

**MAGNITUDE AND PATTERN OF EYE
DISEASES IN KOROGOCHO SLUM
NAIROBI.**

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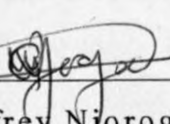
I dedicate this work to my wife Betty and daughter Katherine who have been a great source of inspiration through out my studies.

To my parents who through their work inspired me to go into a career in Ophthalmology.

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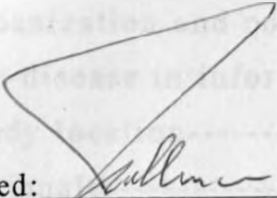
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APPROVAL

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ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
AMD	Age Related Macular Degeneration
APHRC	African Population and Health Research Center
CONJ	Conjunctiva
CMV	Cytomegalovirus
HIV	Human Immunodeficiency Virus
IOP	Intraocular Pressure
KANU	Kenya African National Union
KM	Kilometer
KNH	Kenyatta National Hospital
KOP	Kenya Ophthalmic Program
MOH	Ministry Of Health
SPSS	Statistical Package for Social Scientists
USAID	United States Agency for International Development
WHO	World Health Organization

1. ABSTRACT

Objectives

To determine the magnitude and pattern of eye diseases in Korogocho slum, Nairobi and the relationship with selected social factors thought to have effect on eye disease.

Methodology

This is a cross sectional community based survey conducted between July and August 2002, in Korogocho slum, Nairobi involving 1136 patients. A house to house survey was initially planned but was not possible due to the high level of insecurity in the study area at this time. A provisional eye clinic was set up in a central location of each the village. The clinical complaints of the study subjects were established and a detailed ocular examination performed. The examination of the anterior and posterior segment was performed with a torch, +20 diopter loupe, and direct and indirect ophthalmoscopes. Study subjects were screened for refractive error with a pinhole and subsequently refracted at the KNH eye clinic. Community participation was achieved by involving the area chief and the respective village elders to mobilize the residents. The residents were sensitized and posters put up two weeks prior to the screening. The level of insecurity in one village was too high and an alternative site for screening was established.

Results

Two thousand one hundred and seventy one (2,171) eyes in 1,136 subjects were examined since one subject was single eyed. The sex distribution was 58% females and 42% males. Majority of the subjects examined had abnormal ocular findings at time of screening (61%). Refractive error and allergic conjunctivitis were the leading causes of study subject's eye morbidity accounting for 25% and 20% respectively. About 1% of the

subjects were blind (visual acuity $<3/60$ in the better eye), 2% were severely visually impaired ($<6/60$ and $>3/60$), 5% were visually impaired ($<6/18$ and $>6/60$) and 81% had normal vision ($>6/18$) according to the WHO classification. The leading causes of blindness were cataract (50%) and uncorrected refractive error (25%). Cataract (30%) and postoperative aphakia (15%) were the leading causes of severe visual impairment. Selected social factors such as type of housing, type of toilet, source of water and household size had little effect on the magnitude of eye disease due to confounding factors.

Conclusion

Refractive error and allergic conjunctivitis were the leading cause of eye morbidity in Korogocho slum, Nairobi. Cataract was the leading cause of both blindness and severe visual impairment.

Programmes targeting refractive errors, allergic conjunctivitis and cataract would significantly decrease the ocular disease burden in this community.

TITLE

Magnitude and pattern of eye diseases in Korogocho slum, Nairobi.

2 INTRODUCTION AND LITERATURE REVIEW

Africa is undergoing a population explosion with its cities experiencing the highest population growth rates. This is despite the low economic growth in Africa as a whole. This has led to an increasing proportion of Africans living in overcrowded slums where health conditions and livelihood opportunities are poor (1).

2.1 URBANIZATION AND POVERTY IN KENYA

Kenya's urban population almost doubled between 1980 and 1998, increasing from 16% to 31% of the total population (2). Although the city of Nairobi's contribution to the total urban population in Kenya has decreased from 33 to 23% between 1980 to 1999, it is still one of the fastest growing cities in Africa (2).

A large proportion of Nairobi's population (50% to 70%) lives in informal settlements where environmental and health conditions are very poor (2, 3). Seventy percent of the city's population resides in slums situated within 4 Km of the city centre (3).

A survey in 1993 showed that only 45% of the city's residents had access to portable water and only 63% had access to regular waste collection (2). In Kibera, one of Africa's largest slums, Nairobi residents have to deal with the phenomenon of "flying toilets": faeces discharged into cellophane bags and flung into the air to land where it will with total disregard to the people around (4).

The word Nairobi is derived from the Maasai word "Nyrobi", which means "a place of cool/cold waters". Before the start of the British Colonial administration, Nairobi was a major trading center for the Kikuyu and their

neighbors. Nairobi had been established as a stopover for trading caravans from the coast en-route to Uganda and the construction of the Mombasa-Uganda railway gave it further prominence. In 1899 the railways authorities established their Headquarters in Nairobi. They made more extensive developments here than at any other point on the railway line. (1, 5, 6) In 1905, the British colonial government moved its headquarters from Mombasa to Nairobi after the completion of the railway line and thus the steady growth of Nairobi begun. In 1920, Nairobi's size was 25 square kilometers, in 1927, it had grown to 90 square kilometers and currently the size of Nairobi is 684 square kilometers (1, 7).

Nairobi became a city in 1950 and obtained provincial status in 1963. Nairobi city has eight divisions namely, Dagoretti, Embakasi, Kasarani, Central, Westlands, Kibera, Makadara and Pumwani (see map on Appendix III). The divisions are sub-divided into forty-six locations, which are also divided into sub locations. The Provincial Commissioner is in charge of the province while the District Commissioner and District Officer are in-charge of the administrative tiers. Chiefs are in-charge of locations and Assistant Chiefs are in-charge of sub locations. All the above work in collaboration with the village elders who are elected by the community. All administrative posts from the Assistant Chief onwards are political and salaried appointments from the Office of the President.

Out of Nairobi's total area, the Nairobi National Park covers 17%. The population of Nairobi has been increasing consistently, rising from below 120,000 when the first census was conducted in 1948 to the 1999 size of 2.1 million people (8). Nairobi's growth rate of 7% per annum is one of the fastest amongst African cities. Most of the growth of the city is from rural-urban migration.

During the colonial time, there was strict control of migration in to Nairobi and residential areas were segregated along racial lines. The upper areas of the city were reserved for Europeans while the low areas were left for Africans and other races. This is why most of the major slum settlements are situated in low-lying areas of the city. Post-colonial policies have neglected development needs of urban informal settlements. Informal settlements are located in all the divisions of Nairobi in varying sizes and densities.

