has gone to work or for visit outside, the house is locked, etc.), inability to communicate with the subject (e.g. deafness or dementia) or if the subject refuses to co-operate.

% first eye operated

Calculated for eyes. Proportion first eyes operated

$$= \frac{\text{No. persons 1 eye operated + No. persons both eyes operated}}{\text{No. persons 1 eye operated + 2 x (No. persons both eyes operated)}} \times 100$$

% second eye operated

Proportion second eyes operated

$$= \frac{\text{No. persons both eyes operated}}{\text{No. persons 1 eye operated + 2 x (No. persons both eyes operated)}} \times 100$$

Prevalence	The number of people in a population (in our case the number of people 50+ in the survey area) with an existing disease (e.g. blindness, visual impairment, cataract) divided by the total number of people 50+ in the survey area, expressed as a percentage.
Standard error (SE)	The expected variability from sample to sample is measured in terms of standard error (SE). The smaller the SE, the higher the precision of the estimate. The formula of SE of prevalence (p) depends on the sampling method used. In case of simple random sampling (SRS), estimated $SE(p)=\sqrt{[p(1-p)/n]}$, where n is the number of subjects. In RAAB, cluster sampling is used and the sampling error for cluster sampling is calculated in the report 'Sampling error & design effect' and in the age and sex adjusted report.
Eligible subject	In the RAAB procedure, eligible subjects are defined as persons of 50 years and older, residing in any of the households in the selected segment of a selected population area of the survey.
Simple Random Sampling (SRS)	A sampling methodology in which each subject has an equal chance to be selected. This ensures optimal variation in characteristics of the subjects.
Cluster Random Sampling (CRS)	A sampling methodology in which a group of subjects (called a cluster) has an equal chance of being selected. All subjects in each cluster share certain characteristics and therefore the variation between subjects may be less than in simple random sampling.
Systematic Sampling	Systematic sampling is based on selecting every r^{th} individual from a list or file, after choosing a random number between 1 and r as a starting point. If the list of subjects was compiled in a fashion unrelated to the factor studied (e.g. census list) systematic sampling can be considered equal to simple random sampling.

Chapter 4

INSTALLATION AND USE OF THE RAAB SOFTWARE PACKAGE

4.1 Software package for data entry and analysis

The software package for Rapid Assessment of Avoidable Blindness (RAAB) is designed to help with the planning and implementation of a rapid survey to assess the prevalence of avoidable blindness in a community. It has modules to:

- calculate sample size and sample design;
- select clusters from a sampling frame;
- calculate inter-observer variation;
- enter data from survey records;
- clean data files;
- perform a standard detailed data analysis and produce standardised detailed reports and graphs.

The reports include data on:

- prevalence of blindness, severe and moderate visual impairment;
- prevalence of blindness, severe and moderate visual impairment from avoidable causes;
- prevalence of blindness, severe and moderate visual impairment from cataract;
- actual caseload of cataract surgeries and age and sex adjusted prevalence, if age and sex specific population data are entered;
- main causes of blindness, severe visual impairment and visual impairment;
- prevalence of aphakia and/or pseudophakia;
- cataract surgical coverage;
- visual outcome of cataract surgery;
- barriers to cataract surgery;
- uncorrected refractive errors and uncorrected presbyopia;
- cataract surgery service indicators (age at time of surgery, place, type and costs of surgery, cause of visual impairment after cataract surgery).

These data are all very useful for planning blindness programmes and for ongoing monitoring of existing programmes.

The software package is menu driven and easy to operate. Help screens are available at various stages in the programme. A manual, covering all features of the software, is available on the installation CD. Part of this manual (chapter 4) is built in the software as help file.

4.2 Installation of the RAAB software

Hardware requirements:

- Microsoft Windows XP, Windows 2000 with service pack 4 and higher
- Pentium II processor (200 megahertz) or higher
- 512 MB Random Access Memory (RAM) - more is recommended for Windows NT and XP
- 150 MB of free hard disk space

The RAAB package for Windows is programmed in Visual FoxPro version 9.0 ® and the reports are generated through Crystal Reports 10 ®. Both programmes are runtime versions and the user is authorised to use these free of charge. Changes in the programme cannot be made by the user. The installation programme and support files come on one CD-ROM, can be downloaded as an ISO file and burned on a CD-ROM, or can be installed directly from the internet. After the CD has

been inserted a dialog screen will appear which will guide you through the installation process. Follow the instructions on your screen.

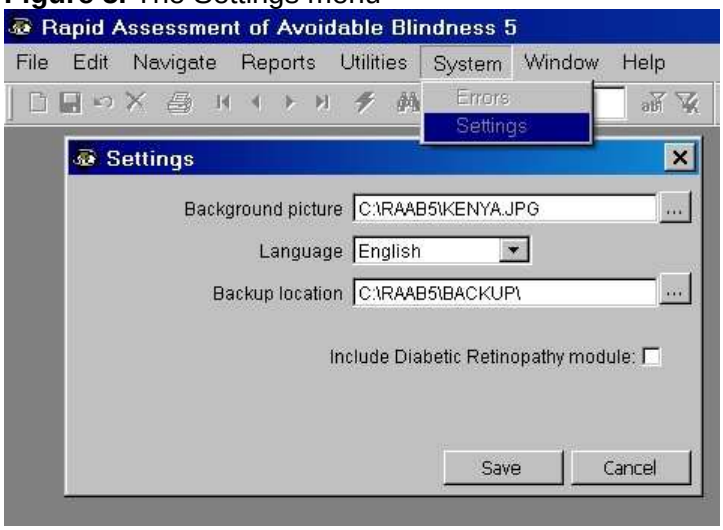
The default installation directory is C:\RAAB5. Under Windows Vista and Windows 7 the programme should not be installed in C:\Program files\. When new databases, containing survey data files, are created by the programme, these will be placed in sub-directories of the same name.

Once the software has been installed, it can be started by clicking on the shortcut button on the desktop, or by clicking on 'Start | All programs' and selecting the RAAB programme from the list.

Settings

When the RAAB package is used for the first time, it is advisable to click on 'Systems' and 'Settings' first to select the background picture for the screen, the language and the location of the backup files (Figure 5).

Figure 5. The Settings menu



Four background photographs are provided in directory C:\RAAB5\: Cambodia, Kenya, China and Mexico. When this box is left empty, the background will remain grey. You can also add your own background picture (jpg format; size depends on the resolution of your screen).

Select the language of your choice: English, Dutch, French, Spanish, Chinese. When the language is changed, this will affect the menus, labels and error messages in the software, as well as the error messages in the consistency check reports. All reports are produced in the selected language with the most common VA measurement system. A conversion table for the different VA measurement systems is provided in the manual. The codes for corresponding VA levels are similar. The survey forms and inter-observer variation (IOV) forms are provided in these four languages on the installation CD-ROM. The language of the labels and the VA measurement system can be adapted to local use.

Finally, select the location where you wish to store your backup data files. It is advisable to store copies of your data files also on removable devices, like a memory stick or a removable hard disk. Click on the 'Save' button to save these settings and close the programme. When the programme is started again, the new settings are implemented. It is essential that data is backed up regularly, at least once per week.

To get the appropriate settings for a standard RAAB, the tick box after 'Include Diabetic Retinopathy module' should be left empty. Including the DR module will require much more fieldwork and will increase the costs substantially. Read chapter 6 carefully before deciding to include the DR module.

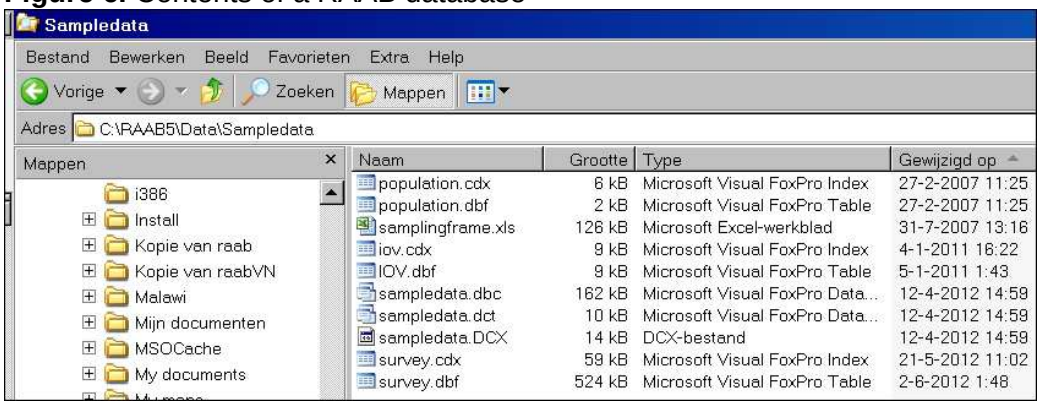
To activate any changes made in the settings, first click on ‘Save’ and then close the software. When RAAB is started again the new settings are activated.
More languages can be added. Please contact the International Centre for Eye Health or the authors of this software ('Help | Info..') for information.

4.3 Files and folders

Part of the RAAB software, especially the executable files, the files generating the reports and the data files containing data of particular RAAB surveys, is located in directory C:\RAAB5. Other files, necessary to run Visual FoxPro © and Crystal Reports © are located in C:\Windows and C:\System. All data files are in directory C:\RAAB5\Data, all report files in directory C:\RAAB5\Reports.

On installation of the RAAB software there are only two databases provided: ‘Sampledata’ and ‘Sampledata2’. Both databases contain data from the same RAAB, which can be used to demonstrate the functioning of the software. All files that belong to database ‘Sampledata’ are in directory C:\RAAB5\Data\Sampledata. (Figure 6). In this directory all the files that relate to a specific RAAB are kept together. The file IOV.DBF contains all data of the inter-observer variation assessment. POPULATION.DBF contains the population data of the survey area by 5-year age group and by gender. SURVEY.DBF contains all the data from the survey records. The .CDX files are index files, necessary to search and order the data. The Sampledata.dbc, .dct and .dcx files contain the links between the data files. The file Samplingframe.xls is an Excel spreadsheet and contains the sampling frame from which the clusters are selected. ‘Sampledata2’ contains data from the same RAAB, entered by a different data entry clerk. By comparing ‘Sampledata’ and ‘Sampledata2’ we can check the quality of the data entry process.

Figure 6. Contents of a RAAB database



Whenever a new database is generated in the RAAB software, a new subdirectory is created with the same (empty) files as in subdirectory ‘Sampledata’. The DATA folder may contain more than one subdirectory, one for each database storing data from a single RAAB. Each subdirectory is a separate entity. For easy location of a database containing RAAB data it is advisable to use the name of the survey area. Do not change the names of data files within a database. When the name is changed they will no longer be recognised as belonging to the same database and it will not be possible to open the data files or run the reports.

When data of a RAAB have to be shared or transferred, all files in that directory have to be transferred. The easiest solution is to ZIP the entire directory containing the data files of this particular RAAB and to send this as an e-mail attachment. Free Zip software can be downloaded from www.7-zip.org or from www.winzip.com or www.winrar.com. (shareware).

4.4 RAAB software menu system

The main menu is shown in Figure 7.

Figure 7. Main menu of the RAAB software

4.5 File menu

All data belonging to a particular RAAB are stored in the three different data files listed below in one separate sub-directory:

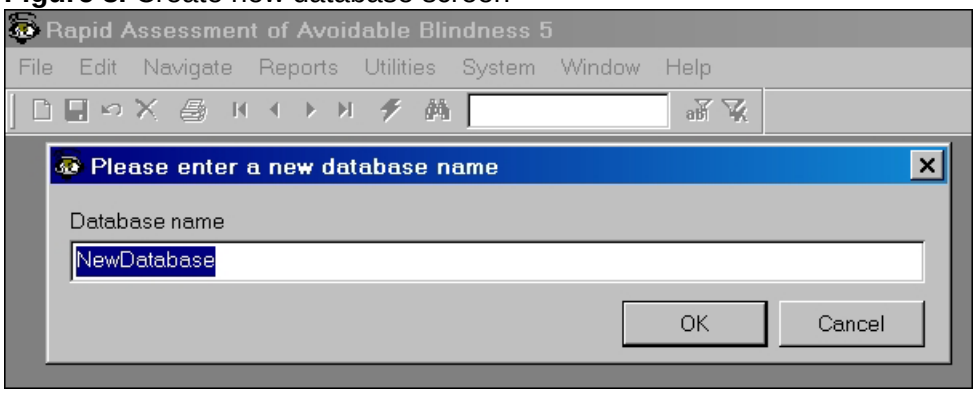
1. A file for the inter-observer variation data (IOV.DBF);
2. A file for the population data (POPULATION.DBF);
3. A file for the survey data (SURVEY.DBF);
4. A file for the DR inter-observer variation data (DRIOV.DBF);
5. A file to convert data generated in the previous version of RAAB to RAAB5(ConvInfo.dbf).

Whenever a new database is created, the user is requested to enter the name of the new database and the programme generates a new sub-directory with this name in the RAAB Data directory, with the three above mentioned data files.

4.5.1 Data entry forms

When the RAAB package is opened, no database is active and no data files can be opened. If no data were entered earlier, a new database has to be created first. To do this click on 'File | New' and a dialog screen will open, asking you to enter a new database name (figure 8). Type the name of the new database, preferably the name of the survey area for easy retrieval (without spaces), and click 'OK'. Click 'File' again and the three new and empty data files are now ready for data entry. The name of the newly created database is visible in the textbox in the toolbar. Always look at the textbox in the toolbar: when empty, no database is open; when a name is shown, that database is active.

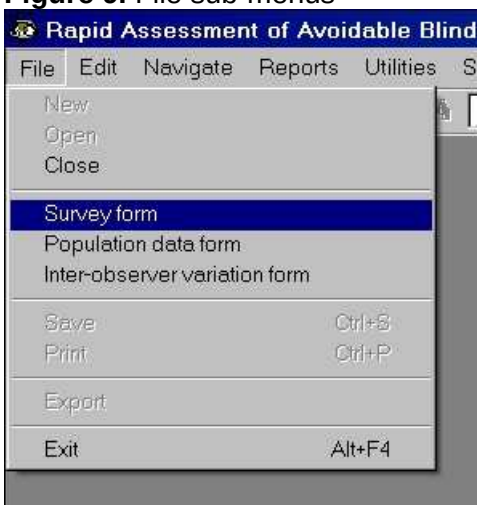
Figure 8. Create new database screen



The newly created database will be placed in a subdirectory with the same name in directory C:\RAAB5\Data\.

If a database for the survey area was already created, click on 'File | Open', and select first the subdirectory and then the .dbc file to open the files. The name of the selected database should now appear in the textbox in the toolbar. Click on File and on the required data form and this format will open on a new record and data entry can be continued. (See Figure 9)

Figure 9. File sub-menus



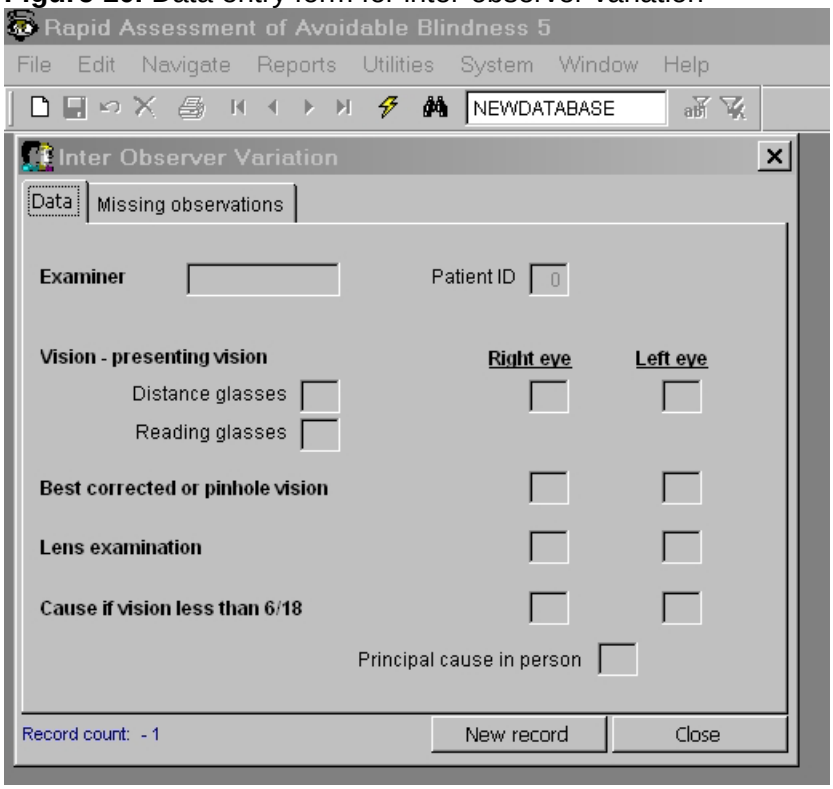
4.5.2 Inter-observer variation (IOV) form

The inter-observer variation assessment is an important aspect of the fieldwork preparation. This exercise measures the extent to which the examiners and their survey teams agree on the findings when they examine the same persons. It determines whether they can be considered to be competent to conduct a proper ophthalmic examination. The procedures to be followed are discussed in chapter 2 of the manual.

Entering data in the inter-observer form

The inter-observer variation file will be used first, because this assessment is completed before the fieldwork starts. When opening the IOV file for the first time, all boxes are closed for data entry. (Figure 10).

Figure 10. Data entry form for inter-observer variation



First click on either the ‘Add’ button far left on the toolbar or on the ‘New record’ button on the IOV form. All the boxes will then open and turn pink. That shows that the consistency check system is working. When a box is pink, it means the entry is missing or not valid. Move the cursor over the pink field and a message will show what is wrong with the entry.

Place the cursor on the first field (examiner) and type the entry in this field. Confirm the entry by pressing <Enter>. The cursor will now move to the next field. Type the entry and press <Enter> again and finish all fields in this way. Do not use the mouse to move the cursor to the next field. It is much faster to use the enter and the arrow keys on the keyboard.

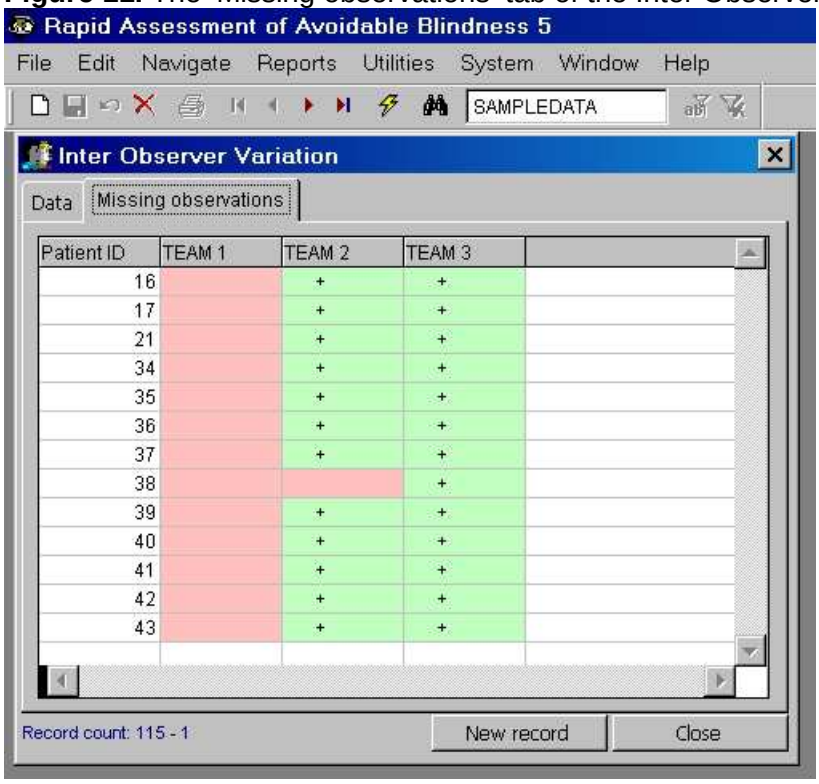
When all entries for one record are complete, check the entries again and if OK, click on the ‘New record’ button. This will save the current record and open a new one. The name of the examiner will be repeated from the previous record. For that reason it saves time to sort all records by examiner before starting data entry. If one of the boxes is left pink, and the button ‘New record’ is clicked, an error message will appear and the cursor will return to the field with the error.

Data entry can be stopped and continued later by using the ‘Close’ button. When the programme is started again, the database that was created earlier can be opened again by clicking on ‘File | Open’, and selecting the sub-directory and the database. When you click on the inter-observer variation form, it will open on a new record and data entry can be continued.

It is important to ensure that all patients are examined by all teams. If some patients are not examined by certain teams, comparison of results for those missing patients will not be possible and the accuracy of the inter-observer agreement assessment will go down.

In the left upper corner of the Inter Observer Variation screen are two tabs visible. By default the ‘Data’ tab is opened, where the IOV data can be entered. When the data entry is completed, press the ‘Missing observations’ tab to see which patients have not been examined by which teams. The missing observations show up red. When nothing is shown, all patients have been examined by all teams. (Figure 11)

Figure 11. The ‘Missing observations’ tab of the Inter Observer Variation screen



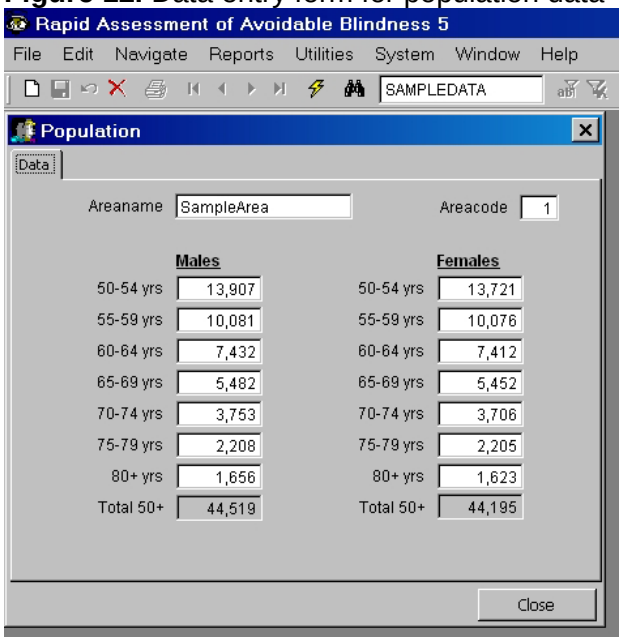
Producing the report from the IOV form
When all inter-observer variation records have been entered in the software, go to 'Reports | Consistency check IOV data' and use this function to check whether the entries are complete and valid. Only after the data file has been checked and corrected ('cleaned') should you use 'Reports | Calculate inter-observer variation' to generate the report on the results of the inter-observer variation exercise.

To compare findings by different teams on the same subject, click on 'Utilities | Review IOV data file'. This will create a Excel sheet with all IOV records sorted by Examiner and by patient ID.

4.5.3 Population data form

The second form to be opened is usually the Population data form. (Figure 12) The population aged 50 years and older in the entire survey area, subdivided by gender and by 5-year age group, should be entered in this form. These data will be used during the data analysis to generate age and gender adjusted prevalence estimates for the entire survey area. The prevalence of blindness and visual impairment increases strongly with age and in most communities females are more affected than males. Normally, the people examined in the RAAB sample should have the same composition by age and by gender as the total population in the survey area. However, when for example. the proportion of people aged 70 and older is higher in the RAAB sample compared to the actual population, the prevalence of blindness in the sample is likely to be higher than in the actual population. By combining the age and gender specific prevalence with the actual population, the age and gender adjusted prevalence and the actual number of people affected by the various blinding conditions, can be calculated.

Figure 12. Data entry form for population data



To enter the age and gender composition of the population in the survey area, click on 'File' and on 'Population data form' and enter the data in the form. Use the menu 'Reports | Age & gender adjusted results' to generate the age and gender adjusted prevalence and the estimated numbers of blind persons, blind eyes and cataract blind persons in the whole survey area.

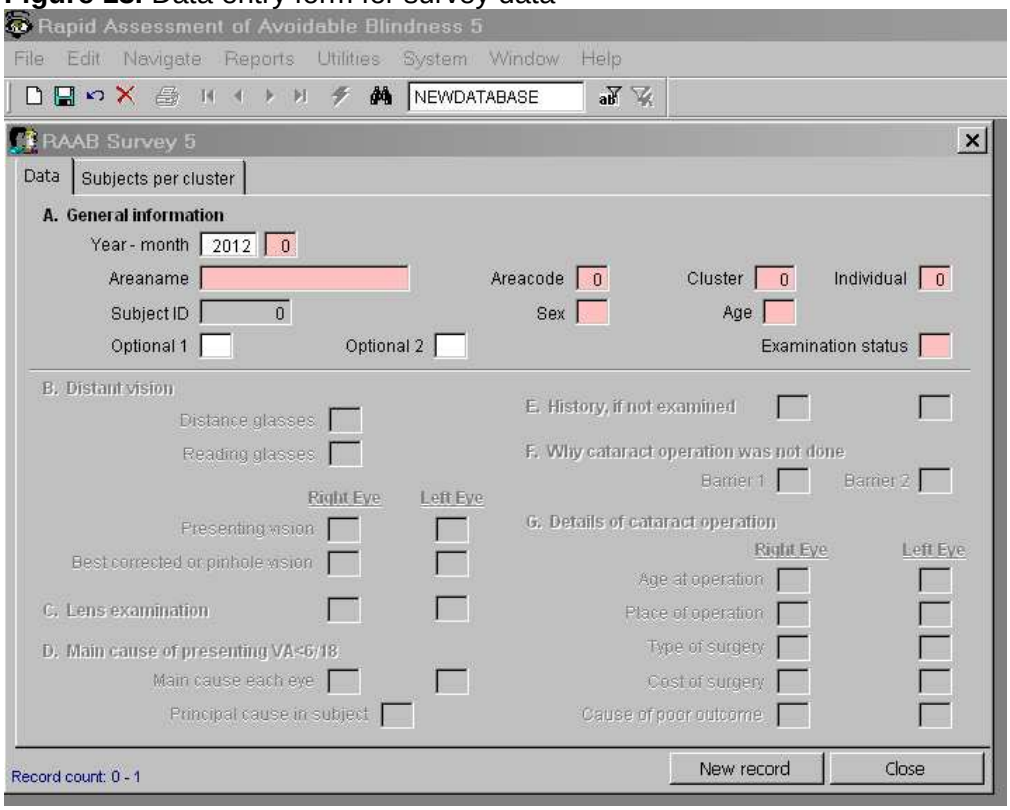
When the age and gender composition of the population of the survey area is not known, either best estimates can be entered, or zero's. In the last case, the age and gender adjusted report cannot be created. Population data are normally available from the national census and statistics offices. If no (recent) census data are available the data provided on http://www.census.gov/population/international/data/idb/informationGateway.php may be helpful.

4.5.4 Survey data form

The survey data form (Figure 13) is used to enter the data from the survey records. The data entry screen on the computer is based on the RAAB Survey Record, shown in Annex 2.

When opening the survey file for the first time, all boxes are closed to data entry. First click on the 'Add' button far left on the toolbar or press the 'New record' button, to open the form. Some boxes will turn pink, others will remain closed. That shows that the consistency check system is working (see also manual). When a box is pink, it means the entry is missing or not valid. If it is closed, it means that, based upon the information entered in the record so far, those fields will not be used. The opening of the data file and the built-in facility to check the consistency of the data are similar to the Inter-observer variation file.

Figure 13. Data entry form for survey data



Place the cursor on the first field ('year') and type the entry in this field. Confirm the entry by pressing <Enter>. The cursor will now move to the next field. Type the entry and press <Enter> again and finish all fields in this way. Do not use the mouse to move the cursor to the next field. It is much faster to use the enter and arrow keys on the keyboard.

Instructions for the data entry clerks on how to enter the data from the survey record forms into the data file are given in Chapter 4 of the manual. Coding instructions for the survey record forms for the survey teams are presented in Chapter 3 of the manual.

