

GHANA Blindness & Visual IMPAIRMENT STUDY 2015



Ghana Blindness and Visual Impairment Study

2015

For further information, contact;

Dr. Boateng Wiafe
Operation Eyesight Universal
653/3 Akanetso NE, Asylum Down
Accra, Ghana
Email: bwiafe@operationeyesight.com
Mobile: +233 245635394

Table of Contents

Table of Contents	ii
FIGURES	v
TABLES	vii
ACRONYMS	viii
FOREWORD	ix
EXECUTIVE SUMMARY	x
Background	x
Methodology	x
Demographic Profile of Respondents	xi
Prevalence of Blindness and Visual Impairment	xi
Principal Causes of Blindness (V/A less than 3/60)	xi
Causes of Severe Visual Impairment	xii
CHAPTER 1: INTRODUCTION	1
1.2 Background	1
1.2 Ghana National Eye Health Program (GNEHP)	1
1.3 Rationale for the Study	2
1.4 Main Study Objective	3
1.4.1 Primary Specific Objectives	3
1.5 Materials and Methods	3
1.5.1 Study Settings	3
1.5.2 Study Population	4
1.6 Sampling Methodology	6
1.6.1 Frame and Sampling Units	6
1.6.2 Stratification	6
1.6.3 Domains and Strata	6
1.6.4 Sample Size	7
1.6.5 Sample Coverage	8
1.7 Study Design	8
1.8 Study Implementation Strategy	9
1.9 Data Collection	9

1.9.1	Survey Instruments	11
1.9.2	Eye Examination	11
1.9.3	Training and Quality Control.....	11
1.10	Data Management and Statistical Analysis.....	12
1.11	Ethical Considerations.....	12
CHAPTER 2:	BACKGROUND CHARACTERISTICS OF HOUSEHOLDS.....	13
2.1	Demographic Profile	13
2.2	Social Characteristics of Households.....	15
CHAPTER 3:	CLINICAL EXAMINATION	19
3.1	Presenting Vision	19
3.2.1	Examined Population who were Blind (V/A Less than 3/60).....	22
3.2.2	Principal Causes of Blindness (V/A less than 3/60)	25
3.2.3	Persons with Cataract Untreated.....	28
3.3	Examined Population who have Severe Visual Impairment.....	31
3.3.1	Severe Visual Impairment.....	31
3.3.2	Causes of Severe Visual Impairment.....	33
3.3.3	Examined Population who have Refractive Error as a Cause of Severe Vision Impairment.....	35
3.3.4	Examined Population who have Refractive Error and the Use of Eyeglasses...37	
Conclusions and Recommendations		39
ESTIMATION OF SAMPLING ERROR		40
REFERENCE.....		41
ANNEX A: Study information and consent form.....		42
A.1	Introduction	42
A.2.	The procedure of the study.....	42
A.3.	Participation is voluntary	42
A.4	To withdraw yourself	42
A.5	Risks in the study	42
A.6	Benefits of the study.....	43
A.7	Confidentiality.....	43
A.8	Questions.....	43
A.9	Consent Form for Detailed Eye Examination	43
ANNEX B: THE INVESTIGATING TEAM.....		45
Principal Investigator (PI)		45

Co-investigators	45
Eye Care Team	45
Assistant Statisticians	45
Collaborating Institutions:	45
Technical Support:	46
Address for correspondence	46
Sponsoring agencies:	46
ANNEX C: QUESTIONNAIRES	47

FIGURES

Figure 1.1 Map of Ghana	5
Figure 1.2 Summary of the Workflow of the Survey	10
Figure 2.1 Population Examined.....	13
Figure 2.2 Examined Population by Sex.....	14
Figure 2.3 Distribution of the Examined Population by Zones	14
Figure 2.4: Distribution of the Examined, 2010 PHC and Sample Population by Type of Residence	15
Figure 2.5: Distribution of Type of Toilet Facility in Households	16
Figure 2.6 Distribution of Type of Fuel for Cooking Used in Households	16
Figure 2.7: Distribution of Source of Drinking Water Used in Households	17
Figure 3.1 Distribution of Blindness (Less than 3/60) by Intervention Zones	23
Figure 3.2 Distribution of Blindness (Less than 3/60) by Type of Residence.....	23
Figure 3.4 Percentage Distribution of Blindness by Sex	24
Figure 3.5 Percentage Distribution of Blindness by Wealth Quintiles.....	24
Figure 3.6 Percentage Distribution of Blindness by Educational level (Population Three Years or Older)	25
Figure 3.7 Principal Causes of Blindness (V/A less than 3/60).....	25
Figure 3.8 Distribution of Principal Causes of Blindness (V/A less than 3/60 by Type of Residence	27
Figure 3.9 Distribution of Principal Causes of Blindness (V/A less than 3/60) by Sex	27
Figure 3.10 Distribution of Classification of the Causes of Blindness (V/A less than 3/60) ..	28
Figure 3.11 Distribution of Specific Age Groups by Cataract Causes as a Cause of Blindness (V/A less than 3/60).....	28
Figure 3.13 Distribution of Cataract Untreated as a Cause of Blindness (V/A less than 3/60) by Sex.....	29
Figure 3.14 Distribution of Type of Residence by Cataract Untreated as a Cause of Blindness (V/A less than 3/60).....	29
Figure 3.15 Percentage Distribution of Barriers to Cataract Operation.....	30
Figure 3.16 Barriers to Cataract Operation by Sex.....	30
Figure 3.17 Barriers to Cataract Operation by Type of Residence.....	31
Figure 3.18 Percentage Distribution of Persons with Severe Visual Impairment by Zones....	32
Figure 3.19 Distribution of Severe Visual Impairment by Specific Age Groups.....	32
Figure 3.20 Percentage Distribution of Severe Visual Impairment by Sex	33

Figure 3.21 Distribution of Severe Visual Impairment by Type of Residence	33
Figure 3.22 Distribution of the Principal Causes of Severe Visual Impairment	34
Figure 3.25 Classification of Causes of Severe Visual Impairment	35
Figure 3.26 Percentage Distribution of Refractive Error as Causes of Severe Visual Impairment by Age Group	36
Figure 3.28 Percentage Distribution of Refractive Error as Causes of Severe Visual Impairment by Type of Residence	36
Figure 3.29 Percentage Distribution of Refractive Error as Causes of Severe Visual Impairment by Sex	37
Figure 3.30 Distribution of Person with Refractive Error who were Using Distant Eyeglasses	37

TABLES

Table 1.1: Summary of Sample Size by Number of Households and Enumeration Areas	7
Table 1.2 Sample Coverage of Households	8
Table 1.3 Sample Coverage of Eligible Individuals	8
Table 1.4 Summary of Job Description for Each Study Personnel.....	10
Table 2.1 Percentage Distribution of Population Examined by Zones	13
Table 2.2 Examined Population of Zones by Sex.....	14
Table 3.1: Distribution of Age by Presentation Vision With and Without Pinhole	19
Table 3.2 Distribution of Sex by Presentation Vision with Pinhole	20
Table 3.3: Distribution of Type of Residence by Presentation Vision with and without Pinhole	20
Table 3.4 Distribution of Intervention Zone by Presentation Vision with Pinhole	21
Table 3.5: Distribution of Wealth Quintiles by Presentation Vision with Pinhole.....	21
Table 3.7 Distribution of Specific Age Group by Presentation Vision with Pinhole	21
Table 3.8 Distribution of Presentation Vision with Pinhole by Presentation Vision Without Pinhole	22
Table 3.9 Distribution of Principal Causes of Blindness (V/A less than 3/60) Among Specific Age Groups	26
Table 3.10 Distribution of Principal Causes of Blindness (V/A less than 3/60) by Intervention Zones.....	26
Table 3.11 Distribution of Principal Causes of Severe Visual Impairment by Age	34
Table 3.12 Distribution of Principal Causes of Severe Visual Impairment by Zones	35

ACRONYMS

ACVA	Available Corrected Visual Acuity
AMD	Age-related Macular Degeneration
BCVA	Best Corrected Visual Acuity
CBM	Christoffel Blinden Mission
CHOs	Community Health Officer
CHPS	Community-Based Health Planning and Services
CSPro	Census and Survey Processing system
EA	Enumeration Area
ECOWAS	Economic Community of West African States
EMIS	Education Management Information System
ERECP	Eastern Regional Eye Care Program
GBVIS	Ghana Blindness and Visual Impairment Study
GCPS	Ghana College of Physicians and Surgeons
GHSERC	Ghana Health Service Ethical Review Committee
GNEHP	Ghana National Eye Health Program
GSS	Ghana Statistical Services
HAP	Household Air Pollution
IAPB	International Agency for the Prevention of Blindness
ICD	International Classification of Disease
IOP	Intra-Ocular Pressure
JMP	Joint Monitoring Program
Log-MAR	Logarithm of Minimum of Resolution
MOH	Ministry of Health
OEU	Operation Eyesight Universal
ONTS	Ophthalmic Nursing Training School
OP	Ophthalmic Epidemiology
PEC	Primary Eye Care
PHC	Population and Housing Census
PPS	Probability Proportional to Size
PVA	Presenting Visual Acuity
SAC	Snellen's Acuity Chart
SOPs	Standard Operating Procedures
SRC	Swiss Red Cross
TT	Trachomatous Trichiasis
UNICEF	United Nations Children's Fund
VA	Visual Acuity
VCDR	Vertical Cup Disc Ratio
VI	Visual Impairment
WHA	World Health Assembly
WHO	World Health Organization

FOREWORD

Blindness and visual impairment are important public health issues globally. They have far-reaching socio-economic consequences for individuals, families and communities. The causes of avoidable blindness are often associated with poverty and lack of access to quality eye health services. Ghana's Eye Health Program is committed to working towards the reduction of avoidable blindness and visual impairment in the country.

Reliable data for effective and appropriate interventions on eye health delivery is vital; however, the country has been limited for many years by limited specific and available data.

The Ghana Blindness and Visual Impairment Study (GBVIS) was undertaken to estimate the causes, magnitude and distribution of avoidable blindness and visual impairment among different age groups, sexes and zones of residence in Ghana. The results of the study are nationally representative and provide quality data for effective planning, allocating resources and collaborating with other partners on eye health interventions.

The findings will further serve as a basis for designing future interventions, setting up monitoring indicators to track performance as well as consolidating the joint efforts of policy makers, partners and eye health professionals working towards the attainment of integrated, accessible, sustainable, equitable and quality eye health to all people living in Ghana. Such interventions, when successfully implemented, could be replicated and validated as an evidence-based model and could be considered for use in other parts of Africa and other developing countries.

Dr. Anthony Nsiah-Asare

Director General, Ghana Health Service

EXECUTIVE SUMMARY

Background

Significant progress has been made in avoiding blindness and visual impairment, particularly from infectious diseases. However, visual impairment remains a major global health issue with about 285 million visually impaired (39 million blind and 246 million having low vision) (WHO Fact Sheet No. 282). Though visual impairment is a debilitating condition, there are limited country-specific estimates. In Africa, few studies on blindness and visual impairment have been conducted, with only one from Ghana. However, these studies were not detailed and nationally representative. The very expensive and time-consuming nature of national blindness and low vision surveys probably explains their rarity in many African countries.

The International Classification of Diseases (ICD) states that there are five levels of visual function: normal vision ($>6/12$), mild visual impairment ($<6/12 - 6/18$), moderate visual impairment ($<6/18 - 6/60$), severe visual impairment ($<6/60 - 3/60$) and blindness ($<3/60$). Moderate visual impairment and severe visual impairment is grouped under the term *low vision*.

Specific data for effective interventions in eye care services is limited. This study aimed to provide a robust nationally representative data on blindness and visual impairment. The key objectives were to:

1. Estimate the prevalence of moderate visual impairment, severe visual impairment and blindness in the general population by age, sex and zone of residence; and
2. Quantify the avoidable causes of blindness and visual impairment.

Methodology

The study is a nationally-represented household survey that involved the whole of Ghana and was intended to estimate indicators of blindness and visual impairment. It targeted all households living in an occupied dwelling for at least six months, or intended to live for six months or more and excluded populations living in institutions.

The sample design was a two-stage stratified cluster sample design. The cluster was the Enumeration Area (EA). A sample of 77 EAs was selected using a systematic method with probability proportional to size (the number of households in each EA) at five percent significance level at the first stage. The sampling units were stratified at the first stage into the two zones (intervention and non-Intervention), and within each zone, the sampling units were further stratified into urban and rural areas.

A comprehensive list of all households in the selected enumeration areas were prepared by carrying out a household listing exercise. The list of households constituted the sampling frame for the second stage sampling. After the listing was completed, 15 households were randomly-selected in each EA for interviews. All members of the selected households were examined.

In all, a total 1,155 households were selected (600 households from the intervention zones and 555 households from the non-intervention zones). Out of this, a total of 1,138 were successfully interviewed representing a 98.5 percent response rate. In all, 4,968 eligible persons were identified, out of whom 4,574 were clinically examined by the study team. This represents 92.1 percent coverage of those sampled.

Two structured questionnaires (household and clinical questionnaires) were developed. A household questionnaire was used to collect data on the socio-economic characteristics and a clinical questionnaire was used to collect data on the results of the clinical examination.

With regard to data management and statistical analysis, all study-related questionnaires at the enumeration level were received at the central coordination office, manually checked for completeness and keyed into a data base using CSPro statistical software. Data cleaning and analysis was done using SPSS.

Results

Demographic Profile of Respondents

The population that was examined shows that 56.6 percent were females while 43.4 percent were males. The age structure of the examined population was similar to the population structure observed in the 2010 Population and Housing Census.

Prevalence of Blindness and Visual Impairment

The study found that 0.74 percent of Ghanaians were blind. Additionally, 1.07 percent had severe visual impairment. The age distribution indicates that blindness (<3/60) is positively related to age. For instance, 0.22 percent of persons in the age group 30 – 39 were found to be blind (Best Corrected Vision Acuity – BCVA). This increased to 0.28 percent among persons in the age group 40 – 49 and continued to increase as age increases to 19.12 percent among those who were 80 years or older. The sex distribution shows that 54.8 percent of persons who were blind were females. The prevalence of blindness is higher in the rural areas of Ghana (0.79) than in the urban areas (0.67). The average prevalence in the intervention zones is 0.46 percent, while in the non-intervention zones, it is 1.00 percent.

The study also found that 67.74 percent of persons who were blind dwell in areas where there is currently no program of blindness prevention or treatment intervention going on, while 32.26 percent live in areas where some program of intervention is currently being implemented.

Principal Causes of Blindness (V/A less than 3/60)

Cataract causes of blindness were responsible for more than half (54.8%) of blindness in Ghana. Glaucoma was found to be the second major cause, accounting for 19.4 percent of

blindness (<3/60) in Ghana. This was followed by posterior segment (12.9%) and cornea opacity (11.2%).

Causes of Severe Visual Impairment

Refractive error (44.4%) and cataract related (42.2%) were the two major causes of severe visual impairment. The other causes were posterior segment, glaucoma and cornea opacity.

Conclusion and Recommendation

A large proportion of those with low vision (88.9%) and blindness (67.7%) are due to avoidable causes. Rural residents carry greater risk of blindness. Persons who are blind are also more likely to live in a non-intervention zone.

Strategies should be put in place to make quality eye care accessible and affordable to all, irrespective of their location.

Blindness prevention programs should focus on addressing the avoidable causes identified in this study.

CHAPTER 1: INTRODUCTION

1.2 Background

Despite the progress made in the last few decades in avoiding blindness and visual impairment, particularly from infectious diseases, visual impairment remains a major global health issue in many developing countries. The World Health Organization (WHO) presently estimates that approximately 285 million people are visually impaired worldwide: 39 million of them are blind and 246 million have low vision. The avoidable causes of this estimate are as high as 80% of the total global burden (1).

Though visual impairment is a serious condition, there are limited country specific estimates. Thus, in 1994, the WHO set up a database to collate publication on visual impairment, and in 2002 updated it with data from 68 countries in 208 studies (2). In this database, only published studies or studies that could be readily obtained from government or agencies that conducted them were included. The populations surveyed were in most cases mixed, sometimes all ages, children or those 50 years and above. Study methods used ranged from detailed epidemiological to rapid methods. Few studies in Africa were included, with only one from Ghana (3) that met the criteria. Moreover, the African studies were not detailed or representative enough (2). The very expensive and time-consuming nature of national blindness and low vision surveys probably explain their rarity in many African countries.

In the last few decades, some countries in Africa have managed to conduct blindness and visual impairment studies (4-7). However, only few of such studies were nationally representative in nature. For instance, a study in Nigeria sampled only persons aged 40 years and above (4).

According to the International Classification of Diseases (ICD), there are five levels of visual function: normal vision, mild visual impairment, moderate visual impairment, severe visual impairment and blindness. Moderate visual impairment and severe visual impairment are grouped under the term *low vision*.

The major causes (frequencies) of visual impairment as reported by WHO are uncorrected refractive errors (43%) and cataract (33%). Uncorrected refractive errors causing visual impairment including blindness are myopia, hyperopia and astigmatism. Cataract remains the leading cause of blindness (51%) in middle- and low-income countries where the majority of all visually impaired people live (1). Other causes of visual impairment are glaucoma, age-related macular degeneration (ARMD), corneal opacities, diabetic retinopathy, childhood blindness, trachoma and onchocerciasis (1). In developing countries, and in particular Sub-Saharan Africa, the causes of avoidable blindness are primarily cataract (50%), glaucoma (15%), corneal opacities (10%), trachoma (6.8%), childhood blindness (5.3%) and onchocerciasis (4%) (1).

1.2 Ghana National Eye Health Program (GNEHP)

The objective of the Ghana National Eye Health Program is to reduce avoidable blindness through the strengthening of capacities that ensure affordable and available eye care services to all people living in the country. This includes the mobilization of communities to participate actively in eye health. The lack of requisite human resources is, however, a major challenge to the work of the program. Presently, there are about 97 ophthalmologists in Ghana, some of whom are either in administrative positions or no longer in active practice.

The majority of those in service delivery are in the capital cities, leaving the rural areas underserved.

Ophthalmic nurses and optometrists are the main personnel who work in eye units at the district hospitals or in urban polyclinics. Eye health services are delivered by other health service providers who have been trained in Primary Eye Care (PEC).

In addition, eye care delivery in communities without specialized personnel has often been delivered through partnership interventions with not-for-profit organizations, particularly in deprived communities. For instance, Sightsavers has supported the national program for several years at base hospitals and on an outreach basis. Sightsavers is currently supporting the Eastern Regional Eye Care Program. Christoffel Blinden Mission (CBM) has supported eye care delivery in Bawku, Agogo, Akwatia, Battor and Breman Asikuma. Sightsavers and CBM have supported training of eye care service providers and the establishment of the Ophthalmic Nursing Training School.

The “Ghana Vision 1ST” Program of the Swiss Red Cross has also invested in training of eye health staff, including for volunteers in selected communities in Brong Ahafo, Upper West and Northern Regions. The program has provided financial support to facilities and health personnel to deliver quality eye health services to hard-to-reach parts of their catchment areas (Ghana Vision 1ST 2009 annual report).

Operation Eyesight Universal supports eye health delivery in the Western Region and some districts in the Northern Region. Operation Eyesight has implemented the “Seeing Is Believing” Project in six regions of Ghana involving 21 districts. During the four-year Project, basic equipment was supplied and ophthalmic nurses were trained in the use of the equipment. Operation Eyesight Universal is now implementing phase V of the Project which seeks to link the base hospitals to the community through the Community-Based Health Planning and Services (CHPS) program, due to the limited eye care services at the primary level of service delivery. This will ensure that eye health services are available and accessible at the community level.

1.3 Rationale for the Study

Reliable estimate of disease burden is the basis for designing good prevention and control programs in public health. Moreover, quality data is vital for effective planning of eye health services, including distribution of skilled eye health providers. There is currently no nationally-representative data on the prevalence and causes of blindness and visual impairment in Ghana. The study therefore aims to provide robust nationally representative data on blindness and visual impairment. The findings of the study will further serve as a basis for designing future interventions to decrease visual impairment in Ghana. Such interventions, when successfully implemented, can be replicated and validated as an evidence-based model that can be adopted for use in other parts of Africa and other developing countries. It will also provide baseline data for evaluating the phase V “Seeing Is Believing” Project.

1.4 Main Study Objective

The main objective of this study is to characterize visual impairment and blindness in the general Ghanaian population by probable aetiology, age group, sex and intervention zones (Intervention Rural, Non-Intervention Rural, Intervention Urban and Non-Intervention Urban areas).

1.4.1 Primary Specific Objectives

1. Estimate the prevalence of moderate visual impairment, severe visual impairment and blindness in the general population by age, sex and zone of residence;
2. Quantify the avoidable causes of blindness and visual impairment; and
3. Explore associations of the major causes of blindness and visual impairment in Ghana.

1.5 Materials and Methods

A representative national study utilizing a cross-sectional epidemiological design with multistage (two stage) sampling technique was undertaken in four zones: Intervention Rural, Intervention Urban, Non-Intervention Rural and Non-Intervention Urban. Probability Proportional to Size (PPS) technique was used in sample allocation. All persons in Ghana were included in the sample design to increase the total representation. This was achieved through stratification of all the 2010 Population and Housing Census Enumeration Areas (EA) into four zones and then randomly selecting enumeration areas from each zone for the study.