Slums represent the legacy of neglect from colonial times, when deliberate policies of constrained provision of housing for Africans were instituted (9).

A main concern of the Government of Kenya with regard to population is to implement appropriate policies, strategies and programs that will constantly match the country's population growth with the available national resources (10).

Rapid population growth has led to diminishing of the land to population ratio. The high growth rate of urban centers with spontaneous growth of slums has led to unemployment and underdevelopment. Street children, drug abuse and prostitution are also on the increase (11). Rapid urban population growth has outstretched existing infrastructure such as hospitals, schools, road network housing and other amenities.

Poverty in urban areas increased from about 29% in 1992 to about 50% in 1997 (12). Nairobi City registered the biggest increase in overall poverty, which almost doubled from 26% to 50% between 1992 and 1997 (12).

2.2 EYE DISEASES IN INFORMAL SETTLEMENTS

Few community-based studies have been done in the past to assess eye disease especially in slum areas. Most studies are hospital based, as these allow for detailed examination of the patients with sophisticated equipment. Current global estimates indicate that blindness affects at least 48 million people (13,

14). Ninety percent of the blind live in developing countries where eye diseases are a major public health problem (13, 14). For each blind person there exist three other people with low vision and this is a fact that raises even greater socioeconomic concern (13, 15).

Fifty percent of the world's blindness is due to cataract. Trachoma, glaucoma, onchocerciasis and trauma are other leading causes of blindness in the adult population (13).

The prevalence of blindness in Kenyan is estimated to be 0.7% as the global prevalence of blindness (16) as no prevalence study has been done in Kenya. Cataract causes 43%, trachoma 19% and glaucoma 9% of blindness in Kenya (16). Most of the cataracts in the general population are senile (17).

In a recent study of a slum in Addis Ababa, Ethiopia, cataract, glaucoma, trachoma and postoperative aphakia were found to be the leading cause of blindness in the elderly population (13).

In the western world, Age Related Macular Degeneration (AMD) is the leading cause of irreversible severe visual loss in individuals over sixty years of age (17).

Allergic conjunctivitis is one of the most frequent eye diseases. This disease is caused by various allergens such as dust, pollens, house dust and many others. The onset of Vernal Keratoconjunctivitis is usually after the age of 5 years and eventually resolves around puberty and rarely persists after the age of 25 years (17, 18, 19).

Bacterial conjunctivitis is a common eye disease where bacteria may invade a normal healthy conjunctiva to produce a primary bacterial conjunctivitis. Some organisms are quite virulent and the infection may be severe and

bilateral. The disease resolves spontaneously in 1-2 weeks often without scarring. When the immune mechanism of the conjunctiva is weak, bacteria invade and cause secondary bacterial conjunctivitis (19). Haemophilus influenza bacteria cause seasonal epidemic conjunctivitis in hot dusty climates. Gonococcus and Chlamydia are important causes of neonatal conjunctivitis (17, 18, 19). In a recent hospital based study S aureus, S epidermidis, and E coli were the most common organisms isolated. E coli were the commonest in preterm neonates (20). Trachoma is an important public health eye disease that causes blindness to an estimated 5.9 million adults due to corneal scarring (21). As an indicator of poverty, trachoma is common in parts of the world that lack water, lack sanitation, and even basic eye and health care services (21). The main carriers of the infection are children below the age of ten years. Overcrowding, poor hygiene and the presence of large number of flies all help the disease to spread

Trauma to the eye is the most common ocular emergency in hospitals. The trauma can be blunt or penetrating. Many blunt injuries do not require special treatment unless they are associated with intraocular damage (17, 19). Penetrating eye trauma is usually from sharp objects and missiles, and it requires specialized treatment. Penetrating eye trauma in urban communities is commonly due to domestic, industrial and road accidents (17, 19). It is a common cause of preventable visual impairment (17, 19). In KNH, inpatient, admission due to ocular trauma from sticks was the commonest while blunt trauma was common in the outpatient department (22).

2.3 STUDY LOCATION

Korogocho slum is located in the North Eastern part of Nairobi neighboring Dandora, Kariobangi and Baba Ndogo estates. It covers an approximate area of 0.9 square kilometers (23). It has an estimated population of 43,800 people and a population density of 48,700 people per square kilometer with 14,650 households.

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Under the Provincial Administration Korogocho is in Kasarani constituency and in Korogocho division.

Korogocho has eight villages namely: -

- Gitathuru
- Korogocho A
- Korogocho B
- Highridge
- Grogan A
- Grogan B
- Ngomongo
- Kisumu Ndogo

Villages are mainly on ethnic groupings and are headed by a village elder elected by the people.

An area chief represents the Provincial Administration.

3. RATIONALE

Since more than half of Nairobi's population live in informal settlements, it is important to have an understanding of eye diseases in these settings. Most of the residents live below the poverty line (2, 3), and are not able to access even basic eye care services. The findings from this study shall give an insight to the magnitude and pattern of eye diseases in Korogocho. Korogocho slum is one of the major representatives of informal settlements in Nairobi as it has minimal formal infrastructure and majority of the residents are squatters. The residents can only have minimal developments on their plots because they do not have their title deeds. There is minimal government effort to provide decent housing for the urban poor such as the Mathare 4A project in Mathare slum. It is the third largest slum in Nairobi after Kibera and Mathare slums respectively.

The global initiative "Vision 2020: the right to sight" focuses on the elimination of avoidable blindness by the year 2020. Findings from this study will help to strategize the development of appropriate eye care services in the growing urban slums in keeping with the Kenya Ophthalmic Program.

Slum areas are hardship areas that are lacking appropriate health infrastructure including eye care services.

Little has been done in Kenya and the world in general to assess the level of eye disease in these communities. Generally, more emphasis is put on diseases with high morbidity and mortality such as HIV/AIDS, malaria, maternal and child health. However, with the Vision 2020 initiative, the great socioeconomic and emotional impacts of avoidable blindness and low vision have clearly been demonstrated.

4. OBJECTIVES

- i) To establish the magnitude of eye disease in Korogocho slum Nairobi.
- ii) To establish the pattern of eye disease in Korogocho slum Nairobi.
- iii) To establish the relationship of eye disease with selected social factors in Korogocho slum Nairobi.

5. METHODOLOGY

5.1 STUDY AREA

Korogocho slum Nairobi.