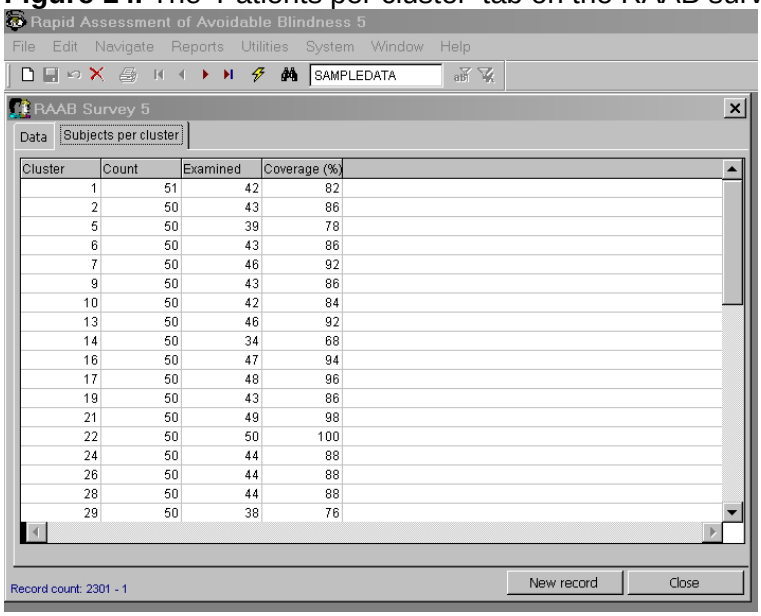
There are two options for entering data:

1. One data entry operator reads the forms and enters the data; or
2. A second person reads out the codes that are marked on the survey form to the data entry operator. Both check the entries on the computer screen and if found correct, save the record and proceed to the next. This system works faster and provides an extra check on data entry.

A comprehensive system of consistency checks has been built in to this package. For further details, see Chapter 4.8.3 on page 49. Do not generate any report until you are sure that all identified errors and inconsistencies have been corrected. If reports are generated on data files that have not been cleaned, the results given in these reports will not be reliable.

The survey data form has two tabs on the top left side. The 'Data' tab is open by default and shows the data entry screen. When the 'Subjects per cluster' tab is clicked, it shows a table with four columns: from left to right the cluster number, the number of forms entered per cluster (count), the number of subjects actually examined and the coverage in percentage for each cluster. This is a quick way to check which clusters have been entered already and what the coverage is in each cluster. When the coverage in one or more clusters is below 80% it is strongly recommended to visit the same cluster(s) again. Figure 14)

Figure 14. The 'Patients per cluster' tab on the RAAB survey screen



4.6 Edit menu

In this menu, the normal Windows functions of Undo, Save, Cut, Copy, Paste, New and Delete are provided. The normal shortcut keys are also valid for these functions. For New, Save and Delete, shortcut buttons are also provided on the toolbar.

When the data entry of a record is complete, this record will be saved automatically by clicking on the 'New record' button. It is not necessary to press the 'Save' button after completion of each record. To delete a record, select that record first, either with the navigation buttons or with the Search function (see Navigate menu) and then press the 'Delete' button on the toolbar. Be careful with this function, because the deleted record is permanently removed from the data file.

4.7 Navigate menu

First / Last / Previous / Next

Use these menus to move through a data file. You may also use the shortcut keys <Ctrl+Home> (first), <Ctrl+End> (last), <Ctrl+PgUp> (previous) and <Ctrl+PgDn> (next), or the navigation buttons on the toolbar. The functions under the Navigate menu are only active if a database is open (i.e. the name of the database is shown in the textbox on the toolbar) and the data entry window for survey forms is open.

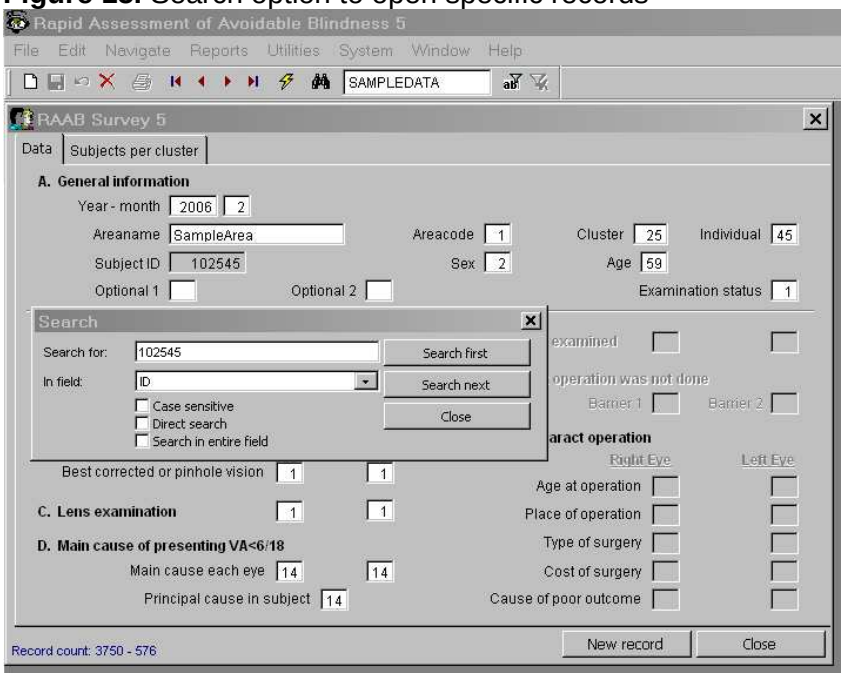
Use of the Search option

If you want to delete or modify some of the records after they were entered and saved, you can open the data file again by clicking on 'File | Open' and by selecting the database that contains the

file you wish to edit. You can use the navigation buttons to move between records, but in large files this may be a slow procedure.

A faster way to locate a certain record is the 'Search' option. This option is particularly handy when editing the survey data file to remove errors (see chapter 4.8.1 on page 47). To locate individual records, use the unique ID number. Place the cursor in the ID field. Then click on the 'Navigate | Search' menu, or click on the 'Search' button, or press <Ctrl+F>, to open the Search window. Type the ID number of the record you want to review in the 'Search for' box. This ID number is provided in the consistency report (see chapter 4.8.3 on page 49). Then click on the 'Search first' button and the record with this ID will be shown. Move the Search window to the side, in case you wish to trace more records, or close this window. (See Figure 15)

Figure 15. Search option to open specific records



If a particular record has been entered twice, one of the records may have to be deleted. Use the 'Delete' button on the toolbar, click on 'Edit | Delete', or press <Ctrl+Del> to delete a record. If there is double entry of the same ID number, a warning is shown that another record with the same ID already exists. Note that 'Delete' permanently removes the record from the data file.

Try out the other functions of the menus on top as well. There is no provision in this package to insert a record in the data file, but missed records can be added to the end of the list.

Browse

Select menu 'Navigate | Browse', or press <Ctrl+B> to see the entire data file in table form. The table cannot be edited in the browse mode. This can only be done in the data entry formats on the data files, using the menu 'File | Open'.

Set filter

With the filter function, records with identical values in certain fields can be found quickly. You may use the Search function to find a record with the desired code first. Place the cursor in the field with the value you wish to search for. Now press the filter button (second from right on the toolbar) or go to menu 'Navigate | Set filter'. The font of the selected field on which the filter is set will change to italics. Press on the navigate buttons on the toolbar to see the next record with the same value in the selected field. You can also use menu 'Navigate | Next' or press <Ctrl + PgDn>.

It is possible to include two or more fields in the filter. After the filter is set on the first field, place the cursor in the second field and select the value with the Search button. When the wanted value appears in the second field click on the 'Set filter' button again. Repeat the same for the third or more buttons. To release a filter, press the 'Release all filters' button, on the far right of the toolbar.

4.8 Reports menu

4.8.1 Control of data entry errors

Survey results are as good as the data they are based on. If the quality of the data is poor, the results will be unreliable. It is therefore of utmost importance to ensure that the data are correct and consistent. Data errors occur at the following three levels:

1. **Errors in the examiner's observations**
   Example: the person is visually impaired from glaucoma and has a slight (non visually impairing) cataract. Yet the examiner does not observe the abnormal cup disc ratio and records 'cause of PVA<6/18' as 'cataract.
   Detailed coding instructions are given in this manual. These instructions should be well known and understood by all members of the survey team. A copy of the 'Coding Instructions' and the 'Instructions for examiners' are also available on the installation CD in the sub-directory called 'Manual'. It is advisable to print a copy of these two documents for each survey team. If necessary, these documents can be translated into the local language. These kind or errors should be minimised by training and conducting an **inter-observer variation study** before the actual survey.

2. **Findings are wrongly entered on the survey form**
   Example: the team examines a man but marks 'female' on the RAAB survey form.
   Members of the survey team have to take care that the information they enter on the survey form is exactly the same as their findings on examination. The examiner should always speak out loud what the findings are and the person writing the survey record should repeat what is being marked on the record form. They have to write clearly so that the data entry clerk can read and enter the data correctly. The team supervisor should examine all survey forms at the end of each field day for completeness and accuracy. Any missing or incorrect information may still be remembered on the same day, but not thereafter. This kind or errors should be minimised by training and conducting an **inter-observer variation study** before the actual survey.

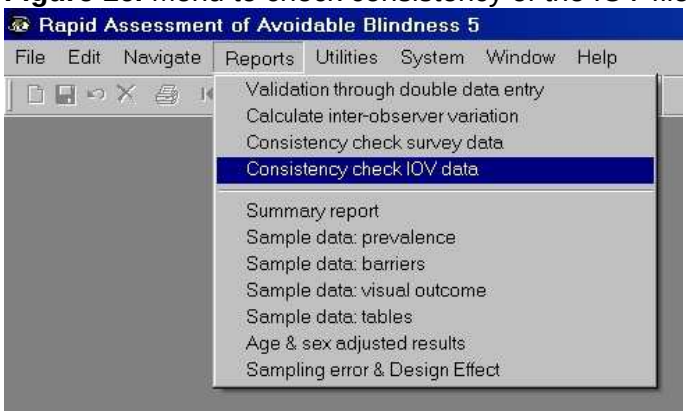
3. **Data on survey form are entered incorrectly in computer**
   Example: age of patient is 69 on survey form, but entered as 96 in data file.
   The data entry clerk has to enter data from the survey record forms into the computer. To reduce typing errors, the package uses an in-built data check programme to check whether each entry has a valid code and whether it is consistent with other entries. This type of error can also be reduced by having a second person reading out loud the code numbers of the survey record, while the computer operator enters these codes in the computer. These errors can also be traced by validation of double data entry.

4.8.2 Inter-observer variation assessment

The organisation of an inter-observer agreement (IOV) assessment is described in detail in Chapter 2 of the manual. Follow these instructions and use the forms provided. When completed, the data from the forms can be entered into a standardised format in the RAAB software. (Chapter 4 of the manual). After all the IOV forms have been entered, this file first has to be checked for any missing or invalid codes. To do this, open the database with the IOV file you wish to analyse. Click on 'Reports | Consistency check IOV data' (see Figure 16).

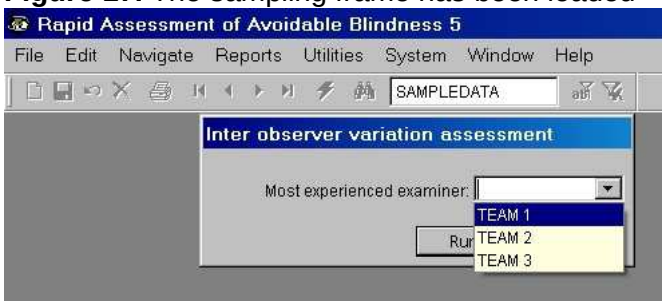
This will open a report where all errors and the ID number of the record in which they occur, are listed. Print this list, retrieve those IOV forms that are listed, check the entries against the paper IOV records and make corrections where needed. Repeat the consistency check until no records with errors are listed anymore. Then we may assume that the IOV data file is clean. Please note that the only missing and non-valid entries will be listed. Inconsistencies are not reported as this is part of what is tested during the IOV assessment.

Figure 16. Menu to check consistency of the IOV file



The next step is to generate the report that shows the agreement and calculates the Kappa statistics. Click on 'Reports | Calculate inter-observer variation' and a dialog screen will appear. On this screen you have to identify the most experienced examiner, the 'Gold Standard' (Figure 17). Click on the down-arrow of the choice box to see the numbers, names or initials of all teams or examiners that participated in the inter-observer variation assessment. Select the most experienced examiner and click on 'Run'. The findings of this 'Gold standard' examiner are assumed to be correct and are compared with the findings of all other examiners. The report will now appear automatically.

Figure 17. The sampling frame has been loaded



What do the results mean?

For the purpose of this survey, the Kappa coefficient is the most appropriate measure of agreement. A Kappa of 1.00 indicates perfect agreement between examiners; A Kappa of 0 indicates no agreement other than what can be attributed to chance, and a negative value indicates less than chance agreement. The following guidelines for the Kappa value can be used:

0.81 - 1.00 or more	very good agreement
0.61 - 0.80	good agreement
0.41 - 0.60	moderate
0.21 - 0.40	fair
0.20 or less	poor agreement

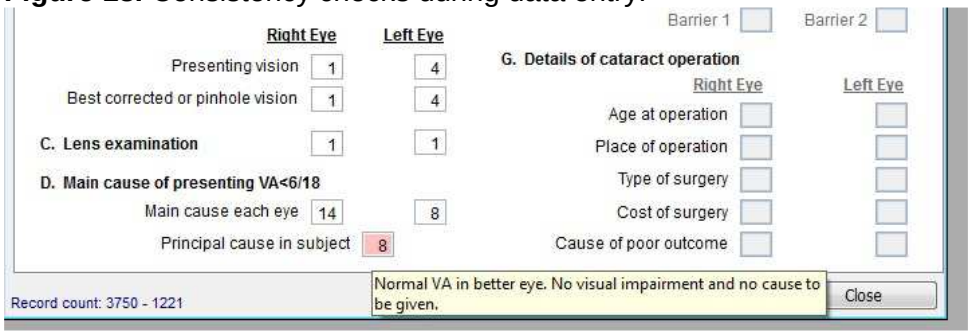
Only examiners that have an agreement higher than 0.60 with the gold standard should be allowed to conduct eye examinations in the survey. If their agreement is lower, they should be replaced by examiners with a good agreement, or undergo additional training until their Kappa coefficient is higher than 0.60.

4.8.3 Consistency checks

When data errors are not removed from the data file, the data analysis and the reports will present invalid information and will not represent the real situation. Before data analysis and report generation starts, the entire data file has to be checked for errors. There are three levels of checks in the RAAB software package:

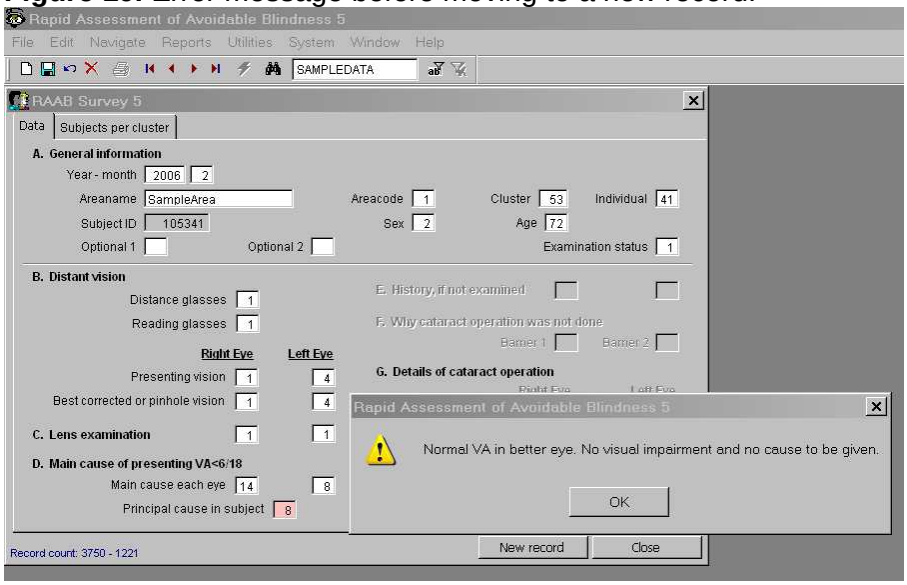
- **consistency checks during data entry.** For example, if the reason for poor outcome after cataract surgery has not been entered, the computer will show this field with a pink background. If the cursor is moved to this field, a message will appear indicating the error. (See Figure 18). These consistency checks will be correct in the majority of cases, but there may always be exceptions. Check carefully whether the entry in the pink field needs any changes or not. If you are convinced that the current entry is correct, despite showing up pink, you may leave it as it is. The programme will include the current entry in the calculations of the reports, but the indication of an 'error' (i.e. pink background) will continue to show up.

Figure 18. Consistency checks during data entry.



If you ignore the pink field and click on 'New record', a message screen will appear indicating the error. (See figure 19). It will not be possible to move directly to a new record without correcting the error. An escape route is to click on the 'Close' button. The error message will show once and then the survey form will close. When the survey form is opened again, you can move to a new record.

Figure 19. Error message before moving to a new record.



- **consistency checks after data entry.** After a number of records, or all records, are entered, the user can select the menu 'Reports | Consistency check survey data'. (Figure 20). The programme then checks all entries of the current survey file. If you wish to check the consistency of a survey or IOV file from another database, the current database has to be

closed first. Then open the database you wish to check and run the above consistency report. A list will be produced of all inconsistencies (Figure 21). Compare the listed inconsistency with the paper survey form. If the inconsistency is not caused by a typing error, ask the team leader to check this entry. Some rules on the cause of VA<6/18 are very strict and exceptions are possible. If the examiner is convinced that the entry is correct, it can be left as it is with a pink field. If no records are shown in the in the consistency check report, it means that no inconsistencies were found. Try this function on database \SampleData2.

Figure 20. Menu 'Consistency check survey data'

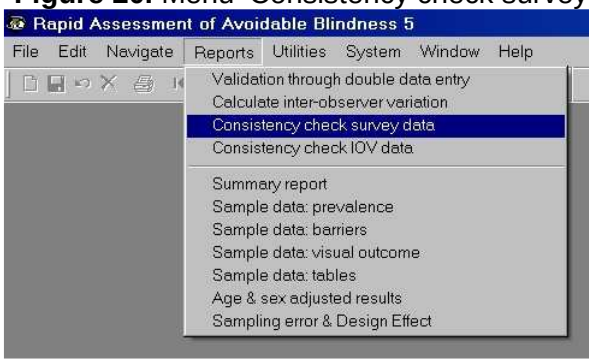
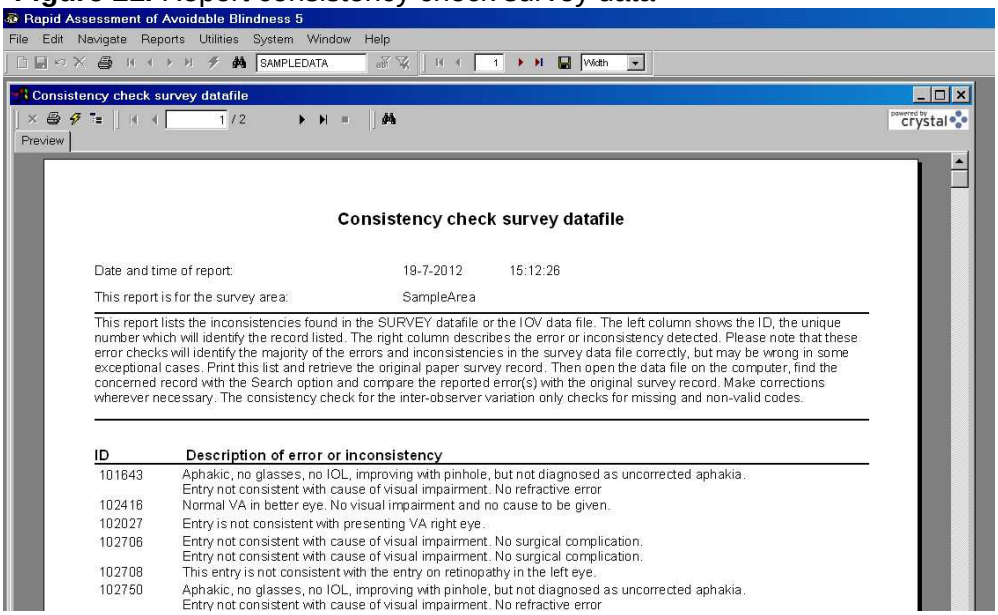


Figure 21. Report consistency check survey data



- **validation of double data entry**. To check for errors made during data entry of the survey record forms the data should be entered twice by different data entry clerks in separate databases and then compared. Data entry clerk 1 creates database A and enters all data from the survey forms in the survey data file in database A. Data entry clerk 2 creates a new database B and enters exactly the same set of records in the survey file of database B. Alternatively, if there is only one data entry clerk, he/she should enter all the survey forms in database A as well as in database B. The sequence in which the records are entered is not important.

- To demonstrate this function open the database SampleData. Click on 'Report | Validation through double data entry' and a dialog screen appears, asking you to select the second database to compare with. Select C:\RAAB5\Data\SampleData2. The software compares the two data files on the basis of the unique ID number, which is composed of the area code, the cluster number and the individual number. A list will be produced of the records, and the specific fields in those records, that are different in the two databases. Print this list and retrieve the paper survey record forms listed. Check the entries against the paper survey record forms

and make the relevant corrections. Corrections should be made in both data files (database SampleData and SampleData2) and after this is completed, the two data files should be compared again until no differences are left. If the two data files show no differences, it is assumed that both data entry clerks have entered the data correctly.

Please note that the above checks cannot trace all errors. If a person is actually male (code 1), but is marked on the survey record as code 2 for female , then it will not be possible to detect this error with any of the above checks.

4.8.4 Analysis of data

After all checks mentioned above have been completed, the data file is considered clean and data analysis and report generation can begin. When there are errors left in the data file, they will also show up in the reports generated.

First open the database from which you wish to generate reports. The name of the selected database will then appear in the textbox in the toolbar on top of the screen. Then click on 'Reports' and select the report to be generated. Prevalence of various indicators will be reported in mutually exclusive categories (blind: VA<3/60; severe visual impairment or SVI: VA<6/60 – 3/60; visual impairment or VI: VA<6/18 – 6/60) and in cumulative categories (VA<3/60; VA<6/60 and VA<6/18) in one report, where applicable.

4.8.5 Responders and non-responders (see also chapter 3, page 20)

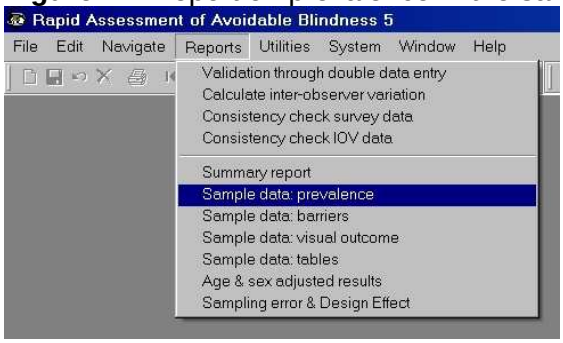
Persons with normal vision are less likely to stay at home than blind persons. When eligible persons (age 50+, residing in a selected house in one of the selected population units) are repeatedly not found at home, or refuse to be examined (non-responders), they should not be replaced by another eligible person, who is found at home and willing to be examined (responders), because this may introduce selection bias. Serious efforts should be made to revisit non-responders and to examine them.

In the Prevalence report, table 16 compares the average age of responders and non-responders and table 15 in the same report compares their eye status. For the remaining analysis only records of responders are used. Ideally, 90% or more of the eligible people in each cluster should be examined. Serious problems could arise if the coverage is less than 80%.

4.8.6 Reports generated by the software

All reports can be created from the database \data\SampleData, which is provided with the software. This database is clean. The database \data\SampleData2 deliberately contains errors and is used to demonstrate the consistency checks and the validation of double data entry.

Figure 22. Report on prevalence in the sample data



1. Summary report: this reports contains the most important tables from all other reports (Figure 22). Additional details are in the other reports listed below.

2. **Sample data: prevalence**, providing the following indicators:
   - Composition of sample by gender and by examination status;
   - Prevalence of blindness, SVI and MVI for persons and eyes by gender;
   - Prevalence of VA<3/60, VA<6/60 and VA<6/18 for persons and eyes by gender;
   - Cause of blindness, SVI and MVI for persons and for eyes by gender;
   - Prevalence of cataract and BCVA<3/60, <6/60 and <6/18 for persons and eyes by gender;
   - Prevalence of (pseudo)aphakia for persons and eyes by gender;
   - Cataract surgical coverage for persons and eyes and by gender;
   - Low vision (VA<6/18), not caused by cataract, uncorrected aphakia or refractive error;
   - Prevalence of uncorrected refractive error, uncorrected presbyopia and spectacle coverage.

3. **Sample data: barriers** to cataract surgery:
   - Barriers in people bilaterally blind and severely visually impaired (VA<6/60) due to cataract;
   - Barriers in people unilaterally blind and severely visually impaired (VA<6/60) due to cataract.

4. **Sample data: visual outcome**, presenting the following indicators:
   - Visual outcome after cataract surgery by type of surgery – presenting and best corrected VA;
   - Visual outcome in operated eyes by years after surgery;
   - Age at time of surgery by gender;
   - Place of surgery by gender;
   - Post-operative presenting VA by place of surgery;
   - Post-operative presenting VA and causes of borderline and poor outcome;
   - Type of surgery by gender.

5. **Sample data: tables** by age group and by gender for most of the prevalence indicators.

6. **Age and gender adjusted results**

The prevalence of blindness (due to cataract as well as other causes) increases by age and is usually higher in females. When the age and gender composition of the sample differs from the actual population composition in the survey area (see example in Table 7), the prevalence calculated from the sample data would not reflect the true prevalence in the population. In such cases, the prevalence calculated from the sample has to be adjusted for the age and gender composition of the actual population in the survey area.

Table 7. Age and gender composition of district and sample population (example)

Age groups	Males in area		Females in area		Total in area	
District	number	%	number	%	number	%
50-59	23,988	53.8%	23,797	53.8%	47,785	53.8%
60-69	12,914	29.0%	12,864	29.1%	25,778	29.0%
70-79	5,961	13.4%	5,911	13.4%	11,872	13.4%
80+	1,656	3.7%	1,623	3.7%	3,279	3.7%
Total 50+	44,519	99.9%	44,195	100.0%	88,714	99.9%

Age groups	Males in sample		Females in sample		Total in sample	
District	number	%	number	%	number	%
50-59	752	45.1%	879	47.9%	1,631	46.6%
60-69	492	29.5%	467	25.5%	959	27.4%
70-79	269	16.2%	294	16.1%	563	16.1%
80+	156	9.3%	194	10.6%	350	10.0%
Total 50+	1,669	100.1%	1,834	100.1%	3,503	100.1%

This can be done only when the age and sex composition of the population of the entire survey area is known and entered into the population data file (Chapter 4.5.3, page 43). The software will automatically adjust the prevalence calculated from the sample data with the population data that

have been entered into the population file. If any of the fields in the population data file are empty, a warning will appear that the age and sex adjusted report cannot be generated.

This report gives the total number of cases of all blindness, cataract and blindness, (pseudo)aphakia and the adjusted prevalence, as well as the adjusted cataract surgical coverage, by sex. An example of this report is given in Annex 6. The 95% confidence intervals, based on the sampling error in cluster sampling, are included for the adjusted prevalence of blindness, SVI and MVI, for cataract and for (pseudo)aphakia. This example report can also be produced with the sample data in the folder SampleData (cleaned), provided in the software package.

7. Sampling error & design effect

The exact prevalence of a condition (e.g. blindness) can only be measured by examining all persons in the entire survey area. This is not feasible and therefore we examine only certain people or groups of people from the entire population, assuming that the results from the sample are representative for the entire survey area. This gives us an estimate of the prevalence of the condition in the sample. The precision of this estimate depends on the number of people examined, the distribution of the condition in the population of the area under survey and the procedure followed in the selection of subjects for examination. This precision is expressed by the sampling error (SE) and the 95% Confidence Interval around the estimate. The Design effect (DEFF) is the correction factor with which the sample size for simple random sampling has to be multiplied to compensate for the Cluster Sampling methodology we have used.

The sampling error for cluster sampling (SEcrs) is usually larger than the sampling error for simple random sampling (SEsrs).

In order to assess the accuracy of the estimate of the prevalence of a condition in the RAAB survey, the sampling error for the prevalence estimate of that condition in cluster sampling is calculated, using the formula's provided by Bennett, Woods et al (1991). The design effect (DEFF) is calculated by SEcrs^2 / SEsrs^2 (square value of Sampling Error in Cluster Random Sampling / square value of Sampling Error in Simple Random Sampling).[5]

The report on the sampling error and design effect shows the number of cases and the prevalence of various conditions in the sample population, and the corresponding 95% confidence intervals. Note that when the age and sex composition of the sample differs from that in the entire survey area, the actual prevalence may differ from that calculated in the sample. Run the report 'Age & sex adjusted results' to calculate the prevalence and estimated number of people with the condition in the entire survey area. To calculate the prevalence interval at 95% confidence, take the age and sex adjusted prevalence from that report and subtract and add the variation at 95% confidence (Var. 95%) to find the 95% lower confidence level and the 95% higher confidence level, respectively. Use the Var. 90% (variation at 90% confidence) and the Var. 80% (variation at 80% confidence) to calculate the prevalence intervals at 90% and 80% confidence.
(Var. 95% = 1.96 * SEcrs; Var. 90% = 1.65 * SEcrs and Var. 80% = 1.28 * SEcrs)

Examples of all reports are given in Appendix 5–12 of the manual. These reports can also be produced with the database SampleData.dbc, provided with the software package.