Different study teams, each led by an ophthalmologist and including an optometrist, an ophthalmic nurse, interviewers and local guides, were constituted to conduct the study. Data collection included interviews using structured questionnaires to assess eye health, as well as physical examinations, including blood pressure and eye examination. Ethical approval was obtained from the Ghana Health Service Ethical Review Committee and oral consent was obtained from all participating households and individuals.

Data from the interview questionnaire and the physical examination forms were double-entered by experienced data entry clerks using CSPro statistical software. This was done after all completed forms at the field level were received at the study coordination office and manually checked for completeness and systematically filed by zones. Statistical analyses include point and interval estimates of blindness and visual impairment were done using the SPSS statistical software. Univariate and bivariate analyses were also used to explore associations of the major causes of blindness and visual impairment in Ghana.

1.5.1 Study Settings

The study involved the whole of Ghana, a country bordered to the east, west and north by Togo, Ivory Coast and Burkina Faso respectively. The Gulf of Guinea borders the south. The geographic coordinates of Ghana are 8 00 N, 2 00 W with a total land area of 238,533 square kilometres divided into ten administrative regions. The climate is tropical, but temperatures vary with seasons and elevations. Two rainy seasons occur: April to July and September to November; but in the north, the single rainy season begins in May and lasts until September. Annual rainfall ranges from about 1,100 mm in the north to about 2,100 mm in the southwest.

There are three main types of vegetation, comprising the coastal plains, the forest belt and the savannah (Figure 1). The coastal plains start from the extreme southern end of the Volta region stretching to the south-eastern part of the Western region. The forest belt is the predominant vegetation in the middle parts of Ghana. The Northern regions of Ghana have savannah vegetation (8).

1.5.2 Study Population

The population of Ghana was estimated in the year 2010 at about 25 million with a sex ratio of 95 males to 100 females. About 50% are under 20 years and above 60 years of age. The percentage breakdowns of the population by the ten regions are: Ashanti (19.4%), Accra (16.3%), Eastern (10.7%), Northern (10.1%), Western (9.6%), Brong Ahafo (9.4%), Central (8.9%), Volta (8.6%), Upper East (4.2%) and Upper West (2.8%) (9). In this study, all members of randomly-selected households, irrespective of age, sex and other socio-demographic characteristics, were invited to participate. Members of a household who have lived in the household for at least six months, those intending to live for six months or more and those who were not within the household at the time of the survey but were expected to be absent from the household for less than six months were included. Persons living in institutions and homeless people were excluded from the survey.

A household constitutes a group of persons who normally live together under the same roof and have common catering arrangements. The head of a household or his designee was interviewed for the background characteristics for that household using the household questionnaire.

Figure 1.1 Map of Ghana



Figure 1: Shows the map of Ghana indicating the ten administrative regions.

1.6 Sampling Methodology

The Ghana Blindness and Visual Impairment Study was a household study intended to estimate indicators of blindness and visual impairment.

The objective of the sampling design was to ensure the collection of reliable, disaggregated and internationally comparable statistics on the prevalence and causes of blindness and visual impairment, with acceptable precision for effective planning, implementation, monitoring and evaluation.

1.6.1 Frame and Sampling Units

The sample universe defined for the Ghana Blindness and Visual Impairment Study was the population living within the individual households in all the intervention and non-intervention zones in Ghana. An intervention zone for this study constitutes all areas where there have been programs of eye health service delivery. The sample was a two-stage stratified cluster sample design. The cluster is defined as the Enumeration Area (EA) as used in the 2010 Population and Housing Census.

The 2010 Population and Housing Census has up-to-date Enumeration Areas, all of which have well-defined identifiable boundaries on maps. The 2010 EAs were thus defined as the sampling frame for the first stage sampling. The individual EAs with zonal, urban/rural characteristics and the population size constitute the units for the first stage sampling.

At the first stage, a sample of 77 EAs were selected using a systematic method with probability proportional to the number of households in each EA. For each of the selected EAs, a list of households was prepared during a field household listing exercise in all the 77 selected households. This list of households constituted the sampling frame for the second stage sampling. After the listing was completed, 15 households were randomly selected in each EA for interviews. All members of the selected households were examined.

1.6.2 Stratification

In order to take advantage of possible gains in precision and reliability of the study estimates, it was important to stratify the sampling units (EAs) of the first stage sampling frame into the four intervention zones. Within each zone, the sampling units were further stratified into urban and rural areas.

1.6.3 Domains and Strata

A domain is part of a sampled universe for which separate and reliable estimates are required. From the survey plan, the acceptable domains are:

- The whole country;
- Each of the four intervention zones;
- The urban area; and
- The rural area.

1.6.4 Sample Size

The sample size for the survey was calculated based on some basic assumptions: the working prevalence of blindness in Ghana was estimated as 0.7% and the national population size was estimated at about 25 million. Other parameters considered for estimating the sample size were relative precision (11%), confidence limits (95%), response rate (80%) and design effect (1.2%). The total sample sizes calculated for the zones were based on their estimated population size.

Table 1.1 shows the summary distribution of the sample across the intervention zones. The two-stage design yielded a total of 1,155 households selected from 77 randomly-selected EAs with probability proportional to size at 5% significance level. A total of 600 households were selected among the intervention zones while 555 households were selected from the non-intervention zones.

The Table further shows that 585 households were selected from the urban areas made up of 300 from the intervention zones and 285 from the non-intervention zones, while in the rural areas, 570 households were selected.

Table 1.1: Summary of Sample Size by Number of Households and Enumeration Areas

Region	Urban / Rural	Number of EAs	2015 Field estimated population	Population distribution by stratum inside zones %	Distribution of the sample of 1540 households by zones	Distribution of the sample of 77 EAs by zones	EA sample distribution by stratum		Household sample distribution by stratum
							Proportional distribution	Revised distribution	
Intervention	Urban	4,422	3,675,815	49.7			19.9	20	300
	Rural	5,697	3,725,794	50.3			20.1	20	300
Sub Total		10,119	7,401,609	100.0	800	40.0	40.0	40	600
Non-Intervention	Urban	12,081	10,401,254	51.3			19.0	19	285
	Rural	15,440	9,867,312	48.7			18.0	18	270
Sub Total		27,521	20,268,566	100.0	740	37.0	37.0	37	555
Whole country		37,640	27,670,175	100.0	1,540	77	77.00	77	1,155

1.6.5 Sample Coverage

Table 1.2 shows the distribution of the response rate by intervention zones. In all, a total of 1,155 households were selected and 1,138 were successfully interviewed, representing a 98.5 percent response rate. In the non-intervention urban zone, all selected households were successfully interviewed.

Table 1.2 Sample Coverage of Households

Zones	Number of Selected Households	Number of Completed Households	Percentage Coverage
Intervention Urban	285	282	98.9
Intervention Rural	315	304	96.5
Non-Intervention Urban	285	285	100.0
Non-Intervention Rural	270	267	98.9
Total	1,155	1,138	98.5

The sampling design specified that all members of the selected households were eligible for examination. Table 1.3 shows the distribution of eligible persons in selected household by the intervention zones. The 1,138 completed household interviews resulted in a total of 4,968 persons eligible for clinical examination, of which 4,574 were clinically examined by the study team. This represents 92.1 percent coverage of those sampled. The response rate for the non-intervention zones was higher (98.3%) than the intervention zones (86.5%).

Table 1.3 Sample Coverage of Eligible Individuals

Zones	Number of Individuals Selected for Clinical Examination	Number of Individuals Examined	Percentage Coverage
Intervention Urban	1177	1017	86.4
Intervention Rural	1450	1256	86.6
Sub Total Intervention Zone	2627	2273	86.5
Non-Intervention Urban	1130	1121	99.2
Non-Intervention Rural	1211	1180	97.4
Sub Total Non-Intervention Zone	2341	2301	98.3
Total Country	4,968	4,574	92.1

1.7 Study Design

Two questionnaires were developed: a household questionnaire and a clinical questionnaire. The household questionnaire was used to collect data on the socio-economic characteristics of a household, including education attainment of each member of the household, age, sex, relationship to the head of the household, and water and sanitation. The clinical questionnaire collected data on the results of the clinical examination of the eyes of each member of the selected household.

1.8 Study Implementation Strategy

A national secretariat of the study was established to coordinate all aspects of the study. A public health specialist was in charge of the overall coordination of this secretariat and was assisted by other core team members. The secretariat oversaw the day-to-day activities of the study and also coordinated activities in the four zones.

1.9 Data Collection

Three clinical teams were established, each led by an ophthalmologist. Each included an optometrist and ophthalmic nurses and was assisted by an enumeration team and other support staff working in different locations concurrently. The ophthalmologists were responsible for the overall scientific and technical activities in the field. The interviewer, the local guide, and ophthalmic nurses together visited selected households. The local guide helped to administer the informed consent in the preferred language and the interviewers completed the household questionnaire. The head of the household or any adult member of the household was eligible to respond the household questions.

Detailed Standard Operating Procedures (SOPs) were developed for the eye examinations, and each clinical staff was obliged to follow them. The optometrists/ophthalmic nurses performed basic eye examinations, including visual acuity for each member of the household. Individuals who read better than 6/12 in both eyes were thanked and released from the study. Those who read 6/12 or less than 6/12 in either eye were further examined using a pinhole test by the team. If their visual acuity improved to better than 6/12, their contact information was recorded on the questionnaire and they were referred to the nearest eye health centre. Those whose visual acuity did not improve using the pinhole test were further examined by the ophthalmologist to determine the cause of blindness or low vision. Figure 1.2 shows the work flow for data collection and eye examination at a household level.

Figure 1.2 Summary of the Workflow of the Survey

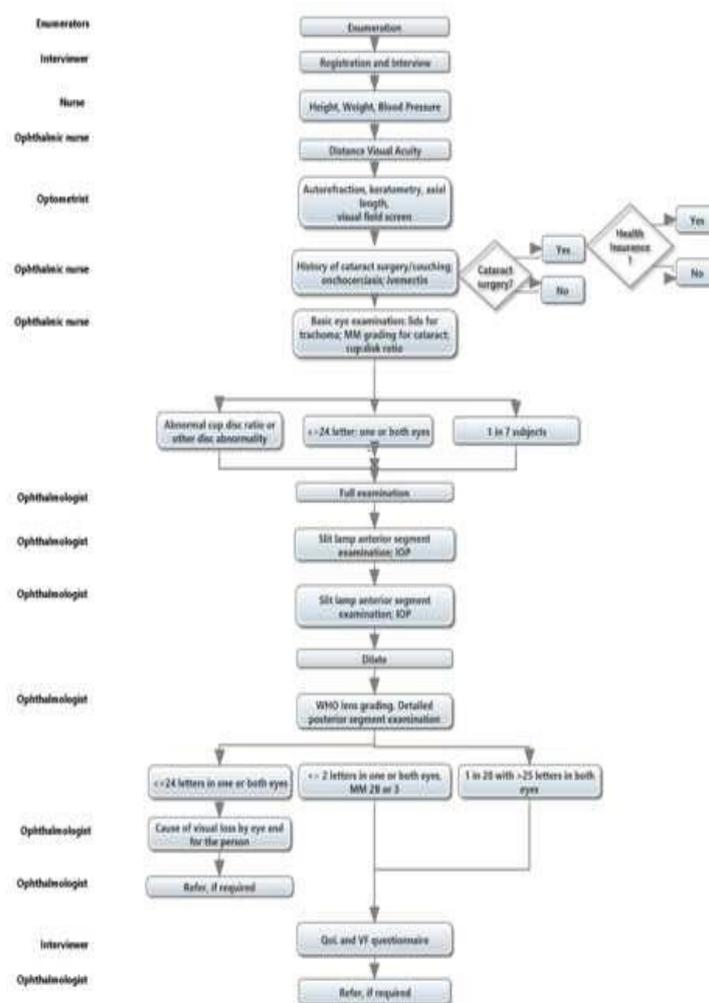


Table 1.4 Summary of Job Description for Each Study Personnel

Step	Personnel	Activity	Outcome
1	Interviewer	1. Identify household members 2. Complete section I of the eye examination form	
2	Ophthalmic nurse	Complete section II questions 1. Perform visual acuity and external examination 2. Ask surgical history 3. Assess for trachoma	
3	Optometrist	Complete basic eye examination 1,2. Assess for refractive error	
4	Ophthalmologist	Confirm vision status 1. Assess cause of low vision and blindness 2. Indicate action to be taken 3. Supervise overall study functions 4. Complete supervision checklist	

1.9.1 Survey Instruments

Study instruments were adapted from previous works by the WHO and other sister countries for this study (6-10). Prior to field work, the study instruments were reviewed by experts experienced in eye health study and pre-tested in the field before final adoption. The pre-tested and validated forms and questionnaires were used to collect information in the study. Two questionnaires - household and clinical examination questionnaires - were used in this study. The household questionnaire collected data on demographic and socio-economic variables as well as other risk factors for eye health at the household level. The eye examination questionnaire, in addition, collected information pertaining to eye health: facial cleanliness, visual acuity and history of eye morbidity and surgery for each individual included in the study. A supervisor's checklist was prepared to ensure that all the necessary data was collected at each level. The questionnaires were prepared in English and the questions were administered by the interviewers in either English or the local language.

1.9.2 Eye Examination

Ophthalmic staff examined both eyes of each member of the selected households. Eye examination was done in accordance with the WHO's methods of assessment of avoidable blindness. Visual acuity was tested using Snellen's Acuity Chart (SAC). Visual acuity measurement was conducted starting with adult members of a household going down to youngest at the end. This way, the children easily got used to the eye examination procedures and volunteered to participate in the assessment. Visual acuity assessment was performed outdoors during daylight hours. All study participants with a visual acuity of $<6/12$ were tested for refractive error. The presence of refractive error was confirmed when improvements in visual acuity were observed with pinhole examination.

The eye examination included anterior and posterior segment evaluations to assess the Vertical Cup Disc Ratio (VCDR) with a direct ophthalmoscope and Intra-Ocular Pressure (IOP) to determine the cause of blindness and low vision with major emphasis on cataract, trachoma, glaucoma and refractive error. Any opacity of the lens visible with direct ophthalmoscope through an undilated pupil was classified as cataract. On the other hand, glaucoma was suspected based on Vertical Cup to Disc Ratio and referred.

1.9.3 Training and Quality Control

Training on survey methods, interviewing techniques and eye examination was given to all members of the study team. Initial training was undertaken in Accra for the team leaders for the purposes of sensitizing health authorities, professional associations and eye health workers. Further training involved the field staff, and included conducting pre-test for field procedures and standardization of eye examination procedures. The pre-test revealed issues about interview flow and eye examination methodologies that were corrected by the central coordinating team before full implementation. As part of the quality control measures, monitoring of field operations started with the field data collection teams. This was to ensure that standard procedures were followed and best practices were observed during the field data collection. The final quality assurance mechanism involved regular meeting of the central coordinating team to consider reports from the field monitoring and to make decisions about implementation at the various stages of the study.

Every effort was made to recruit dedicated people for the study. During the training of the study teams, two days of field practice were conducted to give performance feedback, provide explanations about the study procedures and to help identify and select the best persons for the field. Others constituted a reserve or back-up for any eventualities which may require replacement of field personnel.

1.10 Data Management and Statistical Analysis

All study-related forms at the enumeration level were received at the central coordination office and manually checked for completeness. Data was double-entered using CSPro statistical software by experienced data entry clerks. Data entry was supervised by an experienced data manager. A regular backup system was created to avoid loss of data during the data entry process.

Data cleaning and analysis was done using SPSS. Statistical analyses included point and interval estimates of blindness and visual impairment in Ghana. Cause-specific proportions of blindness and visual impairment were also estimated by socio-demographic variables and intervention zones. Univariate and bivariate analyses were used to explore associations of the major causes of blindness and visual impairment in Ghana. Furthermore, specific population groups were selected during analysis to calculate standard indicators for specific diseases.

1.11 Ethical Considerations

The human use justification for this study was to generate data for effective intervention of eye health problems in Ghana, which are of public health importance. Ethical approval was obtained from the Ghana Health Service Ethical Review Committee. Household consent was obtained from the head of each household before any research-related activity was carried out. Oral consent was obtained from all participating adult individuals and where possible, parental consent and assent for children. Witness individual informed consent was obtained for those who underwent detailed eye examinations. Confidentiality of study information was ensured and all data analyses were anonymous. Benefits in the study included treatment for minor eye ailments during study participation and referral for those with major ailments for the appropriate treatment. The clinical team members also provided appropriate advice on eye health problems where possible.

CHAPTER 2: BACKGROUND CHARACTERISTICS OF HOUSEHOLDS

2.1 Demographic Profile

The distribution of the population examined is provided in Figure 2.1. The proportion of the population whose eyes were examined successfully is 92.0 percent of the eligible population. Eight percent of the eligible population was not examined.

Figure 2.1 Population Examined

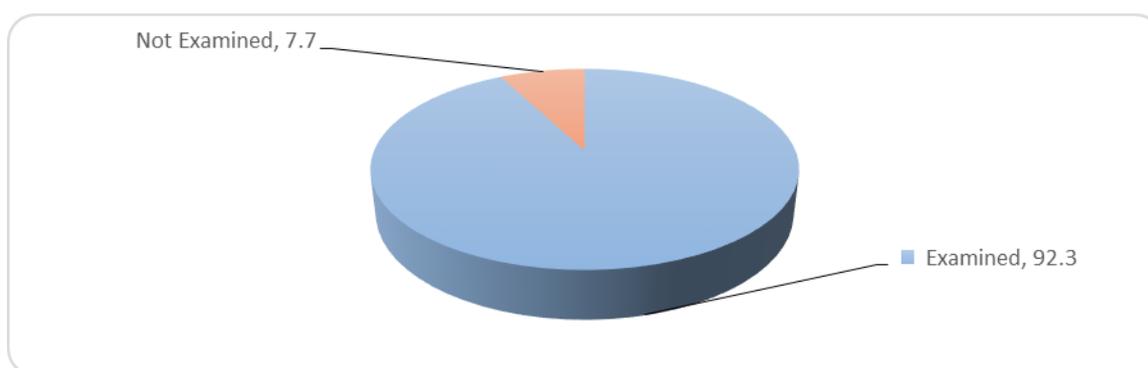


Table 2.1 shows the distribution of the examined population by zones. It was observed that more people living in the urban areas refused to be part of the study (0.7% for Intervention Urban and 1.6% for Non-Intervention Urban) than those in the rural areas (0.1% for Non-Intervention Rural). None of the eligible population in the rural areas of the intervention zones refused to be examined.

Table 2.1 Percentage Distribution of Population Examined by Zones

Intervention Zones	Examined	Not available	Refused	Not able to Communicate	Population Interviewed
Intervention Urban	89.5	7.6	0.7	2.2	100.0
Intervention Rural	91.7	7.0	0.0	1.2	100.0
Non-Intervention Urban	90.9	6.6	1.6	0.8	100.0
Non-Intervention Rural	95.1	4.3	0.1	0.6	100.0
Total	92.3	6.0	0.7	1.0	100.0

The distribution of the eligible population that was examined by sex is presented in Figure 2.2. In the Figure, more females (56.6%) were examined than males (43.4%). This pattern is consistent with the 2010 Population and Housing Census (PHC), which indicated that 49 percent of the population living in Ghana were males while 51 percent were females.

Figure 2.2 Examined Population by Sex

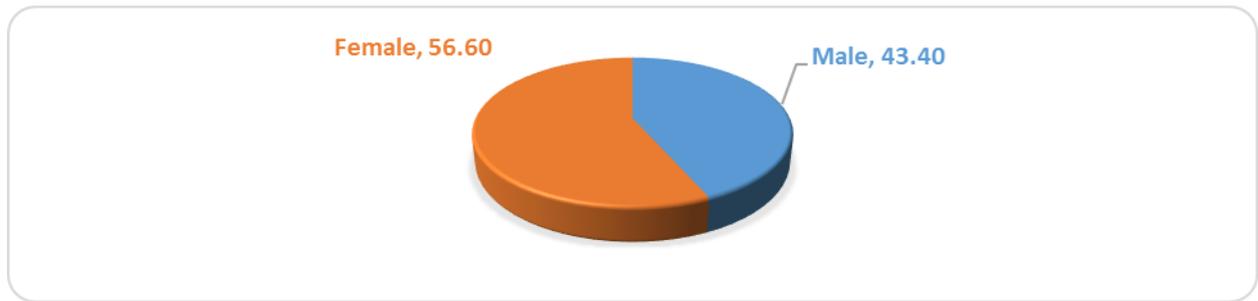


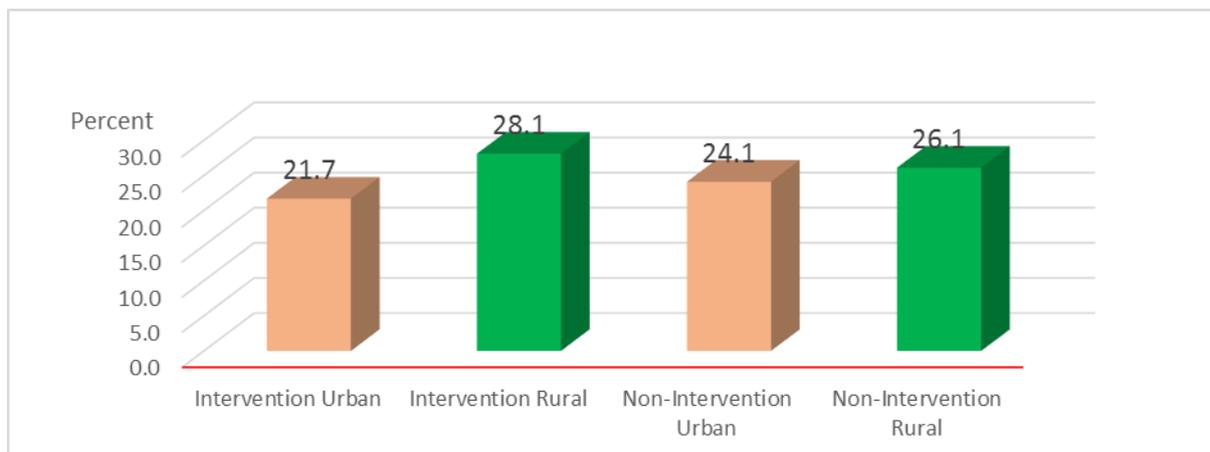
Table 2.2 shows the percentage distribution of the examined population by sex within the zones. From the Table, it was observed that the distribution between males and female in all the four zones were similar and follow the national pattern as reported by the 2010 PHC.