5.2 STUDY POPULATION

Residents of Korogocho slum Nairobi.

5.3 STUDY DESIGN

Descriptive community based study.

5.4 SAMPLE SIZE

$$n = \frac{t^2 \times p(1-p)}{m^2} \qquad \frac{1.96^2 \times 0.007(1-0.007)}{0.005^2}$$

n = Sample size = 1040

t = confidence level at 95% (1.96 standard level)

p = Estimated prevalence of blindness in Kenya

m = margin of error at 0.5% (0.005)

A total of 1136 people were included in the study.

5.5 SAMPLING METHOD

All the eight villages of Korogocho were included in the sample. All the patients who presented themselves for screening in a provisional eye clinic and were residents of Korogocho were included in the study.

5.6 INCLUSION CRITERIA

All the patients who were residents of Korogocho and they presented themselves for eye disease screening.

5.7 EXCLUSION CRITERIA

- i) All patients who were non-residents and presented themselves for eye screening were examined and treated but were excluded from the study.
- ii) All the residents of Korogocho who came for screening but refused to be registered and or examined were excluded from the study.

5.8 STUDY PERIOD

July 2002 to August 2002.

5.9 PROCEDURE

The principal investigator met ahead of the screening exercise with the area Chief and the village elders' representatives from all the eight villages to discuss the best method to screen for eye disease in Korogocho. A house-to-house visit was initially intended but was not possible due to the general high level of insecurity in Korogocho at that time despite involving the chief and the village elders. The investigator and the village elders visited all the villages and identified the sites for provisional eye clinics. The level of insecurity in Grogan B was too high and an alternative screening site was set up in a neighboring village where Grogan B residents were examined. Some of the sites identified included schools, social halls, churches, KANU office and a local health clinic.

Posters were prepared two weeks before the commencement of the screening to inform and invite the residents for the eye screening. The village elders continued to sensitize the residents about the importance and benefit of the screening. The residents were later informed about the dates and venues of the screening exercise through posters and by their village elders.

The support team from each village consisted of three village elders and three youths. This team assisted in the logistics, clerical and the security aspect of the screening exercise. My supervisors continued to provide the much-needed technical support. The youth that assisted in the registration were trained on how to fill the questionnaire and to take visual acuity in the adults.

Screening was done over a two-day period from 8.00 a.m. to 5.00 p.m. in each village having a total of sixteen days for the screening. All the patients who presented themselves for the screening were examined. During the screening exercise the subjects who were registered, were interviewed

using the provided questionnaire (Appendix I). All necessary information was entered into the questionnaire for further analysis.

During examination, the walk in visual acuity was tested using an illiterate E Snellen chart at six meters. Subjects who were unable to identify the largest test type had their vision tested at a distance of less than six meters by counting fingers. Subjects whose vision was less than counting fingers at one meter were tested for hand motions and perception of light. Subjects, whose vision could not be accurately assessed with a Snellen chart due to poor or unreliable communication especially the under fives , were tested with confrontation methods such as following a flash light; their visual acuity was indicated as not assessed since it could not be graded according to WHO criteria. Subjects suspected to have a refractive error had their vision tested with a pinhole and were referred for refraction to KNH eye clinic.

The visual acuity was graded as per the WHO classification (Appendix II). Near vision in all patients except the under fives was assessed using a near reading chart at thirty-three centimeters. Examination of the anterior segment was done using a torch and a magnifying +20 diopter loupe. The posterior pole was examined with a direct and indirect ophthalmoscope when the media was clear. The pupil was dilated with a mydriatic when a wide view of the fundus was needed. For practical reasons glaucoma was defined as typical optic disc atrophy and cupping more than 0.5 or with optic disc asymmetry more than 0.2 between the two eyes with typical atrophy and cupping. The intraocular pressures were measured using a schiøetz tonometer. The diagnosis of other ocular diseases was based on conventional history and clinical manifestations.

All patients who needed immediate medical attention were treated and those who needed further treatment and investigations were referred to KNH.

5.10 MATERIALS

a) Questionnaire (see Appendix 1)

b) Basic equipment:

- Torch and batteries
- Direct and indirect Heine ophthalmoscope
- +20 Diopter Volk loupe
- Fluorescence strips
- Snellen and near vision reading charts
- Pin hole
- Surgical spirit
- Spirit swabs
- Schioetz tonometer

c) Basic drugs:

- Amethocaine 0.5% topical eye drops
- Antibiotic eye drops
- Antiviral eye ointment
- Steroid eye drops
- Povidone iodine eye drops
- Combination of antibiotic and steroid eye drops

5.11 Evaluation of data.

Data capture and analysis was done using SPSS version 10.1 statistical package. The Pearson chi square test was used to check for statistical correlation.

5.12 Ethical considerations.

- i) Community consent was acquired from the village elders after carefully explaining the benefits of the eye screening to them.
- ii) Verbal consent was obtained from all subjects before they were screened after explaining about the study.
- iii) Patient's records were treated with confidentiality.
- iv) All patients who needed treatment were treated regardless of whether they fulfilled the inclusion criteria or not.
- v) Patients who needed further treatment or investigations were referred to KNH.
- vi) All ophthalmic drugs used had been registered in Kenya and were used as recommended.

6. STUDY LIMITATIONS.

- i) The originally planned house-to-house survey was not possible due to the high level of insecurity in the area. Interviews and clinical examinations of the study participants were done in central locations in each village as advised by the village elders.
- ii) Coverage of the survey may have been low because only those who thought they had eye problems subjected themselves for the screening.
- iii) Some elderly people might accept failing vision as a natural aging process and thus may not present themselves for screening for eye disease.
- iv) Some of the residents are suspicious about the benefit of screening exercises and thus may not present themselves to be examined.
- v) Glaucoma cases may have been underreported because we depended on a single examination with intraocular pressure and optic disc assessment. Visual fields could not be done to assist in the diagnosis.
- vi) Subtle ocular findings in the anterior segment may have been missed as only a torch and a +20 diopter loupe were used for purpose of screening.
- vii) The high level of insecurity may have prevented some patients from participating in the screening exercise.

7 RESULTS

TABLE 1: SAMPLED POPULATION FROM THE VILLAGES (n=1136)

RESIDENCE	FREQUENCY
NGOMONGO	210 (18%)
KOROGOCHO A	187 (16%)
GROGON A	186 (16%)
HIGH RIDGE	165 (15%)
KISUMU NDOGO	108 (10%)
GITATHURU	106 (9%)
KOROGOCHO B	97 (9%)
GROGON B	77 (7%)
TOTAL	1136 (100%)

Grogon B was the most insecure village and had the least number of patients screened.