Other analysis

If further analysis of the data is required beyond the standard reports, the data files in the database can be exported as DBASE III or Excel files, which can be read by most other statistical packages. Click on 'Utilities | Export', select the database and the data file you wish to export, and the format in which you want to save this data file for further analysis. Do not use Windows Explorer to copy the Visual FoxPro .dbf files, as these often cannot be read by other software packages.

[5] Bennett S, Woods T, Liyanage WM, Smith DL.A simplified general method for cluster-sample surveys of health in developing countries. World Health Stat Q. 1991;44(3):98-106.

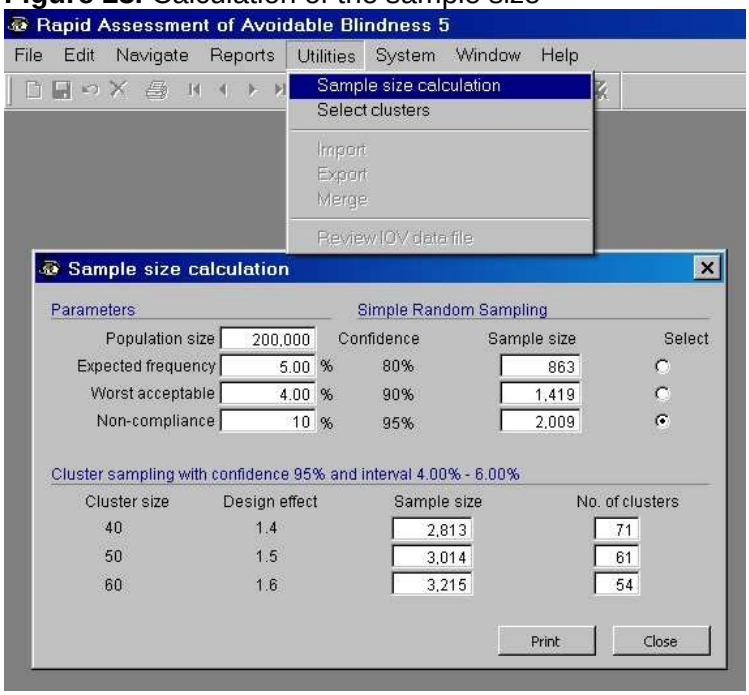
4.9 Utilities menu

4.9.1 Calculation of the sample size

To calculate the required sample size, go to the main menu, click on 'Utilities', and click on 'Calculate sample size'. A screen will appear (Figure 23) where you can enter the following:

- Population eligible for examination in the entire survey area (in this case people aged 50+ only),
- Expected frequency of avoidable blindness,
- Worst acceptable prevalence (variation above or below the expected prevalence),
- Proportion of eligible people expected not to participate in the study (absent or refusing).

Figure 23. Calculation of the sample size



Once these four parameters are entered, the sample size for simple random sampling will appear for 80%, 90% and for 95% confidence. Select the level of confidence you wish to apply to your study and the total sample size for cluster sampling and the required number of clusters of size 40, 50 or 60 will be calculated automatically. It is usual to require 95% confidence and a cluster size of 50.

The formula used for the calculation of the sample size for simple random sampling is the same as in the StatCalc module of Epi-Info 6.04D:

$$\mathbf{S}_{\text{infinite population}} = Z*Z(P(1-P))/D*D$$

$$\mathbf{S}_{\text{finite population}} = S_{inf.}/(1+(S_{inf.}/\text{population}))\text{where}$$

S = sample size
P = expected prevalence of the condition
D = half the width of the desired sample confidence interval
Z = percentile of the standard normal distribution, determined by the specified confidence level (1.96 for 95% CI; 1.65 for 90% CI and 1.28 for 80% CI)

The sample size for cluster sampling is then calculated by multiplying the selected sample size for simple random sampling by the Design Effect. The design effect can only be calculated from the actual data of a study, which means only after completion of that study. From earlier studies on cataract blindness, it was calculated that the design effect for cataract blindness was 1.4 for cluster size 40, 1.5 for cluster size 40, 1.6 for cluster size 60. When the cluster size is higher than 60, the

design effect, and therefore the sample size, increases to around 2.0. These estimates for the design effect are confirmed in recent surveys as well.

Figure 23 shows the screen that helps to calculate the sample size and the number of clusters required. Type the total population of 50 years and older in the entire survey area in the field 'Population size'. For 'Expected frequency', type the frequency you expect to find for the condition under investigation. For 'Worst acceptable' type the end point of the confidence interval you are willing to accept. You can enter either the highest or lowest endpoint in the example in Figure 23, the lower end point (4.0%) is shown, a 20% variation of the expected prevalence of 5.0%. If the higher end point of the same variation (6.0%) is entered, the calculated sample size will be exactly the same. Finally, under 'Non-compliance' the proportion of eligible people expected to be absent or refuse to be examined, can be entered. The total sample size will be increased to compensate for this non-compliance and to ensure that the intended power and accuracy of the survey will be achieved. This should not be more than 20%.
When the above four parameters have been entered, the sample size for simple random sampling with the prevalence interval at the 80%, 90% and 95% confidence level appears in the boxes on the upper right side. Select the required confidence level, and the sample size for cluster sampling with the selected confidence level and interval will appear in the lower part of the screen. The column on the right shows the number of clusters that have to be selected.

The same example is presented in table 8 to illustrate how the various calculations are made.

Table 8. Examples of survey designs for prevalence of 5% and precision of 20%

	CI: 95%	***CI: 90%***	***CI: 80%***
Prevalence cataract blindness in 50+	5.0 %	5.0 %	5.0 %
Worst acceptable prevalence	4.0 %	4.0 %	4.0 %
Non-compliance	10 %	10 %	10 %
Sample size in Simple Random Sampling	2,009	1,419	863
Sample size in Cluster Random Sampling with cluster size 40: design effect 1.4	2.813	1.987	1.208
Survey design (no. clusters x cluster size)	71 x 40	50 x 40	31 x 40
Sample size in Cluster Random Sampling with cluster size 50: design effect 1.5	3.014	2.129	1.295
Survey design (no. clusters x cluster size)	61 x 50	43 x 50	26 x 50
Sample size in Cluster Random Sampling with cluster size 60: design effect 1.6	3.214	2.270	1.381
Survey design (no. clusters x cluster size)	54 x 60	38 x 60	24 x 60

4.9.2 Selection of the clusters

When the size and number of the clusters has been determined, we can proceed to select the population units from which each cluster will be selected through systematic sampling from the sampling frame. A sampling frame is a list of all population units of the entire survey area. (Chapter 2.5, page 10) These can be enumeration areas, settlements or other population units, as indicated earlier. The sampling frame should be entered into a specially designed spreadsheet, as shown below. Whenever a new RAAB database and sub-directory is created, it also contains this spreadsheet format (SAMPLINGFRAME.XLS). If no database for the current RAAB survey has been created yet, it should be done now, following the instructions on page 39. Click on 'File | New' and type the name of the new database. In case of an existing database, click on 'File | Open' and select the database you wish to work on. Then click on the menu 'Utilities | Select clusters'. This will open the Select Clusters module (Figure 24).
When the Select Clusters module is open, the data that will form the sampling frame has to be entered in an Excel spreadsheet. Click on the left upper button 'Open Excel sheet sampling frame'. A search window will open through which the Excel file with the sampling frame of the current

database can be selected. (See Figure 25) Each RAAB needs its own sampling frame to select clusters and an empty copy of this spreadsheet.

Figure 24. Menu to open the Select Clusters module

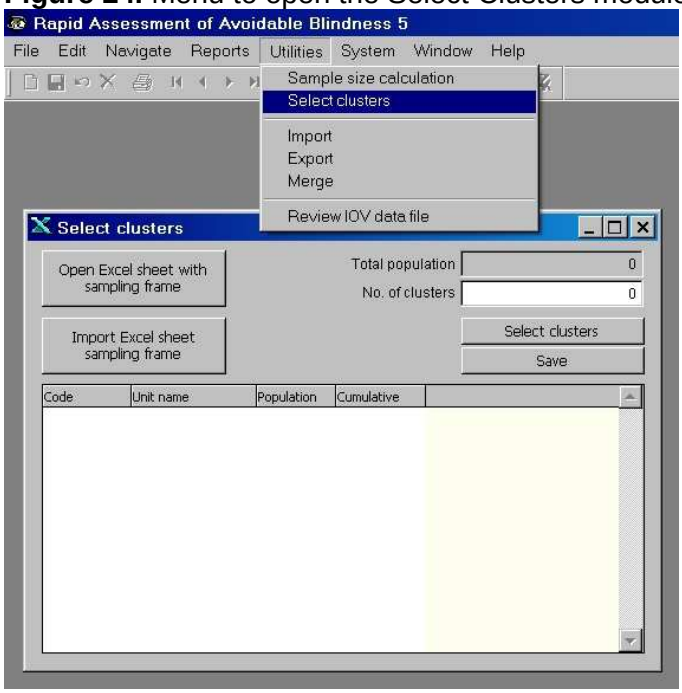
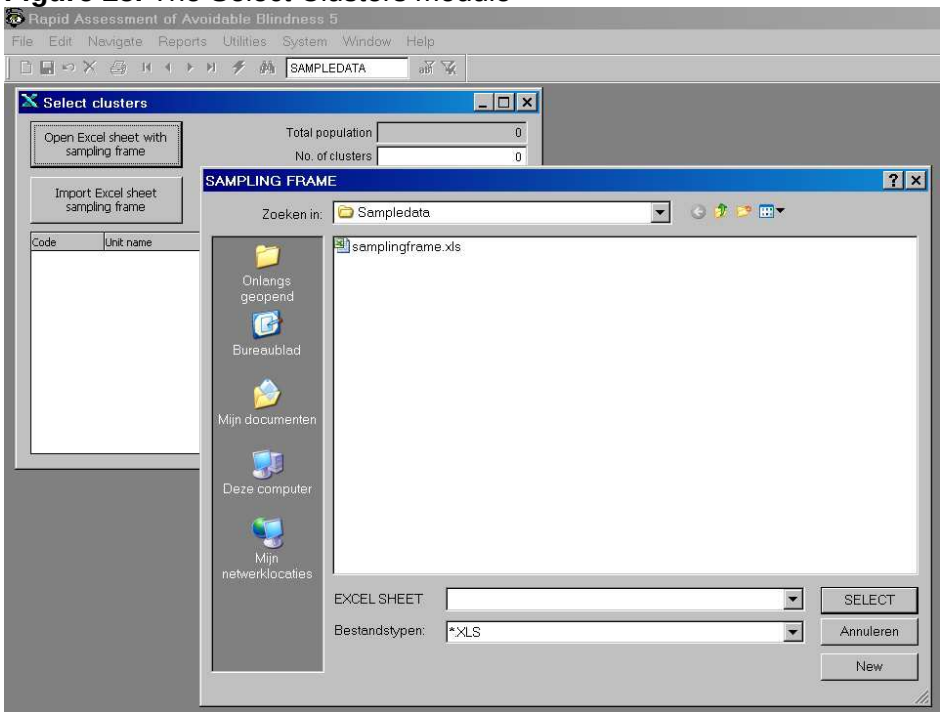


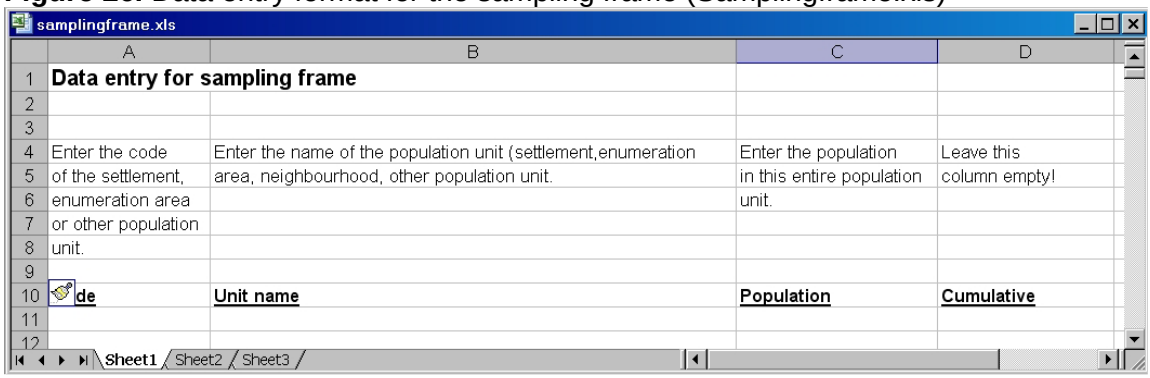
Figure 25. The Select Clusters module



Select the file ‘samplingframe.xls’ from the current database and it will open automatically. (See Figure 26). Check page 7 to find out which data are most suitable for the sampling frame. It is advisable to organise the list of population units from the census office first in the required order before copying it to ‘samplingframe.xls. There should not be any rows without any data below the headings ‘Code’, ‘Unit name’ and ‘Population’ and there should not be any sub-totals.

Enter the data for the sampling frame in three columns: a unique code, the name or other identification of the population unit and the population size in each population unit.

Figure 26. Data entry format for the sampling frame (Samplingframe.xls)



samplingframe.xls

	A	B	C	D
1	**Data entry for sampling frame**			
2				
3				
4	Enter the code	Enter the name of the population unit (settlement,enumeration	Enter the population	Leave this
5	of the settlement,	area, neighbourhood, other population unit.	in this entire population	column empty!
6	enumeration area		unit.	
7	or other population			
8	unit.			
9				
10	**de**	**Unit name**	**Population**	**Cumulative**
11				
12				

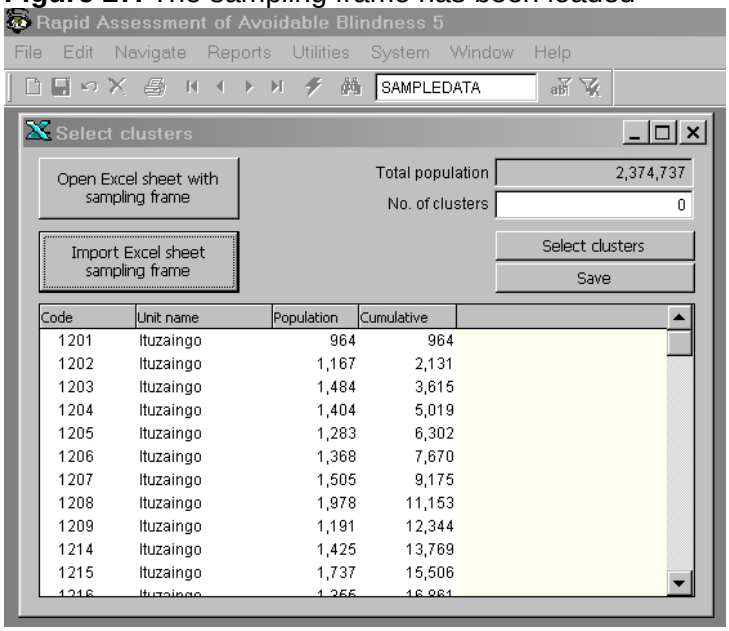
Sheet1 / Sheet2 / Sheet3

When all data have been entered, Samplingframe.xls can be saved and closed.

Important !
Please make sure that the Excel file with the sampling frame is saved as a Microsoft Excel 5.0/95 file. The file format of Excel 2007 and later is different and cannot be read by Visual Foxpro 9.0, which dates from 2004. Although Visual FoxPro is also from Microsoft no update has been provide to solve this. Therefore the only solution is to save the final sampling frame as an Excel 5.0/95 file.

The next step is to import the Excel sheet with the sampling frame. Press the left lower button 'Import Excel sheet sampling frame'. The sampling frame table will appear in the lower part of the screen (see Figure 27). The total population of the entire survey area, as calculated from the sampling frame, will appear in the box with the label 'Total population'. If the screen remains empty, it means the selected spreadsheet contains no data. This may be because no sampling frame data were entered, or because an incorrect file was selected.
If the Excel file is in the 2007 or later format an Error message (no. 1661) will appear that this format is invalid, and the application will shut down. The solution is to open the Excel file with the sampling frame and save it as an Excel 5.0/95 file.

Figure 27. The sampling frame has been loaded

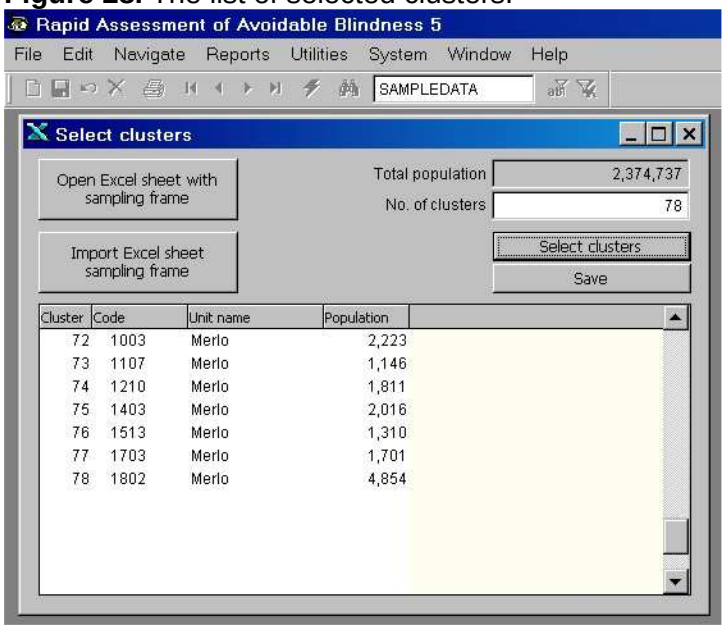


Enter the required number of clusters in the box 'No. of clusters' (below the total population) and click the button 'Select clusters'. The required number of clusters will then be selected by systematic sampling from the cumulative population. This procedure is equal to a random selection

and ensures that the selected clusters are equally spread over the population of the entire survey area. It is also a procedure whereby the probability of selection is proportional to the population size. A more detailed description of this selection method is given on page 10.

The selected population units will now appear in the screen (see Figure 28). Click on the button 'Save' to save this selection in the file format you prefer. The selection can also be printed. By default, this file will be saved in the same sub-directory as the sampling frame spreadsheet.

Figure 28. The list of selected clusters.



Import
With this function, survey records from a RAAB that were entered on another computer can be imported into a new (empty) database. The import function can only be used when you have opened the database where you want to import the data into (target file). When you click on 'Import' a 'Select database' screen will open to select the source file. Highlight the source file and click on 'Select'. All records from the survey file (source) are copied to the target file.

Data entered into the RACSS database can be analysed with the RAAB software, but they need be converted to the file format used by Visual FoxPro 9.0 ©. Some codes have changed during the past eight years, other fields will be empty. If you wish to convert RACSS data to this RAAB package it is advisable to contact Dr. Hans Limburg. (see title page)

Export
With this function, RAAB data files can be exported to other directories and into other file formats. This function can be used when custom analysis of data files has to be done in other statistical packages.

Merge
With this function, survey records from the same RAAB survey that were entered on different computers can be merged into one database. The merge function can only be used when you have opened the database where you want to import the data into (target file). Then click on 'Merge' and a 'Select database' screen will open. Highlight the source file and click on 'Select'. All records from the survey file (source) are copied to the target file.
Records from different RAAB surveys cannot be merged into one database. This is deliberate, because weighting should be applied before such data can be merged.

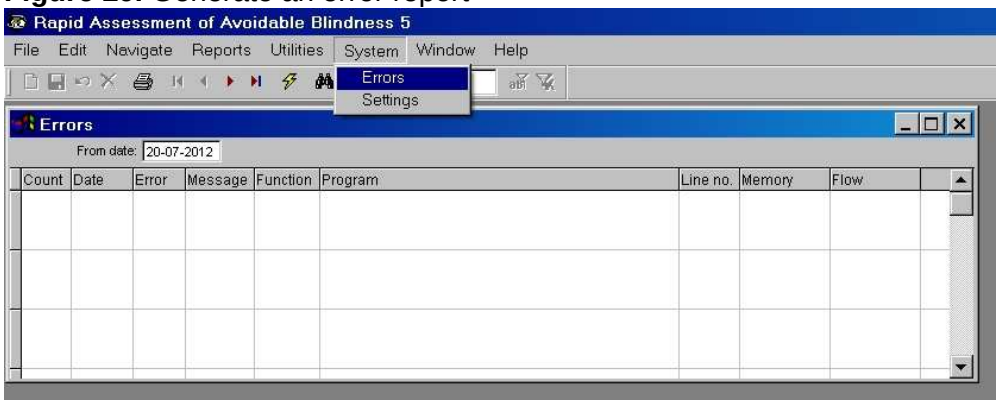
Review IOV data file
As mentioned earlier in Chapter 2.9 on page 14, all records in the IOV data file can be shown as an Excel file, sorted on patient ID and examiner by using this menu option. This list is very helpful on reviewing the findings of the inter-observer variation assessment.

4.10 System menu

Error reports

If the RAAB software encounters any problems, it will automatically save an error message. These error messages can be viewed and saved as a document. They will help the developers of the software to identify and locate the problem. If you want to report any operational problems with the RAAB software, please describe your problem and generate an error report by selecting menu 'System | Errors' (Figure 29) and send both of these to the address on the title page.

Figure 29. Generate an error report



Settings

When the RAAB package is used for the first time, click on 'Systems' and 'Settings' to select the background picture for the screen, the language and the location of the backup files (Figure 30).

Figure 30. The Settings menu

Four background photographs are provided in directory C:\RAAB5\: Cambodia, Kenya, China and Mexico. When this box is left empty the background remains grey. You can also add your own background picture (jpg format; size depends on the resolution of your screen)

Select the language of your choice: English, Dutch French, Spanish or Chinese. When the language is changed, this will affect the menus, labels and error messages in the software, as well as the error messages in the consistency check reports. All reports are produced in the selected language with the most common VA measurement system. A conversion table for the different VA measurement systems is provided in this manual (Table 2). The codes for corresponding VA levels are similar. The survey forms and inter-observer variation (IOV) forms are provided in these four languages on the installation CD-ROM. The language of the labels and the VA measurement system can be adapted to local use.

More languages can be added. Please contact the International Centre for Eye Health or the authors of this software (‘Help | Info..’) for information.

Finally, select the location where you wish to store your backup data files. It is advisable to store copies of your data files also on removable devices, like a memory stick or a removable hard disk. Click on the 'Save' button to save these settings and close the programme. When the programme is started again, the new settings are implemented. It is essential that data is backed up regularly, at least once per week.

4.11 Window menu

Arrange all
When more than one screen is open, this menu offers possibilities to arrange all open windows on your screen.

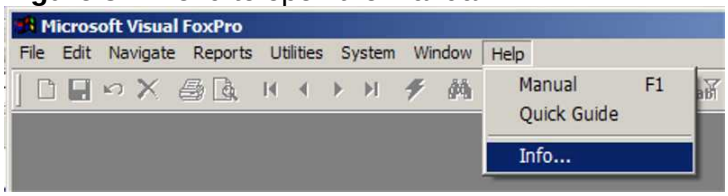
Hide
This menu will hide and unhide screens that are open on the desktop.

Cycle
If more than one screen is open on the desktop, this menu can be used to change the active screen.

4.12 Help menu

Manual
Chapter 4 of the manual can also be viewed directly from the RAAB programme. Click on the menu ‘Help | Manual’ or press <F1>. The complete manual can be printed from the installation CD-ROM. It is available in English and in Spanish.

Figure 31. Menu to open the manual



Quick Guide
The Quick Guide is a list of brief instructions how to operate the RAAB software.

Info …
Select ‘Help | Info …’ to see particulars of the software package and contact addresses.

4.13 Coding instructions and suggested daily procedures for data entry clerk

RAAB Survey Form

A. General Information

When opening a new record in a file for survey data or inter-observer variation data, some fields have a pink background and others are not activated. This is caused by the in-built error checks. If a field is empty and requires an entry, or when a field contains a non-valid entry, the background of this field turns pink. Other fields are inactive, until the value in another field indicates that those fields need to be activated and filled as well.

Year

Enter the year as it is on the record form. Once entered for the first record it will repeat itself for all subsequent records, until the year is changed. The computer will accept the current year and previous years. You must enter a year otherwise you cannot proceed.

Month

Enter the month as it is on the record form. Once entered for the first record it will repeat itself for all the subsequent records, until the month is changed. You must enter a month, or you cannot proceed.

Survey area

Enter the name of the survey area with a maximum of 15 characters. Once entered for the first record it will repeat itself for all the subsequent records, until the name is changed. You must enter a name, or you cannot proceed.

Code of survey area

Enter the code of the survey area as it is on the record form. Once entered for the first record it will repeat itself for all the subsequent records. In most cases, there will be one code only. You must enter a code, or you cannot proceed.

Cluster number

Enter the cluster number as it is on the record form. The cluster number is determined during the selection of clusters from the sampling frame. You can enter numbers between ‘0’ and ‘999’. The previous entry repeats itself, until you change it to a new cluster number. You must enter a number.

Individual number

Enter the individual number as it is on the record form. Any number between 1 and 99 is allowed. You cannot have clusters of more than 99 people. This is a 'must enter' field and cannot be left blank.

Subject ID

The ID number is automatically created and is composed of the area code (first 2 digits), the cluster number (digits 3-5) and the individual number (digits 6, 7). This is a unique number, which means it can only appear once in the data file. If it appears more than once, it means either the same record has been entered twice, or an entry error has been made.

Sex

Enter the code number, given in brackets behind the marked circle. Enter ‘1’ for males or ‘2’ for females. No other entries are possible.

Age (years)

Enter the age as it is on the record form. Any age less than 50 years will not be accepted. For any age between 50-98, write the age in years. For age 99 and over, enter ‘99’. This is a 'must enter' field and cannot be left blank.

Option 1 and 2
It is possible to add one or two extra data fields, if required. Special codes for these fields have to be added. These optional fields are not included in the standard analysis and will require special programming for analysis.

Examination status
Enter the examination status as on the record form. If the subject was examined, enter ‘1’ and the cursor will move to Section B. If the subject was not available enter ‘2’ and the cursor will jump automatically to Section E and all other fields will become inactive. If the subject refused eye examination enter ‘3’ and if the person was unable to cooperate enter ‘4’. In both cases the cursor will move to Section E as well. This is a 'must enter' field and cannot be left blank.

B. Vision Examination

Using distance glasses; using reading glasses
Enter the code as on the record form indicating whether the person used distance glasses during the vision assessment and is using reading glasses. When using bifocal or multifocal glasses both options should be marked as ‘Yes’.

Presenting vision (right and left eye)
Enter here the code for visual acuity in each eye of the subject with available glasses, if any. The possible entries are 1 to 6. This is a 'must enter' field and cannot be left blank for those who were available and examined.

Vision with pinhole (right and left eye)
Enter here the code for visual acuity in each eye of the subject with pinhole correction. The possible entries are 1 to 6. This is a 'must enter' field and cannot be left blank for those who were available and examined.

C. Lens Examination

Lens (right and left eye)
Enter the code for the lens examination as on the record form. You must enter a code.

D. Main Cause of Presenting VA<6/18

Main cause of vision <6/18 (right and left eye)
Enter the code for the main cause as on the record form. Only one main cause of low vision or blindness can be entered for each eye.

Principal cause in better eye
Enter the code for the principal cause as on the record form. Only one principal cause can be entered.

E. History, If Not Examined

This section will automatically be skipped for those subjects who are examined. (examination status code: 1)

History, if not examined
Enter the code as on the survey form. This field will automatically become inactive and skipped if the subject was available and examined.

F. Why cataract operation has not been done

This field is automatically skipped for subjects who were not available or refused examination (code 2, 3 or 4 for examination status), and for those who did not have an obvious lens opacity in combination with a pinhole VA of 6/18 or better.

Why cataract operation has not been done

Enter the code(s) that is/are marked on the survey form. A maximum of two codes can be marked.

