CHARACTERISTICS OF LOW VISION PATIENTS PRESENTING AT KWALE DISTRICT EYE CENTRE AND FRIENDS' CHURCH SABATIA EYE HOSPITAL

A DISSERTATION SUBMITTED IN PART FULFILLMENT FOR THE DEGREE OF MASTER OF MEDICINE IN OPHTHALMOLOGY, UNIVERSITY OF NAIROBI

By

Dr Ndiritu Judy

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DECLARATION

This dissertation is my original work and has not been presented for a degree in any other university.

Signed _____ Date 09/9/2011

Dr Ndiritu Judy

APPROVAL

THE DISSERTATION HAS BEEN SUBMITTED IN PART FULFILLMENT

OF

THE DEGREE OF MASTER OF MEDICINE (OPHTHALMOLOGY) WITH OUR APPROVAL AS UNIVERSITY SUPERVISORS:

Dr Sheila Marco

MB ChB (Nairobi), MMed Ophthalmology (Nairobi), FEACO

Lecturer, Department of Ophthalmology,

University of Nairobi.

Signed: .....

Date: 10/9/2011

Dr Margaret W. Njuguna

MB ChB (Nairobi), MMed Ophthalmology (Nairobi), Fell. Paed. Ophthal (LVPEI – India), FEACO

Lecturer, Department of Ophthalmology,

University of Nairobi.

Signed: .....

Date: 9/9/2011

DEDICATION

TO

Nicole, the light of my life.

My mum, my rock.

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

List of Tables

List of Figures

LIST OF ABBREVIATIONS

BCVA	Best Corrected Visual Acuity
CBM	Christoffel Blindenmission
WHO	World Health Organization
VA	Visual Acuity
GOK	Government of Kenya
LVA	Low Vision Aid
LV	Low Vision
KDEC	Kwale District Eye Centre
SEH	Sabatia Eye Hospital
FLV	Functional Low Vision
ICD-10	International Statistical Classification of Diseases and Health Related Problems, 10^{th} Revision
KEU	Kikuyu Eye Unit
KNH	Kenyatta National Hospital
PL	Perception of light
SSI	Sight Savers International
VA	Visual Acuity
ROP	Retinopathy of Prematurity
VF	Visual Field
FLV	Functional Low Vision
NGO	Non-Governmental Organization

ABSTRACT

Background

In most developing countries, it has been shown that causes of low vision are mostly avoidable with timely diagnosis and appropriate management.

Data on the causes of functional low vision in patients seen at the low vision clinics of Friends' Church Sabatia Eye Hospital and Kwale District Eye Centre is lacking but is important for planning low vision services.

Objectives

The aim of the study was to describe characteristics of patients presenting at the Low Vision Clinic of Kwale District Eye Centre and Friends' Church Sabatia Eye Hospital and to assess the type of Low Vision Aid given to each patient found to have low vision.

Study Design

Retrospective Case Series

Study Setting

Friends' Church Sabatia Eye Hospital Low Vision Clinic, Sabatia District in Western Province.

Kwale District Eye Centre Low Vision Clinic, Kwale District in Coast Province.

Study Subjects

All records of new patients seen Sabatia Eye Hospital Low Vision Clinic from 1st Jan 2007 to 31st Jan 2011, and found to have low vision as per the low vision case definition, were scrutinized.

All records of new patients seen at Kwale District Eye Centre Low Vision Clinic from 1st Jan 2003 to 31st Jan 2011, and found to have low vision as per the low vision case definition, were scrutinized.

Materials and Methods

Low vision assessment sheets of patients were scrutinized and data of eligible patients collected on a structured questionnaire and entered into a database.

Analysis done using the Statistical Package for Social Scientists (SPSS) version 17.0. A significance level of 95% was used.

Results

A total of 382 patient records were reviewed – 237 in SEH and 145 in KDEC Low vision clinics. Overall Male to Female ratio was 1.6:1. Mean age of presentation overall was 23.4 years.

Maculopathy was the main cause of low vision in adults and oculocutaneous albinism in children. Lens disorders were the second most common cause of low vision in children; while in adults it was optic nerve disorders.

Potentially avoidable causes of low vision were 43.6% in adults and 60.2% in children. Associated disabilities were found in only a small minority of patients (2.9%). The most frequently prescribed LV device for distance for children was the x2 telescope, while for adults it was the x4 telescope. The most commonly prescribed LV device for near for children was the x2 dome magnifier while for adults it was the +8D spectacle magnifier. For both adults and children, the most frequently prescribed Non-Optical Aid was reduced working distance.