Ngomongo and Kisumu Ndogo were the safest villages with Ngomongo having the most number of patients screened.

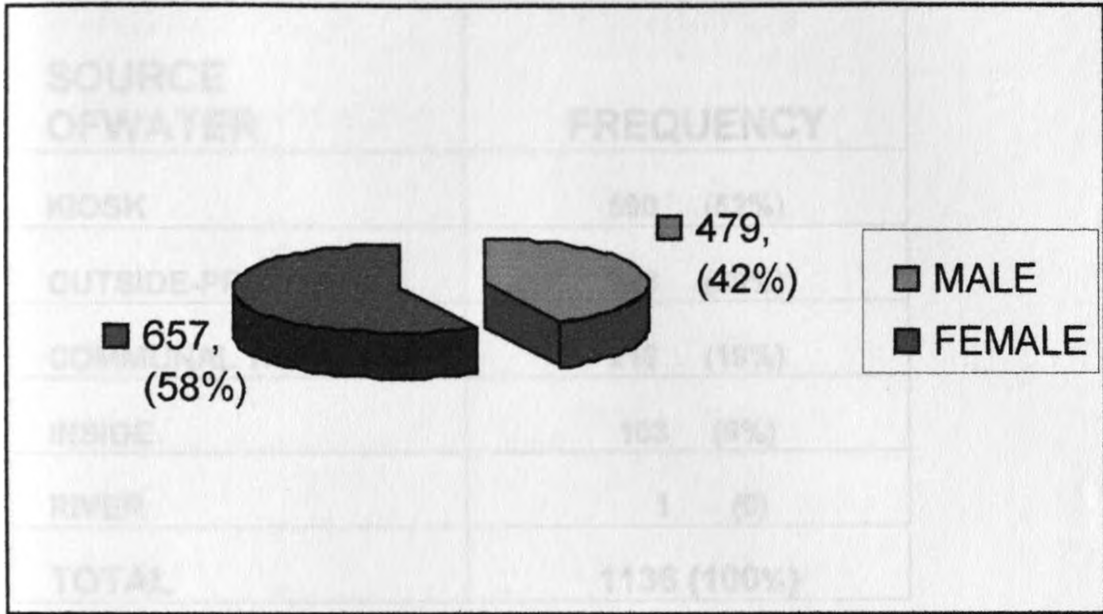
TABLE 2: AGE DISTRIBUTION OF THE POPULATION (n=1136).

AGE IN YEARS	FREQUENCY
0-5YRS	104 (9%)
>5-10YRS	86 (8%)
>10-20YRS	228 (20%)
>20-30YRS	200 (18%)
>30-40YRS	163 (14%)
>40-50YRS	128 (11%)
>50-60YRS	100 (9%)
>60-70YRS	63 (6%)
≥ 70YRS	58 (5%)
UNKNOWN	6 (1%)
TOTAL	1136 (100%)

The ages of six of the patients could not be established (indicated as unknown).

The mean age was 30 years, the median was 26 years and the mode was 13 years.

FIGURE 1: SEX DISTRIBUTION (n=1136)



The male to female ratio was 1: 1.4 respectively.

TABLE 3: TYPE OF HOUSING (n=1136)

TYPE OF HOUSE	FREQUENCY
MUD	607 (53%)
STONE	277 (24%)
CORRUGATED IRON	192 (17%)
OTHERS	28 (2%)
TOTAL	1136 (100%)

More than 50% of the residents screened resided in mud houses. The "others" included carton, polythene paper houses and plastered mud houses.

TABLE 4: SOURCE OF WATER (n=1136)

SOURCE OF WATER	FREQUENCY
KIOSK	590 (52%)
OUTSIDE-PRIVATE	228 (20%)
COMMUNAL TAP	216 (19%)
INSIDE	103 (9%)
RIVER	1 (0)
TOTAL	1136 (100%)

More than 50% of the residents got their water from water vending kiosks in the villages. These had clean piped water from the City Council.

TABLE 5: SANITARY FACILITIES (n = 1136)

PRESENCE OF TOILET	FREQUENCY
COMMUNAL	435 (38%)
OUTSIDE-PRIVATE	362 (35%)
INSIDE	260 (23%)
OTHERS	49 (4%)
NONE	1 (0)
TOTAL	1136 (100%)

Thirty-eight percent of the residents used communal toilets. Pit latrines were the most common type of toilets used. One person said he did not have any toilet facility.

TABLE 6: HOUSEHOLD SIZE (n=1136).

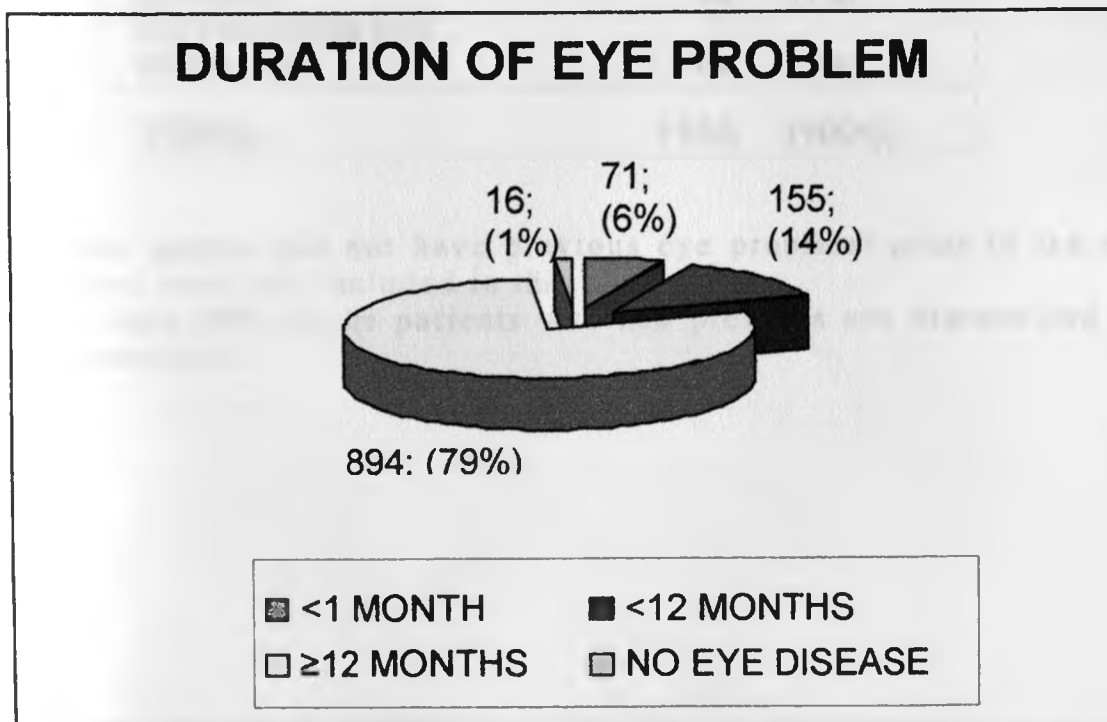
HOUSEHOLD SIZE (No. of residents)	FREQUENCY	
1-2	196	(17%)
3-4	369	(33%)
5-6	295	(26%)
7-8	168	(15%)
≥9	108	(10%)
TOTAL	1136	(100%)