G. Details about cataract operation

This section will automatically be skipped for those subjects who have not had a cataract operation. (lens code: 1,2 or 6)

Age at operation (right and left eye)

The cursor will automatically go to the field 'Age at operation' when cataract surgery has been done (lens code: 3, 4 or 5). Enter the age as written on the survey form. This is a 'must enter' field for those who were operated and cannot be left blank.

Place of operation (right and left eye)

Enter the code of the option that is marked on the survey record. This is a 'must enter' field for those who were operated (lens code: 3, 4 or 5) and cannot be left blank.

Type of surgery (right and left eye)

Enter the code of the option marked on the survey record. This is a 'must enter' field for those who were operated (lens code: 3, 4 or 5) and cannot be left blank.

Cost of surgery (right and left eye)

Enter the code of the option marked on the survey record. This is a 'must enter' field for those who were operated (lens code: 3, 4 or 5) and cannot be left blank.

Main cause of VA<6/18 after cataract surgery? (right and left eye)

Enter the code of the option marked on the survey record. This is a 'must enter' field for those who were operated (lens code: 3, 4 or 5) and cannot be left blank.

After the entry of a record is completed, check all the entries and click on 'New record' if you want to continue data entry. Click 'Close' if you want to exit the data entry module. Whenever you move to a new record, the previous record is saved.

If there is an inconsistency in the data entered, the field with the inconsistency will show a pink background. Move the cursor over this field and a message will appear with the error. Compare the entry with the original paper RAAB record form and correct the data file if the entry differs from the form. If you have entered exactly what is on the form, then contact the team leader who completed the form and check with him/her what the correct answer should be.

Some rare exceptions exist where the reported inconsistency is not valid and the current entry may actually be correct. In that case, if the examiner is sure the entry is correct, or the examiner is not available at that time to check with, just ignore the error messages and proceed with data entry. (See also page 43 and 48) If you ignore the pink field and click on 'New record', a message screen will appear indicating the error and it is not possible to move to the next record. Therefore to proceed with data entry, click on the 'Close' button. The error message will show once, click 'OK' and then the survey form will close. When the survey form is opened again, you can move to a new record. In that way the record with the 'error' will be saved. The programme will not block any further data entry or processing of records, but the indication of an 'error' (i.e. pink background) will continue to show up.

If you want to leave the data entry programme before you have completed the record, click on 'Close'. An error message may appear indicating possible errors in the record. Click 'OK' in this message box and the data entry screen will close. All entries you have made in this record until the moment you click on 'Close' will be saved.

Suggested daily procedure for data entry operators:
Ideally there should be two data entry operators. Data entry operators should be familiar with the data entry procedures (including consistency checks and validation of double data entry) before the start of survey. Training of data entry operators should be the responsibility of the survey coordinator.

At the start of the survey create two databases – using the same survey area name (e.g. LondonA and LondonB). Computer operator 1 creates database A and enters all data from the survey forms in the survey data file in database A. Operator 2 creates database B and enters exactly the same set of records in the survey file of database B. Alternatively, if there is only one data operator, he/she should enter all the survey forms in both database A and in database B.

Note that the data from all clusters should be entered in these two databases. You should **not** create a separate database for each cluster.

Data entry should begin the day after the 1st day of the RAAB survey, and all data collected on that first survey day should be entered twice (i.e all data should be entered into database A and all data should be entered into database B by two different data entry clerks). Thereafter, each day, all the RAAB forms collected by the survey teams the previous day should be double entered.

Validation through double data entry
When double entry of all the forms filled in on the previous day is complete, use the 'validation through double data entry' in reports, to compare the files and identify any errors made during data entry. Open database A. Click on 'Report | Validation through double data entry' and a dialog screen appears, asking you to select the second database to compare with. Select database B. The software compares the two data files on the basis of the unique ID number, which is composed of the area code, the cluster number and the individual number. A list will be produced of the records, and the specific fields in those records, that are different in the two databases. Print this list, find the paper survey record forms that contain these errors and use these to correct the data. Corrections should be made in both data files. When this is complete, the two data files should be compared again until no differences are left. If the two data files show no differences, it is assumed that both operators have entered the data correctly.

By doing this you have now made sure that any inconsistencies in the database are not due to data entry errors.

Consistency checks after data entry
When you are sure both files are the same, open either database A or B select the menu 'Reports | Consistency check survey data'. The programme then checks all entries of the current survey file. A list will be produced of the records, and the specific fields in those records, with inconsistencies. If no records or errors are shown in the list, it means that no inconsistencies were found.

Print out the list of inconsistencies. At the end of each day, check these inconsistencies with the relevant examiner and ask them to make corrections to the data on the survey record forms. Remember that although these consistency checks will be correct in the majority of cases, there are always exceptions. If the examiner is convinced that the entry is correct, it can be left as it is.

Before entering any new survey record forms, first go through the list of inconsistencies from the previous day and make any corrections that the examiners have marked on the forms. Make these corrections in Database A and Database B.

Finally, re-run the ‘validation through double data entry’, to check you have made all the same changes in Database A and Database B

Following this procedure helps to prevent a large build up of data to compare and inconsistencies to check and correct and should therefore save time and ensure the data is clean.

Chapter 5

PLANNING OF EYE CARE SERVICES BASED ON RAAB DATA

5.1 How to use RAAB data for planning of eye care services

The data collected by RAAB is intended for use as baseline information for initial planning of eye care services, as well as for evaluation of ongoing activities. The reports provide the estimated prevalence and estimated numbers of people blind, with severe visual impairment (SVI) and with visual impairment (VI) in the survey area with available and pinhole correction, for males and females separately. Data on the distribution of causes of blindness, SVI and VI give a good picture of the caseload of various eye disorders in the survey area, which is helpful for the planning of the various types of eye care services in the survey area.

The report also provides the prevalence and numbers of people with cataract and various stages of visual impairment. When such data are combined with the available ophthalmic manpower and facilities, it shows the current utilisation of cataract services and provides an insight whether the capacity is adequate to cope with future demands.

The cataract surgical coverage (CSC) provides insight to what proportion of patients with cataract and various level of visual impairment have been operated so far. If the CSC is high for VA<3/60 and low for VA<6/18, it suggests that many blind people but only few with MVI are operated for cataract. When the CSC is also high for VA<6/18 it suggests that cataract surgery is done at an early stage. The CSC is a more sensitive indicator of the impact of cataract surgical services than the prevalence of cataract blindness alone.

There is a special reports on barriers – reasons why people, blind or SVI due to cataract, are not coming for cataract surgery. Understanding these reasons may help to modify service delivery in such a way that more people come forward for cataract surgery.

Not all cataract operations result in restoration of eyesight. Measuring the visual acuity of patients who were operated in the past for cataract provides an insight about quality of cataract surgical services. The visual outcome may be related to the place of surgery and the cause of poor outcome may vary in different settings. This information may help to improve the quality of cataract surgery in the future. The outcome report also shows where people are operated for cataract, whether they pay or use subsidised services, the use of spectacles and the level of satisfaction.

On the RAAB installation CD a planning tool will be provided to assist the user how to apply the information provided by the RAAB in the planning of eye care services.

Once a blindness intervention programme has been implemented, it should be monitored to assess whether it achieves its objectives. A repeat RAAB can be conducted 5-10 years later and the results of the second RAAB can be compared with the baseline data at the start of the intervention, to measure the impact of the intervention.

Chapter 6

DIABETIC RETINOPATHY MODULE

6.1 Introduction

Why include diabetic retinopathy in RAAB?

The prevalence of diabetes is high and rising fast. Worldwide there are an estimated 366 million people with diabetes and this is expected to rise to 552 million by 2030 as a consequence of population growth, aging, lifestyle changes and increasing urbanization. The vast majority (80%) of people with diabetes are in low and middle income countries. Although it is well established that the prevalence of diabetes is rising there is little information on the prevalence of diabetic retinopathy (DR) in different parts of the world and particularly in low and middle-income settings. This makes it difficult to identify where DR screening and treatment programmes are needed. Population based surveys of DR in low and middle income settings are lacking because typically these data are expensive, difficult and time consuming to obtain – relying on sophisticated diagnostic equipment. Most available DR prevalence estimates are from diabetes clinics, which is subject to bias limiting their use in planning ophthalmic services for diabetics in the general population. RAAB+ DR was therefore developed as a relatively rapid and affordable method for estimating the prevalence of diabetes and DR in the population aged ≥50 years in order to inform diabetic eye services.

RAAB+DR overview

RAAB+DR follows the standard RAAB methodology, with additional two additional components:

1. Assessment of the diabetes status of all eligible survey participants at their household;
2. Assessment of DR among eligible survey participants identified as having diabetes at the household.

In addition to RAAB outputs, RAAB+DR provides the following estimates for population aged ≥50 years:

- The prevalence of diabetes;
- The prevalence of DR and sight threatening diabetic retinopathy (STDR) among people with diabetes and in the general population;
- Coverage of DR examinations among people with known diabetes (the proportion of people with known diabetes who have had an eye exam ever and in the past year);
- Levels of glycaemic control among people with diabetes (the proportion of people with known diabetes who have random blood glucose < 200mg/dl).

What makes RAAB+DR rapid?

In order to keep the survey relatively rapid and affordable, simplified diabetes and DR assessment examination procedures are used that can be conducted at the household. Diabetes is assessed through interview and measurement of random blood glucose (RBG). DR is assessed using dilated examination with a direct and indirect ophthalmoscope using a simplified DR grading scheme. There is also automated software for data entry and analysis for RAAB+DR included within the RAAB package.

What RAAB+DR is not

RAAB+DR only includes people aged over 50 years and therefore cannot estimate the prevalence of blindness, diabetes, and DR in younger age groups.

In order to keep the survey relatively affordable and rapid, RAAB+DR uses simplified examination procedures that can be conducted at the household. This has implications for the degree of clinical detail that can be collected:

- the diagnosis of diabetes in RAAB+DR is made based on the participant having a history of diabetes or an elevated RBG rather than a fasting blood glucose or oral glucose tolerance test. This may slightly underestimate the prevalence of diabetes.
- DR assessment is by dilated examination by direct and indirect ophthalmoscope using a simplified grading system. RAAB+DR therefore does not provide comprehensive detail on the level of DR among people with diabetes. This would require stereoscopic seven-field fundus photography or slit lamp biomicroscopy undertaken at a clinic, which would not be practical or affordable in some settings. Dilated examination with an indirect ophthalmoscope has been found to have reasonable sensitivity and specificity for detecting any DR and sight threatening DR. These are the key indicators for planning because it tells us how many people are likely to need monitoring or treatment in the future and how many are likely to require treatment now to prevent loss of vision from DR.

When should RAAB+DR be conducted?

Including the additional diabetes and DR components adds considerably to the complexity, time and cost of the survey compared to a standard RAAB (see details on budget in section 6.2). RAAB+DR should only be conducted if:

- The prevalence of diabetes is expected to be high (e.g. >15% among people aged 50+ years). In the absence of recent population based data, the estimated country level prevalence of diabetes can be found through the International Diabetes Foundation website (http://www.idf.org/atlasmap/atlasmap). If prevalence is low, a standard RAAB should be undertaken.
- There are sufficient resources available (equipment and funding, see section 6.2)
- There is sufficient time available to conduct the survey (see section 6.2)
- Ophthalmologists experienced in examining for DR using indirect ophthalmoscopy are available for the survey (see section 6.2)
- Diabetic and DR examination and treatment services are available and accessible to people in the survey identified as needing diabetic services.
- The information will be used for planning DR services.

6.2 Preparation for the survey

The standard RAAB preparations should be followed (see Chapter 2 and 3) with the following modifications:

Sample size

The sample size should be sufficient to estimate the prevalence of DR as well as prevalence of blindness. You will therefore need to obtain estimates of both the expected prevalence of blindness in people aged 50+, and the expected prevalence of DR in the same age group (approximately 25% of the prevalence of diabetes), and calculate the sample size needed according to the lower prevalence.

Cluster size

A RAAB+DR survey takes longer to complete than a standard RAAB. This is because of the additional components: diabetes testing, dilated examinations for DR and the need for informed consent. In a standard RAAB it is recommended to select a cluster size of 50 people aged 50+ to be examined per team per day. However, pilot surveys have shown that this cluster size is not feasible for one team for RAAB+DR. Instead, cluster sizes should be reduced to 35 for one team or to 60 persons for two teams working together in order to complete one cluster in one day. A modified sample size calculator for clusters of 35 people (1 team) and for 60 people (2 teams) will be shown when the user selects the RAAB+DR option. Please be aware that this will increase the duration of the survey and associated running costs (see under Survey duration).

Selection of survey teams

A RAAB+DR team should include:

- 1 ophthalmologist experienced in examining for DR using direct and indirect ophthalmoscopes.
- 1 person to undertake visual acuity examination. This is often an ophthalmic assistant, ophthalmic nurse or optometrist.
- 1 person to undertake diabetes testing and assist with visual acuity examination. This should be a nurse/health worker.
- 1 driver
- For each cluster, 1 local health worker or community worker (or village elder), who knows the people in the cluster.

Training of field staff

The importance and approaches for RAAB training are described in chapter 2. In addition to the standard RAAB training three additional days should be included for RAAB+DR:

- two days to train ophthalmologists in DR assessment using the Scottish Grading Scheme
- one day (for the full survey team) to allow time to cover the extended survey protocol, diabetes assessment and obtaining informed consent.

The DR training assessment should be conducted by a retinal specialist. Please see the website for details of suggested trainers.

Suggested training schedule for ophthalmologists in DR assessment

Day 1

Participants: survey coordinators and ophthalmologists

Morning

- how to grade DR using the Scottish DR grading scheme
- how to complete the DR section of the survey form

Afternoon

- exercise: practice grading of diabetic patients. The survey co-coordinator should arrange for 20-30 diabetic patients to be available for practice grading.

Day 2:

Participants: survey coordinators and ophthalmologists

Morning

- recap of DR grading scheme
- inter-observer variation assessment for DR grading (see below)

Afternoon

- analysis of IOV results
- discussion of IOV results

Inter-observer variation of DR grading

Before undertaking the RAAB+DR survey, it is important to know whether all examiners agree on the assessment of DR. In order to measure this, a photoset of 40 retinal images has been developed. These have been graded by a retinal expert (referred to as 'Gold Standard' grades). During training, the photographs are graded by each survey ophthalmologist separately (viewed on a computer). The DR grades of each ophthalmologist are compared to the gold standard grades. The grading can be done simultaneously with ophthalmologists using separate computers/laptops if available. Alternatively, all ophthalmologists can view together on a screen, but grading must be done separately without discussion. Each ophthalmologist should record one retinopathy and one maculopathy grade for each photograph using the form provided in Appendix 4.

Survey equipment

All equipment and survey records used during the survey work should be available during the training sessions and for the IOV assessment. In addition to standard RAAB equipment, the following equipment and supplies are required for each team conducting fieldwork for RAAB+DR:

Forms

- Set of diabetes/DR survey records printed on the back of the standard RAAB form
- Referral slips for hospital/health facilities for participants with diabetes/DR
- Participant information sheet and consent forms (see section 6.3 'ethical considerations' and file on CD)
- Dilation record form for ophthalmologists to keep a note of who they dilate, what time and how to find their household (see file on CD).

Equipment

- Inkpad for obtaining thumbprint consent for people unable to write

For diabetes assessment:

- Digital glucose meter (one per team)
- Test strips (designed for use with glucose meter, one per participant)
- Lancets (single use disposable e.g. Accu-chek Safe-T-Pro Lancet, one per participant)
- Disposable gloves (one pair per participant)
- Sharps disposal box (one per team)
- Alcohol swabs (one participant)

For DR assessment:

- Indirect ophthalmoscope with 20 diopter lens (one per team)
- Dilating drops

The Survey Coordinator has to ensure that each survey team has a full set of the equipment.

Survey duration

A RAAB+DR will take longer than a standard RAAB. This is because cluster sizes need to be reduced in order for all the activities to be completed each day. If two teams work together in one cluster of size 60, this will reduce the number of travel days by about 10%, but the costs on allowances will be double. If a cluster size of 35 people per team per day is selected this will increase the number of clusters to be covered by about one third. This also results in extra costs on travel and on allowances.

Despite efforts to make the survey as simple as possible, RAAB+DR is a considerable undertaking and the time and efforts required should not be underestimated. RAAB+DR is more complex and takes longer than a standard RAAB and it is important that the survey coordinator and survey teams are prepared for this.

Budget

RAAB+DR is more expensive than RAAB because:

a) Additional equipment are required for diabetes and DR assessment
b) Additional staff are required for diabetes assessment
c) The survey duration and associated running costs are increased
d) The duration of the training is increased by 3 days and a retinal specialist is recommended

The additional costs will vary depending on salaries, transport and cost and availability of equipment such as indirect ophthalmoscopes and survey running costs. It is expected that RAAB+DR will costs at least 50% more than a standard RAAB.

6.3 Field work.

Examination protocol and coding instructions for the survey record form

A copy of the diabetes/DR survey record is given in Appendix 3. This should be printed on the back of the standard RAAB survey record. The purpose of the diabetes/DR survey record is to collect information that will provide estimates of the following indicators:

- The prevalence of diabetes
- The prevalence of DR and sight threatening DR
- The proportion of diabetics who are aware they had diabetes
- The proportion of known diabetics who have had a previous retinal examination (coverage)
- Levels of glycaemic control among people with diabetes

The diabetes/DR survey form contains three different sections:

H. Diabetes assessment (for all participants)
I. Questions on diabetes for known diabetics
J. Diabetic retinopathy assessment (for all people with known/newly diagnosed diabetes)

The diabetes/DR survey form is completed after completion of the standard RAAB form.

Instructions for completing forms

Boxes need to be filled with a number, circles have to be tick marked or made black and on lines, a text has to be written. Always use a pencil to fill the records and write clearly. It is important that the form is clearly marked so that the data entry person does not get confused. If an error is made, use an eraser to remove the wrong entry.

Section H: Diabetes assessment

Equipment needed – see details under 'Equipment' in 6.2

Methods:

Question 1: Participants are first asked whether they have been previously been told by health professional that they have diabetes, sugar in urine or high blood sugar. Mark the appropriate circle: 1 for 'No', 2 for 'Yes'.

Question 2: Survey participants undergo a random blood glucose (RBG) test using finger prick blood sample. This is carried out for all participants regardless of whether or not they have had a previous diagnosis of diabetes.

Random blood glucose is assessed using a digital glucose meter (also known as a glucometer) and the appropriate glucose test strips for that meter. A number of different glucose meter models exist such as the Roche Accu-chek and Life Scan One-Touch systems. The same model should be used by all teams. Detailed instructions for how to operate the glucose meters will come with the machines on purchase. To obtain the finger prick blood sample, single-use disposable lancets (e.g. Accu-chek Safe-T-Pro plus) or lancing devices designed for multiple use must be used. Disposable gloves are to be worn (replacing with new gloves for each participant) and lancets and test strips should be disposed of in a sharps disposal container. RBG testing should be carried out by the nurse/health worker in the team trained in these activities.

There are two different measurement systems for glucose levels: mg/dl or mmol/l. Make sure the glucose meter is set to the mg/dl measurement system, because this is what the RAAB+DR software uses. Record the random blood glucose level in the boxes provided. Record the random blood glucose level in the boxes provided. All three boxes should be filled in. If a person has a RBG level of less than 100, enter 00 into the first boxes. For example, a RBG of 75mg/dl, would be written in as 0075.

If a person refuses to undergo a RBG test, mark the circle 'refused blood test'

Diabetes classification

For the purposes of this survey, a person is classified as having 'diabetes' if they report being previously diagnosed with the condition and/or they have a RBG of 200mg/dl or more. If a person does not have diabetes according to this definition, the examination finishes here. People with diabetes are further classified into either having 'known diabetes' or 'newly diagnosed diabetes' and this classification determines the next steps:

- Known diabetes: a person is classified as having 'known diabetes' if they answer 'yes' to question H1 (that they have been previously been told by health professional that they have diabetes, sugar in urine or high blood sugar) even if their RBG level is less than 200mg/dl. For people with 'known diabetes, sections I and J of the survey record should also be completed.
- Newly diagnosed diabetes: a person is classified as having 'newly diagnosed diabetes' if they answer 'no' to question 1 but they have a RBG level of 200mg/dl or more. For people with 'newly diagnosed diabetes' section J of the survey record should be completed. Table 9 summarises the diabetes status classifications based on responses to question H1 and H2.

Table 9: Diabetes classification

Response to question H1: 'Have you ever been told by a doctor /nurse that you have diabetes, sugar in your urine or high blood sugar'	**Question H2: RBG level**	**Classification**	**Action**
No	1-199mg/dl	Does not have diabetes	Finish
No	200+ mg/dl	Newly diagnosed diabetes	Complete section J
Yes	1-199mg/dl	Known diabetes	Complete sections I&J
Yes	200+ mg/dl	Known diabetes	Complete sections I&J
Yes	Refuses RBG test	Known diabetes	Complete sections I&J
No	Refuses RBG test	Unknown status	Finish

The RAAB software is programmed in such a way that sections will be open for data entry according to the rules shown above.

Section I: questions for known diabetics

This section should be filled in for participants who had been previously told by a health professional that they had diabetes ('known diabetes').

- Question 4 (age at diagnosis): If the participant can only recall how many years ago they were diagnosed, use their current age recorded on the RAAB survey record to work out the age at diagnosis. Record the age in the boxes provided. Use both the boxes; if the person was older than 99 years at diagnosis, enter '99' in the first box.
- Question 5 (treatment for diabetes): Mark the appropriate circle.
- If the answer is 'No', then mark the circle 'No, No treatment' (1). If the answer is 'Yes' then mark option 2 to 6. If the respondent is modifying their diet to control their diabetes but not using any tablets/insulin, then select option 2 'diet only'. If they are modifying their diet, but also using tablets or insulin, then select either the 'tablets' (3) or 'insulin' (4) option (as appropriate). If they are using both tablets and insulin, select the 'tablets and insulin' (5) option. Only one response option can be marked.

- Question 6 (retinal examination): Ask the question in full. This is important to make it clear to the participant that you are asking about retinal eye examination for DR rather than other more regular eye tests. If the answer to the question was 'No', then mark the circle 'Not examined' (1). If the answer to the question was 'Yes' then option 2 to 4 can be marked.

Section J: Diabetic Retinopathy Assessment

All people with known or newly diagnosed diabetes should have both eyes examined for diabetic retinopathy. Examination is by direct and indirect ophthalmoscope at the household. The Scottish DR grading system is used (see Table 10) which is similar to the International Council of Ophthalmology grading of diabetic retinopathy and diabetic macula oedema. The simplified scheme was developed for DR screening and is therefore designed primarily to detect the presence of any DR and retinopathy that requires referral to an ophthalmologist i.e. Sight threatening DR. This makes it an appropriate grading system to use in a survey designed to inform planning because it tells us how many people are likely to need referral to an ophthalmologist and how many require immediate treatment to prevent loss of vision from DR.

Equipment – – see details under 'Equipment' in 6.2:

Methods

The participant is taken into the house and seated somewhere comfortable. The pupil is dilated with a short-acting mydriatic (tropicamide 0.5%) eye drop. Dilating drops should be left for a minimum of 30 minutes to take effect during which time the team can continue to neighbouring households before returning for examination. The ophthalmologist should keep a record of the participants they have dilated, the location of their house and the time mydriatic was instilled, so they can return to the dilated participants in time. A suggested form for recording this is given the survey forms of the RAAB CD. The DR examination is carried out using a direct ophthalmoscope and an indirect ophthalmoscope with 20 dioptre lens in a darkened room in the household.

The retina is examined first with the indirect ophthalmoscope and 20 dioptre lens. The examiner looks for retinal haemorrhages, or exudates, and evidence of previous laser treatment. It may be possible to detect new vessels and/or micro-aneurysms with the indirect ophthalmoscope, but the low magnification of the indirect means that these signs may be missed. With direct ophthalmoscope, the examiner inspects the optic disc, looking for new vessels, and the macula. The major retinal vessels are then examined. The retinopathy is graded using the grading scheme is shown in the table below:

Table 10. Scottish Diabetic Retinopathy Grading Scheme

RETINOPATHY	**Description**
R0 (no visible retinopathy)	**No diabetic retinopathy anywhere**
R1 (mild)	**Background retinopathy BDR – mild** The presence of at least any of the following: - dot haemorrhages - micro-aneurysms - hard exudates - cotton wool spots - blot haemorrhages - superficial or flame-shaped haemorrhages
R2 (observable background)	**Background diabetic retinopathy BDR - observable** Four or more blot haemorrhages in one hemi-field only (inferior and superior hemi-fields delineated by a line passing through the centre of the fovea and optic disc)

R3 (referable background)	**Background diabetic retinopathy BDR – referable** Any of the following features: - four or more blot haemorrhages in both inferior and superior hemi-fields - venous beading - IRMA
R4 (proliferative)	**Proliferative diabetic retinopathy PDR** Any of the following features: - active new vessels - vitreous haemorrhage
R6 (inadequate)	**Not adequately visualised**: Retina not sufficiently visible for assessment

MACULOPATHY	**Description**
M0 (No maculopathy)	No features in ≤2 disc diameters from the centre of the fovea sufficient to qualify for M1 or M2 as defined below.
M1 (Observable)	Lesions as specified below within a radius of > 1 but ≤2 disc diameters the centre of the fovea. Any hard exudates
M2(Referable)	Lesions as specified below within a radius of ≤ 1 disc diameter of the centre of the fovea. Any hard exudates
M6 (inadequate)	Not adequately visualised: Macula not sufficiently visible for assessment

DR examination is by dilated ophthalmoscopy for reasons of cost and simplicity because this allows examination at the household. However, as improved and affordable handheld portable retinal cameras are developed, these may become viable alternatives to be used at the household to increase the sensitivity and specificity of DR diagnosis.

This section of the form should be completed for all people with known or newly diagnosed diabetes.

- Examination method: Mark whether eyes are examined by fundoscopy (1) or by fundus camera (2). If dilated examination or fundus photography is refused, mark (3) and finish here.
- Question 8: A description of the retinopathy grades is given in the table above. Mark one grade per eye. If an eye cannot be graded because the fundus cannot be adequately visualised (e.g. due to a lens opacity) mark ‘R6 not adequately visualised’ and record the reason why. It is expected that this then also applies to question 9 and 10.
- Question 9: A description of the maculopathy grades is given in the table above. Mark one grade per eye. If the fundus cannot be adequately visualized mark ‘M6 not adequately visualised’.
- Question 10: Mark one option per eye.

Ethical considerations and informed consent

A standard RAAB can rely on verbal informed consent (subject to approval from ethics committees) as the examinations are non-invasive. However, a RAAB+DR includes finger prick blood tests and dilated eye examinations and therefore written informed consent must be obtained. A participant information should be written explaining:

- the purpose of the study
- the procedures involved for the participant in the study

- the risks and benefits of taking part
- that participation is voluntary
- that all information collected will be kept confidential to the survey team

On arrival at the household the information sheet is either read out or given to all study participants to read, depending on literacy levels. If a person agrees to take part, they are then required to sign or thumbprint (using an inkpad) a consent form before any data is collected. A sample participant information sheet and consent forms is included in the survey forms of the RAAB CD. These may need to be adapted to suit local ethical committee requirements. As with other survey forms, consent forms must be kept in a secure place such as a locked filing cabinet.

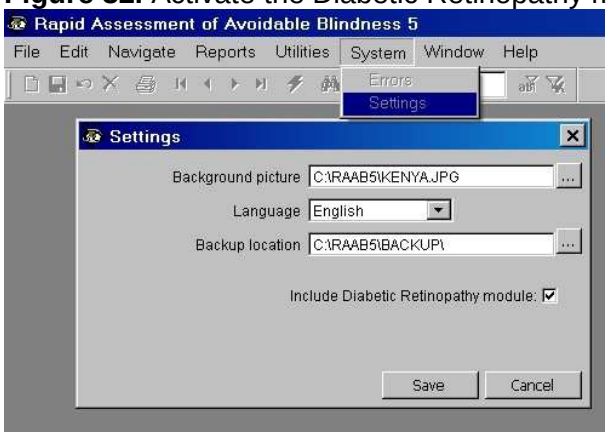
It is very important that appropriate advice is given to participants regarding diabetes and DR. Participants should be informed of their RBG level and results of the DR examination. All participants with elevated RBG levels (whether known or newly diagnosed diabetes) and signs of DR should be referred to the appropriate health facility. Diagnosis of diabetes is made through assessment of glucose levels from non-fasting blood samples, rather than through use of the oral glucose tolerance test or fasting blood glucose. This method may miss some cases of diabetes. Therefore all participants with RBG levels below 200mg/dl should still be advised to attend the appropriate health facility for diabetes check-ups. That actually means every participant in this high prevalence area is referred for further examination Similarly, Participants with diabetes should be advised of the need for regular eye examinations and where they should attend for this. The survey coordinator is responsible for finding out appropriate health facilities for referring people for diabetes and DR.