Table 2.2 Examined Population of Zones by Sex

Zones	Male	Female	Total	N
Intervention Urban	41.8	58.2	100.0	914
Intervention Rural	45.7	54.3	100.0	1180
Non-Intervention Urban	41.9	58.1	100.0	1015
Non-Intervention Rural	43.8	56.2	100.0	1097
Total	43.4	56.6	100.0	4206

The distribution of the examined population by zones is presented in Figure 2.3. The distribution shows that the proportion of the examined population in each of the zones was evenly distributed and that they constituted a fair representation in each of the zones. The intervention zones constituted 49.8 percent while the non-intervention zones constituted 50.2 percent. The examined population in rural areas of the intervention zones (28.1%) was greater than that of the urban areas (21.7%). Similar observations were made among the non-intervention zones.

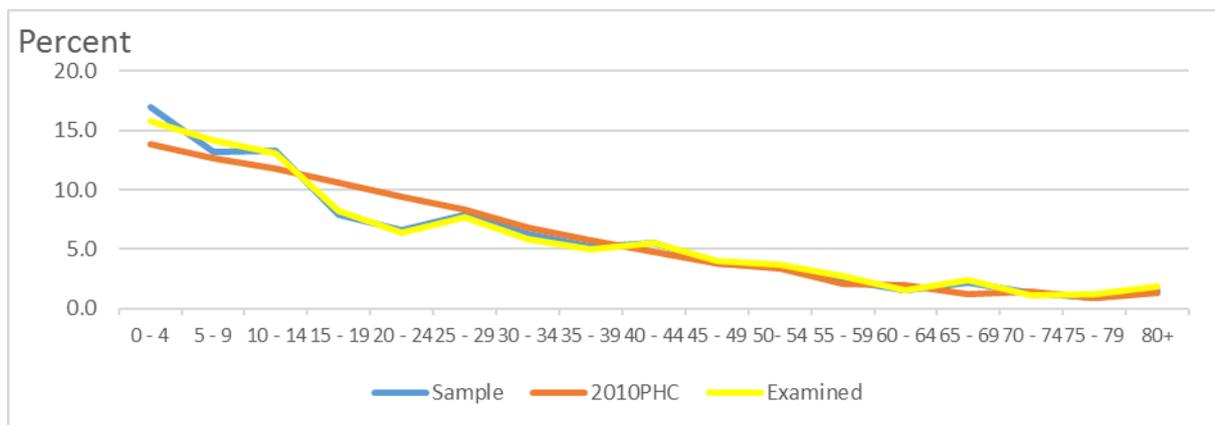
Figure 2.3 Distribution of the Examined Population by Zones



The percentage distribution of the eligible population and examined population by age group compared to the 2010 Population and Housing Census is shown in Figure 2.4. The Figure shows that there was not much difference in the population structure between the sampled population and the examined population, except for the population under 10 years, where the sampled population was higher than the examined for those in the age group 0 – 4 but lower than the examined for those in the age group 5 – 9.

Comparing the distribution of the 2010 census population with the examined and sampled population, however, shows significant variation among the population under 30 years when compared to the examined population. For instance, the 2010 census population for persons younger than 15 years were lower than the examined or sampled population of same age but higher than the examined or sampled population for persons who were between the age group of 15 – 29. This could be the result of age misreporting, which had been adjusted for in the census data. The Figure further shows that there was not much difference between the examined, the sampled and the 2010 census distribution for the population 30 years or older.

Figure 2.4: Distribution of the Examined, 2010 PHC and Sample Population by Type of Residence



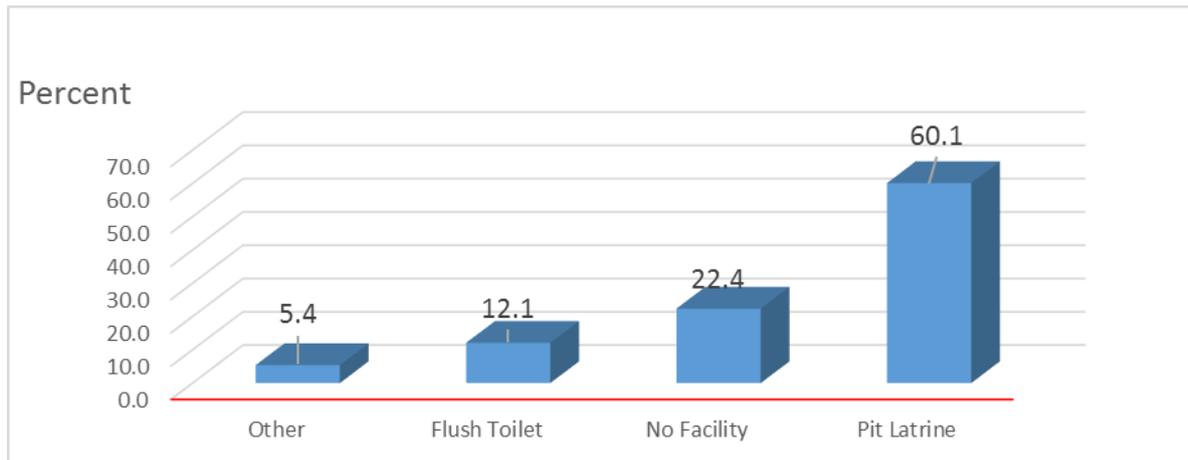
2.2 Social Characteristics of Households

Personal and environmental hygiene have been identified as crucial determinants in reducing the spread of trachoma. Sanitary infrastructure and services, lifestyle and health-related behavioural factors constitute critical aspects in primary prevention of trachoma.

Trachoma is a highly infectious disease that can cause blindness. It is spread through personal contact with hands, towels or other tissues, or indirectly by flies seeking the secretions (discharges) from eyes. The flies that play a role in the transmission of trachoma probably breed in human excreta, or are attracted to it (WHO, 2014).

The type of toilet facility being used by the household is an important indicator of sanitary conditions of the household. Figure 2.5 shows the distribution of the types of toilet facility used by the examined population. About two-thirds of the population (60.1%) were using pit latrines while 22.4 percent had no toilet facilities at all, compared to the 2010 census figure of 19.3 percent of the population with no toilet facilities.

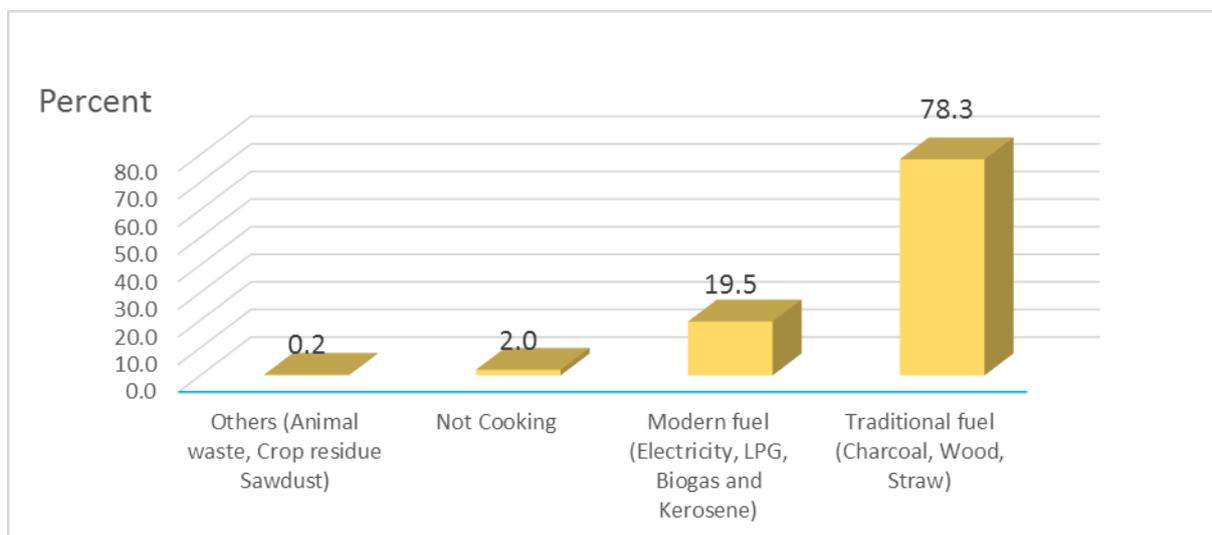
Figure 2.5: Distribution of Type of Toilet Facility in Households



In developing countries, Household Air Pollution (HAP) resulting from the inefficient burning of coal and biomass (wood, charcoal, animal dung and crop residues) for cooking and heating has been linked to a number of negative health outcomes, notably respiratory diseases and cancers. There has only been suggestive evidence and biological plausibility that HAP is associated with some of the major blindness and painful eye conditions. However, a case-control study of indoor cooking smoke exposure and cataract in Nepal and India conducted by Pokhrel AK¹, Smith KR, Khalakdina A, Deuja A and Bates MN in 2015 concluded that there is confirmatory evidence that the use of solid fuel in indoor stoves with no chimney is associated with increased risk of cataracts in women who do the cooking.

Figure 2.6 presents the distribution of various types of cooking fuel used by households in this study. The Figure shows that 78.3 percent of all examined households were using traditional fuel as cooking fuel. Only 19.5 percent of households depend on modern fuel for cooking.

Figure 2.6 Distribution of Type of Fuel for Cooking Used in Households



An improved drinking water source is defined as one that, by nature of its construction or through active intervention, is protected from outside contamination – particularly from contamination with faecal matter.

The World Health Organization/UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation defines “improved” drinking water sources as follows:

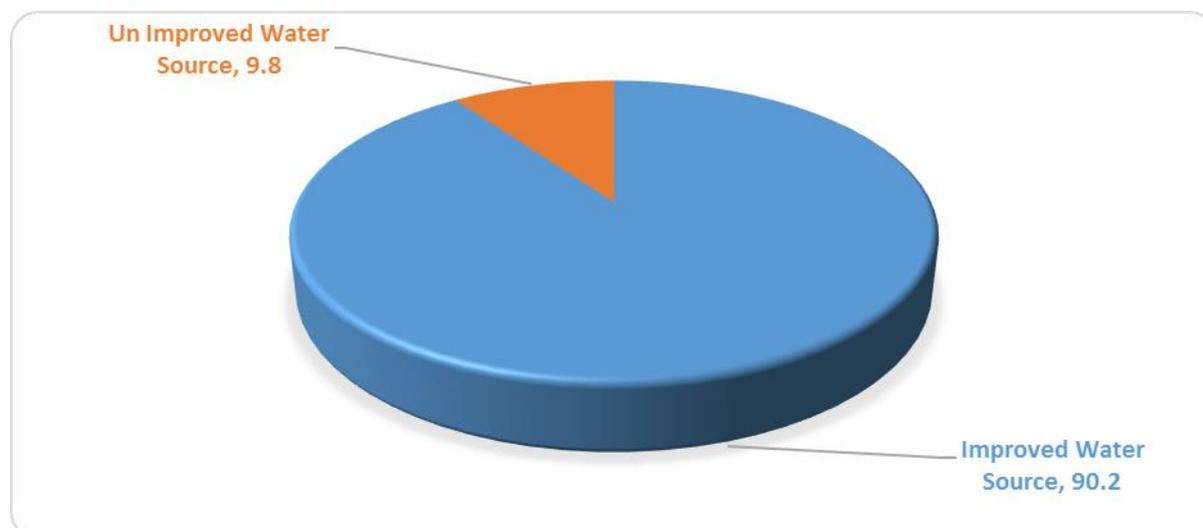
- Piped water into dwelling
- Piped water into yard/plot
- Public tap/standpipes
- Tube well/boreholes
- Protected dug wells
- Protected springs (normally part of a spring supply)
- Rainwater collection
- Bottled water, if the secondary source used by the household for cooking and personal hygiene is improved

Water sources that are not considered as “improved” are:

- Unprotected dug wells
- Unprotected springs
- Vendor provided water
- Cart with small tank/drum
- Bottled water, if the secondary source used by the household for cooking and personal hygiene is unimproved
- Tanker truck water
- Surface water

Figure 2.7 is the distribution of the source of drinking water used by households. In the Figure, only 9.8 percent of households were drinking from unimproved source of water.

Figure 2.7: Distribution of Source of Drinking Water Used in Households



CHAPTER 3: CLINICAL EXAMINATION

3.1 Presenting Vision

There are five levels of visual acuity, according to the WHO 10th International Classification of Diseases. These are Normal or near to normal ($> 6/12$), Mild Visual Impairment ($< 6/12 - 6/18$), Moderate Visual Impairment ($< 6/18 - 6/60$), Severe Visual Impairment ($< 6/60 - 3/60$) and Blindness or near to blindness ($< 3/60$). Table 3.1 presents the distribution of the five levels of visual acuity with pinhole and without pinhole for each level and classified by age of the examined person.

Table 3.1 shows that 0.74 percent (95% CI, 0.48 – 1.00) of Ghanaians have visual acuity of less than 3/60 in the better eye with the best possible correction (with pinhole). This means that 190,089 Ghanaians were blind in 2015 – or, in other words, 74 out of every 10,000 Ghanaians were blind. The Table further shows that additional 1.07 percent (95% CI 0.76 – 1.38) of Ghanaians had severe visual impairment (107 out of every 10,000 Ghanaian).

The age distribution indicates that blindness ($< 3/60$) is positively related to age. After escaping childhood blindness, persons who were 30 years or older have a higher risk of becoming blind. For instance, 0.22 percent of persons in the age group 30 – 39 were found to be blind at Best Corrected Vision Acuity (BCVA). This increases to 0.28 percent among persons in the age group 40 – 49 and continued to increase as age increases to 19.12 percent among those who were 80 years or older. A similar pattern is observed among persons with severe visual impairment ($< 6/30 - 3/60$). It starts among persons in the age group 20 – 29 with a proportion of 0.17 percent and increases continuously as age increases to 16.18 percent among persons who were 80 years or older.

Table 3.1: Distribution of Age by Presentation Vision With and Without Pinhole

Age Group of Member	Normal or Near Normal (6/12)		Mild VI (6/12-6/18)		Moderate VI (<6/18 to 6/60)		Severe VI (<6/60-3/60)		Blindness (<3/60)		Total
	With	Without	With	Without	With	Without	With	Without	With	Without	
0 - 9	99.15	99.23	0.15	0.15	0.39	0.31	0.15	0.15	0.15	0.15	100.00
10 - 19	99.42	99.42	0.12	0.35	0.35	0.12	0.00	0.00	0.12	0.12	100.00
20 - 29	98.50	98.17	0.83	0.66	0.50	0.83	0.17	0.33	0.00	0.00	100.00
30 - 39	98.01	97.79	0.66	1.32	0.66	0.44	0.44	0.00	0.22	0.44	100.00
40 - 49	96.91	97.19	0.56	1.69	0.84	0.84	1.40	0.00	0.28	0.28	100.00
50 - 59	92.28	93.01	2.57	2.94	3.31	3.68	1.47	0.00	0.37	0.37	100.00
60 - 69	73.68	75.44	7.60	8.77	9.36	9.94	6.43	2.92	2.92	2.92	100.00
70 - 79	60.15	60.15	10.53	9.77	17.29	19.55	6.77	3.76	5.26	6.77	100.00
80+	29.41	30.88	14.71	11.76	20.59	22.06	16.18	11.76	19.12	23.53	100.00
Total	94.96	95.08	1.36	1.55	1.88	1.97	1.07	0.52	0.74	0.88	100.00

Table 3.2 is the sex distribution of the levels of blindness with BCVA and ACVA. The Table shows that 0.71 percent of all females were blind (<3/60 best corrected vision acuity) compared to 0.77 percent of their male counterparts. Even though there were more males who were blind than females, there is not much difference between them. Severe visual impairment was higher among females (1.34%) than among males (0.71%) with BCVA.

Table 3.2 Distribution of Sex by Presentation Vision with Pinhole

Sex	Normal or Near Normal (6/12)		Mild VI (6/12-6/18)		Moderate VI (<6/18 to 6/60)		Severe VI (<6/60-3/60)		Blindness (<3/60)		Total
	With	Without	With	Without	With	Without	With	Without	With	Without	
Male	95.78	95.84	1.15	1.15	1.59	1.81	0.71	0.38	0.77	0.82	100.00
Female	94.33	94.50	1.51	1.85	2.10	2.10	1.34	0.63	0.71	0.92	100.00
Total	94.96	95.08	1.36	1.55	1.88	1.97	1.07	0.52	0.74	0.88	100.00

Type of residence has some association with blindness and visual impairment. Table 3.3 presents the distribution of the levels of blindness by type of residence. The table shows that the prevalence is higher in the rural areas (0.79%) than in the urban areas (0.67%). However, with severe visual impairment, the prevalence is higher in the urban areas (1.14%) than in the rural areas (1.01%).

Table 3.3: Distribution of Type of Residence by Presentation Vision with and without Pinhole

Type of Residence	Normal or Near Normal (6/12)		Mild VI (6/12-6/18)		Moderate VI (<6/18 to 6/60)		Severe VI (<6/60-3/60)		Blindness (<3/60)		Total
	With	Without	With	Without	With	Without	With	Without	With	Without	
Urban	94.82	94.87	1.61	2.02	1.76	1.87	1.14	0.57	0.67	0.67	100.00
Rural	95.08	95.26	1.14	1.14	1.98	2.06	1.01	0.48	0.79	1.05	100.00
Total	94.96	95.08	1.36	1.55	1.88	1.97	1.07	0.52	0.74	0.88	100.00

The distribution of the prevalence of the levels of visual impairment in the four domains of the study is presented in Table 3.4. Information from the Table shows that intervention programs are major factors in the prevention of blindness in Ghana. For instance, only 0.33 percent of persons living in the urban areas of the intervention zones were found to be blind compared to 0.99 percent of their counterparts in the non-intervention zones. Similarly, 0.59 percent of persons living in the rural areas of the intervention zones were blind, compared to 1.00 percent of their counterparts in the rural non-intervention zones.

The average prevalence in the intervention zones is 0.46 percent, while in the non-intervention zones, it is 1.00 percent. This suggests that if intervention programs are sent to

all areas of Ghana, the current prevalence of blindness (3/60) would decrease by more than half. A similar pattern is observed for persons with severe visual impairment.

Table 3.4 Distribution of Intervention Zone by Presentation Vision with Pinhole

Zones	Normal or Near Normal (6/12)		Mild VI (6/12-6/18)		Moderate VI (<6/18 to 6/60)		Severe VI (<6/60-3/60)		Blindness (<3/60)		Total
	With	Without	With	Without	With	Without	With	Without	With	Without	
	Intervention Urban	95.62	95.73	1.64	1.75	1.86	1.86	0.55	0.33	0.33	
Intervention Rural	94.66	94.92	1.61	1.44	2.37	2.03	0.76	0.76	0.59	0.85	100.00
Non-Intervention Urban	94.09	94.09	1.58	2.27	1.67	1.87	1.67	0.79	0.99	0.99	100.00
Non-Intervention Rural	95.53	95.62	0.64	0.82	1.55	2.10	1.28	0.18	1.00	1.28	100.00
Total	94.96	95.08	1.36	1.55	1.88	1.97	1.07	0.52	0.74	0.88	100.00

The medication and treatment of visual impairment comes with some cost, which could be beyond the affordability levels of poor households. The poor, therefore, were at higher risk of avoidable blindness. Table 3.5 presents levels of blindness classified by wealth quintiles of households. The Table shows a strong relationship between poverty levels and blindness. For instance, the prevalence of blindness was estimated at 0.36 percent among the rich compared to 1.47 percent among the poorest households.