Most of the households had between 3 to 6 people per household. The mode was 3-4 people per family.

TABLE 7: DURATION OF EYE PROBLEM (n=1136)

DURATION	FREQUENCY
<1 MONTH	71 (6%)
<12 MONTHS	155 (14%)
≥ 12 MONTHS	894 (79%)
NO PREVIOUS EYE DISEASE	6 (1%)
TOTAL	1136 (100%)

FIGURE 2



Sixteen (1%) people said they did not have previous eye problem prior to the screening.

Eight hundred and ninety four (79%) of the people said they had eye problem for more than twelve months prior to the eye screening.

TABLE 8: WHERE PATIENTS WENT FOR TREATMENT (n=1136)

TREATMENT	FREQUENCY
NOT SOUGHT TREATMENT	613 (55%)
TRADITIONAL/ HERBAL MEDICINE	8 (1%)
PRIVATE CLINIC	102 (9%)
MISSION/NGO CLINIC	128 (11%)
GOK/ CITY COUNCIL CLINIC	107 (9%)
HOSPITAL	89 (8%)
FREE MEDICAL CLINIC	59 (5%)
OTHERS	14 (1%)
NO PREVIOUS EYE PROBLEM	16 (1%)
TOTAL	1136 (100%)

Sixteen people did not have previous eye problems prior to the screening and they were not included in this analysis.

More than 50% Of the patients who had previous eye disease had not gone for treatment.

TABLE 9: VISUAL ACUITY OF THE BETTER EYE (n= 1136)

VISUAL ACUITY	FREQUENCY
>6/18	925 (81%)
<6/18->6/60	58 (5%)
<6/60->3/60	20 (2%)
<3/60	8 (1%)
NOT ASSESSABLE	125 (11%)
TOTAL	1136 (100%)

104 children under five years did not have their snellen visual acuity assessed. 21 adults had unreliable visual acuity that could not be accurately assessed. Both these groups were recorded as not assessable.

TABLE 10: TYPE OF EYE DISEASES (n=1136)

DIAGNOSIS	FREQUENCY
NORMAL	442 (39%)
CATARACT	42 (4%)
REFRACTIVE ERROR	288 (25%)
ALLERGIC CONJUNCTIVITIS	230 (20%)
PURULENT CONJUNCTIVITIS	31 (3%)
OTHERS (SEE TABLE 11)	103 (9%)
TOTAL	1136 (100%)

Allergic conjunctivitis and refractive error were the leading causes of eye morbidity.

TABLE 11: "OTHER" DIAGNOSIS (n=103)

DIAGNOSIS	FREQUENCY
CONJUCTIVAL DISEASE	24 (23%)
CORNEAL DISEASE	19 (18%)
EYELID AND ADNEXA	17 (16%)
LENTICULAR DISEASE	12 (12%)
RETINAL DISEASE	10 (10%)
UVEAL TRACT DISEASES	8 (8%)
GLAUCOMA	5 (5%)
TRAUMA	5 (5%)
SIXTH NERVE PALSY	2 (2%)
ENUCLEATED	1 (1%)
TOTAL	103 (100%)

Conjunctival diseases such as pterygium and pinguecula were the most common in the category of "other". See (Appendix IV) for the breakdown of the diseases.

TABLE 12: EYES WITH MULTIPLE DIAGNOSIS (n=109)

DIAGNOSIS	TOTAL
REFRACTIVE ERROR AND ALLERGIC CONJUNCTIVITIS	61 (55%)
REFRACTIVE ERROR AND CORNEAL SCAR	2 (2%)
ALLERGIC CONJUNCTIVITIS AND CORNEAL SCAR	3 (3%)
CATARACT AND REFRACTIVE ERROR	8 (7%)
CATARACT AND ALLERGIC CONJUNCTIVITIS	6 (6%)
CATARACT AND SQUINT	4 (4%)
REFRACTIVE ERROR AND PTERYGIUM	18 (16%)
REFRACTIVE ERROR AND PSEUDOAPHAKIA	3 (3%)
CORNEAL SCAR AND EXOTROPIA	1 (1%)
RETINAL DISEASE AND SQUINT	1 (1%)
GLAUCOMA AND PSEUDOAPHAKIA	1 (1%)
REFRACTIVE ERROR AND HORDOLEUM EXTERNUM	1 (1%)
TOTAL	109 (100%)

Refractive error and allergic conjunctivitis was the most common combined diagnosis.

TABLE 13: EYE DISEASE AND LATERALLITY (N=2272)

DIAGNOSIS	RIGHT EYE	LEFT EYE
	FREQUENCY	FREQUENCY
NORMAL	464 (41%)	442 (39%)
ALLERGIC CONJUNCTIVITIS	229 (20%)	230 (20%)
REFRACTIVE ERROR	277 (24%)	288 (25%)
OTHER MINOR DIAGNOSIS	92 (8%)	103 (9%)
CATARACT	42 (4%)	42 (4%)
PURULENT CONJUNCTIVITIS	32 (3%)	31 (3%)
TOTAL	1136 (100%)	1136 (100%)

The pattern of eye disease was similar for the right and left eye.