6.4 Data entry and reports

To activate the Diabetic retinopathy module in the RAAB software select menu ‘Systems / settings’. Mark the tick box 'Include Diabetic Retinopathy module', click on ‘Save’ and close the application. When RAAB is started again the following changes in the software have been activated:

- The standard sample size calculator is replaced by a special sample size calculator for DR (menu ‘Utilities / sample size calculation’)
- An additional DR IOV form becomes visible (menu ‘File / IOV form for DR)
- On the standard RAAB Survey form an additional page for DR becomes visible (menu ‘File / survey form’).
- An additional DR report becomes visible(menu ‘Reports / DR report’)

Figure 32. Activate the Diabetic Retinopathy module

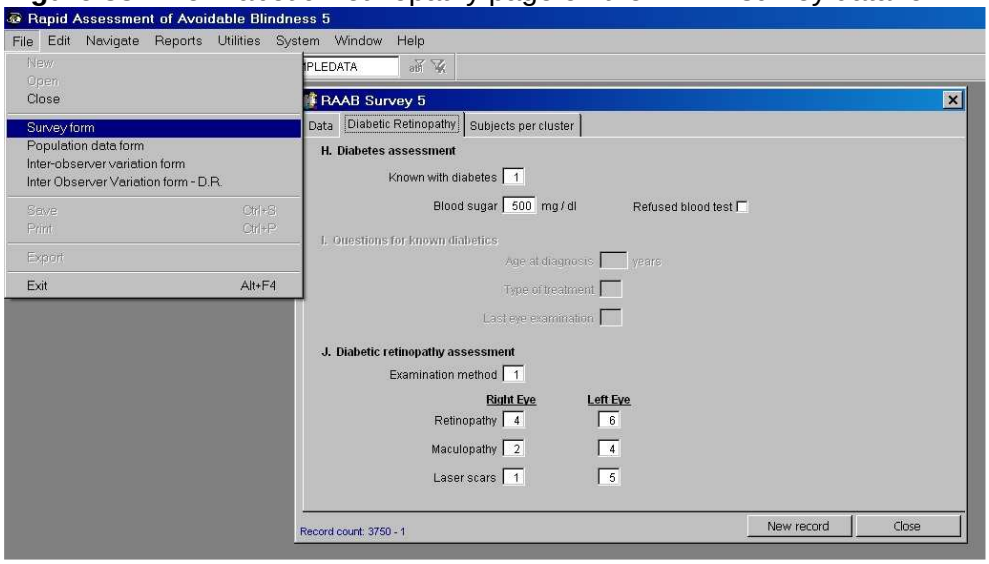


Survey data form

The survey data form is used to enter data from the RAAB and DR survey records. For each record enter first the standard RAAB data (using the data form under the ‘data’ tab) and then the

DR data (using the data form under the ‘diabetic retinopathy’ tab). When you have entered the RAAB data for a respondent, the boxes in the diabetic retinopathy data form will be opened (Figure 33). Place the cursor in the ‘known with diabetes’ box and type the entry in this field. Confirm the entry by pressing <Enter>. The cursor will now move to the next field. Type the entry and press <enter> again and continue to finish all fields in this way.

Figure 33. The Diabetic Retinopathy page on the RAAB survey data form



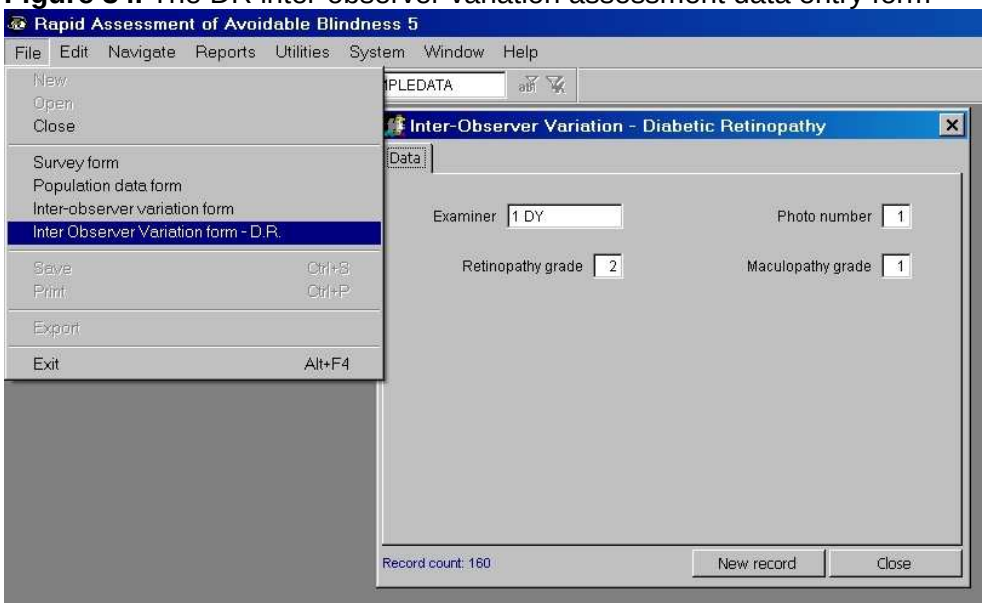
Instructions for data entry clerks are given below. Coding instructions for the survey teams are presented in 6.3.

If the tick box 'Include Diabetic Retinopathy module' is marked then the consistency checks for the DR module are activated. Any inconsistencies in the DR form will be included in the general Consistency check report, together with any inconsistencies in the RAAB data entry form (see chapter 4.8.1: Control of data entry errors). When the tick box 'Include Diabetic Retinopathy module' is not marked the consistency report will only list any inconsistencies in the RAAB data entry form only.

Diabetic retinopathy inter-observer variation assessment

The ophthalmologists responsible for the grading of the retinopathy and maculopathy are tested on their grading skills by showing them 40 slides of fundus photographs. Each ophthalmologists marks their grading on a standard form (see Appendix 4). These forms are then entered in a special data entry form (Figure 34). The grading of the Gold Standard do not have to be entered as these are built in the RAAB software.

Figure 34. The DR inter-observer variation assessment data entry form



Diabetes and Diabetic Retinopathy report

When the Diabetic Retinopathy module has been activated, an automatic report can be generated like the other reports in RAAB. Use menu 'Reports / Diabetes and Diabetic Retinopathy' to generate this report.

Coding instructions for data entry staff for DR form

H. Diabetes Assessment

Known with diabetes: Enter the code that is on the record form indicating whether or not the person has been previously diagnosed with diabetes ('1' for No or '2' for Yes). This is a 'must enter' field and cannot be left blank.

Blood sugar: Enter the three digit random blood sugar number as it is on the record form. If a person refused to have the RBG test, this field will be blank and the 'refused blood test' box will be marked.

Refused blood test: If this is marked on the record form, use the mouse to check the box on the data entry form. If this is marked *and a* person does not have known diabetes (i.e. answer to 'known diabetes' is '1' No) all other fields will become inactive.

I. Questions to known diabetics

The fields in this section will only be opened if the answer to 'known with diabetes' was '2' (Yes).

Age at diagnosis: Enter the age as it is on the record form.

Type of treatment: Enter the code as on the record form indicating type of treatment the person receives for their diabetes. If they do not receive any treatment, the code should be '1' 'No treatment)'. If they do receive treatment code 2-6 apply. Only one entry is allowed.

'Last eye examination': Enter the code as on the survey record form indicating when the person had an eye examination. If they have not had an examination, the code should be '1' .

J. Diabetic retinopathy assessment.

The fields in this section will only be opened if a person has diabetes – i.e. the answer to 'known with diabetes' was '2' (for Yes) and / or they have a blood sugar level of 200mg/dl or more.

Retinopathy examination method - Enter the code as on the survey record form indicating how the participant was examined for DR. If the person refused dilation and/or refused fundus photography code '3' should be marked. It indicates that no eye examination was done and all other fields in this section will become inactive.

Retinopathy (right and left eye): Enter code for retinopathy grade as on the survey record form
Maculopathy (right and left eye): Enter code for maculopathy grade as on the survey record form
Laser scars (right and left eye): Enter code for laser scars as on the survey record form

Consistency checks
The 'Validation of double data entry' facility and consistency checks can be used as in the standard RAAB. When the DR module is activated the fields on the DR form will be checked together with all other fields of the RAAB database. If the DR module is not activated, the fields of the DR data entry form should be empty and are not checked. (see chapter 4.8.3 on page 49).

Annex 1. RAAB Survey Record form

RAPID ASSESSMENT FOR AVOIDABLE BLINDNESS

A. GENERAL INFORMATION

Survey area: _____ ☐☐ Cluster: ☐☐☐ Year - month: ☐☐☐☐ - ☐☐

Name: _____ Sex: Male: O (1) Female: O (2) Individual no.: ☐☐ Age (years): ☐☐

Optional 1: ☐☐

Optional 2: ☐☐

Examination status:

Examined: O (1) (go to B) Refused: O (3) (go to E)

Not available: O (2) (go to E) Not able to communicate: O (4) (go to E)

Always ask: "Did you ever have any problems with your eyes?" Yes: O (1) No: O (2)

If not available - details (availability / tel number / address)

B. VISION

Using distance glasses: No: O (1) Yes: O (2)

Using reading glasses: No: O (1) Yes: O (2)

Presenting vision	Right eye	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)

Pinhole vision	Right eye	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)

C. LENS EXAMINATION

	Right eye	Left eye
Normal lens / minimal lens opacity:	O (1)	O (1)
Obvious lens opacity:	O (2)	O (2)
Lens absent (aphakia):	O (3)	O (3)
Pseudophakia without PCO:	O (4)	O (4)
Pseudophakia with PCO:	O (5)	O (5)
No view of lens:	O (6)	O (6)

D. MAIN CAUSE OF PRESENTING VA>0.5

(Mark only one cause for each eye)

	Right eye	Left eye	Principal cause in person
Refractive error:	O (1)	O (1)	O (1)
Aphakia, uncorrected:	O (2)	O (2)	O (2)
Cataract, untreated	O (3)	O (3)	O (3) (F)
Cataract surgical complicatior	O (4)	O (4)	O (4)
Trachoma corneal opacity:	O (5)	O (5)	O (5)
Other corneal opacity:	O (6)	O (6)	O (6)
Phthisis:	O (7)	O (7)	O (7)
Onchocerciasis:	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)
Other posterior segment:	O (12)	O (12)	O (12)
All globe/CNS abnormalities:	O (13)	O (13)	O (13)
Not examined: can see 6/18	O (14)	O (14)	O (14)

E. HISTORY, IF NOT EXAMINED

(From relative or neighbour)

Believed	Right eye	Left eye
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 SURGERY WAS NOT DONE

(Mark up to 2 responses, if VA<6/18, not improving with pinhole, with visually impairing lens opacity in one or both eyes)

Need not felt	O (1)
Fear for surgery or poor result	O (2)
Cannot afford operation	O (3)
Treatment denied by provider	O (4)
Unaware that treatment is possible	O (5)
No access to treatment	O (6)
Local reason (optional)	O (7)

G. DETAILS ABOUT CATARACT OPERATION

	Right eye	Left eye
Age at operation (years)	☐☐	☐☐
Place of operation		
Government hospital	O (1)	O (1)
Voluntary / charitable hospital	O (2)	O (2)
Private hospital	O (3)	O (3)
Eye camp / improvised setting	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 free	O (2)	O (2)
Fully paid	O (3)	O (3)
Cause of VA>0.5 after cataract surgery		
Ocular comorbidity (Selection)	O (1)	O (1)
Operative complications (Surgery)	O (2)	O (2)
Refractive error (Spectacles)	O (3)	O (3)
Longterm complications (Sequelae)	O (4)	O (4)
Does not apply - can see 6/18	O (5)	O (5)

Annex 2. RAAB inter-observer variation form

ASSESSMENT OF INTER-OBSERVER VARIATION - RAAB

Examiner _____ **Patient ID** ☐☐

B. VISION

Using distance glasses: **No:** O (1) **Yes:** O (2)
Using reading glasses: **No:** O (1) **Yes:** O (2)

Presenting vision	Right eye	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)

Pinhole vision	Right eye	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)

C. LENS EXAMINATION

	Right eye	Left eye
Normal lens / minimal lens opacity:	O (1)	O (1)
Obvious lens opacity:	O (2)	O (2)
Lens absent (aphakia):	O (3)	O (3)
Pseudophakia without PCO:	O (4)	O (4)
Pseudophakia with PCO:	O (5)	O (5)
No view of lens:	O (6)	O (6)

D. MAIN CAUSE OF PRESENTING VA<6/18

(Mark only one cause for each eye)

	Right eye	Left eye	Principal cause in person
Refractive error:	O (1)	O (1)	O (1)
Aphakia, uncorrected:	O (2)	O (2)	O (2)
Cataract, untreated	O (3)	O (3)	O (3)
Surgical complications:	O (4)	O (4)	O (4)
Trachoma corneal opacity:	O (5)	O (5)	O (5)
Other corneal opacity:	O (6)	O (6)	O (6)
Phthisis:	O (7)	O (7)	O (7)
Onchocerciasis:	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)
Other posterior segment:	O (12)	O (12)	O (12)
All globe/CNS abnormalities:	O (13)	O (13)	O (13)
Not examined (can see 6/18)	O (14)	O (14)	O (14)

Annex 3. Diabetes and Diabetic Retinopathy form (optional)

DIABETES AND DIABETIC RETINOPATHY

H. Diabetes Assessment (complete for everyone)

1 Have you ever been told by a doctor or nurse that you have diabetes, sugar in your urine or high blood sugar? No O (1) Yes O (2)

2 Action: Measure blood sugar ☐☐☐☐ mg/dl 3 Refused blood test O

I. Questions for known diabetics (i.e. said 'YES' to question A1)

4 What age were you when you were told you had diabetes? ☐☐ Years

5 Are you currently receiving treatment for diabetes? No
- If 'Yes', what type of treatment do you receive? Yes

No treatment O (1)
Diet O (2)
Tablets O (3)
Insulin O (4)
Tablets and insulin O (5)
Other O (6)

6 Before today, have you ever had your eyes examined because of your diabetes e.g. drops were put in your eyes before the examination or a photograph was taken of the back of your eye? No
- If 'Yes', when was the last time you had your eyes examined because of your diabetes? Yes

Not examined O (1)
0-12 months ago O (2)
13-24 months ago O (3)
>24 months ago O (4)

J. Diabetic retinopathy assessment Complete if known diabetic ('YES' to A1) or if blood sugar ≥200mg/dl

7 Examination method:
dilatation and fundoscopy O (1)
fundus camera O (2)
refused dilatation and/or fundus photograph O (3)

8 Retinopathy	Right Eye	Left Eye
R0 (No visible retinopathy)	O (1)	O (1)
R1 (mild)*	O (2)	O (2)
R2 (observable background)*	O (3)	O (3)
R3 (referable)*	O (4)	O (4)
R4 (proliferative)*	O (5)	O (5)
R6 (Not adequately visualized)*	O (6)	O (6)
Reason not adequately visualised?	.....	.....
	.....	.....

9 Maculopathy		
M0 (No maculopathy)	O (1)	O (1)
M1 (Observable)*	O (2)	O (2)
M2 (Referable)*	O (3)	O (3)
M6 (Not adequately visualized)*	O (4)	O (4)

10 Laser photocoagulation scars		
Laser scars absent	O (1)	O (1)
Scars present – pan retinal laser	O (2)	O (2)
Scars present – macular laser	O (3)	O (3)
Scars present – pan retinal and macular laser	O (4)	O (4)
Not adequately visualized*	O (5)	O (5)

*Refer if newly diagnosed/uncontrolled diabetes. Refer if any signs of retinopathy or if not visualized (R1-6/M1-M6)

Annex 4. DR grading form for inter-observer variation assessment (optional)

DR grading record for interobserver variation assessment

Circle one retinopathy and one maculopathy grade for each photograph

	Retinopathy Grade						Maculopathy grade			
Photo	R0	R1	R2	R3	R4	R6	M0	M1	M2	M6
1	0	1	2	3	4	6	0	1	2	6
2	0	1	2	3	4	6	0	1	2	6
3	0	1	2	3	4	6	0	1	2	6
4	0	1	2	3	4	6	0	1	2	6
5	0	1	2	3	4	6	0	1	2	6
6	0	1	2	3	4	6	0	1	2	6
7	0	1	2	3	4	6	0	1	2	6
8	0	1	2	3	4	6	0	1	2	6
9	0	1	2	3	4	6	0	1	2	6
10	0	1	2	3	4	6	0	1	2	6
11	0	1	2	3	4	6	0	1	2	6
12	0	1	2	3	4	6	0	1	2	6
13	0	1	2	3	4	6	0	1	2	6
14	0	1	2	3	4	6	0	1	2	6
15	0	1	2	3	4	6	0	1	2	6
16	0	1	2	3	4	6	0	1	2	6
17	0	1	2	3	4	6	0	1	2	6
18	0	1	2	3	4	6	0	1	2	6
19	0	1	2	3	4	6	0	1	2	6
20	0	1	2	3	4	6	0	1	2	6
21	0	1	2	3	4	6	0	1	2	6
22	0	1	2	3	4	6	0	1	2	6
23	0	1	2	3	4	6	0	1	2	6
24	0	1	2	3	4	6	0	1	2	6
25	0	1	2	3	4	6	0	1	2	6
26	0	1	2	3	4	6	0	1	2	6
27	0	1	2	3	4	6	0	1	2	6
28	0	1	2	3	4	6	0	1	2	6
29	0	1	2	3	4	6	0	1	2	6
30	0	1	2	3	4	6	0	1	2	6
31	0	1	2	3	4	6	0	1	2	6
32	0	1	2	3	4	6	0	1	2	6
33	0	1	2	3	4	6	0	1	2	6
34	0	1	2	3	4	6	0	1	2	6
35	0	1	2	3	4	6	0	1	2	6
36	0	1	2	3	4	6	0	1	2	6
37	0	1	2	3	4	6	0	1	2	6
38	0	1	2	3	4	6	0	1	2	6
39	0	1	2	3	4	6	0	1	2	6
40	0	1	2	3	4	6	0	1	2	6
41	0	1	2	3	4	6	0	1	2	6
42	0	1	2	3	4	6	0	1	2	6
43	0	1	2	3	4	6	0	1	2	6
44	0	1	2	3	4	6	0	1	2	6
45	0	1	2	3	4	6	0	1	2	6
46	0	1	2	3	4	6	0	1	2	6
47	0	1	2	3	4	6	0	1	2	6
48	0	1	2	3	4	6	0	1	2	6
49	0	1	2	3	4	6	0	1	2	6
50	0	1	2	3	4	6	0	1	2	6

Ophthalmologist Name:

_____

Retinopathy grades

R0 (No visible retinopathy)
R1 (mild)
R2 (observable background)
R3 (referable)
R4 (proliferative)
R6 (Not adequately visualized)

Maculopathy grades

M0 (No maculopathy)
M1 (Observable)
M2 (Referable)
M6 (Not adequately visualized)

Annex 5. Fieldnames used in the survey data file

Name of field	Type	Length	Meaning / codes
YEAR	Number	4	Year of examination
MONTH	Number	2	Month of examination
AREANAME	Character	20	Name of survey area
AREACODE	Number	2	Code of survey area
CLUSTER	Number	3	Cluster number
INDIVIDUAL	Number	2	Individual number
ID	Number	7	Areacode*100,000 + cluster no.*1,000 + individual no.
SEX	Number	1	1=Male, 2=Female
AGE	Number	2	50 + only; 99 = 99 years and older
OPTION 1	Number	2	Option 1: to be defined
OPTION 2	Number	2	Option 2: to be defined
STATUS	Number	1	Examination status
GLASSES	Number	1	Unaided, or with distance glasses
GLASSESN	Number	1	Unaided, or with reading glasses
PVARE	Number	1	Presenting vision right eye
PVALE	Number	1	Presenting vision left eye
BVARE	Number	1	Pinhole vision right eye
BVALE	Number	1	Pinhole vision left eye
LERE	Number	1	Lens status right eye
LELE	Number	1	Lens status left eye
CAUSERE	Number	2	Principal cause of VA<6/18, right eye
CAUSELE	Number	2	Principal cause of VA<6/18, left eye
PRCAUSE	Number	2	Principal cause VA<6/18, person
HISTRE	Number	1	History, if not examined, right eye
HISTLE	Number	1	History, if not examined, left eye
BAR1	Number	2	Barrier to cataract surgery 1
BAR2	Number	2	Barrier to cataract surgery 2
AGERE	Number	2	Age at operation right eye
AGELE	Number	2	Age at operation left eye
PLRE	Number	1	Place of operation right eye
PLLE	Number	1	Place of operation left eye
SURGRE	Number	1	Type of surgery right eye
SURGLE	Number	1	Type of surgery left eye
COSTRE	Number	1	Costs of services right eye
COSTLE	Number	1	Costs of services left eye
OUTLOWRE	Number	1	Cause of VA<6/18 after cataract surgery right eye
OUTLOWLE	Number	1	Cause of VA<6/18 after cataract surgery left eye
KNOWNDM	Number	1	Known to have diabetes
BLOODSUGAR	Number	3	Measure blood sugar in mg/dl
NOBLOOD	Logical	1	Refuses blood test
DMTYPETREAT	Number	1	Receiving treatment for diabetes and type of treatment
DMLASTEXAM	Number	1	Ever had eye examination because of diabetes and when
DREXAM	Number	1	Current examination for diabetic retinopathy
DRNODILATE	Logical	1	Refuses dilatation of the eye
DRNOPHOTO	Logical	1	Refuses fundus photograph
DRRETINARE	Number	1	Assessment of retinopathy in right eye
DRRETINALE	Number	1	Assessment of retinopathy in left eye
DRMACULARE	Number	1	Assessment of maculopathy in right eye
DRMACULALE	Number	1	Assessment of maculopathy in left eye
DRSCARSRE	Number	1	Assessment of laser treatment scars in right eye
DRSCARSLE	Number	1	Assessment of laser treatment scars in left eye

*: for codes: see RAAB Survey Record

Annex 6. Selection of population units through systematic sampling from a sampling frame

The installation CD contains a file (SAMPLING.XLS) which also demonstrates this method. When opening this file, a warning screen may appear, stating that the spreadsheet contains macros. Select 'Enable Macros'. This file has been checked by the latest version of Norton anti-virus software and is free of any viruses.

The sampling frame is located in the sheet 'Sampling frame'. The first column contains a list of code numbers, the second column the names of the population units, and the third column the total population of each unit. In the fourth column, the cumulative population will be calculated as follows: the cumulative population of the first population unit is equal to the total population of the first unit (unit A). The cumulative population of the second population unit is equal to the population of the first unit plus the population of the second unit (unit A plus unit B). The cumulative population of the third unit is equal to the cumulative population of the second unit plus the population of the third unit, etc. A short example of such a list is given in Table 1.

Table 1. Example of list of all population units in survey area

Code	Name Population unit	Population	Cumulative population
1	A	3000	3000
2	B	4500	7500
3	C	2000	9500
4	D	350	9850
5	E	2500	12350
6	F	3400	15750
7	G	200	15950
8	H	3000	18950
n	Etc.		

Assume it was decided that 60 clusters of 50 people aged 50 years and older were to be examined in the entire survey area. These 60 units have to be selected at random from the total number of population units in the sampling frame with a probability proportional to the size of the population unit. From each selected population unit one cluster will be examined.

The sampling of clusters is shown on the sheet 'Sampling explained'. First, the total population of the entire survey area (say 900,000) is divided by 60 to obtain the sampling interval. This gives a sampling interval of 15,000. The first population unit that will produce cluster 1 is selected within the first 15,000 people by multiplying the sampling interval (15,000) by a random number between 0 and 1 (e.g. 0.223), so 0.223 x 15,000 = 3,345. This would be in population unit B in table 1. From this population unit 50 people of 50 years and older will be examined and they form cluster 1. To identify the population unit from where the second cluster will be selected, add the sampling interval 15,000 to the number that identified the first cluster (i.e. 3,345 + 15,000 = 18,345, which is in population unit H). From this population unit 50 people of 50 years and older will be selected as the second cluster. Add 15,000 again to identify the third cluster (i.e. 18,345+15,000 = 33,345), etc, until you have located all 60 clusters (See Table 2).

Table 2. Example of systematic sampling of clusters

Survey design:	60 clusters of 50 people of 50+
Total population:	900,000
Sampling interval:	900,000 / 60 = 15,000
Random number 0-1:	0.223
First cluster:	0.223 x 15,000 = 3,345
Second cluster:	3,345 + 15,000 = 18,345
Third cluster:	18,345 + 15,000 = 33,345
etc.	

Now move to sheet 2 ‘Select your clusters’. Only fill the number of required clusters in cell B7. Press the button ‘New selection’ and a selection will be made automatically from the sampling frame by systematic sampling. Print the results and save the file. This is your list of selected population units where the clusters have to be taken. When the button ‘New selection’ is pressed again, a new selection will be made and it will be impossible to retrieve the original list of selected units.

In the example of table 2, units with a population of 20,000 people will definitely contain one and possibly two clusters. On the other hand, small units will have a much smaller chance of being selected as a cluster. With systematic sampling population units are selected with a probability according to their population size and this procedure is known to be self-weighing. This method also ensures that the selection of clusters is evenly spread over the entire population.

Annex 7. CALCULATION OF INTER-OBSERVER VARIATION (RAAB)

Date and time of report: 27-10-2012 0:50:46

This report is for the survey area: SampleArea

Gold Standard 1

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
0.81 - 1.00	Very good

Comparing the 'Gold Standard' with examiner: **2**

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

1 \ 2	1	2	3	4	5	6	Total
1	25	1					**26**
2		8	2	2			**12**
3			1				**1**
4							**0**
5				1	5		**6**
6				1	2		**3**
Total	**25**	**9**	**3**	**4**	**7**	**0**	**48**

Kappa Coefficient: 0.71

CI95% of Kappa: (0.54 - 0.88)

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

1 \ 2	1	2	3	4	5	6	Total
1	22	1					**23**
2		6	1				**7**
3		1	1	1			**3**
4				3			**3**
5				1	9		**10**
6						2	**2**
Total	**22**	**8**	**2**	**5**	**9**	**2**	**48**

Kappa Coefficient: 0.85

CI95% of Kappa: (0.73 - 0.97)

3. Inter-observer variation on best (pinhole) VA in the right eye:

1 \ 2	1	2	3	4	5	6	Total
1	28						**28**
2		8	1	2			**11**
3							**0**
4				1			**1**
5					5		**5**
6				1	2		**3**
Total	**28**	**8**	**1**	**4**	**7**	**0**	**48**

Kappa Coefficient: 0.79

CI95% of Kappa: (0.64 - 0.95)

4. Inter-observer variation on best (pinhole) VA in the left eye:

1 \ 2	1	2	3	4	5	6	Total
1	26						**26**
2	1	3	1	1			**6**
3			1	2			**3**
4				1	1		**2**
5				1	8		**9**
6						2	**2**
Total	**27**	**3**	**2**	**5**	**9**	**2**	**48**

Kappa Coefficient: 0.77

CI95% of Kappa: (0.62 - 0.93)

5. Inter-observer variation on examination of the lens in the right eye:

1 \ 2	1	2	3	4	5	6	Total
1	24	2					**26**
2	1	3		1			**5**
3			1	1			**2**
4	1			11	1		**13**
5				2			**2**
6							**0**
Total	**26**	**5**	**1**	**15**	**1**	**0**	**48**

Kappa Coefficient: 0.69

CI95% of Kappa: (0.51 - 0.87)

6. Inter-observer variation on examination of the lens in the left eye:

1 \ 2	1	2	3	4	5	6	Total
1	22	1		1			**24**
2	5	11					**16**
3				1			**1**
4				4			**4**
5				1			**1**
6						2	**2**
Total	**27**	**12**	**0**	**7**	**0**	**2**	**48**

Kappa Coefficient: 0.70

CI95% of Kappa: (0.52 - 0.88)

7. Inter-observer variation on main cause of visual impairment in the right eye:

1 \ 2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1	2														**2**
2												1			**1**
3			4												**4**
4				1					1	1		1			**4**
5															**0**
6						1									**1**
7															**0**
8															**0**
9									3						**3**
10										2					**2**
11															**0**
12											1	4			**5**
13															**0**
14	1													25	**26**
Total	**3**	**0**	**4**	**1**	**0**	**1**	**0**	**0**	**4**	**3**	**1**	**6**	**0**	**25**	**48**

Kappa Coefficient: 0.82

CI95% of Kappa: (0.68 - 0.95)

8. Inter-observer variation on main cause of visual impairment in the left eye:

1 \ 2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1	3														**3**
2															**0**
3			10						1						**11**
4	1									1					**2**
5															**0**
6							1								**1**
7															**0**
8															**0**
9									2			1			**3**
10										1					**1**
11											1				**1**
12										1		1			**2**
13			1												**1**
14	1													22	**23**
Total	**5**	**0**	**11**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**1**	**2**	**0**	**22**	**48**

Kappa Coefficient: 0.77

CI95% of Kappa: (0.62 - 0.91)

9. Inter-observer variation on principal cause of visual impairment in the person:

1 \ 2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1	2														**2**
2												1			**1**
3			4												**4**
4									1	1					**2**
5															**0**
6															**0**
7															**0**
8															**0**
9									2						**2**
10										1					**1**
11															**0**
12															**0**
13															**0**
14	1													35	**36**
Total	**3**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**3**	**2**	**0**	**1**	**0**	**35**	**48**

Kappa Coefficient: 0.81

CI95% of Kappa: (0.63 - 0.99)

Annex 8. INTER-OBSERVER AGREEMENT FOR DIABETIC RETINOPATHY

Date and time of report: 27-10-20 0:51:14

This report is for the survey area: SampleArea

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
0.81 - 1.00	Very good

INTER-OBSERVER AGREEMENT FOR DIABETIC RETINOPATHY

Gold Standard \ 1	0	1	2	3	4	Total
0	3			1		**4**
1	2	7	6	1	1	**17**
2			2	2	1	**5**
3			1	4	2	**7**
4				1	6	**7**
Total	**5**	**7**	**9**	**9**	**10**	**40**

Kappa Coefficient: 0.44

CI95% of Kappa: (0.25 - 0.63)

INTER-OBSERVER AGREEMENT FOR DIABETIC MACULOPATHY

Gold Standard \ 1	0	1	2	Total
0	15	1	5	**21**
1	4		3	**7**
2			12	**12**
Total	**19**	**1**	**20**	**40**

Kappa Coefficient: 0.45

CI95% of Kappa: (0.21 - 0.70)

Annex 9. RESULTS OF RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

SUMMARY REPORT

Date and time of report: 27-10-2012 0:51:42

This report is for the survey area: SampleArea

Year and month when survey was conducted: 2012- 5 until 2012- 6

This report shows the most important results from all the other reports. The 95% confidence interval (95% CI) is based on the sampling error in cluster sampling. More detailed information is provided in the other reports.