Table 3.5: Distribution of Wealth Quintiles by Presentation Vision with Pinhole

Wealth Quintiles	Normal or Near Normal (6/12)		Mild VI (6/12-6/18)		Moderate VI (<6/18 to 6/60)		Severe VI (<6/60-3/60)		Blindness (<3/60)		Total
	With	Without	With	Without	With	Without	With	Without	With	Without	
	Poorest	94.63	93.89	0.85	0.98	1.71	2.44	1.34	1.22	1.47	
Second	94.55	95.41	0.53	0.85	2.88	2.35	1.07	0.32	0.96	1.07	100.00
Middle	94.52	94.78	2.17	2.17	2.04	2.17	1.02	0.13	0.25	0.76	100.00
Fourth	94.76	95.01	1.95	2.07	1.22	1.58	1.46	0.61	0.61	0.73	100.00
Richest	96.33	96.21	1.42	1.78	1.42	1.30	0.47	0.36	0.36	0.36	100.00
Total	94.96	95.08	1.36	1.55	1.88	1.97	1.07	0.52	0.74	0.88	100.00

As observed earlier, the prevalence of blindness is higher among adults, especially persons aged 50 years or older. Table 3.7 presents different age cohorts of persons aged 50 years or older by the levels of blindness with the best corrected vision. Information from the Tables confirm the previous findings that the risk of blindness increases with age. The prevalence of blindness estimated among persons who were 50 years or older is 4.0 percent, while for the same age group, the prevalence of severe visual impairment is 5.4 percent. The Table further shows that the prevalence of blindness increases with age.

Table 3.7 Distribution of Specific Age Group by Presentation Vision with Pinhole

Age Group	Normal or Near Normal (6/12)		Mild VI (6/12-6/18)		Moderate VI (<6/18 to 6/60)		Severe VI (<6/60-3/60)		Blindness (<3/60)		Total
	With	Without	With	Without	With	Without	With	Without	With	Without	
50+			74.1	6.8	9.6		5.4		4.0		100.0
60+			60.8	9.9	14.2		8.3		6.7		100.0

70+	49.8	11.9	18.4	10.0	10.0	100.0
80+	29.4	14.7	20.6	16.2	19.1	100.0

Table 3.8 presents the analysis of the extent to which the introduction of pinhole improved the vision of the respondent. For example, the Table shows that for all those who had visual acuity of 3/60 or less without correction, 75.68 percent of them remained blind after the introduction of the pinhole. Therefore, 24.32 percent benefitted from pinhole examination.

Table 3.8 Distribution of Presentation Vision with Pinhole by Presentation Vision Without Pinhole

Presentation Vision Without Pinhole	Presentation Vision with Pinhole					Total
	Normal (6/12)	Mild VI (6/12-6/18)	Moderate VI (<6/18- 6/60)	Severe VI (<6/60-3/60)	Blindness (<3/60)	
Normal or Near Normal (6/12)	99.52	0.00	0.23	0.23	0.03	100.00
Mild VI (6/12-6/18)	10.77	50.77	15.38	23.08	0.00	100.00
Moderate VI (<6/18 to ?6/60)	8.43	25.30	59.04	6.02	1.20	100.00
Severe VI (<6/60-3/60)	0.00	9.09	31.82	54.55	4.55	100.00
Blindness (<3/60)	0.00	2.70	10.81	10.81	75.68	100.00
Total	94.96	1.36	1.88	1.07	0.74	100.00

3.2.1 Examined Population who were Blind (V/A Less than 3/60)

The analysis in this section focused only on persons who were blind. It provides indicators on the distribution of blindness (<3/60) among the zones, type of residence and the relationship between blindness and age, sex, wealth quintiles and education.

Figure 3.1 presents the distribution of blindness among the zones. The Figure shows that 67.74 percent of persons who were blind (<3/60) dwell in non-intervention zones, while 32.26 percent live in areas where some program of interventions are currently being implemented.

Figure 3.1 Distribution of Blindness (Less than 3/60) by Intervention Zones

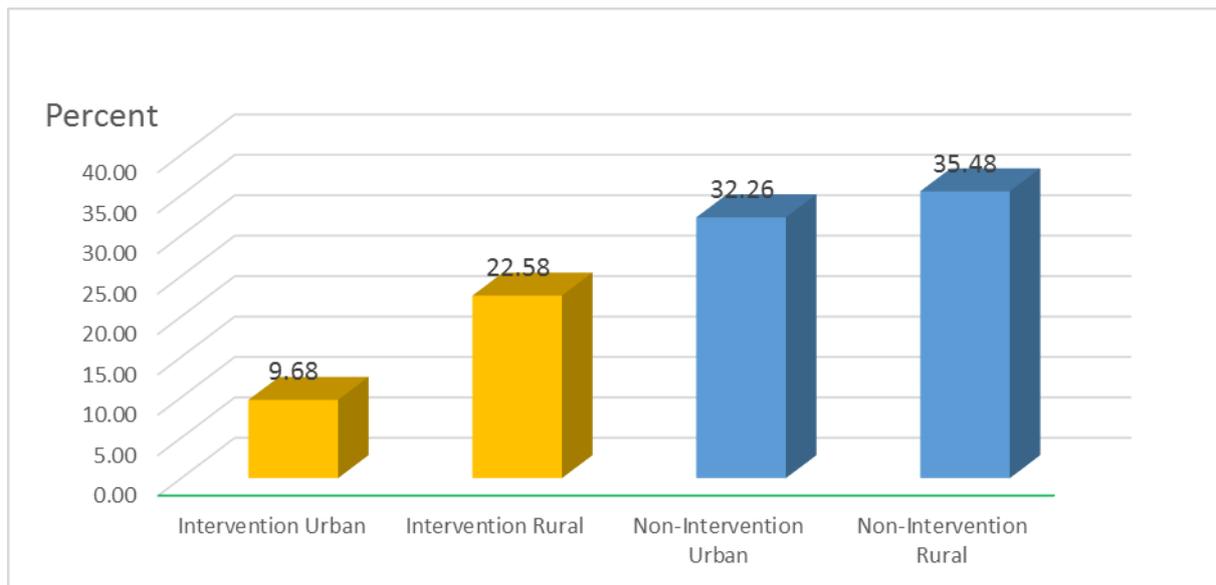
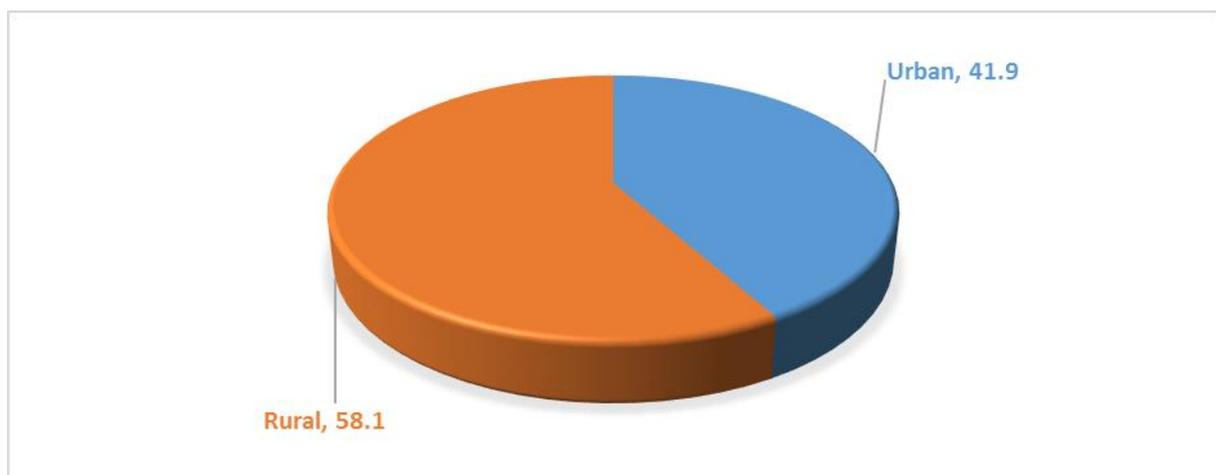


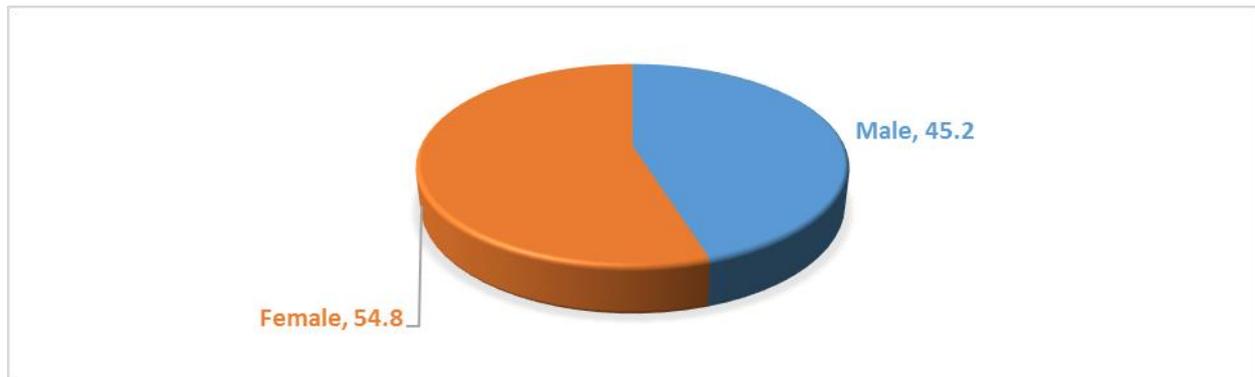
Figure 3.2 is the distribution of persons who were blind (<3/60) and their type of residence. The figure shows that 41.9 percent of all persons who were blind were living in the urban areas of Ghana while 58.1 percent were living in the rural areas.

Figure 3.2 Distribution of Blindness (Less than 3/60) by Type of Residence



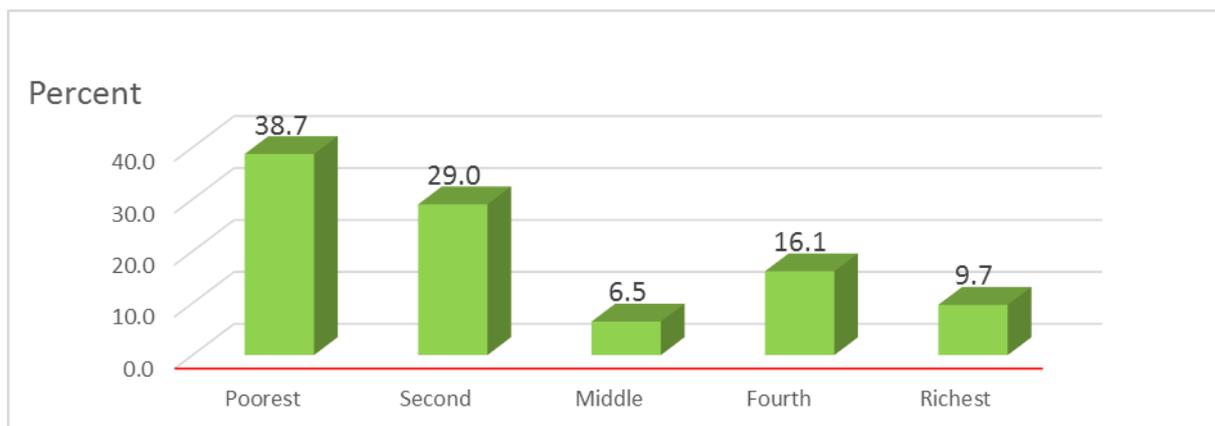
The distribution of blindness by sex of person is presented in Figure 3.4. In the Figure, females who were blind were more common (54.8%) than males with same visual acuity (45.2%).

Figure 3.4 Percentage Distribution of Blindness by Sex



The treatment of visual impairment comes with some cost, which could be a barrier to those who cannot afford it. Figure 3.5 presents the distribution of persons who were blind (<3/60) across wealth quintiles. The Figure shows an inverse relationship between wealth and blindness (<3/60). For instance, 38.7 percent of persons who were blind were among the poorest households in terms of wealth. As wealth increases among households, the proportions that are blind decreases to 9.7 percent among the rich.

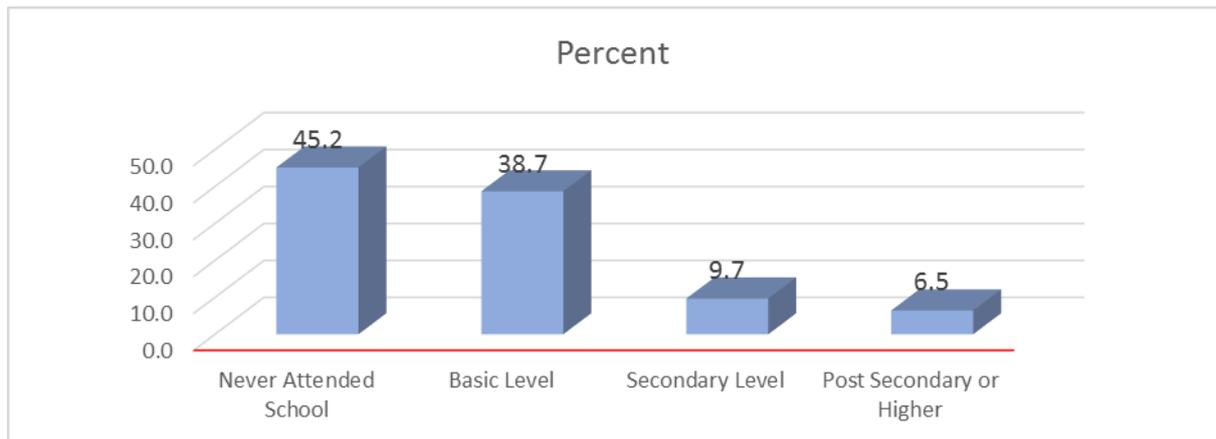
Figure 3.5 Percentage Distribution of Blindness by Wealth Quintiles



Education plays a role in the prevention and treatment of blindness. Figure 3.6 shows that 45.2 percent of person who were blind (<3/60) had never attended school, while an additional 38.7 percent attained only basic level of formal education. This indicates that 83.9 percent of persons who were blind (<3/60) have never attended school or attained only a basic level of education.

The Figure further shows a large difference in the proportion between a basic level of education (38.7%) and a secondary level of education (9.7%), indicating that secondary or higher education has a positive impact on avoidance of blindness.

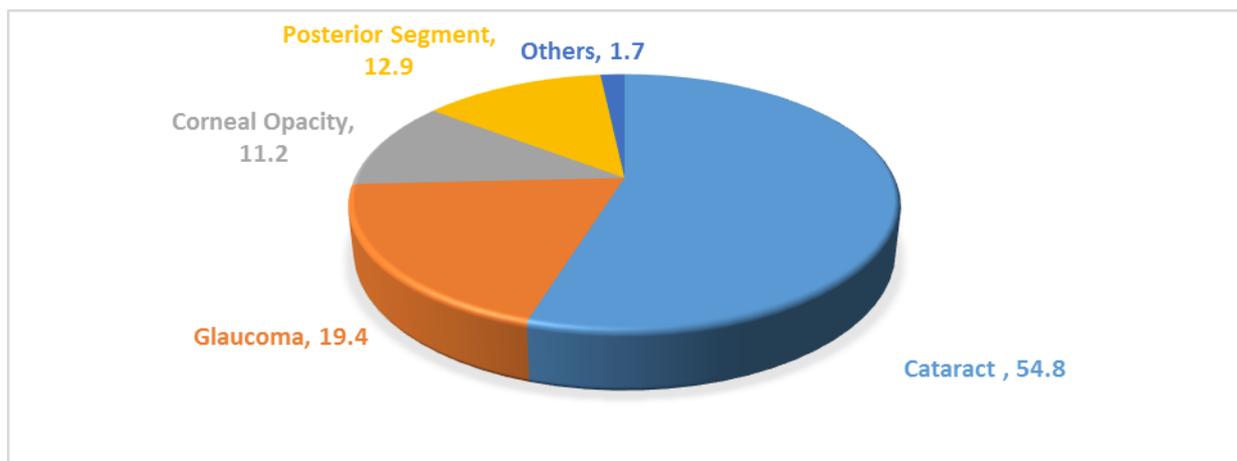
Figure 3.6 Percentage Distribution of Blindness by Educational level (Population Three Years or Older)



3.2.2 Principal Causes of Blindness (V/A less than 3/60)

The principal causes of blindness are cataract, glaucoma, posterior segment diseases and cornea opacity. Figure 3.7 presents common causes of blindness as found in this study. The Figure shows that cataract was a major cause of blindness, responsible for more than half (54.8%) of blindness. Glaucoma is the second major cause, accounting for 19.4 percent of blindness (<math><3/60</math>) in Ghana.

Figure 3.7 Principal Causes of Blindness (V/A less than 3/60)



The distribution of the causes of blindness among the various age groups is presented in Table 3.9. The Table shows that cataract was common among both children and adults, especially those 60 years or older.

Glaucoma as a cause of blindness was common among persons 50 years or older, while posterior segment as a cause of blindness was mainly found among persons who were 60 years or older.

Table 3.9 Distribution of Principal Causes of Blindness (V/A less than 3/60) Among Specific Age Groups

Principal Cause of Blindness	Cataract	Corneal Opacity	Glaucoma	Posterior Segment	Others	Total
0 - 9	11.8	0.0	0.0	0.0	0.0	6.5
10 - 19	5.9	0.0	0.0	0.0	0.0	3.2
30 - 39	5.9	0.0	0.0	0.0	0.0	3.2
40 - 49	0.0	13.5	0.0	0.0	0.0	3.2
50 - 59	0.0	0.0	16.7	0.0	0.0	3.2
60 - 69	11.8	0.0	16.7	50.0	0.0	16.1
70 - 79	11.8	28.8	50.0	25.0	100.0	22.6
80+	52.9	57.6	16.7	25.0	0.0	41.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 3.10 shows the distribution of the principal causes of blindness among the zones. The table shows that 76.5 percent of persons who were blind as a result of cataract were found in the non-intervention areas. Also, two thirds (66.6%) of glaucoma cases were recorded in non-intervention zones. Similarly, posterior segment causes of blindness were common among the non-intervention areas. On the other hand, cornea opacity was common in intervention areas, with 86.5 percent of all cases of cornea opacity as a cause of blindness recorded in the intervention zones.

Table 3.10 Distribution of Principal Causes of Blindness (V/A less than 3/60) by Intervention Zones

Principal Cause of Blindness	Intervention Urban	Intervention Rural	Non-Intervention Urban	Non-Intervention Rural	Total
Cataract	5.9	17.6	35.3	41.2	100.0
Corneal Opacity	0.0	86.5	13.5	0.0	100.0
Glaucoma	16.7	16.7	33.3	33.3	100.0
Posterior Segment	25.0	0.0	25.0	50.0	100.0
Others	0.0	0.0	100.0	0.0	100.0
Total	9.7	22.6	32.3	35.5	100.0

The distribution of the principal causes of blindness among urban and rural areas separately is presented in Figure 3.8. This is to compare the main causes of blindness (<3/60) in the urban and rural areas. The result, as seen in the Figure, shows that cataract remains the major cause of blindness both in the urban (53.8%) and in the rural areas (55.6%). In urban areas, glaucoma is the second major cause of blindness (23.1%) followed by the posterior segment causes (15.4%). In the rural areas, however, cornea opacity (16.7%) and glaucoma (16.7%) were the second highest, while posterior segment (11.1%) was the least common cause of blindness in the rural areas.