TABLE 14: CAUSES OF SEVERE VISUAL IMPAIRMENT AND BLINDNESS (n=28)

DIAGNOSIS	VISUAL ACUITY		TOTAL
	<6/60- >3/60	<3/60	
CATARACT	6 (30%)	4 (50%)	10 (36%)
REFRACTIVE ERROR	1 (5%)	2 (25%)	3 (11%)
RETINAL DISEASE	2 (10%)	1 (12.5%)	3 (11%)
APHAKIA	3 (15%)	0	3 (11%)
GLAUCOMA	2 (10%)	0	2 (7%)
TRACHOMA	1 (5%)	0	1 (3%)
KERATOCONUS	2 (10%)	0	2 (7%)
CORNEAL SCAR	2 (10%)	0	2 (7%)
UNEXPLAINED	1 (5%)	1 (12.5%)	2 (7%)
TOTAL	20 (100%)	8 (100%)	28 (100%)

Cataract was the leading cause of severe visual impairment and blindness. Poor visual acuity could not be explained in two patients and they were referred to KNH eye clinic for further evaluation.

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TABLE 15: DIAGNOSIS AND AGE (n=1136)

AGE IN YEARS	DIAGNOSIS						TOTAL
	NORMAL	CATARACT	OTHER	REFRACTIVE ERRORS	ALLERGIC CONJ	PURULENT CONJ	
0-5YRS	41	0	14	0	26	23	104
>5-10YRS	33	1	4	9	36	3	86
>10-20YRS	133	0	11	35	48	0	228
>20-30YRS	103	1	19	22	52	3	200
>30-40YRS	66	2	13	41	40	1	163
>40-50YRS	32	5	7	76	9	0	128
>50-60YRS	13	7	7	59	14	0	100
>60-70YRS	12	5	15	27	4	0	63
>70 YRS	6	19	13	18	1	1	58
NOT KNOWN	0	0	0	0	0	0	6
TOTAL	439	40	103	287	230	31	1136

Six patients did not know their age (indicated as not known). The frequency of cataract was increasing with age and the P value of < 0.05 was statistically significant.

TABLE 16: DIAGNOSIS IN RELATION TO HOUSEHOLD SIZE (n=1136)

DIAGNOSIS	HOUSEHOLD SIZE					TOTAL
	1-2	3-4	5-6	7-8	≥9	
NORMAL	61 (31%)	138 (37%)	132 (45%)	74 (44%)	36 (33%)	441
REFRACTIVE ERROR	66 (34%)	76 (21%)	74 (25%)	42 (25%)	30 (28%)	288
ALLERGIC CONJUNCTIVITIS	30 (15%)	97 (26%)	56 (19%)	28 (17%)	19 (18%)	230
OTHER	21 (11%)	29 (8%)	22 (7%)	16 (10%)	15 (14%)	103
CATARACT	13 (7%)	12 (3%)	5 (2%)	5 (3%)	7 (6%)	42
PURULENT CONJUNCTIVITIS	5 (3%)	17 (5%)	5 (2%)	3 (2%)	1 (1%)	31
NOT KNOWN	0	0	0	0	0	2
TOTAL	196(100%)	369(100%)	294(100%)	168(100%)	108(100%)	1136

Refractive error was highest in the 1-2 household size, while allergic and purulent conjunctivitis was highest in the 3-4 household size. P value was <0.05 and was statistically significant. Two people did not provide data on household size (indicated as not known)

TABLE 17: DIAGNOSIS AND TYPE OF HOUSING (n=1136)

DIAGNOSIS	TYPE OF HOUSE WALLS					TOTAL
	STONE	TIMBER	CORRUGATED IRON	MUD	OTHERS	
NORMAL	134 (48%)	8 (25%)	80 (42%)	207 (34%)	13 (46%)	442
CATARACT	3 (1%)	1 (3%)	5 (3%)	33 (5%)	0	42
OTHERS	23 (8%)	7 (22%)	14 (7%)	54 (9%)	4 (14%)	102
REFRACTIVE ERRORS	56(20%)	8 (25%)	48 (25%)	171 (28%)	5 (18%)	288
ALLERGIC CONJUNCTIVITIS	51(18%)	8 (25%)	40 (21%)	126 (21%)	5 (18%)	230
PURULENT CONJUNCTIVITIS	10 (4%)	0	5 (3%)	15 (2%)	1 (4%)	31
UNKNOWN	0	0	0	0	0-	1
TOTAL	277 (100%)	32 (100%)	192 (100%)	606 (100%)	28 (100%)	1136

55% of the patients with allergic conjunctivitis and 48% with purulent conjunctivitis lived in mud houses. For one person the household size was not shown (indicated as unknown).

TABLE 18: SOURCE OF WATER AND CLINICAL DIAGNOSIS (n=1136)

DIAGNOSIS	SOURCE OF WATER					TOTAL
	INSIDE	OUTSIDE-PRIVATE	COMMUNAL TAP	KIOSK	RIVER	
NORMAL	48 (47%)	96 (42%)	92 (43%)	206 (35%)	0	442
CATARACT	4 (4%)	13 (6%)	10 (5%)	15 (3%)	0	42
OTHERS	6 (6%)	26 (11%)	21 (10%)	49 (8%)	0	102
REFRACTIVE ERROR	23 (23%)	47 (20%)	59 (27%)	158 (25%)	0	194
ALLERGIC CONJUNCTIVITIS	20 (19%)	42 (18%)	31 (14%)	136 (23%)	1(100%)	230
PURULENT CONJUNCTIVITIS	2 (2%)	4 (2%)	3 (1%)	22 (4%)	0-	31
NOT KNOWN	0	0-	0	0-	0	2
TOTAL	103 (100%)	228 (100%)	216 (100%)	586 (100%)	1 (100%)	1136

Majority (71%) of the patients who had purulent conjunctivitis got their water from water vending kiosks. Two patients did not indicate their water source (indicated as unknown)

TABLE 19: TYPE OF TOILET AND CLINICAL DIAGNOSIS (n= 1136)

TOILET LOCATION	DIAGNOSIS						TOTAL
	NORMAL	CATARACT	OTHER	REFRACTIVE ERROR	ALLERGIC CONJUNCTIVITIS	PURULENT CONJUNCTIVITIS	
NONE	0	0	1 (1%)	0	0	0	1
INSIDE	113 (26%)	14 (33%)	23 (23%)	55 (19%)	51 (22%)	4 (13%)	260
OUTSIDE-PRIVATE	161 (36%)	18 (43%)	44 (43%)	96 (33%)	63 (27%)	9 (29%)	391
COMMUNAL	151 (34%)	9 (21%)	30 (29%)	118 (41%)	112 (49%)	15 (48%)	435
OTHERS	17 (4%)	1 (2%)	4 (4%)	19 (7%)	4 (2%)	3 (10%)	48
NOT KNOWN	0	0	0	0	0	0	1
TOTAL	442 (100%)	42 (100%)	102 (100%)	288 (100%)	230 (100%)	31 (100%)	1136

People who used communal toilets constituted the majority of patients with purulent conjunctivitis. One person did not provide data (indicated as not known).