1. Eligible persons, coverage, absentees and refusals

	Total eligible		Examined		Not available		Refused		Not capable	
	n	%	n	%	n	%	n	%	n	%
Males	873	100.0%	872	99.9%	1	0.1%	0	0.0%	0	0.0%
Females	1,820	100.0%	1,815	99.7%	3	0.2%	1	0.1%	1	0.1%
Total	2,693	100.0%	2,687	99.8%	4	0.1%	1	0.0%	1	0.0%

2. Age and gender distribution of people examined in the sample

	Males		Females		Total	
	n	%	n	%	n	%
50 - 59 ye	371	42.5%	896	49.4%	1,267	46.0%
60 - 69 ye	283	32.5%	557	30.7%	840	31.6%
70 - 79 ye	179	20.5%	288	15.9%	467	18.2%
80+ years	39	4.5%	74	4.1%	113	4.3%
Total	872	100.0%	1,815	100.0%	2,687	100.0%

3. Sample prevalence of blindness, severe (SVI) and moderate (MVI) visual impairment - bilateral PVA

	Males		Females		Total	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Blindness	15	1.7 (0.8 - 2.6)	25	1.4 (0.7 - 2.0)	40	1.5 (0.9 - 2.0)
SVI	17	2.0 (1.0 - 2.9)	37	2.0 (1.4 - 2.7)	54	2.0 (1.5 - 2.6)
MVI	99	11.4 (8.8 - 13.9)	227	12.5 (10.8 - 14.3)	326	12.1 (10.6 - 13.7)
Functional Low Vision	16	1.8 (0.9 - 2.6)	48	2.6 (1.7 - 3.6)	64	2.4 (1.7 – 3.1)

4. Extrapolated magnitude of blindness, severe (SVI) and moderate (MVI) visual impairment - bilateral PVA

	Males		Females		Total	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Blindness	7,811	1.6 (0.7 - 2.5)	12,415	2.0 (1.3 - 2.6)	20,226	1.8 (1.3 - 2.4)
SVI	8,239	1.7 (0.8 - 2.6)	18,026	2.8 (2.2 - 3.5)	26,265	2.4 (1.8 - 2.9)
MVI	50,891	10.5 (8.0 - 13.1)	90,974	14.3 (12.5 - 16.0)	141,863	12.7 (11.1 - 14.2)
Functional Low Vision	8,482	1.8 (0.9 - 2.6)	21,543	3.4 (2.5 - 4.3)	30,025	2.7 (2.0 - 3.4)

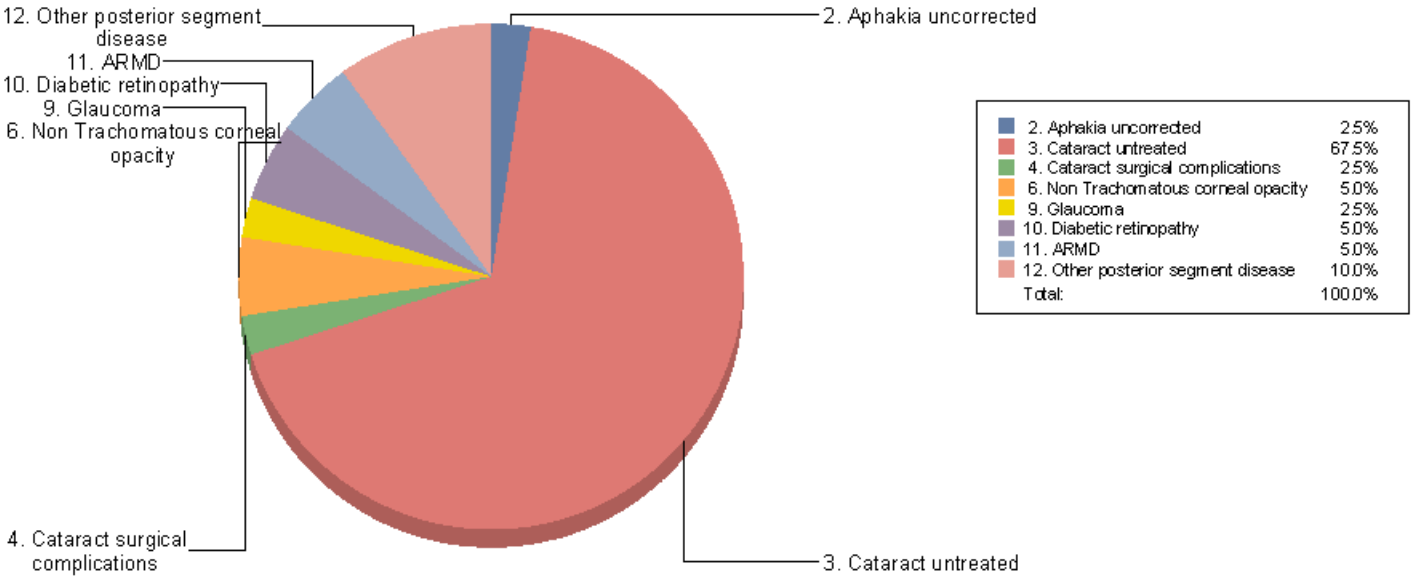
5. Blindness prevalence (PVA<3/60 in better eye) by age group

	Males		Females		Total	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
50 - 59 years	2	0.5 (0.0 - 1.3)	4	0.5 (0.0 - 0.9)	6	0.5 (0.1 - 0.8)
60 - 69 years	4	1.4 (0.0 - 2.8)	7	1.3 (0.2 - 2.3)	11	1.3 (0.5 - 2.2)
70 - 79 years	5	2.8 (0.5 - 5.1)	6	2.1 (0.6 - 3.6)	11	2.4 (1.1 - 3.6)
80+ years	4	10.3 (0.9 - 19.6)	8	10.8 (4.1 - 17.5)	12	10.6 (4.7 - 16.5)
Total	**15**	**10.3 (0.9 - 19.6)**	**25**	**10.8 (4.1 - 17.5)**	**40**	**10.6 (4.7 - 16.5)**

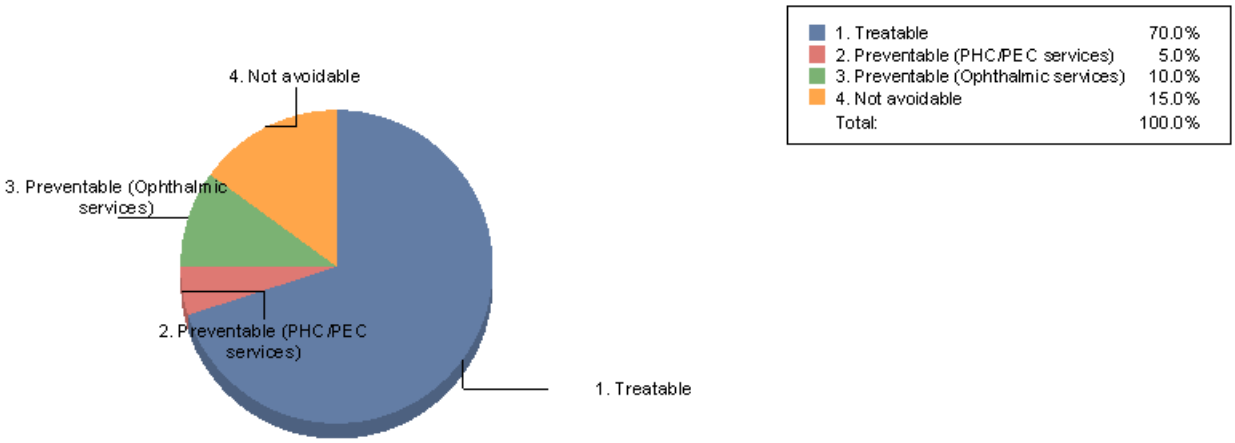
6. Principal cause of blindness, severe (SVI) and moderate (MVI) visual impairment in persons (PVA)

	Blindness		SVI		MVI	
	n	%	n	%	n	%
1. Refractive error	0	0.0%	2	3.7%	201	61.7%
2. Aphakia uncorrected	1	2.5%	0	0.0%	3	0.9%
3. Cataract untreated	27	67.5%	35	64.8%	86	26.4%
4. Cataract surgical complications	1	2.5%	0	0.0%	1	0.3%
5. Trachomatous corneal opacity	0	0.0%	0	0.0%	0	0.0%
6. Non Trachomatous corneal opacity	2	5.0%	0	0.0%	0	0.0%
7. Phthisis	0	0.0%	0	0.0%	0	0.0%
8. Onchocerciasis	0	0.0%	0	0.0%	0	0.0%
9. Glaucoma	1	2.5%	3	5.6%	7	2.1%
10. Diabetic retinopathy	2	5.0%	3	5.6%	12	3.7%
11. ARMD	2	5.0%	5	9.3%	6	1.8%
12. Other posterior segment disease	4	10.0%	6	11.1%	9	2.8%
13. All other globe/CNS abnormalities	0	0.0%	0	0.0%	1	0.3%
A. Treatable (1,2,3)	28	70.0%	37	68.5%	290	89.0%
B. Preventable (PHC/PEC services) (5,6,7,8)	2	5.0%	0	0.0%	0	0.0%
C. Preventable (Ophthalmic services) (4,9,10)	4	10.0%	6	11.1%	20	6.1%
D. Avoidable (A+B+C)	34	85.0%	43	79.6%	310	95.1%
E. Posterior segment causes (8,9,10,11,12)	9	22.5%	17	31.5%	34	10.4%

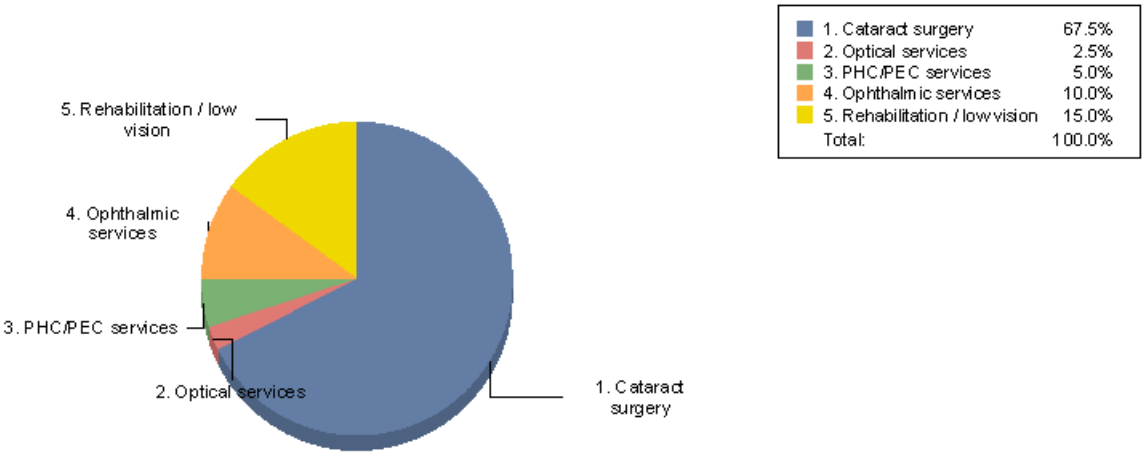
7. Graph: main cause of blindness in persons



8. Graph: main category of blindness in persons



9. Graph: action required to reduce blindness



10. Cataract surgical coverage (persons) - percentage

	Males	Females	Total
VA < 3/60	72,7	71,4	71,9
VA < 6/60	50,0	56,6	54,0
VA < 6/18	28,4	35,1	32,6

11. Barriers to cataract surgery - bilateral VA<6/60 due to cataract

	Males		Females		Total	
	n	%	n	%	n	%
Need not felt	0	0.0%	4	16.0%	4	8.0%
Fear	3	17.6%	3	12.0%	6	14.8%
Cost	4	23.5%	9	36.0%	13	29.8%
Treatment denied by provider	3	17.6%	3	12.0%	6	14.8%
Unaware treatment is possible	6	35.3%	5	20.0%	11	27.7%
Cannot access treatment	1	5.9%	1	4.0%	2	5.0%
Local reason	0	0.0%	0	0.0%	0	0.0%
Total	17	100.0%	25	100.0%	42	100.0%

12. Outcome after cataract surgery with available correction (eyes)

	Males		Females		Total	
	n	%	n	%	n	%
Good: can see 6/18	20	60.6%	30	43.4%	50	49.0%
Cannot see 6/18, sees 6/60	6	18.1%	21	30.4%	27	26.4%
Poor: cannot see 6/60	7	21.2%	18	26.0%	25	24.5%
Total	33	100.0%	69	100.0%	102	100.0%

13. Outcome by type of cataract surgery with available correction (eyes)

	Non-IOL		IOL	
	n	%	n	%
Good: can see 6/18	2	11.1%	48	57.1%
Cannot see 6/18, sees 6/60	7	38.8%	20	23.8%
Poor: cannot see 6/60	9	50.0%	16	19.0%
Total	18	100.0%	84	100.0%

14. Cause of PVA<6/18 (borderline and poor outcome) after cataract surgery

	Cannot see 6/18, sees		Poor: cannot see 6/60		Total	
	n	%	n	%	n	%
Selection	6	22.2%	3	12.0%	9	17.3%
Surgery	7	25.9%	6	24.0%	13	25.0%
Spectacles	13	48.1%	2	8.0%	15	28.8%
Sequelae	1	3.7%	14	56.0%	15	28.8%
Total	27	100.0%	25	100.0%	52	100.0%

Annex 10 RESULTS OF RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

SAMPLE RESULTS - NOT ADJUSTED FOR AGE AND SEX

Date and time of report: 27-10-2012 0:51:50

This report is for the survey area: SampleArea

Year and month when survey was conducted: 2012- 5 until 2012- 6

The sample size of the RAAB is sufficient to provide an acceptable accuracy of the overall prevalence of bilateral blindness (best corrected VA <3/60). The accuracy of prevalence estimates for any subgroup is far less and caution should be taken in the interpretation of these data.

1. Eligible persons, coverage, absentees and refusals in survey

	Examined		Not available		Refused		Not capable		Total	
	n	%	n	%	n	%	n	%	n	%
Males	872	99.9%	1	0.1%	0	0.0%	0	0.0%	**873**	**100.0%**
Females	1,815	99.7%	3	0.2%	1	0.1%	1	0.1%	**1,820**	**100.0%**
Total	**2,687**	**99.8%**	**4**	**0.1%**	**1**	**0.0%**	**1**	**0.0%**	**2,693**	**100.0%**

2. Prevalence of blindness, severe (SVI) and moderate visual impairment (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	10	1.2% (0.5-1.8)	23	1.3% (0.6-1.9)	**33**	**1.2% (0.7-1.7)**
All blind eyes	77	4.4% (3.3-5.6)	109	3.0% (2.2-3.8)	**186**	**3.5% (2.8-4.1)**
Blindness - VA < 3/60 in the better eye with available correction (presenting VA)						
All bilateral blindness	15	1.7% (0.8-2.6)	25	1.4% (0.7-2.0)	**40**	**1.5% (0.9-2.0)**
All blind eyes	92	5.3% (3.9-6.6)	119	3.3% (2.5-4.1)	**211**	**3.9% (3.2-4.6)**
Severe visual impairment (SVI) - VA<6/60 - 3/60 in the better eye with available correction						
All bilateral SVI	17	2.0% (1.0-2.9)	37	2.0% (1.4-2.7)	**54**	**2.0% (1.5-2.6)**
All SVI eyes	53	3.0% (2.1-4.0)	103	2.8% (2.2-3.5)	**156**	**2.9% (2.3-3.5)**
Moderate visual impairment (MVI) - VA<6/18 - 6/60 in the better eye with available correction						
All bilateral MVI	99	11.4% (8.8-13.9)	227	12.5% (10.8-14.3)	**326**	**12.1% (10.6-13.7)**
All MVI eyes	231	13.3% (10.6-15.9)	516	14.2% (12.5-15.9)	**747**	**13.9% (12.4-15.5)**

3. Prevalence of presenting VA<3/60, VA<6/60 and VA<6/18 - all causes (cumulative categories)

	Males		Females		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 blindness	15	1.7% (0.8-2.6)	25	1.4% (0.7-2.0)	**40**	**1.5% (0.9-2.0)**
All blind eyes	92	5.3% (3.9-6.6)	119	3.3% (2.5-4.1)	**211**	**3.9% (3.2-4.6)**
VA<6/60 in the better eye, with available correction (presenting VA)						
All bilateral cases	32	3.7% (2.4-4.9)	62	3.4% (2.4-4.4)	**94**	**3.5% (2.6-4.3)**
All eyes	145	8.3% (6.6-10.0)	222	6.1% (4.9-7.3)	**367**	**6.8% (5.8-7.8)**
VA<6/18 in the better eye, with available correction (presenting VA)						
All bilateral cases	131	15.0% (12.1-17.9)	289	15.9% (13.9-17.9)	**420**	**15.6% (13.8-17.4)**
All eyes	376	21.6% (18.4-24.8)	738	20.3% (18.2-22.5)	**1,114**	**20.7% (18.8-22.7)**

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

	Males		Females		Total	
	n	%	n	%	n	%
1. Refractive error	0	0.0%	0	0.0%	**0**	**0.0%**
2. Aphakia uncorrected	1	6.7%	0	0.0%	**1**	**2.5%**
3. Cataract untreated	11	73.3%	16	64.0%	**27**	**67.5%**
4. Cataract surgical complications	0	0.0%	1	4.0%	**1**	**2.5%**
5. Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
6. Non Trachomatous corneal opacity	1	6.7%	1	4.0%	**2**	**5.0%**
7. Phthisis	0	0.0%	0	0.0%	**0**	**0.0%**
8. Onchocerciasis	0	0.0%	0	0.0%	**0**	**0.0%**
9. Glaucoma	1	6.7%	0	0.0%	**1**	**2.5%**
10. Diabetic retinopathy	0	0.0%	2	8.0%	**2**	**5.0%**
11. ARMD	1	6.7%	1	4.0%	**2**	**5.0%**
12. Other posterior segment disease	0	0.0%	4	16.0%	**4**	**10.0%**
13. All other globe/CNS abnormalities	0	0.0%	0	0.0%	**0**	**0.0%**
Total	**15**	**100.0%**	**25**	**100.0%**	**40**	**100.0%**
Intervention by this visual impairment						
A. Treatable (1,2,3)	12	80.0%	16	64.0%	**28**	**70.9%**
B. Preventable (PHC/PEC services) (5,6,7,8)	1	6.7%	1	4.0%	**2**	**5.3%**
C. Preventable (Ophthalmic services) (4,9,10)	1	6.7%	3	12.0%	**4**	**10.7%**
D. Avoidable (A+B+C)	14	93.3%	20	80.0%	**34**	**85.5%**
E. Posterior segment causes (8,9,10,11,12)	2	13.3%	7	28.0%	**9**	**24.7%**

5. Main cause of blindness in eyes - VA<3/60 with available correction, no pinhole

	Males		Females		Total	
	n	%	n	%	n	%
1. Refractive error	0	0.0%	0	0.0%	**0**	**0.0%**
2. Aphakia uncorrected	1	1.1%	0	0.0%	**1**	**0.5%**
3. Cataract untreated	51	55.4%	61	51.3%	**112**	**53.1%**
4. Cataract surgical complications	4	4.3%	5	4.2%	**9**	**4.3%**
5. Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
6. Non Trachomatous corneal opacity	5	5.4%	6	5.0%	**11**	**5.2%**
7. Phthisis	3	3.3%	3	2.5%	**6**	**2.8%**
8. Onchocerciasis	0	0.0%	0	0.0%	**0**	**0.0%**
9. Glaucoma	9	9.8%	8	6.7%	**17**	**8.1%**
10. Diabetic retinopathy	2	2.2%	10	8.4%	**12**	**5.7%**
11. ARMD	2	2.2%	3	2.5%	**5**	**2.4%**
12. Other posterior segment disease	10	10.9%	22	18.5%	**32**	**15.2%**
13. All other globe/CNS abnormalities	5	5.4%	1	0.8%	**6**	**2.8%**
Total	**92**	**100.0%**	**119**	**100.0%**	**211**	**100.0%**
Intervention by this visual impairment						
A. Treatable (1,2,3)	52	56.5%	61	51.3%	**113**	**53.7%**
B. Preventable (PHC/PEC services) (5,6,7,8)	8	8.7%	9	7.6%	**17**	**8.1%**
C. Preventable (Ophthalmic services) (4,9,10)	15	16.3%	23	19.3%	**38**	**18.1%**
D. Avoidable (A+B+C)	75	81.5%	93	78.2%	**168**	**79.7%**
E. Posterior segment causes (8,9,10,11,12)	23	25.0%	43	36.1%	**66**	**32.3%**

6. Principal cause severe visual impairment in persons: VA<6/60 - 3/60 with available correction

	Males		Females		Total	
	n	%	n	%	n	%
1. Refractive error	0	0.0%	2	5.4%	**2**	**3.7%**
2. Aphakia uncorrected	0	0.0%	0	0.0%	**0**	**0.0%**
3. Cataract untreated	16	94.1%	19	51.4%	**35**	**64.8%**
4. Cataract surgical complications	0	0.0%	0	0.0%	**0**	**0.0%**
5. Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
6. Non Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
7. Phthisis	0	0.0%	0	0.0%	**0**	**0.0%**
8. Onchocerciasis	0	0.0%	0	0.0%	**0**	**0.0%**
9. Glaucoma	0	0.0%	3	8.1%	**3**	**5.6%**
10. Diabetic retinopathy	0	0.0%	3	8.1%	**3**	**5.6%**
11. ARMD	0	0.0%	5	13.5%	**5**	**9.3%**
12. Other posterior segment disease	1	5.9%	5	13.5%	**6**	**11.1%**
13. All other globe/CNS abnormalities	0	0.0%	0	0.0%	**0**	**0.0%**
Total	**17**	**100.0%**	**37**	**100.0%**	**54**	**100.0%**
Intervention by this visual impairment						
A. Treatable (1,2,3)	16	94.1%	21	56.8%	**37**	**72.9%**
B. Preventable (PHC/PEC services) (5,6,7,8)	0		0		**0**	
C. Preventable (Ophthalmic services) (4,9,10)	0		6	16.2%	**6**	**16.2%**
D. Avoidable (A+B+C)	16	94.1%	27	73.0%	**43**	**80.8%**
E. Posterior segment causes (8,9,10,11,12)	1	5.9%	16	43.2%	**17**	**41.0%**

7. Main cause of severe visual impairment in eyes - VA<6/60 - 3/60 with available correction

	Males		Females		Total	
	n	%	n	%	n	%
1. Refractive error	1	1.9%	8	7.8%	**9**	**5.8%**
2. Aphakia uncorrected	0	0.0%	0	0.0%	**0**	**0.0%**
3. Cataract untreated	40	75.5%	46	44.7%	**86**	**55.1%**
4. Cataract surgical complications	1	1.9%	4	3.9%	**5**	**3.2%**
5. Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
6. Non Trachomatous corneal opacity	0	0.0%	2	1.9%	**2**	**1.3%**
7. Phthisis	0	0.0%	0	0.0%	**0**	**0.0%**
8. Onchocerciasis	0	0.0%	0	0.0%	**0**	**0.0%**
9. Glaucoma	2	3.8%	7	6.8%	**9**	**5.8%**
10. Diabetic retinopathy	1	1.9%	6	5.8%	**7**	**4.5%**
11. ARMD	3	5.7%	11	10.7%	**14**	**9.0%**
12. Other posterior segment disease	5	9.4%	18	17.5%	**23**	**14.7%**
13. All other globe/CNS abnormalities	0	0.0%	1	1.0%	**1**	**0.6%**
Total	**53**	**100.0%**	**103**	**100.0%**	**156**	**100.0%**
Intervention by this visual impairment						
A. Treatable (1,2,3)	41	77.4%	54	52.4%	**95**	**63.2%**
B. Preventable (PHC/PEC services) (5,6,7,8)	0		2	1.9%	**2**	**1.9%**
C. Preventable (Ophthalmic services) (4,9,10)	4	7.5%	17	16.5%	**21**	**14.8%**
D. Avoidable (A+B+C)	45	84.9%	73	70.9%	**118**	**76.2%**
E. Posterior segment causes (8,9,10,11,12)	11	20.8%	42	40.8%	**53**	**36.6%**

8. Principal cause moderate visual impairment in persons: VA<6/18 - 6/60 with available correction

	Males		Females		Total	
	n	%	n	%	n	%
1. Refractive error	55	55.6%	146	64.3%	**201**	**61.7%**
2. Aphakia uncorrected	1	1.0%	1	0.4%	**2**	**0.6%**
3. Cataract untreated	30	30.3%	57	25.1%	**87**	**26.7%**
4. Cataract surgical complications	1	1.0%	0	0.0%	**1**	**0.3%**
5. Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
6. Non Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
7. Phthisis	0	0.0%	0	0.0%	**0**	**0.0%**
8. Onchocerciasis	0	0.0%	0	0.0%	**0**	**0.0%**
9. Glaucoma	3	3.0%	4	1.8%	**7**	**2.1%**
10. Diabetic retinopathy	4	4.0%	8	3.5%	**12**	**3.7%**
11. ARMD	3	3.0%	3	1.3%	**6**	**1.8%**
12. Other posterior segment disease	2	2.0%	7	3.1%	**9**	**2.8%**
13. All other globe/CNS abnormalities	0	0.0%	1	0.4%	**1**	**0.3%**
Total	**99**	**100.0%**	**227**	**100.0%**	**326**	**100.0%**
Intervention by this visual impairment						
A. Treatable (1,2,3)	86	86.9%	204	89.9%	**290**	**89.0%**
B. Preventable (PHC/PEC services) (5,6,7,8)	0		0		**0**	
C. Preventable (Ophthalmic services) (4,9,10)	8	8.1%	12	5.3%	**20**	**6.4%**
D. Avoidable (A+B+C)	94	95.0%	216	95.2%	**310**	**95.1%**
E. Posterior segment causes (8,9,10,11,12)	12	12.1%	22	9.7%	**34**	**10.5%**