Figure 3.8 Distribution of Principal Causes of Blindness (V/A less than 3/60 by Type of Residence

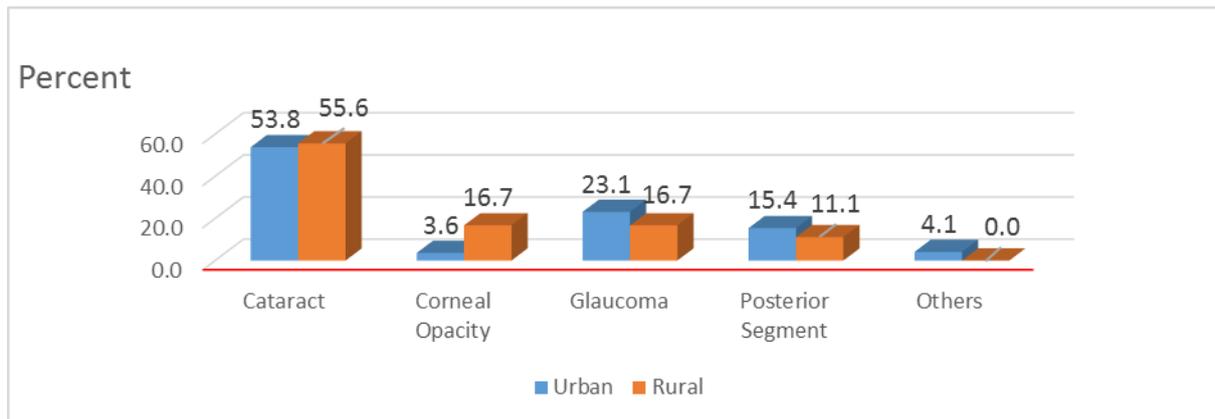
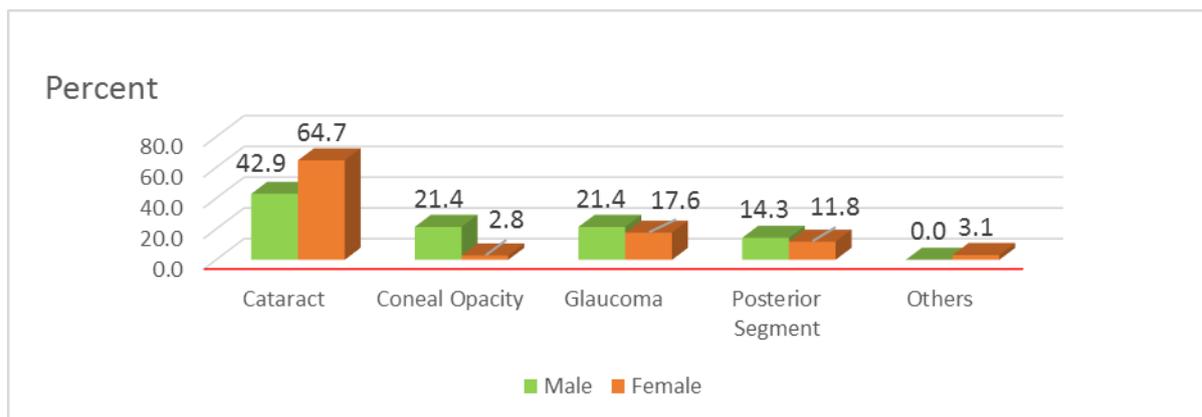


Figure 3.9 presents the distribution of the principal causes of blindness among males separately from females. Cataract was the major cause of blindness among both males and females, even though the proportion of females (64.7%) who were blind from cataract was higher than that of males (42.9%). Cornea opacity and glaucoma were the second major causes of blindness among males, while among females it is mainly glaucoma. It was also observed that, apart from cataract, the proportion of males that were blind as a result of cornea opacity (21.4%), glaucoma (21.4%), and posterior segment (14.3%) causes were high than their female counterparts (5.9%, 17.6%, and 11.8% respectively).

Figure 3.9 Distribution of Principal Causes of Blindness (V/A less than 3/60) by Sex

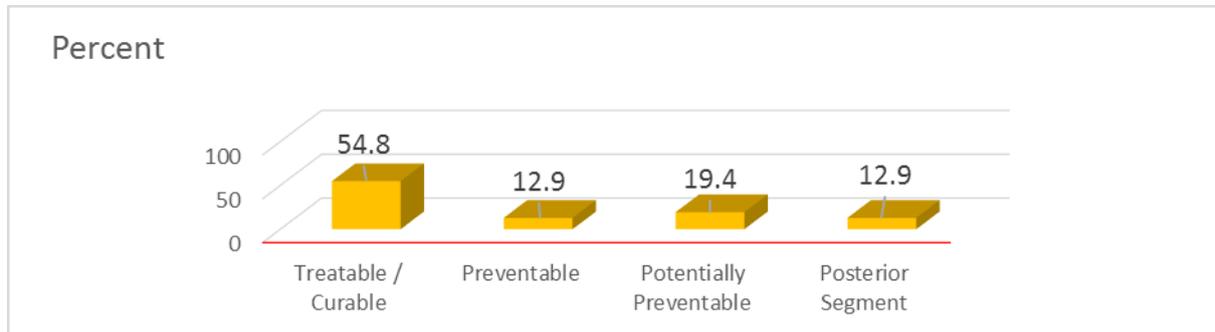


In May 2006, the World Health Assembly adopted Resolution WHA 59.25, “Prevention of avoidable blindness and visual impairment” (Annex II), indicating that some of the causes of blindness could be prevented while others could be avoided or treated. The prevention of avoidable visual impairment will only be achieved if effective, efficient, comprehensive eye health services are integrated into the six building blocks of health systems strengthening.

Figure 3.10 presents the distribution of the classification of the causes of blindness in the form of avoidable (treatable and preventable) and unavoidable causes of blindness. The Figure shows that more than half (54.8%) of person who were blind could have been treated

or cured. An additional 12.9 percent of person who were found blind could have been prevented from going blind. In all, the findings indicate that 67.7 percent of all blindness could have been avoided.

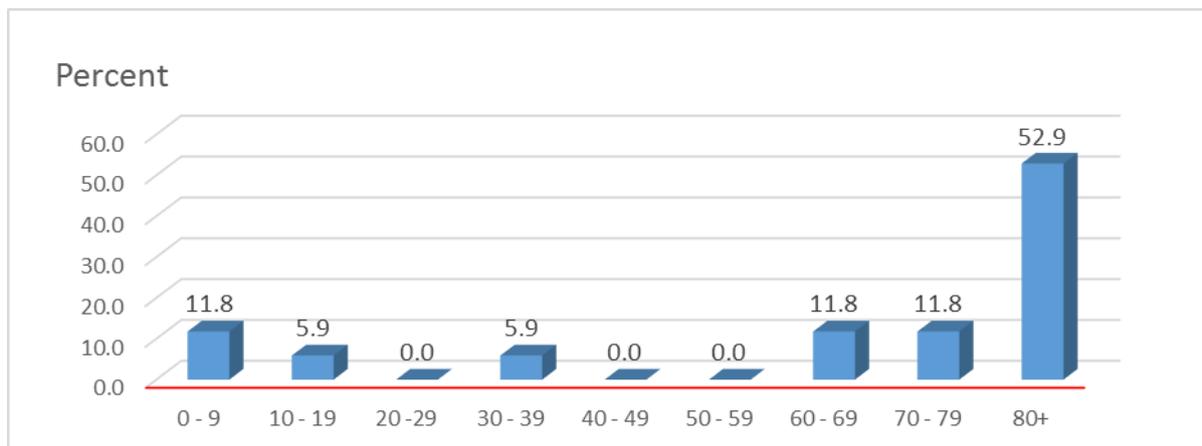
Figure 3.10 Distribution of Classification of the Causes of Blindness (V/A less than 3/60)



3.2.3 Persons with Cataract Untreated

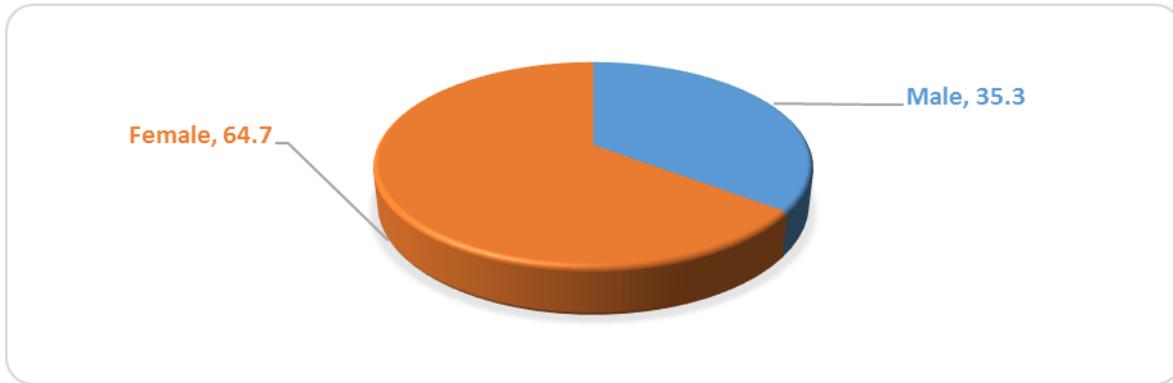
Cataract has been found to be the leading cause of blindness in Ghana, accounting for more than half (54.8%) of blind persons in the country. Figure 3.11 shows the distribution of persons who were blind from cataract by their various age groups. The Figure shows that cataract was common among persons who were 80 years or older, accounting for 52.9 percent of persons who were blind due to cataract. The next age groups of person at risk of cataract as a cause of blindness were 0 – 9, 60 -69 and 70 – 79, all of which recorded 11.8 percent each.

Figure 3.11 Distribution of Specific Age Groups by Cataract Causes as a Cause of Blindness (V/A less than 3/60)



Cataract causes of blindness were higher in females than in males. Figure 3.13 shows that 64.7 percent of persons who were blind from cataract were females while 35.6 percent were males.

Figure 3.13 Distribution of Cataract Untreated as a Cause of Blindness (V/A less than 3/60) by Sex



Persons living in the rural areas were more at risk of cataract as a cause of blindness than their urban counterparts. Figure 3.14 shows that, 58.8 percent of persons who were blind as a result of cataract live in rural areas, while 41.2 percent live in urban areas.

Figure 3.14 Distribution of Type of Residence by Cataract Untreated as a Cause of Blindness (V/A less than 3/60)

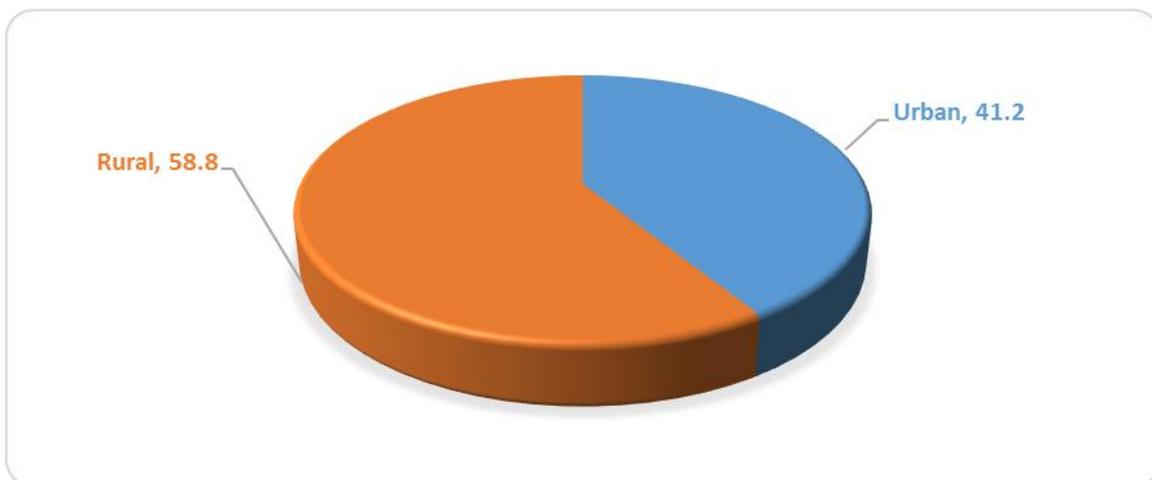
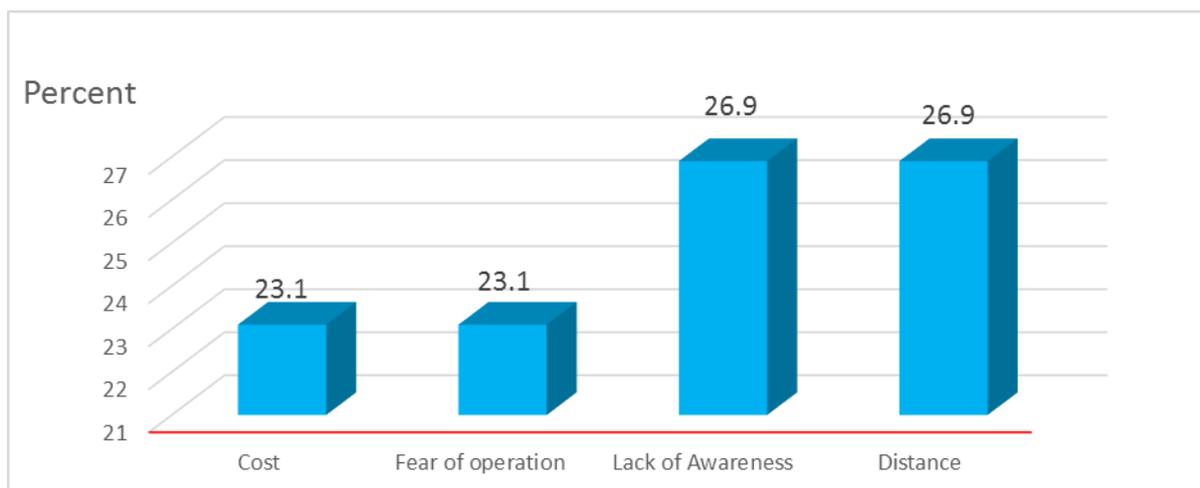


Figure 3.15 shows the distribution of some socio-cultural factors that impede the treatment of cataract as a cause of blindness. The Figure shows that distance to treatment site and lack of awareness were the two main reasons why 53.8 percent of persons who were blind due to cataract did not seek treatment.

Figure 3.15 Percentage Distribution of Barriers to Cataract Operation



The distribution of the barriers to cataract operation among males and females is presented in Figure 3.16. Four main barriers to the treatment of cataract were identified, including fear of operation, distance to service provider, cost of treatment and lack of awareness.

The Figure shows that among the males, distance is the major hindrance (37.5%) to the treatment of cataract. Among the females, however, lack of awareness and fear of operation were the two main reasons why 55.6 percent of females were blind as a result of untreated cataract.

Figure 3.16 Barriers to Cataract Operation by Sex



In the urban areas, the main barrier to cataract operations is the lack of awareness, which explains why 36.4 percent of persons living in the urban areas had not been treated for cataract (Figure 3.17). Persons living in the rural areas on the other hand, recorded fear of

treatment (26.7%), distance (26.7%) and cost (26.7%), as the major reasons why their cataracts were not treated.

It was further observed that lack of awareness (36.4%) and distance to services (27.3%) were higher in the urban areas than in the rural areas (20.0% and 26.7% respectively).

Figure 3.17 Barriers to Cataract Operation by Type of Residence



3.3 Examined Population who have Severe Visual Impairment

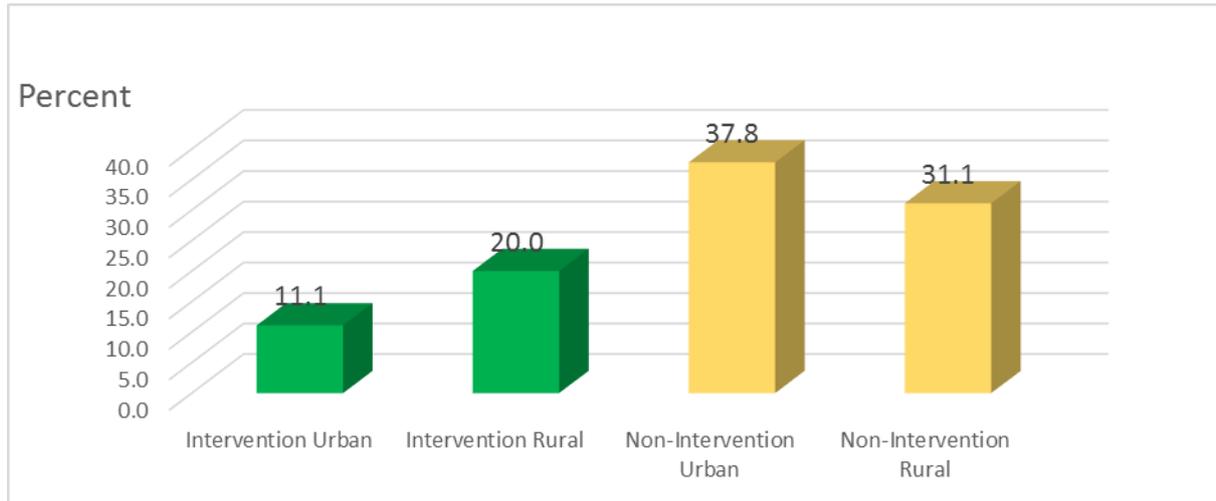
For the purpose of this study, Severe Visual Impairment was defined as best corrected visual acuity of $<6/60 - 3/60$. The prevalence of severe visual impairment was found to be 1.07 percent. (95% CI: 0.76 – 1.38)

3.3.1 Severe Visual Impairment

Figure 3.18 presents the distribution of persons who have severe visual impairment classified by the zones. The Figure shows that severe visual impairment is more common in the non-intervention zones than among the areas where there has been some intervention. For instance, 68.9 percent of persons who had severe visual impairment were found in the non-intervention zones compared to 31.1 percent in the intervention zone. A similar pattern was observed among those who were blind.

The proportion of severe visual impairment was higher in the urban areas of the non-intervention zones (37.8%) than in the rural areas of the non-intervention zones (31.1%). On the other hand, the proportion of persons with severe visual impairment was higher in the rural areas of the intervention zone (20.0%) than in the urban areas (11.1%).

Figure 3.18 Percentage Distribution of Persons with Severe Visual Impairment by Zones



The distribution of persons with severe visual impairment by age is shown in Figure 3.19. The Figure shows that the proportion of severe visual impairment increases with age. It was estimated as 4.4 percent among persons who were in the age group of 0 – 9 and thereafter increases with age to 24.4 percent among persons who were in the age group of 80 years or older.

Figure 3.19 Distribution of Severe Visual Impairment by Specific Age Groups

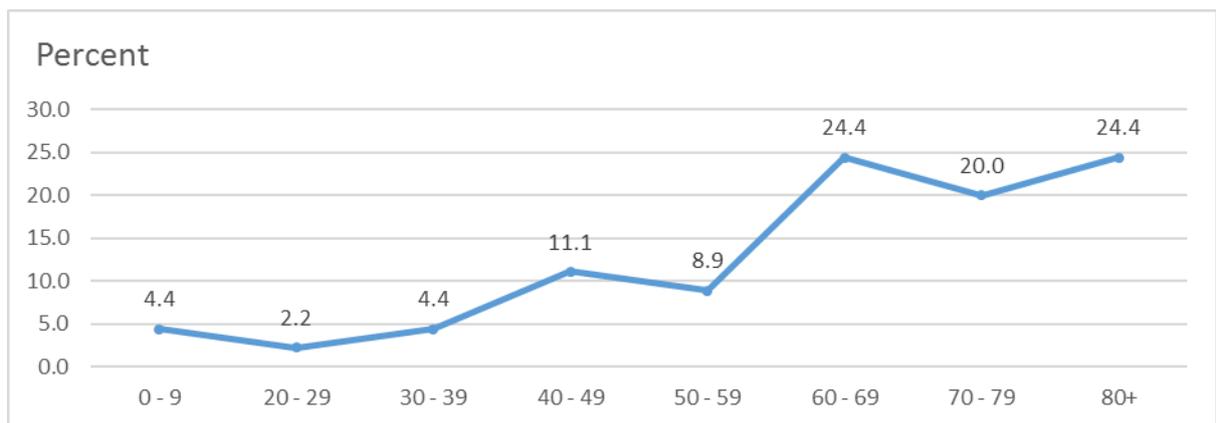
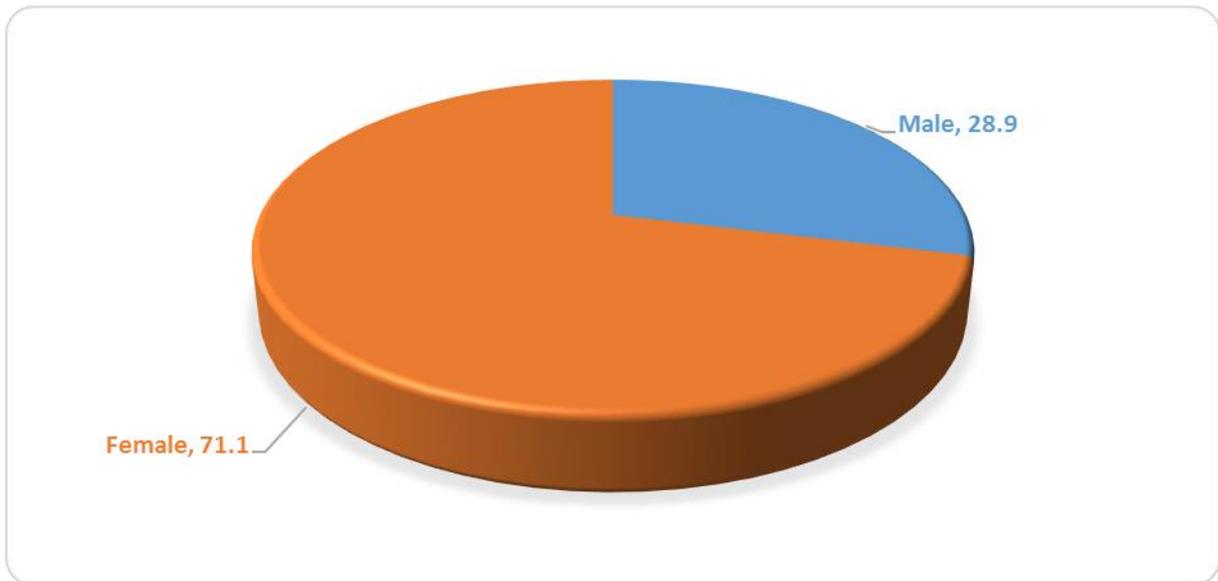


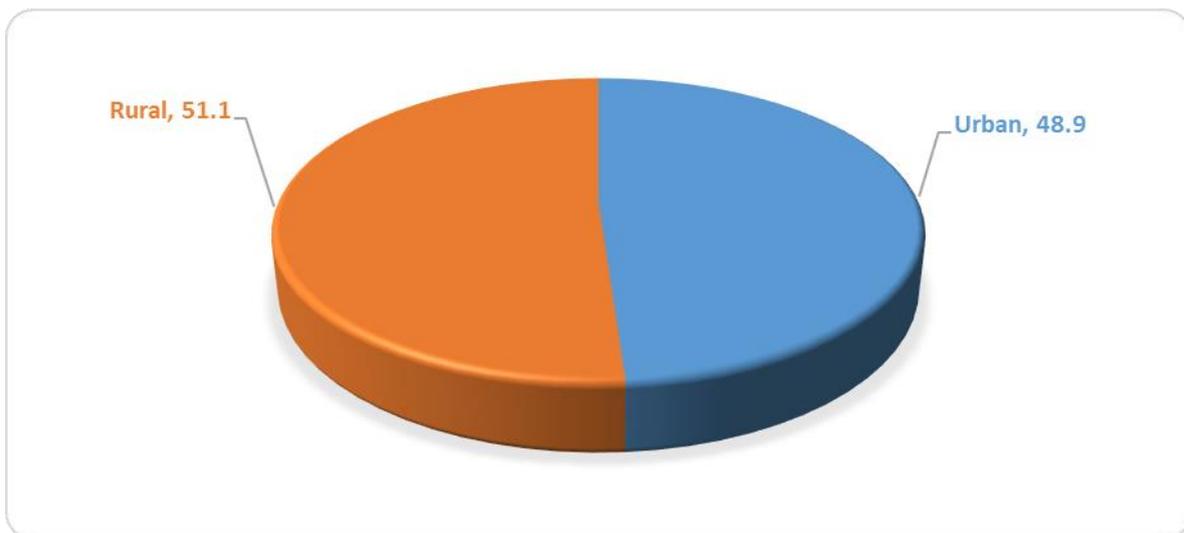
Figure 3.20 shows the distribution of persons who have severe visual impairment by sex, and indicates that 71.1 percent of all persons with severe visual impairment were females, while less than a third were males.