8. DISSCUSION

One thousand one hundred and thirty six (1136) study subjects were eligible for the study. Two thousand, two hundred and seventy one (2271) eyes were examined due the fact that one of the subjects was single eyed.

All the eight villages in Korogocho were included in the survey. Grogon B had the least number of the sampled participants (7%) as it had the least residential population and the highest level of insecurity. Ngomongo had the highest number of sampled study participants (Table 1).

The age distribution range of the study subjects was two weeks to one hundred years. The mean age was thirty years (30yrs), median was twenty-six years (26yrs) and the mode was thirteen years (13yrs) (Table 2).

The sex distribution was 58% females and 42% males with a sex ratio of 1.4: 1. Most men went to work early in the morning and came late in the evening and this explains the higher number of females screened (Fig 1).

Most of the study subjects resided in mud houses (53%). Majority of the residents in Korogocho are squatters and thus cannot put up permanent stone residential houses due lack of proper Title deeds.

Water vending kiosks were the commonest source of water used by the residents (52%); they provided piped water from the Nairobi City Council. A local Non Governmental Organization set up most of the water vending kiosks in the villages (Table 4).

Majority of the study subjects used communal toilets (38%) most of which were pit latrines

Majority of the households had three to four residents (33%). The mean and median was five people while the mode was four (Table 6).

More than 95% of the study subjects reported to have eye symptoms prior to the screening, 79% of them had eye symptoms for longer than twelve months (Table 7, Fig 2). Majority of the study subjects had not sought treatment for their eye illnesses (55%). Some of the reasons they gave, were that they did not have enough financial means to go to hospital, and they did not think that the illness was serious enough to warrant medical intervention or that they were waiting for a free medical eye camp (Table 8).

Most of the study subjects examined (81%) had a walk-in visual acuity of more than 6/18 in the better eye (normal vision according to WHO classification of visual acuity), 5% were visually impaired, 2% were severely visually impaired and 1% were blind (Table 9).

Majority of the patients examined had abnormal ocular findings at the time of screening (61%). Refractive error (25%) and allergic conjunctivitis (20%) were the leading cause of eye disease among the study subjects (Table 10). The "other" disease category included diseases that had low frequencies and could not be statistically analyzed individually (9%). Conjunctival diseases included pterygium, pinguecula, nevus and conjunctival growths that appeared malignant on inspection. Corneal diseases included corneal scars, corneal ulcers and keratoconus. Eyelid and adnexal diseases included blepharitis, chalazia, styes and preseptal cellulites. Lenticular diseases included ectopia lentis, aphakia and pseudoaphakia. Retinal diseases included retinal dystrophies, maculopathies, retinal scars and vasculitis. Uveal tract diseases included uveitis and iris coloboma. Eyes that had blunt or penetrating injuries were grouped under trauma (Table 11).

Cataract was the leading cause of both blindness (50%) and severe visual impairment (30%) respectively. Uncorrected refractive error accounted for 25% of the causes of blindness, while postoperative aphakia was responsible for 10% of severe visual impairment (Table 14).

The frequency of cataract increased progressively with advancing age. This accounted for 50% of the causes of eye pathology in the elderly population above seventy years. Majority of the study subjects with cataract had senile cataracts, which compared well with the general population (12). The P value of <0.05 was statistically significant (Table 14).

Refractive error was present across all the age groups and was commonest in the forty to fifty year age group. Presbyopia was the most common eye disease in this age group.

Allergic conjunctivitis was common across all the age groups with most of the study subjects aged less than forty years. The high level of allergens such as dust in these overcrowded areas may contribute to the high level of allergic conjunctivitis in the sampled population.

Most of the study subjects with purulent conjunctivitis were in the under five year's age group (23). This may be due to low levels of hygiene in this age group. Children are exposed to raw sewage that flows around their houses as they play and thus collect pathogens that may cause purulent conjunctivitis. Most of the residents buy water for domestic use and normally have to use it sparingly and will thus not waste it on cleaning the hands and faces of the children as frequently as they should (Table 15).

Refractive error had almost an even distribution across the different household sizes (Table 16). Cataract was commonest in the 1-2 (7%) and ≥ 9 (6%) household sizes respectively. The highest proportion of cataract in the

1-2 household size may be due to old people blind from cataract being left alone (Table 16). Purulent conjunctivitis had an even distribution across all household sizes (Table 16). The P value < 0.05 was statistically significant in relating eye disease and household size.

For other selected social factors such as source of water, type of toilet, and type of housing, no correlation with eye disease could be demonstrated (Table 17, 18 and 19).

9. CONCLUSION

The majority of the residents of Korogocho had abnormal ocular findings at time of the survey (61%). Refractive error (25%) and allergic conjunctivitis (20%) were the main cause of eye morbidity in this survey. Cataract was the leading cause of blindness and severe visual impairment in Korogocho. This is a treatable cause of blindness and cataract surgical services can reduce the magnitude of blindness in Korogocho

10. RECOMMENDATIONS

i) This study demonstrates that the magnitude of eye disease in Korogocho slums is high. Sixty one percent of the subjects examined had abnormal eye findings during the screening. Refractive error and allergic conjunctivitis were the most common eye diseases and intervention programs that target them will significantly reduce eye morbidity in Korogocho.

ii) Cataract was the leading cause of blindness and low vision and provision of cataract surgical services will address this problem.

iii) Refractive services be provided to the residents of Korogocho as demonstrated by the high number of study subjects with refractive error, in need for refraction and glasses.

iv) Integration of primary eye care services into the existing primary health care facilities would help to provide affordable eye care to the residents. The development of appropriate referral system to the area hospitals would allow complicated cases to be adequately managed. Mobile eye services to these areas may reduce the cost of delivering these services.

v) The improvement of the existing general infrastructure and development of better sanitation facilities would reduce some of the community eye diseases such as purulent conjunctivitis.

Summary of recommendations

- i) Programs targeting refractive errors will significantly improve eye health in Korogocho.
- ii) Screening and surgical services for cataract should be provided.
- iii) Provision of integrated primary eye care services and appropriate referral system in Korogocho is recommended.
- iv) Promotion of sanitation facilities in the community and improvement of the infrastructure is required.