9. Main cause of moderate visual impairment in eyes - VA<6/18 - 6/60 with available correction

	Males		Females		Total	
	n	%	n	%	n	%
1. Refractive error	131	56.7%	331	64.1%	**462**	**61.8%**
2. Aphakia uncorrected	1	0.4%	2	0.4%	**3**	**0.4%**
3. Cataract untreated	65	28.1%	116	22.5%	**181**	**24.2%**
4. Cataract surgical complications	4	1.7%	4	0.8%	**8**	**1.1%**
5. Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
6. Non Trachomatous corneal opacity	0	0.0%	4	0.8%	**4**	**0.5%**
7. Phthisis	0	0.0%	0	0.0%	**0**	**0.0%**
8. Onchocerciasis	0	0.0%	0	0.0%	**0**	**0.0%**
9. Glaucoma	5	2.2%	6	1.2%	**11**	**1.5%**
10. Diabetic retinopathy	10	4.3%	19	3.7%	**29**	**3.9%**
11. ARMD	7	3.0%	14	2.7%	**21**	**2.8%**
12. Other posterior segment disease	8	3.5%	18	3.5%	**26**	**3.5%**
13. All other globe/CNS abnormalities	0	0.0%	2	0.4%	**2**	**0.3%**
Total	**231**	**100.0%**	**516**	**100.0%**	**747**	**100.0%**
Intervention by this visual impairment						
A. Treatable (1,2,3)	197	85.3%	449	87.0%	**646**	**86.5%**
B. Preventable (PHC/PEC services) (5,6,7,8)	0		4	0.8%	**4**	**0.8%**
C. Preventable (Ophthalmic services) (4,9,10)	19	8.2%	29	5.6%	**48**	**6.7%**
D. Avoidable (A+B+C)	216	93.5%	482	93.4%	**698**	**93.4%**
E. Posterior segment causes (8,9,10,11,12)	30	13.0%	57	11.0%	**87**	**11.7%**

10. Prevalence of cataract with VA<3/60, VA<6/60 and VA<6/18 - best corrected VA or pinhole

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Cataract and VA<3/60 with best correction or pinhole						
Bilateral cataract	6	0.7% (0.2-1.2)	12	0.7% (0.3-1.0)	**18**	**0.7% (0.4-1.0)**
Unilateral cataract	31	3.6% (2.3-4.8)	36	2.0% (1.4-2.6)	**67**	**2.5% (1.9-3.1)**
Cataract eyes	43	2.5% (1.6-3.3)	60	1.7% (1.1-2.2)	**103**	**1.9% (1.5-2.4)**
Cataract and VA<6/60 with best correction or pinhole						
Bilateral cataract	17	2.0% (1.0-2.9)	23	1.3% (0.7-1.8)	**40**	**1.5% (1.0-2.0)**
Unilateral cataract	40	4.6% (3.7-6.6)	43	2.4% (1.8-3.4)	**83**	**3.1% (2.7-4.2)**
Cataract eyes	74	4.2% (3.0-5.5)	89	2.5% (1.8-3.1)	**163**	**3.0% (2.4-3.6)**
Cataract and VA<6/18 with best correction or pinhole						
Bilateral cataract	48	5.5% (3.8-7.2)	74	4.1% (3.1-5.0)	**122**	**4.5% (3.6-5.5)**
Unilateral cataract	63	7.2% (5.1-9.3)	78	4.3% (3.2-5.4)	**141**	**5.3% (4.2-6.3)**
Cataract eyes	159	9.1% (7.1-11.1)	226	6.2% (5.1-7.3)	**385**	**7.2% (6.1-8.2)**

11. Sample prevalence of (pseudo)aphakia

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Bilateral (pseudo)aphakia	7	0.8% (0.2-1.4)	17	0.9% (0.5-1.4)	**24**	**0.9% (0.5-1.2)**
Unilateral (pseudo)aphakia	19	2.2% (1.2-3.1)	35	1.9% (1.4-2.5)	**54**	**2.0% (1.5-2.5)**
(Pseudo)aphakic eyes	33	1.9% (1.1-2.7)	69	1.9% (1.3-2.5)	**102**	**1.9% (1.4-2.4)**

12. Cataract Surgical Coverage

	Males	Females	Total
Cataract Surgical Coverage (eyes) - percentage			
VA < 3/60	43.4	53.5	49.8
VA < 6/60	30.8	43.7	38.5
VA < 6/18	17.2	23.4	20.9
Cataract Surgical Coverage (Persons) - percentage			
VA < 3/60	72.7	71.4	71.9
VA < 6/60	50.0	56.6	54.0
VA < 6/18	28.4	35.1	32.6

13. Number and percentage of first eyes and second eyes operated

	Males		Females		Total	
	n	%	n	%	n	%
First eyes	26	78.8%	52	75.4%	**78**	**76.5%**
Second eyes	7	21.2%	17	24.6%	**24**	**23.5%**

14. Uncorrected refractive error and uncorrected presbyopia

	Males		Females		Total	
	n	%	n	%	n	%
Total refractive errors	109	12.5%	260	14.3%	**369**	**13.7%**
Uncorrected refractive errors	57	6.5%	149	8.2%	**206**	**7.7%**
Uncorrected presbyopia	388	44.5%	617	34.0%	**1,005**	**37.4%**

15. Persons with Functional Low Vision: BCVA<6/18 in the better eye; incurable

	Males		Females		Total	
	n	%	n	%	n	%
50 - 59	4	1.1%	8	0.9%	**12**	**1.0%**
60 - 69	6	2.1%	16	2.9%	**22**	**2.6%**
70 - 79	4	2.2%	14	4.9%	**18**	**3.9%**
80+	2	5.1%	9	12.2%	**11**	**9.7%**
Total	16	1.8%	47	2.6%	**63**	**2.4%**

16. Principal cause of functional low vision in persons: BCVA<6/18 in better eye, incurable

	Males		Females		Total	
	n	%	n	%	n	%
1. Refractive error	0	0.0%	0	0.0%	**0**	**0.0%**
2. Aphakia uncorrected	0	0.0%	0	0.0%	**0**	**0.0%**
3. Cataract untreated	0	0.0%	0	0.0%	**0**	**0.0%**
4. Cataract surgical complications	1	6.3%	0	0.0%	**1**	**1.6%**
5. Trachomatous corneal opacity	0	0.0%	0	0.0%	**0**	**0.0%**
6. Non Trachomatous corneal opacity	1	6.3%	1	2.1%	**2**	**3.2%**
7. Phthisis	0	0.0%	0	0.0%	**0**	**0.0%**
8. Onchocerciasis	0	0.0%	0	0.0%	**0**	**0.0%**
9. Glaucoma	3	18.8%	7	14.9%	**10**	**15.9%**
10. Diabetic retinopathy	4	25.0%	13	27.7%	**17**	**27.0%**
11. ARMD	4	25.0%	9	19.1%	**13**	**20.6%**
12. Other posterior segment disease	3	18.8%	16	34.0%	**19**	**30.2%**
13. All other globe/CNS abnormalities	0	0.0%	1	2.1%	**1**	**1.6%**
Total	**16**	**100.0%**	**47**	**100.0%**	**63**	**100.0%**
Intervention by this visual impairment						
A. Treatable (1,2,3)	0		0		**0**	
B. Preventable (PHC/PEC services) (5,6,7,8)	1	6.3%	1	2.1%	**2**	**4.2%**
C. Preventable (Ophthalmic services) (4,9,10)	8	50.0%	20	42.6%	**28**	**44.7%**
D. Avoidable (A+B+C)	9	56.3%	21	44.7%	**30**	**48.2%**
E. Posterior segment causes (8,9,10,11,12)	14	87.5%	45	95.7%	**59**	**93.8%**

17. Persons with FLV and proportion of all persons in corresponding category of visual impairment with available correction

	Males		Females		Total	
	n	%	n	%	n	%
BCVA<3/60 – PL+	2	13.3%	7	28.0%	**9**	**22.5%**
BCVA<6/60 – 3/60	0	0.0%	7	18.9%	**7**	**13.0%**
BCVA<6/18 – 6/60	14	14.1%	33	14.5%	**47**	**14.4%**
Total	16	12.2%	47	16.3%	**63**	**15.0%**

Annex 11. RESULTS OF RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

REASONS WHY PEOPLE, BLIND DUE TO CATARACT, HAVE NOT BEEN OPERATED

Date and time of report: 27-10-2012 0:53:00

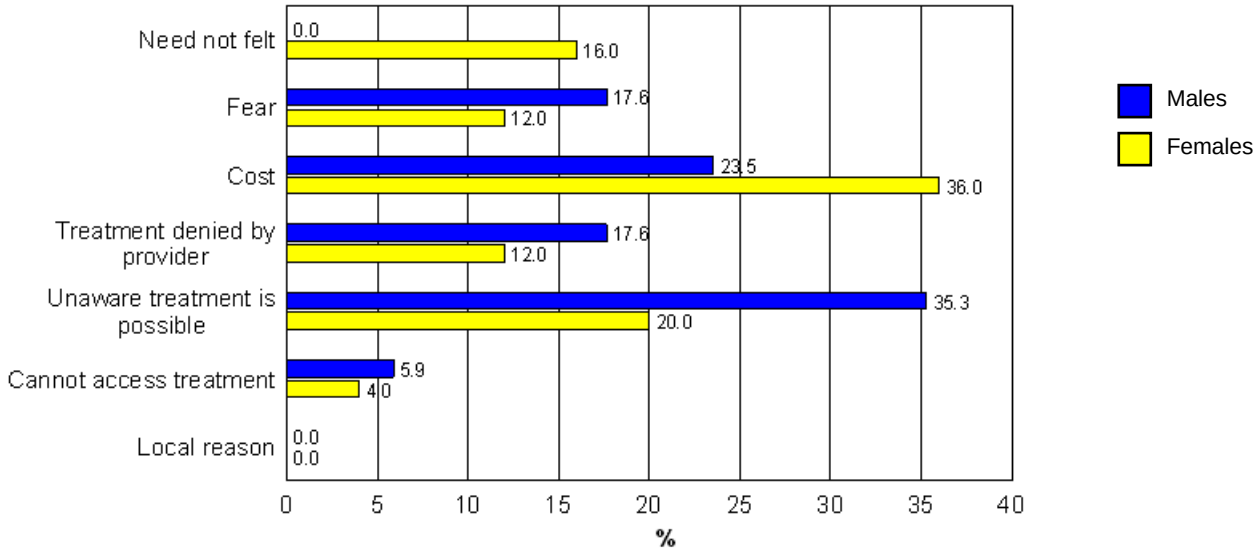
This report is for the survey area: SampleArea

Year and month when survey was conducted: 2012- 5 until 2012- 6

RAAB is designed as a rapid procedure and there is not enough time during the RAAB to hold in-dept interviews why people blind from cataract have not yet been operated. Hence, the data on barriers should be regarded as an indication whether more detailed qualitative studies are required.

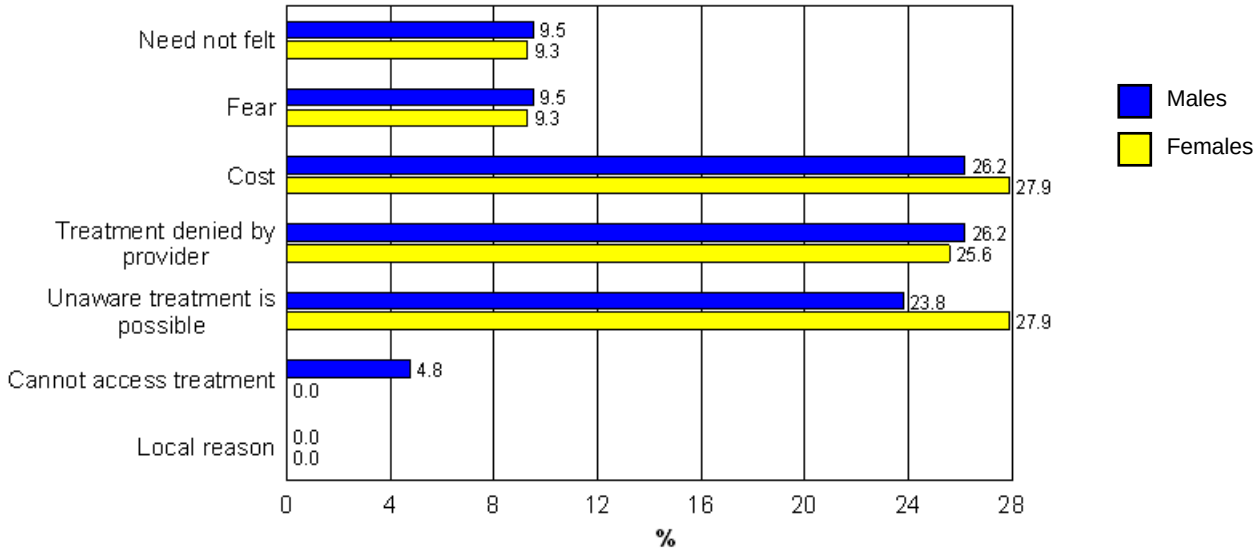
1. Barriers to cataract surgery in sample (bilateral BCVA<6/60 due to cataract)

	Males		Females		Total	
	n	%	n	%	n	%
Need not felt	0	0,0	4	16,0	4	9,5
Fear	3	17,6	3	12,0	6	14,3
Cost	4	23,5	9	36,0	13	31,0
Treatment denied by provider	3	17,6	3	12,0	6	14,3
Unaware treatment is possible	6	35,3	5	20,0	11	26,2
Cannot access treatment	1	5,9	1	4,0	2	4,8
Local reason	0	0,0	0	0,0	0	0,0
Total	**17**	**100.0**	**25**	**100.0**	**42**	**100.0**



2. Barriers to cataract surgery in sample (unilateral BCVA<6/60 due to cataract)

	Males		Females		Total	
	n	%	n	%	n	%
Need not felt	4	9,5	4	9,3	8	9,4
Fear	4	9,5	4	9,3	8	9,4
Cost	11	26,2	12	27,9	23	27,1
Treatment denied by provider	11	26,2	11	25,6	22	25,9
Unaware treatment is possible	10	23,8	12	27,9	22	25,9
Cannot access treatment	2	4,8	0	0,0	2	2,4
Local reason	0	0,0	0	0,0	0	0,0
Total	**42**	**100.0**	**43**	**100.0**	**85**	**100.0**



Annex 12. RESULTS OF RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

VISUAL OUTCOME AFTER CATARACT SURGERY (LONG-TERM OUTCOME)

Date and time of report: 27-10-2012 0:53:22

This report is for the survey area: SampleArea

Year and month when survey was conducted: 2012- 5 until 2012- 6

The visual acuity of all subjects operated earlier is measured with available correction and with a pinhole. This report gives population based data on visual outcome, not specific for one surgeon or one hospital and with follow-up periods ranging from one month to several decades. When cataract surgery took place several years earlier, the chance of vision loss due to other causes than cataract increases. If the proportion of eyes with a visual outcome less than 6/60 is higher than 10%, research into the possible causes of poor visual outcome is indicated.

1. VA in operated eyes in sample with available correction (PVA)

	Non-IOL		IOL		Couching		Total	
	Eyes	%	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	2	11.1	48	57.1	0	0.0	**50**	**49.0**
Cannot see 6/18, sees 6/60	7	38.9	20	23.8	0	0.0	**27**	**26.5**
Poor: cannot see 6/60	9	50.0	16	19.0	0	0.0	**25**	**24.5**
Total	**18**	**100.0**	**84**	**100.0**	**0**	**0.0**	**102**	**100.0**

2. VA in operated eyes in sample with best correction (BCVA)

	Non-IOL		IOL		Couching		Total	
	Eyes	%	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	6	33.3	56	66.7	0	0.0	**62**	**60.8**
Cannot see 6/18, sees 6/60	4	22.2	16	19.0	0	0.0	**20**	**19.6**
Poor: cannot see 6/60	8	44.4	12	14.3	0	0.0	**20**	**19.6**
Total	**18**	**100.0**	**84**	**100.0**	**0**	**0.0**	**102**	**100.0**

3. VA in operated eyes in sample by years after surgery

	3 yrs postop		4 - 6 yrs postop.		7+ yrs postop		Total	
	Eyes	%	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	28	56.0	9	40.9	13	43.3	**50**	**49.0**
Cannot see 6/18, sees 6/60	12	24.0	6	27.3	9	30.0	**27**	**26.5**
Poor: cannot see 6/60	10	20.0	7	31.8	8	26.7	**25**	**24.5**
Total	**50**	**100.0**	**22**	**100.0**	**30**	**100.0**	**102**	**100.0**

4. Age at time of surgery in males and females

	Males		Females		Total	
	Eyes	%	Eyes	%	Eyes	%
	0	0.0	1	1.4	**1**	**1.0**
30 - 39	0	0.0	0	0.0	**0**	**0.0**
40 - 49	0	0.0	4	5.8	**4**	**3.9**
50 - 59	2	6.1	10	14.5	**12**	**11.8**
60 - 69	12	36.4	24	34.8	**36**	**35.3**
70 - 79	18	54.5	26	37.7	**44**	**43.1**
80+	1	3.0	4	5.8	**5**	**4.9**
Total	**33**	**100.0**	**69**	**100.0**	**102**	**100.0**

5. Place of surgery by sex

	Males		Females		Total	
	Eyes	%	Eyes	%	Eyes	%
Government Hosp.	32	97.0	61	88.4	**93**	**91.2**
Private hospital	1	3.0	8	11.6	**9**	**8.8**
Total	**33**	**100.0**	**69**	**100.0**	**102**	**100.0**

6. Post-op VA with available correction by place of surgery

	Gov. Hosp.		Priv. Hosp.		Total	
	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	45	48.4	5	55.6	**50**	**49.0**
Cannot see 6/18, sees 6/60	24	25.8	3	33.3	**27**	**26.5**
Poor: cannot see 6/60	24	25.8	1	11.1	**25**	**24.5**
Total	**93**	**100.0**	**9**	**100.0**	**102**	**100.0**

7. Post-op presenting VA and causes of borderline and poor outcome

	Selection		Surgery		Spectacles		Sequelae		Can see 6/18		Total	
	Eyes	%	Eyes	%	Eyes	%	Eyes	%	Eyes	%	Eyes	%
Good: can see 6/18	0	0.0	0	0.0	0	0.0	0	0.0	50	100.0	**50**	**49.0**
Cannot see 6/18, sees 6/60	6	66.7	7	53.8	13	86.7	1	6.7	0	0.0	**27**	**26.5**
Poor: cannot see 6/60	3	33.3	6	46.2	2	13.3	14	93.3	0	0.0	**25**	**24.5**
Total	**9**	**100.0**	**13**	**100.0**	**15**	**100.0**	**15**	**100.0**	**50**	**100.0**	**102**	**100.0**

8. Proportion and type of surgery

	Males		Females		Total	
	Eyes	%	Eyes	%	Eyes	%
Non-IOL	6	18.2	12	17.4	**18**	**17.6**
IOL	27	81.8	57	82.6	**84**	**82.4**
Couching	0	0.0	0	0.0	**0**	**0.0**
Total	**33**	**100.0**	**69**	**100.0**	**102**	**100.0**

Annex 13. RESULTS OF RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

INDICATORS BY SEX AND BY AGE GROUP - FINDINGS FROM SAMPLE

Date and time of report: 27-10-2012 0:54:14

This report is for the survey area: SampleArea

Year and month when survey was conducted: 2012- 5 until 2012- 6

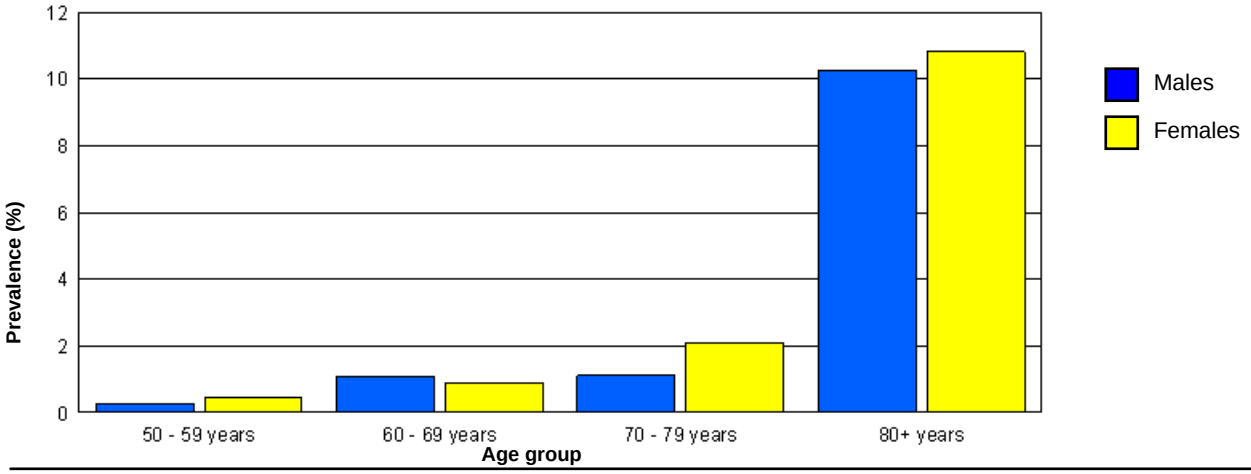
The sample size of the Rapid Assessment is sufficient to provide an acceptable accuracy of the overall prevalence of bilateral cataract blindness (VA <3/60). The accuracy of prevalence estimates for any subgroup is far less and caution should be taken in the interpretation of these data. Confidence intervals for prevalence of various conditions can be calculated with menu Reports / Sampling error & Design Effect.

1. Age and sex distribution of people examined in the sample

	Males		Females		Total	
	n	%	n	%	n	%
50 - 59 years	371	42.5	896	49.4	1,267	46.0
60 - 69 years	283	32.5	557	30.7	840	31.6
70 - 79 years	179	20.5	288	15.9	467	18.2
80+ years	39	4.5	74	4.1	113	4.3
Total	**872**	**100.0**	**1,815**	**100.0**	**2,687**	**100.0**

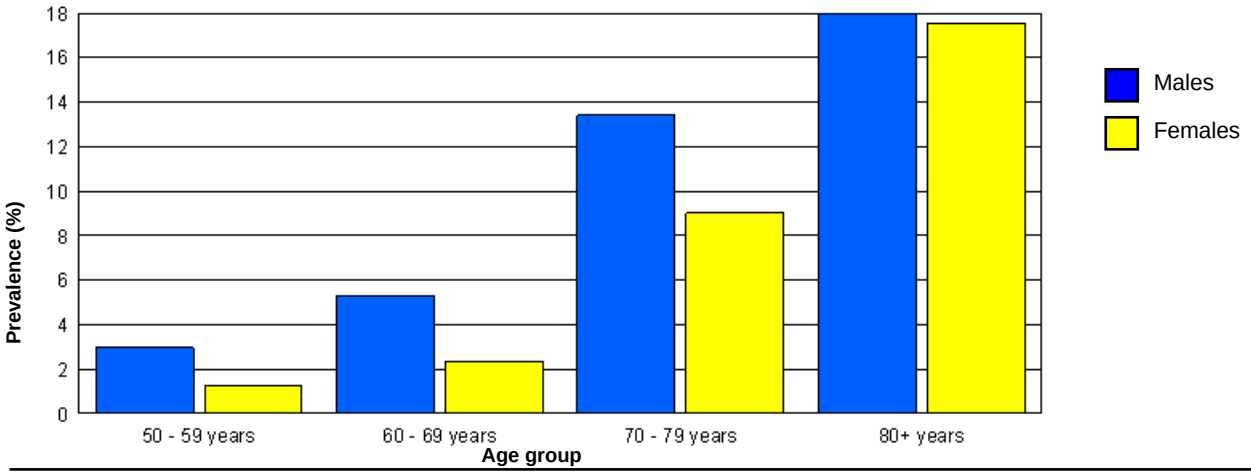
2. Prevalence of people with bilateral blindness - VA <3/60 in better eye with best correction

	Males		Females		Total	
	n	%	n	%	n	%
50 - 59 years	1	0.3	4	0.4	5	0.4
60 - 69 years	3	1.1	5	0.9	8	1.0
70 - 79 years	2	1.1	6	2.1	8	1.7
80+ years	4	10.3	8	10.8	12	10.6
Total	**10**	**1.1**	**23**	**1.3**	**33**	**1.2**



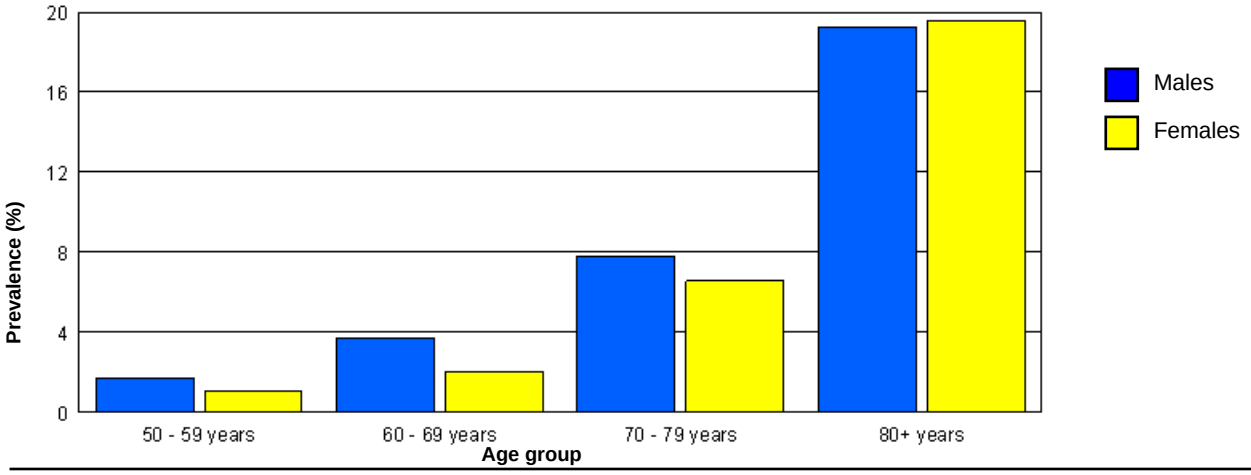
3. Prevalence of people with unilateral blindness - VA <3/60 with best correction

	Males		Females		Total	
	n	%	n	%	n	%
50 - 59 years	11	3.0	11	1.2	22	1.7
60 - 69 years	15	5.3	13	2.3	28	3.3
70 - 79 years	24	13.4	26	9.0	50	10.7
80+ years	7	17.9	13	17.6	20	17.7
Total	**57**	**6.5**	**63**	**3.5**	**120**	**4.5**



4. Prevalence of blind eyes - VA <3/60 with best correction

	Males		Females		Total	
	n	%	n	%	n	%
50 - 59 years	13	1.8	19	1.1	32	1.3
60 - 69 years	21	3.7	23	2.1	44	2.6
70 - 79 years	28	7.8	38	6.6	66	7.1
80+ years	15	19.2	29	19.6	44	19.5
Total	**77**	**4.4**	**109**	**3.0**	**186**	**3.5**



Annex 14. RESULTS OF RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

AGE AND SEX ADJUSTED PREVALENCE AND ESTIMATED NUMBERS

Date and time of report: 29-10-2012 11:43:03

This report is for the survey area: SampleArea

Year and month when survey was conducted: 2012- 5 until 2012- 6

The prevalence of blindness and visual impairment increases strongly with age and in most communities, females are more affected than males. Normally, the people examined in the sample should have the same composition by age and by sex as the total population in the survey area. When there is a difference, the prevalence for the survey area will also differ. Table 2 and 3 compare the composition in the sample with that of the survey area. By combining the age and sex specific prevalence with the actual population, the age and sex adjusted prevalence and the actual number of people affected in the survey area can be calculated. The 95% confidence interval, based on the sample error in cluster sampling, is also given.