Figure 3.20 Percentage Distribution of Severe Visual Impairment by Sex



Severe visual impairment was found to be slightly higher in the rural areas (51.1%) than in the urban areas (48.9%). This indicates that the incidence of severe visual impairment is common in both urban and rural areas of Ghana.

Figure 3.21 Distribution of Severe Visual Impairment by Type of Residence



33.2 Causes of Severe Visual Impairment

The distribution of the principal causes of severe visual impairment is presented in Figure 3.22. The study identified five main causes of severe visual impairment: refractive error, cataract-related, posterior segment, glaucoma and cornea opacity. The Figure shows that refractive error (44.4%) and cataract-related (42.2%) were the two major causes of severe visual impairment, accounting for 86.6 percent of the total causes of severe visual impairment. Posterior segment, which was the third highest, accounted for 8.9 percent.

Figure 3.22 Distribution of the Principal Causes of Severe Visual Impairment

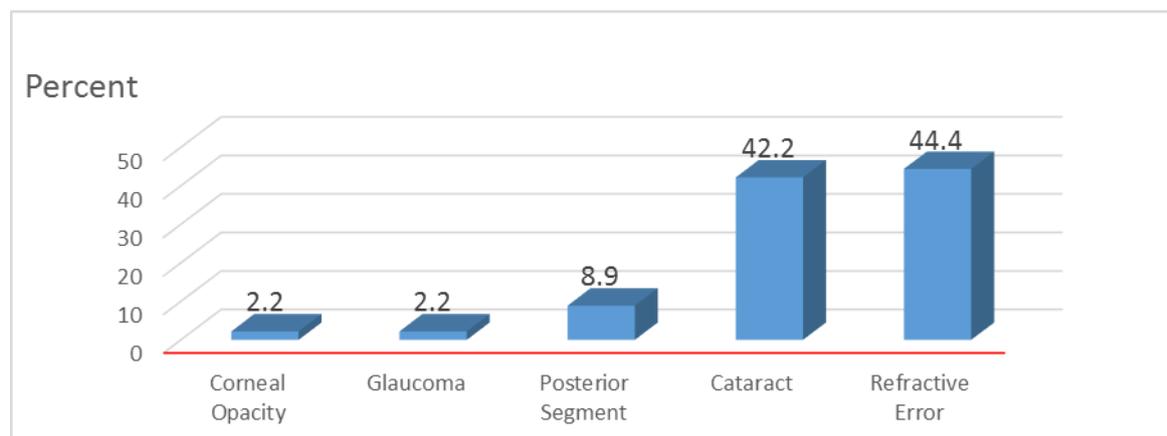


Table 3.11 presents the distribution of each principal cause of severe visual impairment by the various age groups. Uncorrected refractive error is common among persons in the age group of 30 – 79. It can be observed that uncorrected refractive error as a cause of severe visual impairment was more common (30.0%) among the age group 60 – 69, followed by the age group 40 – 49 with 25.0 percent.

The Table shows that 10.5 percent of the cataract causes of severe visual impairment were found in children in the age group of 0 – 9. This was the only cause of severe visual impairment among the children. Cataract causes of severe visual impairment were also common among persons who were 50 years or older, ranging from 5.3 percent among persons in the age group 50 – 59 to 42.1 percent among persons who were 80 years or older.

Table 3.11 Distribution of Principal Causes of Severe Visual Impairment by Age

Principal Cause of Severe Visual Impairment (<6/60-3/60)	Cataract	Corneal Opacity	Glaucoma	Posterior Segment	Refractive Error	Total
0 - 9	10.5	0.0	0.0	0.0	0.0	4.4
20 - 29	0.0	0.0	0.0	25.0	0.0	2.2
30 - 39	0.0	0.0	0.0	0.0	10.0	4.4
40 - 49	0.0	0.0	0.0	0.0	25.0	11.1
50 - 59	5.3	0.0	0.0	0.0	15.0	8.9
60 - 69	21.1	0.0	100.0	0.0	30.0	24.4
70 - 79	21.1	0.0	0.0	25.0	20.0	20.0
80+	42.1	100.0	0.0	50.0	0.0	24.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Tables 3.12 presents the distribution of the principal causes of severe visual impairment among the zones. Cornea opacity and glaucoma as causes of severe visual impairment were

found only among non-intervention zones. Also, only a quarter of the posterior segment causes of severe visual impairment were in the intervention zones.

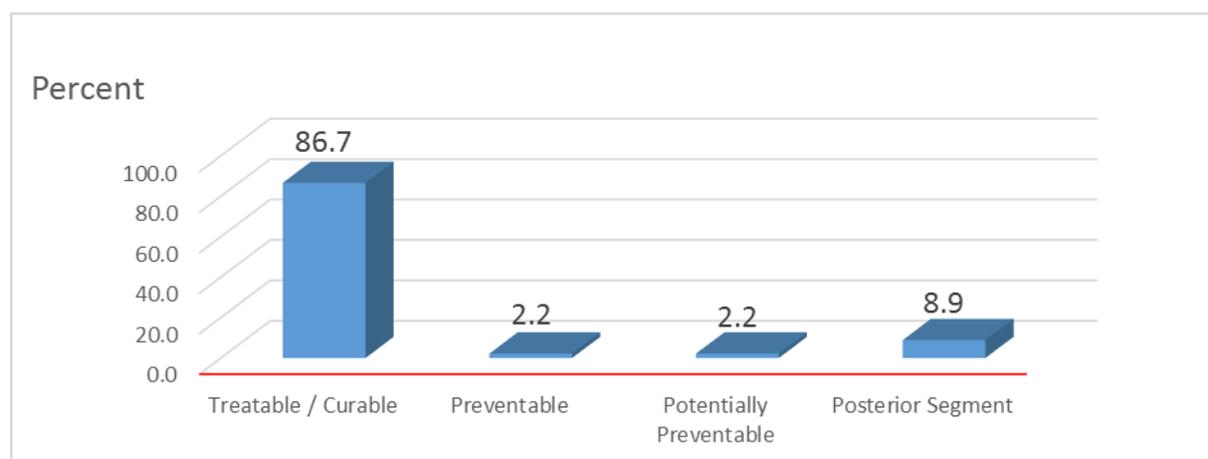
About a third (31.6%) of the cataract causes of severe visual impairment were found among the rural areas of the intervention zones. On the other hand, 36.8 percent of the cataract causes of the severe visual impairment were found among the urban areas of the non-intervention zones. Uncorrected refractive error was found in all the zones with 30.0 percent in the intervention zones, while the other 70 was among the non-intervention zones.

Table 3.12 Distribution of Principal Causes of Severe Visual Impairment by Zones

Principal Cause of Severe Visual Impairment (<6/60-3/60)	Intervention Urban	Intervention Rural	Non-Intervention Urban	Non-Intervention Rural	Total
Cataract	5.3	31.6	36.8	26.3	100.0
Corneal Opacity	0.0	0.0	100.0	0.0	100.0
Glaucoma	0.0	0.0	100.0	0.0	100.0
Posterior Segment	25.0	0.0	50.0	25.0	100.0
Refractive Error	15.0	15.0	30.0	40.0	100.0
Total	11.1	20.0	37.8	31.1	100.0

Figure 3.25 presents the classification of the causes of severe visual impairment into avoidable or non-avoidable causes. The figure shows that 88.9 percent of the causes of severe visual impairment were avoidable.

Figure 3.25 Classification of Causes of Severe Visual Impairment

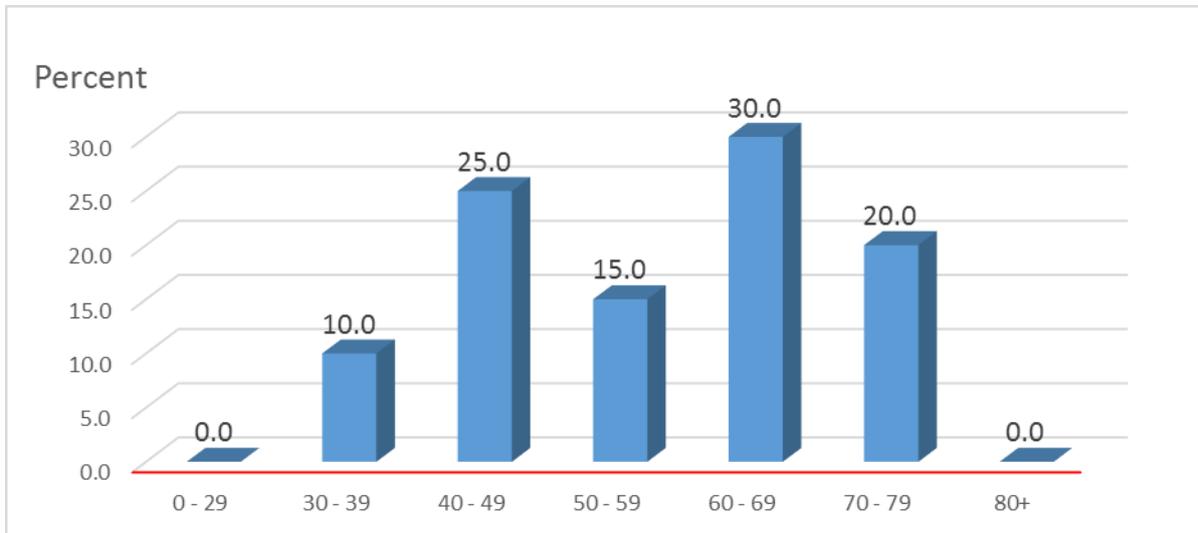


3.3.3 Examined Population who have Refractive Error as a Cause of Severe Vision Impairment

Uncorrected refractive error has been identified as a leading cause of severe visual impairment, accounting for 44.4 percent of all the causes of severe visual impairment in Ghana. Figure 3.26 presents the distribution of refractive error as a cause of severe visual impairment among the various age groups. From the figure, uncorrected refractive error was

not found as a cause of severe visual impairment among persons who were less than 30 years and persons 80 years or older.

Figure 3.26 Percentage Distribution of Refractive Error as Causes of Severe Visual Impairment by Age Group



The rural and urban distribution of uncorrected refractive error as a cause of severe visual impairment shows that the proportion was greater in the rural areas (55.0%) than in the urban areas (45.0%). (Figure 3.28).

Figure 3.28 Percentage Distribution of Refractive Error as Causes of Severe Visual Impairment by Type of Residence

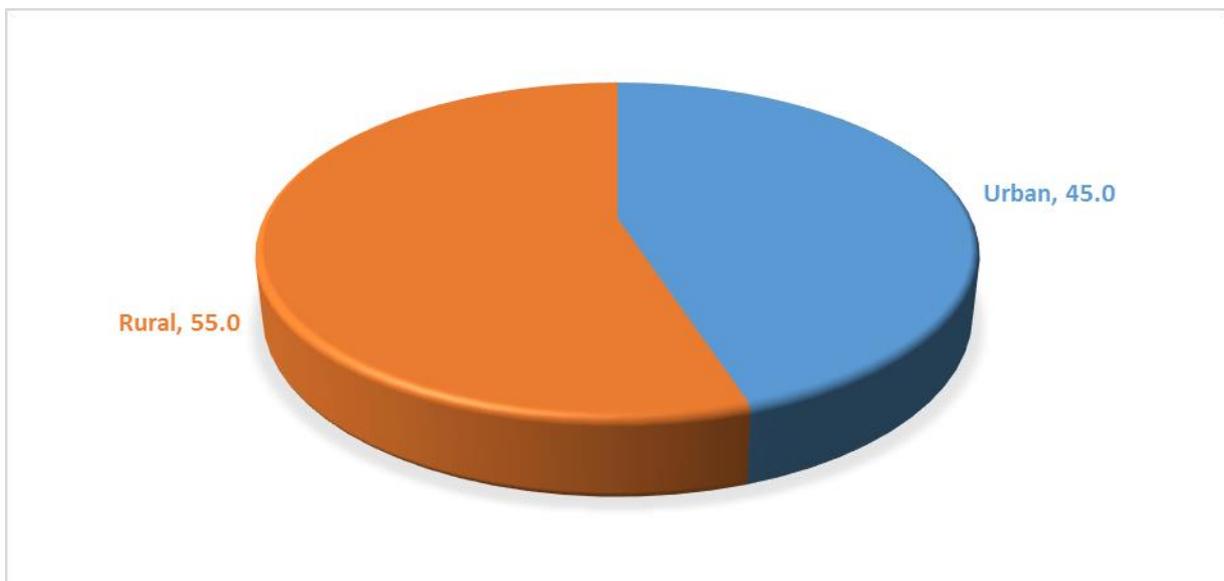
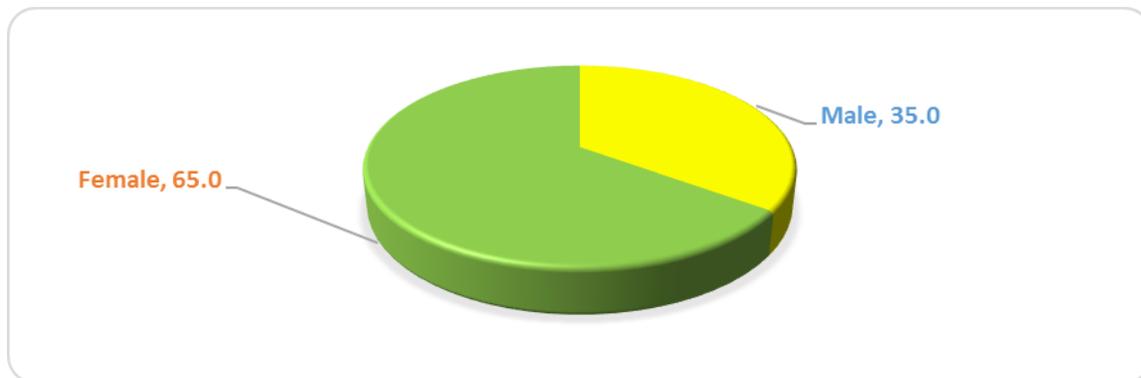


Figure 3.29 presents the distribution of refractive error as a cause of severe visual impairment by sex. The figure shows that about two-thirds (65%) of uncorrected refractive error as a cause of severe visual impairment was found in females.

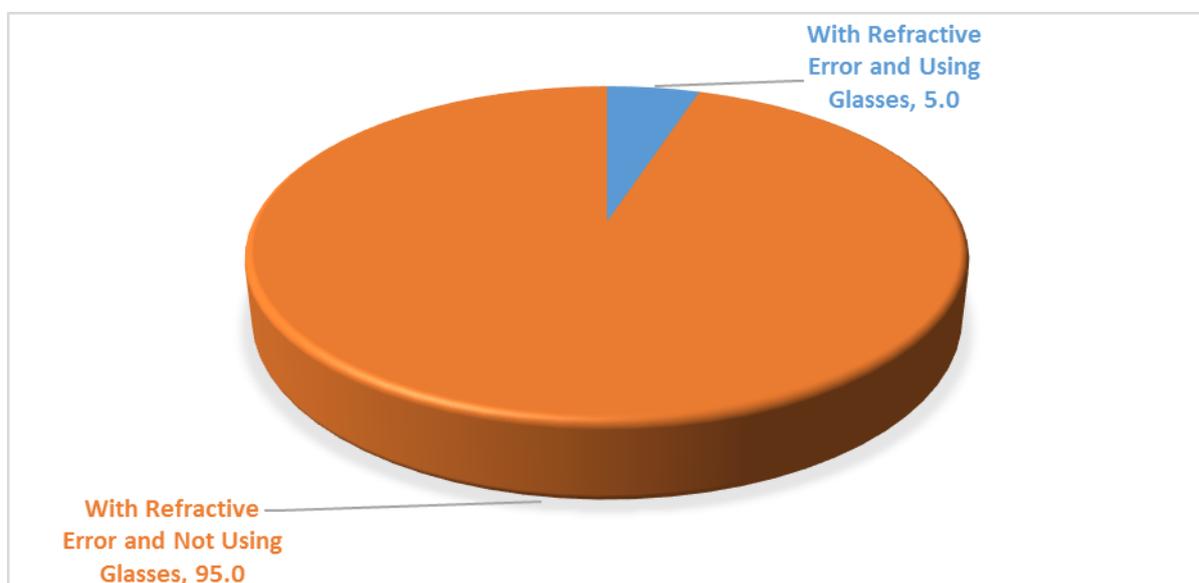
Figure 3.29 Percentage Distribution of Refractive Error as Causes of Severe Visual Impairment by Sex



3.3.4 Examined Population who have Refractive Error and the Use of Eyeglasses

Persons with refractive error could use eyeglasses to correct the error. Figure 3.30 presents the distribution of persons with refractive error who were using eyeglasses and those who were not. As high as 95.0 percent of persons with refractive error were not using eyeglasses to correct the error.

Figure 3.30 Distribution of Person with Refractive Error who were Using Distant Eyeglasses



Conclusions and Recommendations

The largest proportion of low vision (88.9%) and blindness (67.7%) in Ghana is due to avoidable causes.

Rural residents are at greater risk for blindness, as are the poor.

Cataract, which is a major cause of blindness, is more common among women than in men.

There is a very low uptake of eyeglasses (5.0%) among those identified to have refractive errors.

The Government of Ghana National Eye Health Policy should focus on addressing glaucoma, retinal diseases, cataract and refractive error, as well as gender issues.

Strategies should be put in place to make affordable eye care accessible to all Ghanaians.