Appendix I Questionnaire

A. PERSONAL DETAILS

1. Name _____
2. Age (Years) _____
3. Sex _____
4. Residence _____
5. Date of interview _____
6. Number of people per household _____
7. Duration of stay in household _____

B) HOUSING/SANITATION

1. Type of house walls (Tick one)
 - a) Stone
 - b) Timber
 - c) Corrugated iron
 - d) Mud
 - e) Others (specify)
2. Source of water. (Tick one)
 - a) Inside home
 - b) Outside house and private
 - c) Communal tap
 - d) Others (specify)

3. Presence and location of toilets. (Tick one)

- a) Inside home
- b) Outside house and private.
- c) Communal
- d) Others (specify)

C) OPHTHALMIC HISTORY

Tick appropriately

1. Do you have an eye problem? Yes No

If yes, go to number 2

If no, go to number 4

2. How long have you had the eye problem

Days

Months

Years

3. Where did you seek treatment for the eye problem?

- a) Traditional/herbal medicine
- b) Private clinic
- c) Missionary/NGO clinic
- d) Government/City council clinic
- e) Hospital
- f) Free medical camp
- g) Others (specify)

4. Have you ever had or been told you have an eye problem?

Yes go to No. 5

No Leave alone

5. Where did you seek treatment?

- a) Traditional/herbal medicine
- b) Private clinic
- c) Missionary/NGO clinic
- d) Government/City council clinic
- e) Hospital
- f) Free medical camp
- g) Others (specify)

EXAMINATION SHEET

A) EXAMINATION TABLE

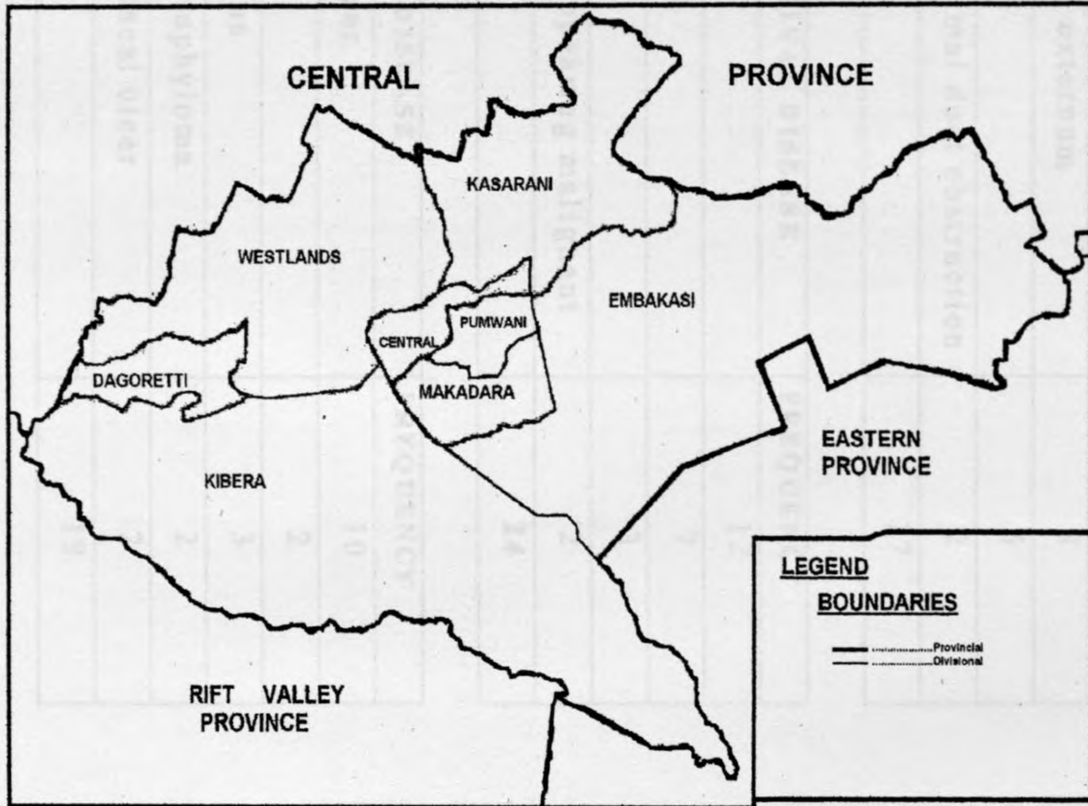
	RE	LE
Visual acuity		
VA with PH		
Lids		
Conjunctiva		
Cornea		
Anterior Chamber		
Pupil		
Lens		
Vitreous		
Fundus		
IOP		

B) WORKING DIAGNOSIS

1. Normal
2. Cataract
3. Glaucoma
4. Trachoma
5. Refractive error
6. Allergic conjunctivitis
7. Purulent conjunctivitis
8. Corneal scar
9. Injury
10. Neoplasm
11. Retinal disease
12. Strabismus
13. Active corneal ulcer
14. Xerophthalmia
15. Others specify

Appendix II: WHO grading of visual Acuity

- 1) Grade 1: -Visual acuity equal or greater than 6/18 (normal vision)
- 2) Grade 2: -Visual acuity less than 6/18 but more or equal to 6/60.(visually impaired)
- 3) Grade 3: -Visual acuity less than 6/60 but more than 3/60.(severe visually impaired)
- 4) Grade 4: -Visual acuity equal to or less than 3/60. (economically and socially blind)



Appendix IV: CATEGORIES OF "OTHER" DISEASE

EYELID AND ADNEXA DISEASE	FREQUENCY
Chalazia	2
Hordoleum externum	8
Blepharitis	5
Nasal-lacrimal duct obstruction	2
TOTAL	17

CONJUNCTIVAL DISEASE	FREQUENCY
Pterygium	12
Pinguecula	7
Nevus	3
Growths appearing malignant	2
TOTAL	24

CORNEAL DISEASE	FREQUENCY
Corneal Scar	10
Trachoma	2
Keratoconus	3
Anterior staphyloma	2
Active corneal ulcer	2
TOTAL	19

UVEAL TRACT DISEASE	FREQUENCY
Uveitis	4
Iris atrophy	1
Iris coloboma	2
Iris nevus	1
TOTAL	8

LENTICULAR DISEASE	FREQUENCY
Aphakia	5
Pseudoaphakia	5
Subluxated lens	2
TOTAL	12

RETINAL DISEASE	FREQUENCY
Retinitis Pigmentosa	1
CMV retinitis	2
Diabetic retinopathy	1
Vasculitis	1
Optic disc coloboma	1
Optic neuritis	2
Optic atrophy	2
TOTAL	10

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