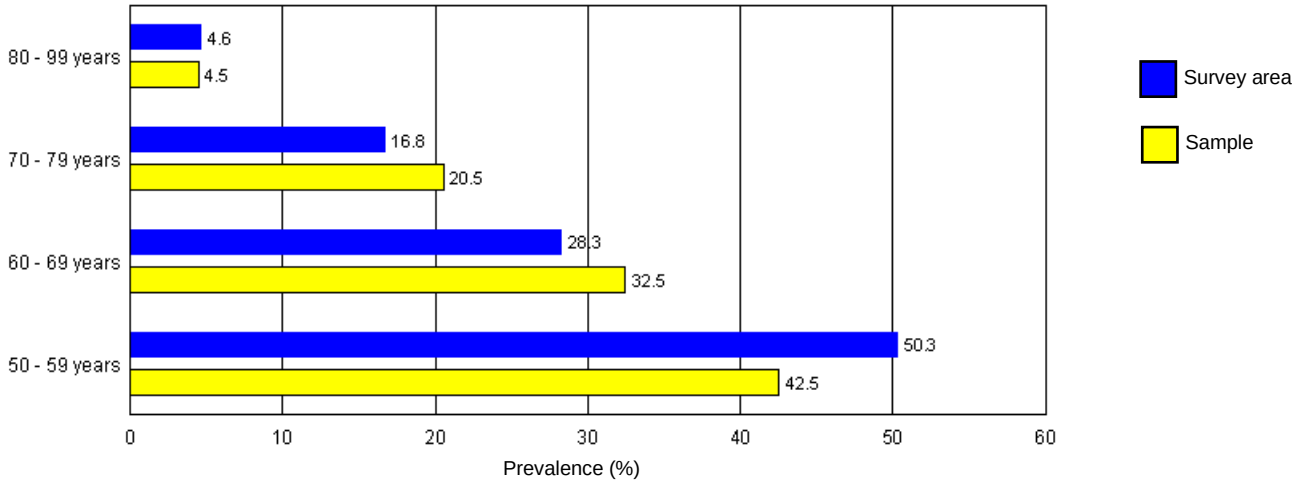
1. Age and sex distribution of people examined in the sample

	Males		Females		Total	
	n	%	n	%	n	%
50 - 59 years	371	42.5%	896	49.4%	**1,267**	**47.2%**
60 - 69 years	283	32.5%	557	30.7%	**840**	**31.3%**
70 - 79 years	179	20.5%	288	15.9%	**467**	**17.4%**
80 - 99 years	39	4.5%	74	4.1%	**113**	**4.2%**
Total	**872**	**100.0%**	**1,815**	**100.0%**	**2,687**	**100.0%**

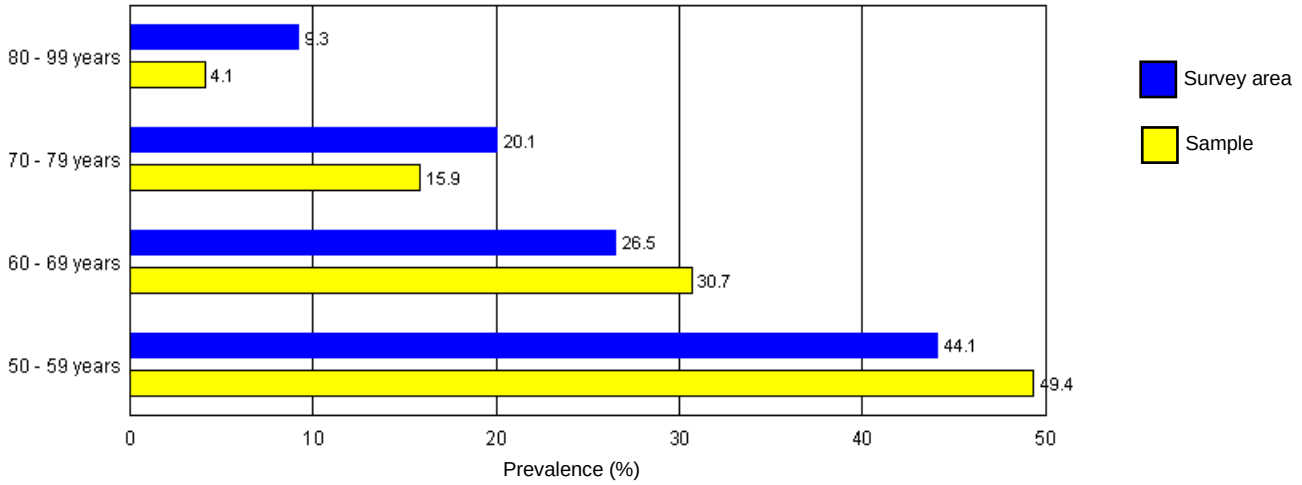
2. Total number of people aged 50+ in survey area

	Males		Females		Total	
	n	%	n	%	n	%
50 - 59 years	243,046	50.3%	280,819	44.1%	**523,865**	**46.8%**
60 - 69 years	136,690	28.3%	168,861	26.5%	**305,551**	**27.3%**
70 - 79 years	81,011	16.8%	127,866	20.1%	**208,877**	**18.7%**
80 - 99 years	22,456	4.6%	58,994	9.3%	**81,450**	**7.3%**
Total	**483,203**	**100.0%**	**636,540**	**100.0%**	**1,119,743**	**100.0%**

3. Proportion of males in total survey area and in sample



4. Proportion of females in total survey area and in sample



5. 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	5,312	1.1 (0.4 - 1.8)	11,81	1.9 (1.2 - 2.5)	17,12	1.5 (1.0 - 2.0)
All eyes	39,96	4.1 (3.0 - 5.3)	52,91	4.2 (3.4 - 4.9)	92,88	4.1 (3.5 - 4.8)
Blindness - VA < 3/60 in the better eye with available correction (presenting VA)						
All bilateral cases	7,808	1.6 (0.7 - 2.5)	12,41	2.0 (1.3 - 2.6)	20,22	1.8 (1.3 - 2.4)
All eyes	48,04	5.0 (3.6 - 6.3)	56,88	4.5 (3.7 - 5.2)	104,9	4.7 (4.0 - 5.4)
Severe visual impairment (SVI) - VA<6/60 - 3/60 in the better eye with available correction						
All bilateral cases	8,234	1.7 (0.8 - 2.6)	18,03	2.8 (2.2 - 3.5)	26,26	2.3 (1.8 - 2.9)
All eyes	26,33	2.7 (1.8 - 3.7)	45,57	3.6 (2.9 - 4.3)	71,91	3.2 (2.6 - 3.8)
Moderate visual impairment (MVI) - VA<6/18 - 6/60 in the better eye with available correction						
All bilateral cases	50,88	10.5 (8.0 - 13.1)	90,97	14.3 (12.5 - 16.0)	141,8	12.7 (11.1 - 14.2)
All eyes	119,8	12.4 (9.8 - 15.0)	200,4	15.7 (14.1 - 17.4)	320,2	14.3 (12.7 - 15.8)

6. Adjusted results for all causes of blindness, VA<3/60, <6/60 and <6/18 with available correction

	Males		Females		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	7,808	1.6 (0.7 - 2.5)	12,41	2.0 (1.3 - 2.6)	20,22	1.8 (1.3 - 2.4)
All eyes	48,04	5.0 (3.6 - 6.3)	56,88	4.5 (3.7 - 5.2)	104,9	4.7 (4.0 - 5.4)
VA<6/60 in the better eye, with available correction (presenting VA)						
All bilateral cases	16,04	3.3 (2.1 - 4.6)	30,44	4.8 (3.8 - 5.8)	46,48	4.2 (3.3 - 5.0)
All eyes	74,38	7.7 (6.0 - 9.4)	102,4	8.0 (6.9 - 9.2)	176,8	7.9 (6.9 - 8.9)
VA<6/18 in the better eye, with available correction (presenting VA)						
All bilateral cases	66,92	13.9 (10.9 - 16.8)	121,4	19.1 (17.1 - 21.1)	188,3	16.8 (15.0 - 18.6)
All eyes	194,1	20.1 (16.9 - 23.3)	302,8	23.8 (21.6 - 25.9)	497,0	22.2 (20.3 - 24.1)

7. Adjusted results for cataract and blindness, SVI and VI (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	3,146	0.7 (0.1 - 1.2)	6,692	1.1 (0.7 - 1.4)	9,838	0.9 (0.6 - 1.2)
Unilateral cataract	15,87	3.3 (2.0 - 4.5)	17,23	2.7 (2.1 - 3.3)	33,10	3.0 (2.3 - 3.6)
Cataract eyes	22,16	2.3 (1.5 - 3.1)	30,61	2.4 (1.9 - 2.9)	52,78	2.4 (1.9 - 2.8)
Cataract and SVI in better eye with best correction or pinhole						
Bilateral cataract	5,335	1.1 (0.5 - 1.7)	5,260	0.8 (0.5 - 1.1)	10,59	0.9 (0.7 - 1.2)
Unilateral cataract	6,266	1.3 (0.4 - 2.2)	5,997	0.9 (0.5 - 1.4)	12,26	1.1 (0.7 - 1.5)
Cataract eyes	15,37	1.6 (0.8 - 2.4)	13,41	1.1 (0.7 - 1.4)	28,79	1.3 (0.9 - 1.6)
Cataract and MVI in better eye with best correction or pinhole						
Bilateral cataract	15,48	3.2 (2.2 - 4.2)	24,24	3.8 (3.0 - 4.6)	39,72	3.5 (2.9 - 4.2)
Unilateral cataract	15,71	3.3 (1.8 - 4.7)	19,48	3.1 (2.1 - 4.0)	35,19	3.1 (2.3 - 4.0)
Cataract eyes	42,15	4.4 (3.0 - 5.7)	62,44	4.9 (4.0 - 5.8)	104,5	4.7 (3.9 - 5.5)

8. Adjusted results for cataract and VA<3/60, VA<6/60 and VA<6/18

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Cataract and VA<3/60 with best correction or pinhole						
Bilateral cataract	3,146	0.7 (0.1 - 1.2)	6,692	1.1 (0.7 - 1.4)	9,838	0.9 (0.6 - 1.2)
Unilateral cataract	15,87	3.3 (2.0 - 4.5)	17,23	2.7 (2.1 - 3.3)	33,10	3.0 (2.3 - 3.6)
Cataract eyes	22,16	2.3 (1.5 - 3.1)	30,61	2.4 (1.9 - 2.9)	52,78	2.4 (1.9 - 2.8)
Cataract and VA<6/60 with best correction or pinhole						
Bilateral cataract	8,480	1.8 (0.9 - 2.6)	11,95	1.9 (1.3 - 2.4)	20,43	1.8 (1.4 - 2.3)
Unilateral cataract	22,13	4.6 (2.9 - 6.3)	23,22	3.6 (2.8 - 4.5)	45,36	4.1 (3.3 - 4.9)
Cataract eyes	37,53	3.9 (2.6 - 5.1)	44,03	3.5 (2.8 - 4.1)	81,57	3.6 (3.0 - 4.3)
Cataract and VA<6/18 with best correction or pinhole						
Bilateral cataract	23,96	5.0 (3.6 - 6.4)	36,19	5.7 (4.8 - 6.6)	60,15	5.4 (4.6 - 6.2)
Unilateral cataract	37,85	7.8 (5.3 - 10.3)	42,71	6.7 (5.2 - 8.2)	80,56	7.2 (5.9 - 8.5)
Cataract eyes	79,69	8.2 (6.3 - 10.2)	106,4	8.4 (7.3 - 9.5)	186,1	8.3 (7.2 - 9.4)

9. Adjusted results for aphakia and pseudophakia

	Males		Females		Total	
	n	% (95%CI)	n	% (95%CI)	n	% (95%CI)
Bilateral (pseudo)aphakia	3,198	0.7 (0.1 - 1.2)	8,702	1.4 (0.9 - 1.8)	11,90	1.1 (0.7 - 1.4)
Unilateral (pseudo)aphakia	9,244	1.9 (1.0 - 2.9)	14,96	2.4 (1.8 - 2.9)	24,20	2.2 (1.6 - 2.7)
Eyes (pseudo)aphakia	15,64	1.6 (0.8 - 2.4)	32,36	2.5 (2.0 - 3.1)	48,00	2.1 (1.6 - 2.6)

10. Adjusted results for cataract surgical coverage

	Males	Females	Total
Cataract Surgical Coverage (eyes) - percentage			
VA < 3/60	41.4	51.4	47.6
VA < 6/60	29.4	42.4	37.0
VA < 6/18	16.4	23.3	20.5
Cataract Surgical Coverage (persons) - percentage			
VA < 3/60	70.7	68.2	69.0
VA < 6/60	49.0	54.6	52.4
VA < 6/18	27.4	34.5	31.9

Annex 15. RESULTS OF RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

SAMPLING ERROR (CLUSTER SAMPLING) & DESIGN EFFECT

Date and time of report: 27-10-2012 0:55:11

This report is for the survey area: SampleArea

Year and month when survey was conducted: 2012- 5 until 2012- 6

The accuracy of the estimate of the prevalence of a condition in the RAAB survey is calculated for sampling (SEcrs) specifically, using the formula's provided by:
Bennett S, Woods T, Liyanage WM, Smith DL.A simplified general method for cluster-sample surveys of health in developing countries. World Health Stat Q. 1991;44(3):98-106. The design effect (DEFF) is calculated by SEcrs^2 / SEsrs^2.

The table below shows the number of cases and the prevalence (sample prev.) of various conditions in the sample population, and the corresponding 95% confidence interval (CI 95%).
When the age and sex composition of the sample differs from that in the entire survey area, the actual prevalence may differ from that calculated in the sample. Run the report 'Age & sex adjusted results' to calculate the prevalence for and estimated number of people with the condition in the entire survey area. The prevalence interval at 95% confidence and the corresponding sampling error are shown. Use the Var. 90% and the Var. 80% to calculate the prevalence intervals at 90% and 80% confidence. Var. 95% = 1.96 * SEcrs; Var. 90% = 1.65 * SEcrs; Var. 80% = 1.28 * SEcrs.

Bilateral blind, best corrected			Cluster sampling					
	Cases in sample	**Sample prev.**	**CI 95%**	**Var. 95%**	**Var. 90%**	**Var. 80%**	**DEFF**	**SEcrs**
Males	10	1.15	0.47 - 1.82	0.67	0.57	0.44	0.91	0.34
Females	23	1.27	0.65 - 1.89	0.62	0.52	0.41	1.46	0.32
Total	33	1.23	0.74 - 1.72	0.49	0.41	0.32	1.40	0.25

Blind eyes, best corrected			Cluster sampling					
	Cases in sample	**Sample prev.**	**CI 95%**	**Var. 95%**	**Var. 90%**	**Var. 80%**	**DEFF**	**SEcrs**
Males	78	4.42	3.26 - 5.57	1.16	0.97	0.76	0.72	0.59
Females	110	3.00	2.24 - 3.76	0.76	0.64	0.50	0.94	0.39
Total	186	3.46	2.80 - 4.12	0.66	0.56	0.43	0.92	0.34

Bilateral SVI, best corrected			Cluster sampling					
	Cases in sample	**Sample prev.**	**CI 95%**	**Var. 95%**	**Var. 90%**	**Var. 80%**	**DEFF**	**SEcrs**
Males	12	1.38	0.59 - 2.16	0.78	0.66	0.51	1.03	0.40
Females	21	1.16	0.61 - 1.70	0.55	0.46	0.36	1.24	0.28
Total	33	1.23	0.76 - 1.70	0.47	0.39	0.31	1.27	0.24

SVI eyes, best corrected			Cluster sampling					
	Cases in sample	**Sample prev.**	**CI 95%**	**Var. 95%**	**Var. 90%**	**Var. 80%**	**DEFF**	**SEcrs**
Males	42	2.35	1.51 - 3.19	0.84	0.70	0.55	0.69	0.43
Females	60	1.63	1.08 - 2.17	0.55	0.46	0.36	0.89	0.28
Total	100	1.86	1.36 - 2.36	0.50	0.42	0.33	0.97	0.26

Bilateral MVI, best corrected			Cluster sampling					
	Cases in sample	**Sample prev.**	**CI 95%**	**Var. 95%**	**Var. 90%**	**Var. 80%**	**DEFF**	**SEcrs**
Males	54	6.19	4.59 - 7.79	1.60	1.34	1.05	1.00	0.82
Females	94	5.18	3.80 - 6.56	1.38	1.16	0.90	1.83	0.70
Total	148	5.51	4.36 - 6.65	1.15	0.96	0.75	1.76	0.58

MVI eyes, best corrected			Cluster sampling					
	Cases in sample	**Sample prev.**	**CI 95%**	**Var. 95%**	**Var. 90%**	**Var. 80%**	**DEFF**	**SEcrs**
Males	126	7.22	5.63 - 8.82	1.60	1.34	1.04	0.86	0.81
Females	230	6.31	4.99 - 7.62	1.32	1.10	0.86	1.38	0.67
Total	356	6.61	5.53 - 7.68	1.08	0.91	0.71	1.32	0.55

Bilateral blind, available correction			Cluster sampling					
	Cases in sample	**Sample prev.**	**CI 95%**	**Var. 95%**	**Var. 90%**	**Var. 80%**	**DEFF**	**SEcrs**
Males	15	1.72	0.81 - 2.63	0.91	0.77	0.60	1.12	0.47
Females	25	1.38	0.75 - 2.01	0.63	0.53	0.41	1.39	0.32
Total	40	1.49	0.93 - 2.04	0.56	0.47	0.36	1.47	0.28

Blind eyes, available correction			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	92	5.28	3.94 - 6.61	1.33	1.12	0.87	0.81	0.68
Females	120	3.28	2.50 - 4.05	0.78	0.65	0.51	0.90	0.40
Total	212	3.93	3.22 - 4.64	0.71	0.60	0.46	0.93	0.36

Bilateral SVI, available correction			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	17	1.95	1.02 - 2.88	0.93	0.78	0.61	1.03	0.48
Females	37	2.04	1.37 - 2.71	0.67	0.56	0.44	1.05	0.34
Total	54	2.01	1.46 - 2.56	0.55	0.46	0.36	1.08	0.28

SVI eyes, available correction			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	54	3.04	2.11 - 3.97	0.93	0.78	0.61	0.67	0.48
Females	104	2.84	2.16 - 3.52	0.68	0.57	0.44	0.79	0.35
Total	156	2.90	2.31 - 3.50	0.59	0.50	0.39	0.87	0.30

Bilateral MVI, available correction			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	99	11.35	8.80 - 13.90	2.55	2.14	1.67	1.46	1.30
Females	227	12.51	10.76 - 14.25	1.75	1.47	1.14	1.32	0.89
Total	326	12.13	10.55 - 13.71	1.58	1.32	1.03	1.63	0.81

MVI eyes, available correction			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	232	13.25	10.62 - 15.87	2.63	2.20	1.72	1.36	1.34
Females	516	14.21	12.53 - 15.90	1.69	1.41	1.10	1.10	0.86
Total	748	13.90	12.35 - 15.45	1.55	1.30	1.01	1.40	0.79

Bilateral cataract blind			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	6	0.69	0.16 - 1.22	0.53	0.45	0.35	0.94	0.27
Females	12	0.66	0.28 - 1.05	0.38	0.32	0.25	1.06	0.20
Total	18	0.67	0.36 - 0.98	0.31	0.26	0.20	1.01	0.16

Unilateral cataract blind			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	31	3.56	2.31 - 4.80	1.25	1.05	0.81	1.03	0.64
Females	36	1.98	1.35 - 2.62	0.63	0.53	0.41	0.97	0.32
Total	67	2.49	1.87 - 3.12	0.63	0.53	0.41	1.13	0.32

Eyes cataract blind			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	44	2.47	1.63 - 3.30	0.84	0.70	0.55	0.66	0.43
Females	60	1.65	1.14 - 2.16	0.51	0.43	0.33	0.76	0.26
Total	104	1.92	1.46 - 2.38	0.46	0.39	0.30	0.79	0.24

Bilateral cataract SVI			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	11	1.26	0.49 - 2.03	0.77	0.64	0.50	1.07	0.39
Females	11	0.61	0.24 - 0.97	0.37	0.31	0.24	1.06	0.19
Total	22	0.82	0.48 - 1.16	0.34	0.29	0.22	1.01	0.17

Unilateral cataract SVI			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%	Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	15	1.72	0.82 - 2.62	0.90	0.75	0.59	1.09	0.46
Females	19	1.05	0.56 - 1.54	0.49	0.41	0.32	1.09	0.25
Total	34	1.27	0.86 - 1.67	0.41	0.34	0.27	0.93	0.21

Eyes cataract SVI			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%			Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	32	1.78	1.01	-	2.54	0.77	0.64	0.50	0.76	0.39
Females	30	0.80	0.45	-	1.15	0.35	0.30	0.23	0.74	0.18
Total	60	1.12	0.77	-	1.46	0.34	0.29	0.22	0.75	0.18

Bilateral cataract MVI			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%			Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	31	3.56	2.28	-	4.83	1.28	1.07	0.84	1.08	0.65
Females	51	2.81	1.93	-	3.69	0.88	0.74	0.58	1.35	0.45
Total	82	3.05	2.29	-	3.82	0.77	0.64	0.50	1.39	0.39

Unilateral cataract MVI			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%			Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	41	4.70	3.22	-	6.18	1.48	1.24	0.97	1.11	0.76
Females	57	3.14	2.16	-	4.12	0.98	0.82	0.64	1.48	0.50
Total	98	3.65	2.80	-	4.49	0.85	0.71	0.55	1.43	0.43

Eyes cataract MVI			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%			Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	86	4.87	3.52	-	6.23	1.36	1.14	0.89	0.90	0.69
Females	138	3.77	2.86	-	4.69	0.91	0.77	0.60	1.08	0.47
Total	222	4.13	3.32	-	4.94	0.81	0.68	0.53	1.15	0.41

Bilateral (pseudo)aphakia			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%			Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	7	0.80	0.23	-	1.38	0.58	0.48	0.38	0.95	0.29
Females	17	0.94	0.51	-	1.36	0.43	0.36	0.28	0.92	0.22
Total	24	0.89	0.54	-	1.24	0.35	0.29	0.23	0.96	0.18

Unilateral (pseudo)aphakia			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%			Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	19	2.18	1.24	-	3.12	0.94	0.79	0.62	0.95	0.48
Females	35	1.93	1.37	-	2.49	0.56	0.47	0.37	0.79	0.29
Total	54	2.01	1.47	-	2.55	0.54	0.45	0.35	1.04	0.28

Eyes (pseudo)aphakia			Cluster sampling					
	Cases in sample	Sample prev.	CI 95%			Var. 95%	Var. 90%	Var. 80%	DEFF	SEcrs
Males	34	1.89	1.11	-	2.68	0.79	0.66	0.51	0.76	0.40
Females	70	1.90	1.34	-	2.46	0.56	0.47	0.36	0.79	0.28
Total	102	1.90	1.40	-	2.40	0.50	0.42	0.33	0.93	0.25

Annex 16. RESULTS OF RAPID ASSESSMENT OF AVOIDABLE BLINDNESS

FINDINGS ON DIABETES AND DIABETIC RETINOPATHY

Date and time of report: 27-10-2012 0:55:40

This report is for the survey area: SampleArea

Year and month when survey was conducted: 2012- 5 until 2012- 6

The diagnosis of diabetes is based on either a history of known diabetes, or, in case the person is not known with diabetes, on a random blood sugar of 200 mg/dl or higher.

1. Prevalence of known and newly diagnosed diabetes by age group and by gender

	Males		Females		Total	
	n	p (95% CI)	n	p (95% CI)	n	p (95% CI)
50 - 59	37	10.0% (7.0-12.9)	93	10.4% (8.2-12.5)	130	10.2% (8.4-12.1)
60 - 69	44	15.5% (11.5-19.6)	96	17.2% (14.0-20.5)	140	16.7% (13.9-19.4)
70 - 79	11	6.1% (2.8-9.5)	40	13.8% (8.7-19.0)	51	10.9% (7.6-14.2)
80+	4	10.3% (1.5-19.0)	5	6.8% (1.2-12.3)	9	8.0% (2.9-13.0)
All ages	96	11.0% (9.0-13.0)	234	12.9% (11.0-14.7)	330	12.3% (10.7-13.8)

2. Diabetics and random blood sugar level

		Males		Females		Total	
		n	%	n	%	n	%
All diabetics	Known diabetes	73	76.0%	214	91.5%	**287**	**87.0%**
	Newly diagnosed diabetes	23	24.0%	20	8.5%	**43**	**13.0%**
	Total	96	100.0%	234	100.0%	**330**	**100.0%**
Known diabetes	Bloodsugar <200 mg/dl	37	50.7%	114	53.3%	**151**	**52.6%**
	Bloodsugar >200 mg/dl	36	49.3%	100	46.7%	**136**	**47.4%**
	Total	73	100.0%	214	100.0%	**287**	**100.0%**

3. Treatment in people with known diabetes

	Males		Females		Total	
	n	%	n	%	n	%
No treatment	7	9.6%	22	10.3%	**29**	**10.1%**
Diet only	8	11.0%	21	9.8%	**29**	**10.1%**
Tablets	39	53.4%	130	60.7%	**169**	**58.9%**
Insulin	16	21.9%	38	17.8%	**54**	**18.8%**
Tablets + Insulin	3	4.1%	3	1.4%	**6**	**2.1%**
Other	0	0.0%	0	0.0%	**0**	**0.0%**
Total	**73**	**100.0%**	**214**	**100.0%**	**287**	**100.0%**

4. Last eye examination for DR among known diabetics

	Males		Females		Total	
	n	%	n	%	n	%
Never had eye examination for DR	27	37.0%	66	30.8%	**93**	**32.4%**
0-12 months ago	36	49.3%	118	55.1%	**154**	**53.7%**
13-24 months ago	1	1.4%	10	4.7%	**11**	**3.8%**
>24 months ago	9	12.3%	20	9.3%	**29**	**10.1%**
	73	**100.0%**	**214**	**100.0%**	**287**	**100.0%**

5. Prevalence of DR in diabetics and in entire sample

	N	Among diabetics p (95% CI)	Full sample p (95% CI)
Retinopathy grade			
No retinopathy (R0)	146	44.2% (37.7-50.8)	5.4% (4.5-6.4)
Background DR - mild (R1)	123	37.3% (30.8-43.8)	4.6% (3.5-5.6)
Background DR - observable (R2)	30	9.1% (5.9-12.2)	1.1% (0.7-1.5)
Background DR - referable (R3)	12	3.6% (1.6-5.6)	0.4% (0.2-0.7)
Proliferative DR (R4)	8	2.4% (0.6-4.2)	0.3% (0.1-0.5)
Ungradable DR (R6)	5	1.5% (0.2-2.8)	0.2% (0.0-0.3)
Any retinopathy	178	53.9% (47.3-60.5)	6.6% (5.4-7.9)
Maculopathy grade			
No maculopathy (M0)	208	63.0% (56.7-69.4)	7.7% (6.6-8.9)
Maculopathy - observable (M1)	61	18.5% (13.5-23.4)	2.3% (1.6-3.0)
Maculopathy - referable (M2)	40	12.1% (8.5-15.8)	1.5% (1.0-2.0)
Any maculopathy	116	35.2% (28.6-41.7)	4.3% (3.3-5.4)
Any retinopathy and/or maculopathy	182	55.2% (48.4-61.9)	6.8% (5.5-8.0)
Sight threatening DR (R4 and/or M2)	44	13.3% (9.5-17.2)	1.6% (1.1-2.2)
Any laser scars	19	5.8% (3.3-8.2)	0.7% (0.4-1.0)

6. Prevalence of any retinopathy and/or maculopathy by age and gender

	Males		Females		Total	
	n	p (95% CI)	n	p (95% CI)	n	p (95% CI)
50 - 59	16	43.2% (25.8-60.7)	39	41.9% (31.6-52.2)	55	42.3% (32.3-52.3)
60 - 69	23	52.3% (37.1-67.5)	58	60.4% (50.1-70.7)	81	57.9% (48.5-67.2)
70 - 79	6	54.5% (24.9-84.2)	27	67.5% (49.3-85.7)	33	64.7% (49.4-80.0)
80+	2	50.0% (0.7-99.3)	3	60.0% (16.8-100.0)	5	55.6% (20.1-91.0)
All ages	47	49.0% (38.3-59.6)	127	54.3% (46.9-61.6)	174	52.7% (45.8-59.7)

7. Prevalence of MVI, SVI and blindness among people with and without diabetes

	Persons with diabetes		Persons without diabetes	
	n	p (95% CI)	n	p (95% CI)
Normal vision	267	80.9% (76.8-85.0)	2,000	84.7% (82.8-86.7)
MVI	50	15.2% (11.1-19.2)	276	11.7% (10.0-13.4)
SVI	7	2.1% (0.6-3.6)	47	2.0% (1.4-2.5)
Blindness	6	1.8% (0.4-3.2)	34	1.4% (0.9-2.0)

8. Causes of visual impairment among people with and without diabetes

	MVI				Blindness			
	Non-diabetes		Diabetes		Non-diabetes		Diabetes	
	n	%	n	%	n	%	n	%
Refr. error	185	67%	19	38%	2	2%	1	7%
Cataract	69	25%	17	34%	56	69%	6	46%
DR	0	0%	12	24%	0	0%	5	38%
Other PSD	20	7%	2	4%	20	24%	1	7%
Other	2	0%	0	0%	3	3%	0	0%