Further studies should be commissioned to address the following:

- Cataract surgical coverage
- Barriers to the uptake of eyeglasses
- Association between pterygium, dry eyes and cooking with solid fuel
- Trachoma and pit latrines
- Glaucoma
- Posterior segment diseases (diabetic retinopathy)
- Childhood blindness

ESTIMATION OF SAMPLING ERROR

Variable	Value of Indicator	Standard Error	Variance	Confidence Interval		Number of Cases
				Lower Bound	Upper Bound	
National						
Blindness	0.0074	0.0013	0.0073	0.0048	0.0100	4,206
Severe Visual Impairment	0.0107	0.0016	0.0106	0.0076	0.0138	4,206
Moderate Visual Impairment	0.0188	0.0021	0.0184	0.0147	0.0229	4,206
Mild Visual Impairment	0.0136	0.0018	0.0134	0.0101	0.0170	4,206
Normal Vision	0.9496	0.0034	0.0479	0.9430	0.9562	4,206
Intervention Urban						
Blindness	0.0033	0.0019	0.0033	0.0004	0.0070	914
Severe Visual Impairment	0.0055	0.0024	0.0054	0.0007	0.0103	914
Moderate Visual Impairment	0.0186	0.0045	0.0183	0.0098	0.0274	914
Mild Visual Impairment	0.0164	0.0042	0.0162	0.0082	0.0247	914
Normal Vision	0.9562	0.0068	0.0419	0.9429	0.9695	914
Intervention Rural						
Blindness	0.0059	0.0022	0.0059	0.0015	0.0103	1,180
Severe Visual Impairment	0.0076	0.0025	0.0076	0.0027	0.0126	1,180
Moderate Visual Impairment	0.0237	0.0044	0.0232	0.0150	0.0324	1,180
Mild Visual Impairment	0.0161	0.0037	0.0159	0.0089	0.0233	1,180
Normal Vision	0.9466	0.0065	1.0000	0.9338	0.9595	1,180
Non-Intervention Urban						
Blindness	0.0099	0.0031	0.0098	0.0038	0.0159	1,015
Severe Visual Impairment	0.0167	0.0040	0.0167	0.0088	0.0247	1,015
Moderate Visual Impairment	0.0167	0.0040	0.0167	0.0088	0.0247	1,015
Mild Visual Impairment	0.0158	0.0039	0.0155	0.0081	0.0234	1,015
Normal Vision	0.9409	0.0074	0.9409	0.9264	0.9554	1,015
Non-Intervention Rural						
Blindness	0.0100	0.0030	0.0099	0.0041	0.0159	1,097
Severe Visual Impairment	0.0128	0.0034	0.0126	0.0061	0.0194	1,097
Moderate Visual Impairment	0.0155	0.0037	0.0153	0.0082	0.0228	1,097
Mild Visual Impairment	0.0064	0.0024	0.0063	0.0017	0.0111	1,097
Normal Vision	0.9553	0.0062	0.9553	0.9431	0.9676	1,097
Urban						
Blindness	0.0067	0.0019	0.0067	0.0031	0.0104	1,929
Severe Visual Impairment	0.0114	0.0024	0.0113	0.0067	0.0161	1,929
Moderate Visual Impairment	0.0176	0.0030	0.0173	0.0117	0.0235	1,929
Mild Visual Impairment	0.0161	0.0029	0.0158	0.0105	0.0217	1,929
Normal Vision	0.9482	0.0050	0.0492	0.9383	0.9581	1,929
Rural						
Blindness	0.0079	0.0019	0.0078	0.0043	0.0115	2,277
Severe Visual Impairment	0.0101	0.0021	0.0100	0.0060	0.0142	2,277
Moderate Visual Impairment	0.0198	0.0029	0.0194	0.0140	0.0255	2,277
Mild Visual Impairment	0.0114	0.0022	0.0114	0.0071	0.0158	2,277
Normal Vision	0.9508	0.0045	0.0468	0.9419	0.9597	2,277
Males						
Blindness	0.0077	0.0020	0.0076	0.0037	0.0117	1826
Severe Visual Impairment	0.0071	0.0020	0.0071	0.0033	0.0110	1826
Moderate Visual Impairment	0.0159	0.0029	0.0156	0.0101	0.0216	1826
Mild Visual Impairment	0.0115	0.0025	0.0114	0.0066	0.0164	1826
Normal Vision	0.9578	0.0047	0.0404	0.9578	0.9486	1826
Females						
Blindness	0.0071	0.0017	0.0071	0.0038	0.0105	2380
Severe Visual Impairment	0.0134	0.0024	0.0133	0.0088	0.0181	2380
Moderate Visual Impairment	0.0210	0.0029	0.0206	0.0152	0.0268	2380
Mild Visual Impairment	0.0151	0.0025	0.0149	0.0102	0.0200	2380
Normal Vision	0.9433	0.0047	0.0535	0.9340	0.9526	2380

REFERENCE

1. World Health Organization. Global data on visual impairment. Prevention of Blindness and Visual Impairment. <http://www.who.int/blindness/publications/globaldata/en/index.html>
2. Pascolini D, Mariotti SP, Pokharel GP, Pararajasegaram R, Etya'ale D, Négrel A-D, Resnikoff S. Global update of available data on visual impairment: a compilation of population-based prevalence studies. *Ophthalmic Epidemiology* 2004, 11:67-115
3. Moll AC, van der Linden AJ, Hogeweg M, Shader WE, Hermans J, Seizer RJ. Prevalence of blindness and low vision of people over 30 years in the Wenchi district, Ghana in relation to eye care programs. *Br J Ophthalmol* 1994;78:273-279.
4. Abdull MM, Sivasubramaniam S, Murthy GV, Gilbert C, Abubakar T, Ezelum C, Rabi MM; Nigeria National Blindness and Visual Impairment Study Group. Causes of blindness and visual impairment in Nigeria: the Nigeria national blindness and visual impairment survey. *Invest Ophthalmol Vis Sci.* 2009;50(9):4114-20.
5. Berhane Y, Worku A, Bejjiga A, et al. Prevalence and causes of blindness and low vision in Ethiopia. *Ethiop J Health Dev* 2007; 21:204–10.
6. Mathenge W, Nkurikiye J, Limburg H, et al . Rapid assessment of avoidable blindness in Western Rwanda: blindness in a post conflict setting. *PLoS Med* 2007;4:e217
7. Müller A, Zerom M, Limburg H, Ghebrat Y, Meresie G, Fessahazion K, Beyene K, Mathenge W, Mebrahtu G Results of a rapid assessment of avoidable blindness (RAAB) in Eritrea. *Ophthalmic Epidemiol.* 2011;18(3):103-8.
8. The Geography of Ghana; <http://www.postcolonialweb.org/africa/ghana/geography/geography1.html>
9. Ghana Statistical Service. 2010 Population and Housing Census. <http://www.census-ghana.net/index.html>
10. Dineen B, Gilbert CE, Rabi M, Kyari F, Mahdi AM, Abubakar T, Ezelum CC, Gabriel E, Elhassan E, Abiose A, Faal H, Jiya JY, Ozemela CP, Lee PS, Gudlavalleti MV. The Nigerian national blindness and visual impairment survey: Rationale, objectives and detailed methodology. *BMC Ophthalmol.* 2008; 8:17.

ANNEX A: Study information and consent form

A.1 Introduction

We are from the Ghana Health Service / Ministry of Health and we are about to do research regarding visual impairment and blindness in Ghana and we would like you and your household to be included in the study. According to the World Health Organization approximately 285 million people are either blind or visually impaired in the world. Reliable estimates of the burden of blindness and visual impairment is lacking in many developing countries including Ghana. Reliable estimate of disease burden will help design good prevention and control programs. Moreover quality data is vital for effective planning of eye care services including distribution of skilled eye care providers. The study aims to provide a robust nationally representative data on blindness and visual impairment. The findings of the survey will further serve as a basis for designing future interventions to decrease visual impairment in Ghana. Such interventions when successfully implemented can be replicated in other parts of Africa and other developing countries.

A2. The procedure of the study

The study will take place in the whole of Ghana and will involve all districts and about 4,400 households. Your household is included in those households that have been selected, so that is the reason why we are inviting you and your household to take part in our study. All persons in your household are eligible to take part. If you agree to be part of the study we will ask you and members of your households some few questions about your households and eye problems that you or any member of the household may be having. We will then examine your eyes, measure your weight, blood pressure and blood glucose.

A3. Participation is voluntary

Your participation in this study is according to your wish. You can decide that you do not want to participate without giving a reason. If you decide not to participate in this study, it will not affect the benefits that you are otherwise entitled.

A.4 To withdraw yourself

If you agree to take part in this study and later you want to withdraw yourself, you have the right to do so at any time and you will not be compelled to continue. If you want to withdraw yourself from the study, it will not affect treatment or benefit that you get.

A.5 Risks in the study

There is no risk in participating in this study, however, for those who may receive detailed eye examination from the doctors this may carry a small risk of pain or discomfort. We will use experience workers and also ensure that we take our time to examine you well so you do not experience any risk. Moreover we will treat any risk you get for taking part in the study.

A.6 Benefits of the study

You will not get direct benefits for participating in the study but the knowledge that we will get will help us know what to do to prevent blindness and poor vision, something that will help people who are in places where blindness is common in Ghana. However, if we notice that you have problem in seeing during the period when the study is being done, we will give you the treatment you need during the period the study is being done and you will pay nothing. Moreover if the problem is severe or you have other sickness during the time of the study, we will let you go to the appropriate hospital for further treatment.

A.7 Confidentiality

The information that we collect will be given marks that no one could know that this information is for this participant. We cannot also give your information to anyone without your permission or those who ensure that there is no harm in research work known as the ethics committee. When we finish with the study information, we will put it in a metal cabinet where no one can see it except the research team and they will be locked up in the cabinet for many years

A.8 Questions

If you want more information regarding this study, you can contact

- Dr Abraham Oduro of the Ghana Health Service, Research and Development Division (0244593231) or
- Dr Ofosu Barko of Ghana College of Physicians and Surgeons, Faculty of Public Health (0264000039).

Those in Ghana Health Service that ensure that there is no harm in research known as the ethics committee have reviewed the study for its risks and benefits before given approval for us to allow people to participate in the study. You can send your questions or concerns about your rights or how you are handled in the study to the chairman of GHS ethics review committee at GHS research and development division or call him on the number 0249712919.

A.9 Consent Form for Detailed Eye Examination

I confirm that I have read or someone has read everything above to me. I have also had the opportunity to ask any question that I did not understand about the study and I have received satisfactory answers. I willingly decided to agree to participate in this study and be included in the examination that this study requires. I understand that I have the right to withdraw myself from this study at any time and that wouldn't affect the treatment that I am entitled to.

Name of study participant:

Signature/left thumbprint:

Date: (Day/month/year)

(Person required as witness for parent/guardian who is illiterate)

I have witnessed the reading of the consent form to the person who can take part in the study, and the person also had the opportunity to ask any questions that he/she has. I confirm that the person willingly agreed to take part in this study.

Name of witness:

Signature of witness:Date:
(Day/month/year)

Name of person taking consent:

Signature:

I agree that I have explained everything above to him/her, the purpose of the study, the procedure of the study, benefits and risks that can occur for participating in the study and I have answered satisfactorily to all the questions that are asked and I also confirm that he/she willingly agreed to take part in this study.

Name of Researcher:

Researcher's signature: Date:
(Day/month/year)

I have given this consent form to the participant

ANNEX B: THE INVESTIGATING TEAM

Principal Investigator (PI):

- Dr Boateng Wiafe¹,

Co-investigators:

- Dr Albert Quainoo²
- Dr Phyllis Antwi ²
- Dr Kenneth Ofosu-Barko²
- Dr Abraham Oduro ^{2,3}
- Dr Abraham Hodgson³,
- Dr. Ebenezer Appiah – Denkyira³
- Dr. Oscar Debrah³
- Dr. James Addy³
- Emmanuel Kwasi Kumah¹
- Anthony Agbesi Amuzu - Pharin⁴
- Gifty Osew –Boafo³

Eye Care Team

- Dr. Joseph K. Amoabeng (deceased) - Ophthalmologist
- Dr. Seth Wanye - Ophthalmologist
- Dr. Kwadwo Amoah - Ophthalmologist
- Mrs. Evelyn Bayuoh - Ophthalmic Nurse
- Dr. Dr. Kwame Otu-Danquah – Optometrist
- Ms. Sarah Djanie - Ophthalmic Nurse
- Mr. Fusheini Kwadjah - Ophthalmic Nurse
- Dr. Noel Miezah Arizi – Optometrist
- Dr. Agbesie Elvis Lawson – Optometrist,

Assistant Statisticians

- William Pharin
- Essinam Amaglo
- Magdalene Ducan
- Shelta Pharin
- Cheryl Jonah
- Lynda Ntiamoah
- Emmanuel Pharin
- Francis Pharin
- Raymond Asare

Collaborating Institutions:

1. Operation Eyesight Universal
2. The Faculty of Public Health, Ghana College of Physician and Surgeons
3. Ghana Health Service, Ministry of Health

Technical Support:

4. The Ghana Statistical Service

Address for correspondence

Dr. Boateng Wiafe
Operation Eyesight Universal
653/3 Akanetso NE, Asylum Down
Accra, Ghana
Email: bwiafe@operationeyesight.com
Mobile: +233 245635394

Sponsoring agencies:

- Swiss Red Cross
- Operation Eyesight Universal
- Standard Chartered Bank
- Seeing is Believing
- Ghana Health Service

ANNEX C: QUESTIONNAIRES

BLINDNESS AND VISUAL IMPAIRMENT STUDY HOUSEHOLD QUESTIONNAIRE

HOUSEHOLD INFORMATION PANEL				HH
HH1. Locality Name: _____				
HH2. Cluster No.: ____ ____ ____		HH3. Household Number: ____ ____		
HH4. Interviewer name		HH6. Supervisor name: _____		
HH5 Code: ____ ____ ____		HH7 Code: ____ ____ ____		
HH8. Date of interview: (DD/ MM / YYYY) ____ ____ / ____ ____ /2014				
HH9. AREA: Urban.....1 Rural.....2		HH10.Regio n ____ ____	HH11.District ____ ____	HH12. Dist-type ____ ____
HH14. Structure Address:		HH15: Contact No of HH:		

MAY I START NOW?

- Yes, permission is given ⇒ Go to HH10 to get signature, then HH18 to record time, then begin interview.
- No, permission is not given ⇒ Complete HH9. Discuss this result with your supervisor.

<i>After all questionnaires for the household have been completed, fill in the following information:</i>	
HH16. Name of head of household: _____	
HH17. Result of household interview: Completed 01 No household member or no competent respondent at home at time of visit 02 Entire household absent for extended period of time..... 03 Refused 04 Dwelling vacant / Address not a dwelling 05 Dwelling destroyed 06 Dwelling not found 07 Other (<i>specify</i>) _____ 96	HH18. Respondent to household questionnaire: Name: _____ _____ <i>(Respondent's signature or thumbprint)</i> Line Number: _____
HH19. Total number of household members: _____	
HH20. Number of Ophthalmological questionnaires completed: _____	

HH21. Field edited by (Name and code): Name _____	HH22. Data entry clerk (Name and code): Name _____
----------------------------------------------------------	-----------------------------------------------------------

HH23. 24GMT
Record the time.
Hour..... ____
Minutes..... ____

HOUSEHOLD LISTING FORM AND EDUCATION HL/ED
 FIRST, PLEASE TELL ME THE NAME OF EACH PERSON IN YOUR HOUSEHOLD WHO USUALLY LIVES HERE, STARTING WITH THE HEAD OF THE HOUSEHOLD.
 List the head of the household in line 01. List all household members (HL2), their relationship to the household head (HL3), and their sex (HL4)
 Then ask: **ARE THERE ANY OTHERS WHO LIVE HERE, EVEN IF THEY ARE NOT AT HOME NOW? (THESE MAY INCLUDE CHILDREN CURRENTLY IN SCHOOL OR AT WORK).**
 If yes, complete listing for questions HL2-HL4. Then, ask questions starting with HL5 for each person at a time.
 Use an additional questionnaire if all rows in the household listing form have been used.

HL24. Line number	HL25. Name	HL26. WHAT IS THE RELATION-SHIP OF (name) TO THE HEAD OF HOUSE-HOLD?	HL27. IS (name) MALE OR FEMALE? 1 Male 2 Female	HL28. WHAT IS (name)'S DATE OF BIRTH?		HL29. HOW OLD IS (name)? Record in completed years.	HL30. DID (NAME)STAY HERE LAST NIGHT 1 Yes 2 NO	HL31 IN THE LAST 5 YEARS DOES (NAME) WASHES HIS/HER FACE WHEN SHE/HE WAKES UP IN THE MORNING? 1 Yes 2 No ED33 3 N/A	HL32. HOW OFTEN DOES (NAME) USUALLY WASH HIS/HER FACE IN A WEEK?	ED33. HAS (name) EVER ATTENDED SCHOOL OR PRE-SCHOOL? 1 Yes 2 No WS36	ED34 WHAT IS THE HIGHEST LEVEL OF SCHOOL (NAME) ATTENDED?	ED35 What is the highest class/year (name) completed at this level? If less than a class/year completed enter 0	
Line	Name	Relation*	M	F	Month	Year	Age	Y N	Y N	Number of times	Y N	Level	Class/Form
01		0 1	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___
02		___	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___
03		___	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___
04		___	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___
05		___	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___
06		___	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___
07		___	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___
08		___	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___
09		___	1	2	___	_____	___	1 2	1 2 3	___	1 2	___	___

HL24. Line number	HL25. Name	HL26. WHAT IS THE RELATIONSHIP OF (name) TO THE HEAD OF HOUSE-HOLD?	HL27. IS (name) MALE OR FEMALE?		HL28. WHAT IS (name)'S DATE OF BIRTH?		HL29. HOW OLD IS (name)?	HL30. DID (NAME)STAY HERE LAST NIGHT		HL31 IN THE LAST 5 YEARS DOES (NAME) WASHES HIS/HER FACE WHEN SHE/HE WAKES UP IN THE MORNING?	HL32. HOW OFTEN DOES (NAME) USUALLY WASH HIS/HER FACE IN A WEEK?	ED33. HAS (name) EVER ATTENDED SCHOOL OR PRE-SCHOOL?	ED34 WHAT IS THE HIGHEST LEVEL OF SCHOOL (NAME) ATTENDED?	ED35 What is the highest class/year (name) completed at this level?
			1 Male 2 Female				Record in completed years.	1 Yes 2 NO		1 Yes 2 No ED33 3 N/A		1 Yes 2 No WS36		If less than a class/year completed enter 0
Line	Name	Relation*	M	F	Month	Year	Age	Y N		Y N	Number of times	Y N	Level	Class/Form
10		_____	1	2	___	_____	_____	1 2		1 2 3	_____	1 2	_____	_____
11		_____	1	2	___	_____	_____	1	2	1 2 3	_____	1 2	_____	_____
12		_____	1	2	___	_____	_____	1	2	1 2 3	_____	1 2	_____	_____
13		_____	1	2	___	_____	_____	1	2	1 2 3	_____	1 2	_____	_____
14		_____	1	2	___	_____	_____	1	2	1 2 3	_____	1 2	_____	_____
15		_____	1	2	___	_____	_____	1	2	1 2 3	_____	1 2	_____	_____

Check box if additional questionnaire is used

* Codes for HL3: Relationship to head of household:

01 Head	06 Parent	11 Niece / Nephew
02 Wife / Husband/Cohabiting partner	07 Parent-In-Law	12 Other relative (specify)
03 Son / Daughter	08 Brother / Sister	13 Adopted / Foster / Stepchild
04 Son-In-Law / Daughter-In-Law	09 Brother-In-Law / Sister-In-Law	14 Not related
05 Grandchild	10 Uncle / Aunt	98 Don't know

* Codes for Educational Level: ED4A

0 Pre-school	2 Middle/JSS/JHS	4 Voc/Comm/Tech	6 Tertiary
1 Primary	3 Secondary/SSS/SHS	5 Post Secondary (Nursing/Teacher Training)	8 DK

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

WATER AND SANITATION	WS	
WS36. WHAT IS THE <u>MAIN</u> SOURCE OF DRINKING WATER FOR MEMBERS OF YOUR HOUSEHOLD?	Piped water Piped into dwelling.....11 Piped into compound, yard or plot.....12 Piped to neighbour.....13 Public tap / standpipe14 Tube Well, Borehole21 Dug well Protected well31 Unprotected well32 Protected spring.....41 Unprotected spring42 Rainwater collection51 Tanker-truck.....61 Cart with small tank / drum71 Surface water River/ stream 81 Dam, lake, pond, canal, irrigation channel)82 Bottled / Sachet water91 Other (<i>specify</i>) _____ 96	
WS37. WHAT IS THE <u>MAIN</u> SOURCE OF WATER USED BY YOUR HOUSEHOLD FOR OTHER PURPOSES SUCH AS COOKING AND HAND AND FACE WASHING?	Piped water Piped into dwelling.....11 Piped into compound, yard or plot.....12 Piped to neighbour.....13 Public tap / standpipe14 Tube Well, Borehole21 Dug well Protected well31 Unprotected well32 Water from spring Protected spring.....41 Unprotected spring42 Rainwater collection51 Tanker-truck61 Cart with small tank / drum71 Surface water River/ stream 81 Dam, lake, pond, canal, irrigation channel)82 Other (<i>specify</i>) _____ 96	
WS38. WHERE IS THAT WATER SOURCE LOCATED?	In own dwelling 1 In own yard / plot2 Elsewhere3	1⇒WS40 2⇒WS40
WS39. HOW LONG DOES IT TAKE TO GO THERE, GET WATER, AND COME BACK?	Number of minutes__ __ __ DK.....998	

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

WS40. DO YOU DO ANYTHING TO THE WATER TO MAKE IT SAFER TO DRINK?	Yes.....1 No2 DK.....8	2⇒WS42 8⇒WS42
WS41. WHAT DO YOU USUALLY DO TO MAKE THE WATER SAFER TO DRINK? <i>Probe:</i> ANYTHING ELSE? <i>Record all items mentioned.</i>	Boil..... A Add bleach / chlorine B Strain it through a cloth..... C Use water filter (ceramic, sand, composite, etc.) D Solar disinfection E Let it stand and settle F Add camphor/naphthalene G Add water tablet H Other (<i>specify</i>) X DK..... Z	
WS42. WHAT KIND OF TOILET FACILITY DO MEMBERS OF YOUR HOUSEHOLD USUALLY USE? <i>If “flush”, probe:</i> WHERE DOES IT FLUSH TO? <i>If necessary, ask permission to observe the facility.</i>	Flush Flush to piped sewer system..... 11 Flush to septic tank 12 Flush to pit (latrine) 13 Flush to somewhere else 14 Flush, don't know where 15 Pit latrine Ventilated Improved Pit latrine (VIP) 21 Pit latrine with slab 22 Pit latrine without slab / Open pit 23 Composting toilet 31 Bucket 41 Hanging toilet, Hanging latrine..... 51 Mobile Toilet 61 No facility, Bush, Field, Beach 95 Other (<i>specify</i>) 96	95⇒Next Module
WS43. DO YOU SHARE THIS FACILITY WITH OTHERS WHO ARE NOT MEMBERS OF YOUR HOUSEHOLD?	Yes 1 No..... 2	2⇒Next Module
WS44. DO YOU SHARE THIS FACILITY ONLY WITH MEMBERS OF OTHER HOUSEHOLDS THAT YOU KNOW, OR IS THE FACILITY OPEN TO THE USE OF THE GENERAL PUBLIC?	Other households only (not public) 1 Public facility 2	2⇒Next Module
WS45. HOW MANY HOUSEHOLDS IN TOTAL USE THIS TOILET FACILITY, INCLUDING YOUR OWN HOUSEHOLD?	Number of households (if less than 10) 0__ Ten or more households 10 DK 98	

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

HOUSEHOLD CHARACTERISTICS		HC
HC46. WHAT IS THE RELIGION OF THE HEAD OF THIS HOUSEHOLD?	Catholic 11 Protestant..... 12 Pentecostal/Charismatic 13 Deeper Life..... 14 Jehovah Witness..... 15 SDA..... 16 Other Christian 17 Moslem..... 21 Traditional 31 Spiritualist..... 32 Other religion (<i>specify</i>) _____ 96 No Religion..... 97	
HC47. TO WHAT ETHNIC GROUP DOES THE HEAD OF THIS HOUSEHOLD BELONG? <i>Refer to Manual for Ethnic classifications</i>	Akan 11 Ga/Dangme..... 12 Ewe 13 Guan 14 Gruma 15 Mole Dagbani 21 Grusi 22 Mande 23 Non-Ghanaian..... 24 Other ethnic group (<i>specify</i>) _____ 96	
HC48. HOW MANY ROOMS IN THIS HOUSEHOLD ARE USED FOR SLEEPING?	Number of rooms _ _ _	
HC49. WHAT TYPE OF FUEL DOES YOUR HOUSEHOLD <u>MAINLY</u> USE FOR COOKING?	Electricity..... 01 Liquefied Petroleum Gas (LPG)..... 02 Biogas 04 Kerosene..... 05 Charcoal..... 07 Wood/Firewood..... 08 Straw / Shrubs / Grass..... 09 Animal waste..... 10 Agricultural crop residue/sawdust..... 11 No food cooked in household 95 Other (<i>specify</i>)..... 96	01⇒HC52 02⇒HC52 04⇒HC52 05⇒HC52 95⇒HC52
HC50. IN THIS HOUSEHOLD, IS FOOD COOKED ON AN OPEN FIRE, A COAL POT OR A CLOSED STOVE?	Open fire 1 Coal pot..... 2 Closed stove 3 Other (<i>specify</i>) _____ 6	
HC51. IS THE COOKING USUALLY DONE IN AN OPEN ENCLOSED PLACE?	In the house OPEN..... 1 ENCLOSED 2	

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

<p>HC52. DOES YOUR HOUSEHOLD HAVE:</p> <p>[A] ELECTRICITY? [B] A RADIO? [C] A BLACK AND WHITE TELEVISION? [C1] A COLOUR TELEVISION? [D] A LAND/FIXED TELEPHONE? [E] A REFRIGERATOR/FREEZER? [F] A WASHING MACHINE? [G] A LAPTOP COMPUTER? [H] A DESKTOP COMPUTER? [I] A VIDEO DECK? [J] A DVD/VCD PLAYER? [K] A SEWING MACHINE?</p>	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;"></th> <th style="width: 10%; text-align: center;">Yes</th> <th style="width: 10%; text-align: center;">No</th> </tr> </thead> <tbody> <tr> <td>A. Electricity</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>B. Radio</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>C. Black and white television</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>C1. Colour Television</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>D. Land/Fixed Telephone.....</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>E. Refrigerator/freezer</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>F. Washing Machine</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>G. Laptop Computer</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>H. Desktop Computer</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>I. Video Deck.....</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>J. DVD/VCD Player</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>K. Sewing Machine</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> </tbody> </table>		Yes	No	A. Electricity	1	2	B. Radio	1	2	C. Black and white television	1	2	C1. Colour Television	1	2	D. Land/Fixed Telephone.....	1	2	E. Refrigerator/freezer	1	2	F. Washing Machine	1	2	G. Laptop Computer	1	2	H. Desktop Computer	1	2	I. Video Deck.....	1	2	J. DVD/VCD Player	1	2	K. Sewing Machine	1	2	
	Yes	No																																							
A. Electricity	1	2																																							
B. Radio	1	2																																							
C. Black and white television	1	2																																							
C1. Colour Television	1	2																																							
D. Land/Fixed Telephone.....	1	2																																							
E. Refrigerator/freezer	1	2																																							
F. Washing Machine	1	2																																							
G. Laptop Computer	1	2																																							
H. Desktop Computer	1	2																																							
I. Video Deck.....	1	2																																							
J. DVD/VCD Player	1	2																																							
K. Sewing Machine	1	2																																							
<p>HC53. DOES ANY MEMBER OF YOUR HOUSEHOLD OWN:</p> <p>[A] A WATCH? [B] A MOBILE TELEPHONE? [C] A BICYCLE? [D] A MOTORCYCLE OR SCOOTER? [E] AN ANIMAL-DRAWN CART? [F] A CAR OR TRUCK? [G] A CANOE/BOAT WITH A MOTOR? [H] A CANOE/BOAT WITHOUT A MOTOR?</p>	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;"></th> <th style="width: 10%; text-align: center;">Yes</th> <th style="width: 10%; text-align: center;">No</th> </tr> </thead> <tbody> <tr> <td>A. A watch</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>B. Mobile Telephone</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>C. Bicycle</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>D. Motorcycle or Scooter</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>E. Animal drawn-cart.....</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>F. Car / Truck</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>G. Canoe/Boat with motor.....</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>H. Canoe/Boat without a motor</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> </tr> </tbody> </table>		Yes	No	A. A watch	1	2	B. Mobile Telephone	1	2	C. Bicycle	1	2	D. Motorcycle or Scooter	1	2	E. Animal drawn-cart.....	1	2	F. Car / Truck	1	2	G. Canoe/Boat with motor.....	1	2	H. Canoe/Boat without a motor	1	2													
	Yes	No																																							
A. A watch	1	2																																							
B. Mobile Telephone	1	2																																							
C. Bicycle	1	2																																							
D. Motorcycle or Scooter	1	2																																							
E. Animal drawn-cart.....	1	2																																							
F. Car / Truck	1	2																																							
G. Canoe/Boat with motor.....	1	2																																							
H. Canoe/Boat without a motor	1	2																																							
<p>HC54. WHAT IS THE OCCUPANCY STATUS OF YOUR HOUSEHOLD IN THIS DWELLING?</p>	<p>Own</p> <p>Rent.....</p> <p>Squatting</p> <p>Caretaker</p> <p>Perching.....</p> <p>Rent Free</p> <p>Other (<i>specify</i>)</p>	<p>01</p> <p>02</p> <p>03</p> <p>04</p> <p>05</p> <p>06</p> <p>96</p>																																							
<p>HC55. DOES ANY MEMBER OF THIS HOUSEHOLD OWN ANY PIECE OF LAND THAT IS USED OR CAN BE USED FOR AGRICULTURE?</p>	<p>Yes</p> <p>No.....</p>	<p>1</p> <p>2</p> <p>2⇒HC57</p>																																							
<p>HC56. HOW MANY (<i>HECTARES Poles/ACRES/PLOT</i>) OF AGRICULTURAL LAND DO MEMBERS OF THIS HOUSEHOLD OWN?</p> <p><i>If less than 1, record "00". If 95 or more, record '95'. If unknown, record '98' for Number.</i></p> <p><i>If Unit is not known, circle "998".</i></p>	<p>Unit Number</p> <p>Hectares</p> <p>Poles.....</p> <p>Acres</p> <p>Plot.....</p> <p>Ropes</p> <p>DK</p>	<p>1 ___</p> <p>2 ___</p> <p>3 ___</p> <p>4 ___</p> <p>5 ___</p> <p>998</p>																																							
<p>HC57. APART FROM THE PLOT DESCRIBED IN HC56 ABOVE, DOES ANY MEMBER OF THIS HOUSEHOLD OWN ANY PIECE OF LAND THAT IS USED OR CAN BE USED FOR RESIDENTIAL AND/OR COMMERCIAL PURPOSES?</p>	<p>Yes</p> <p>No.....</p>	<p>1</p> <p>2</p> <p>2⇒HC59</p>																																							

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

<p>HC58. HOW MANY (<i>HECTARES</i> <i>POLES/ACRES/PLOT/ROPES</i>) OF RESIDENTIAL PLOTS DO MEMBERS OF THIS HOUSEHOLD OWN?</p> <p><i>If less than 1, record "00". If 95 or more, record '95'. If unknown, record '98' for Number. If Unit is not known, circle "998".</i></p>	<p>Unit Number</p> <p>Hectares 1 ___</p> <p>Poles..... 2 ___</p> <p>Acres 3 ___</p> <p>Plot..... 4 ___</p> <p>Ropes 5 ___</p> <p>DK 998</p>	
<p>HC59. DOES THIS HOUSEHOLD OWN ANY LIVESTOCK, HERDS, OTHER FARM ANIMALS, OR POULTRY?</p>	<p>Yes 1</p> <p>No..... 2</p>	<p>2⇒HW61</p>
<p>HC60. HOW MANY OF THE FOLLOWING ANIMALS DOES THIS HOUSEHOLD HAVE?</p> <p>[A] CATTLE, MILK COWS, OR BULLS?</p> <p>[B] HORSES, DONKEYS, OR MULES?</p> <p>[C] GOATS?</p> <p>[D] SHEEP?</p> <p>[E] CHICKENS?</p> <p>[F] PIGS?</p> <p>[G] RABBITS?</p> <p>[H] DUCKS?</p> <p>[I] OTHERS (SPECIFY)</p> <p><i>If none, record '00'. If 95 or more, record '95'. If unknown, record '98'.</i></p>	<p>Number</p> <p>Cattle, milk cows, or bulls ___</p> <p>Horses, donkeys, or mules ___</p> <p>Goats..... ___</p> <p>Sheep..... ___</p> <p>Chickens/Roosters..... ___</p> <p>Pigs ___</p> <p>Rabbits ___</p> <p>Ducks ___</p> <p>Other (<i>specify</i>) ___</p>	

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

HAND WASHING		HW
HW61. DO MEMBERS OF YOUR HOUSEHOLD USUALLY WASH THEIR?	Yes 1 No..... 2	2 ⇨ END IT HERE
HW62 WHEN DO MEMBERS OF THIS HOUSEHOLD USUALLY WASH THEIR HANDS	Any time they come from townA Any time they visit the toiletB Any time they visit the urinalC Before they eat in the houseD Before they eat anywhereE	
HW63. PLEASE SHOW ME WHERE MEMBERS OF YOUR HOUSEHOLD MOST OFTEN WASH THEIR HANDS AFTER VISITING THE WASH ROOM OR WHEN THEY COME FROM TOWN.	Observed..... 1 Not observed Not in dwelling / plot / yard..... 2 Anywhere in dwelling / plot / yard.....3 No permission to see 4 Other reason 5	2 ⇨ HW66 3 ⇨ HW66 4 ⇨ HW66 5 ⇨ HW66
HW64. <i>Observe presence of water at the specific place for hand washing.</i> <i>Verify by checking the tap/pump, or basin, bucket, water container or similar objects for presence of water.</i>	Water is available..... 1 Water is not available..... 2	
HW65. <i>Record if soap or detergent or other traditional detergents are present at the specific place for hand washing.</i> <i>Circle all that apply.</i> <i>Skip to Next Module if any soap or detergent code (A, B, C, D, E or X) is circled. If "None" (Y) is circled, continue with HW4.</i>	Washing Soap (e.g. Key soap)A Detergent (Powder / Liquid / Paste).....B Liquid hand washing soapC AshD Toilet Soap (e.g. Lux).....E Other (<i>specify</i>)X None.....Y	A⇨HH68 B⇨HH68 C⇨HH68 D⇨HH68 E⇨HH68 X⇨HH68
HW66. DO YOU HAVE ANY SOAP OR DETERGENT OR ANY OTHER TRADITIONAL DETERGENTS IN YOUR HOUSEHOLD SOLELY RESERVED FOR WASHING HANDS?	Yes 1 No..... 2	2⇨HH68
HW67. CAN YOU PLEASE SHOW IT TO ME? <i>Record observation. Circle all that apply.</i>	Washing Soap (e.g. Key soap)A Detergent (Powder / Liquid / Paste).....B Liquid handwashing soapC Toilet Soap (e.g. Lux).....E AshD Other (<i>specify</i>)X Not able / Does not want to showY	
HH68. 24 GMT <i>Record the time.</i>	Hour and minutes..... __ __ : __ __	

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

INTERVIEWER OBSERVATION

SUPERVISOR'S OBSERVATION

MONITOR'S OBSERVATION

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

CLINICAL EXAMINATION

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

RESPONDENTS BACKGROUND	HC
CLA68. AGE OF HOUSEHOLD MEMBER?	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid green; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid green; width: 40px; height: 20px; margin-right: 5px;"></div> </div> <p style="text-align: center; margin-top: 5px;">Months Years</p>
CLA69. SEX OF RESPONDENT?	Male 1 Female 2
CLA70. OPTIONS?	Optional 1 1 Optional 2 2
CLA70. BLOOD PRESSURE?	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid green; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid green; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid green; width: 30px; height: 20px; margin-right: 5px;"></div> / <div style="border: 1px solid green; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid green; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid green; width: 30px; height: 20px; margin-right: 5px;"></div> </div>
CLA72. RANDOM BLOOD SUGAR?	<div style="border: 1px solid green; width: 60px; height: 20px; margin: 0 auto;"></div>
CLA73. EXAMINATION STATUS?	Examined 1 Not Available 2 Refused 3 Not Able to communicate 4
B. VISION - PRESENTING VISION	
CLB74. DID YOU EVER HAVE ANY PROBLEMS WITH YOUR EYES?	Yes 1 No 2
CLB75. ARE YOU USING DISTANCE GLASSES?	Yes 1 No 2
CLB76. ARE YOU USING READING GLASSES?	Yes 1 No 2
CLB77. PRESENTATION VISION: [1] CAN SEE 6/12? [2] CANNOT SEE 6/12 BUT CAN SEE 6/18? [3] CANNOT SEE 6/18 BUT CAN SEE 6/60? [4] CANNOT SEE 6/60 BUT CAN SEE 3/60? [5] CANNOT SEE 3/60 BUT CAN SEE 1/60? [6] LIGHT PERCEPTION (PL+)? [7] NO LIGHT PERCEPTION (PL-)?	<div style="display: flex; justify-content: space-around; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid green; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid green; width: 40px; height: 20px; margin-right: 5px;"></div> </div> <p style="text-align: center;">Right eye Left eye</p>

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

<p>CLB78. VISION WITH PINHOLE:</p> <p>[1] CAN SEE 6/12? [2] CANNOT SEE 6/12 BUT CAN SEE 6/18? [3] CANNOT SEE 6/18 BUT CAN SEE 6/60? [4] CANNOT SEE 6/60 BUT CAN SEE 3/60? [5] CANNOT SEE 3/60 BUT CAN SEE 1/60? [6] LIGHT PERCEPTION (PL+)? [7] NO LIGHT PERCEPTION (PL-)?</p>	<p align="center"> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Right eye Left eye </p>	
<p>CLB79. LENS EXAMINATION:</p> <p>[1] NORMAL LENS MINIMAL / LENS OPACITY [2] OBVIOUS LENS OPACITY [3] LENS ABSENT (APHAKIA) [4] PSEUDOPHAKIA WITHOUT PCO [5] PSEUDOPHAKIA WITH PCO [6] NO VIEW OF LENS</p>	<p align="center"> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Right eye Left eye </p>	
<p>D. MAIN CAUSE OF PRESENTING VA<6/12</p>		
<p>CLB80. PRINCIPAL CAUSE IN PERSON:</p> <p>Refractive error 1 Aphakia uncorrected 2 Cataract, untreated 3 Cataract Surgical Complications 4 Trachoma corneal opacity 5 Other corneal opacity 6 Phthisis 7 Onchocerciasis 8 Glaucoma 9 Diabetic retinopathy 10 ARMD 11 Other post segment 12 AI Globe / CNS Abnormality 13 Not examined (can see 6/12) 14</p>	<p align="center"> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Right eye Left eye <input type="text"/> <input type="text"/> Principal Cause in Person </p>	

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

E. HISTORY, IF NOT EXAMINED		
<p>CLB81. HISTORY, IF NOT EXAMINED</p> <p>(From relative or neighbour)</p> <p>[1] NOT BLIND</p> <p>[2] BLIND DUE TO CATARACT</p> <p>[3] BLIND DUE TO OTHER CAUSES</p> <p>[4] OPERATED FOR CATARACT</p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid green; width: 40px; height: 20px; display: flex; justify-content: space-between; padding: 2px;"> </div> <div style="border: 1px solid green; width: 40px; height: 20px; display: flex; justify-content: space-between; padding: 2px;"> </div> </div> <p>Right eye Left eye</p>	
F. WHY CATARACT OPERATION WAS NOT DONE		
<p>CLB82. WHY CATARACT OPERATION WAS NOT DONE</p> <p>(Mark up to 2 responses, if VA<6/12, not improving pinhole, with visually impairing lens opacity in one or both eyes)</p> <p>[1] NO ACCESS TO TREATMENT</p> <p>[2] UNAWARE THAT TREATMENT IS POSSIBLE</p> <p>[3] BELIEVES IT TO BE DESTINY/GOD'S WILL</p> <p>[4] TOLD TO WAIT FOR CATARACT TO MATURE</p> <p>[5] SURGICAL SERVICES NOT AVAILABLE OR VERY FAR</p> <p>[6] DON'T KNOW HOW TO GET SURGERY</p> <p>[7] CANNOT AFFORD OPERATION</p> <p>[8] NO ONE TO ACCOMPANY</p> <p>[9] NO TIME AVAILABLE / OTHER PRIORITIES</p> <p>[10] OLD AGE AND NEED NOT FELT</p> <p>[11] ONE EYE ADEQUATE VISION /NEED NOT FELT</p> <p>[12] FEAR OF OPERATION</p> <p>[13] FEAR OF LOSING EYE SIGHT</p> <p>[14] OTHER DISEASE CONTRA-INDICATING OPERATION</p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid green; width: 40px; height: 20px; display: flex; justify-content: space-between; padding: 2px;"> </div> <div style="border: 1px solid green; width: 40px; height: 20px; display: flex; justify-content: space-between; padding: 2px;"> </div> </div> <p>First Reason Second Reason</p>	
G. DETAILS ABOUT CATARACT OPERATION		
<p>CLB83. AGE AT OPERATION</p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid green; width: 40px; height: 20px; display: flex; justify-content: space-between; padding: 2px;"> </div> <div style="border: 1px solid green; width: 40px; height: 20px; display: flex; justify-content: space-between; padding: 2px;"> </div> </div> <p>Right eye Left eye</p>	

GHANA NATIONAL BLINDNESS AND VISUAL IMPAIRMENT SURVEY

BASELINE SURVEY FOR PREVENTABLE BLINDNESS INTERVENTION

CLB84. PLACE OF OPERATION	Government hospital..... 1 Voluntary / charitable hospital..... 2 Private hospital 3 Eye camp / improvised setting 4 Traditional setting..... 5	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px;"></div> </div> <p style="text-align: center;">RIGHT EYE LEFT EYE</p>
CLB85. TYPE OF SURGERY	Non IOL..... 1 IOL implant..... 2 Couching..... 3	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px;"></div> </div> <p style="text-align: center;">RIGHT EYE LEFT EYE</p>
CLB86. HOW THE COST OF SURGERY WAS PAID	Totally free 1 Partially free 2 Fully paid..... 3 Paid by NHIS 4 Paid by other 5	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px;"></div> </div> <p style="text-align: center;">RIGHT EYE LEFT EYE</p>
CLB87. CAUSE OF VA<6/18 AFTER CATARACT SURGERY	Ocular comorbidity (Selection)..... 1 Operative complications (Surgery) 2 Refractive error (Spectacles) 3 Long term complications (Sequelae) 4 Does not apply - can see 6/12 5	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px;"></div> </div> <p style="text-align: center;">RIGHT EYE LEFT EYE</p>
CLB88. ARE YOU SATISFIED WITH RESULTS OF CATARACT SURGERY?	Very satisfied 1 Partially satisfied 2 Indifferent 3 Partially dissatisfied 4 Very dissatisfied..... 5	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 40px; height: 20px;"></div> </div> <p style="text-align: center;">RIGHT EYE LEFT EYE</p>