Conclusions

More males than females were seen at the low vision clinics, majority of whom were adults. Retinal diseases were the leading cause of low vision in both children and adults. Most of the causes of low vision in children were potentially avoidable (60.2%). Adults were more likely to benefit from near optical aids. Most of the patients were in category 3 and 4 of low vision, and therefore likely to benefit from low vision devices.

INTRODUCTION

The development of the World Health Organization Global Database on Blindness and Visual Impairment[1] provided the first reliable estimates of the global burden of blindness and visual impairment and served as baseline data for the World Bank's World development report 1993[2]. The findings were disturbing - an estimated 38 million persons blind and 110 million visually impaired (based on the 1990 world population). Subsequent extrapolation of these data to the 1996 world population led to an upward revision to 45 million blind and 135 million visually impaired.

According to new preliminary data released by the World Health Organization (WHO)[3], world-wide, 325 million people are visually impaired or blind:

- 285.3 million people are visually impaired
- 39.8 million people are blind

Up to 80% of blindness and up to 85% of moderate or severe visual impairment is avoidable.

Ageing populations and changes in lifestyle could considerably increase the magnitude of visual impairment due to chronic conditions such as diabetic retinopathy, glaucoma and age-related macular degeneration, unless appropriate eye care services are provided

For low vision, the following two definitions are in use:

• (WHO[1]) Low vision is visual acuity less than 6/18 (20/60) and equal to or better than 3/60 (20/400) in the better eye with best correction (Appendix 1).

• **(Low Vision Services or Care[4]) a person with low vision is one who has impairment of visual functioning even after treatment and/or standard refractive correction, and has a visual acuity of less than 6/18 to light perception, or a visual field less than 10 degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task for which vision is essential.**

The second definition, which is used by the Low Vision Service Providers, has been adopted for this study.

MAGNITUDE

According to the most recent data available to WHO[4], there are an estimated 124 million people in the world with low vision. About a fourth of these would benefit from low vision services.

VISION 2020 role

Launched in early 1999 in Geneva by WHO's Director-General, VISION 2020[3] — The Right to Sight - a collaborative effort between WHO and a number of partners has as its goal, the elimination of avoidable blindness by the year 2020. While adopting the basic strategy of providing comprehensive eye care as an integral part of the primary health care system, "VISION 2020" includes three major components as target activities: specific disease control, human resource development, and infrastructure and appropriate technology development. In the first five-year phase, disease control efforts focused largely on cataract, trachoma, onchocerciasis, avoidable causes of childhood blindness, uncorrected refractive error, and low vision.

VISION 2020 partners develop models to provide affordable optical correction and low vision aids to persons in need worldwide, specifically those from poor urban and rural areas with limited available services. The availability of these services helps ensure a better future for visually impaired children and adults. Appropriate correction prevents the development of childhood amblyopia and enables better performance at school. Children with low vision can be integrated into regular schools rather than having to be taught in special schools for the blind. In adults, appropriate optical correction facilitates accomplishment of job tasks and development of knowledge and skills.

As VISION 2020 enters its second 5-year phase, the provision of low-vision services and their integration into national eye care programs is a priority. In Kenya, planning must take account of the causes and magnitude along with the demographic and educational characteristics of those affected.

According to the National Strategic Plan for Eye Care in Kenya[5] (2005-2010) developed by the Division of Ophthalmic Services, eye diseases are ranked eighth among the top ten causes of morbidity in Kenya. It is estimated that there are close to 672,000 people suffering from low vision, most of it being preventable.

The efforts to fight blindness and low vision are coordinated by the Division of Ophthalmic Services within the Ministry of Public Health. The Division coordinates a whole range of eye care services provided by the GOK, NGOs, Private and Faith Based Hospitals.

One of the specific objectives of the National Strategic Plan is to enhance strategies for rehabilitation and integration of the visually impaired, to establish the magnitude and enhance systems of monitoring the pattern of blindness and low vision in Kenya.

The plan focuses on refractive errors, low vision, trauma, diabetic retinopathy, corneal scars, and ocular complications of HIV/AIDS as other important causes of ocular morbidity.

During this plan period, the aim will be to improve functional vision by intensifying provision of Low Vision services.

Here in Kenya, the Kenya Institute for Special Education trains special education teachers, Kenya Society for the Blind trains eye care workers and rehabilitation workers. Low Vision Services are provided at Kikuyu Eye Unit, Sabatia Eye Hospital and Kwale District Eye Centre, while Low Vision Service Providers are trained by the government.

LITERATURE REVIEW

PREVALENCE AND CAUSES OF LOW VISION

Little attention has been given in literature to low vision and its characteristics. Studies done on the topic begin with the intention of studying low vision, and end up studying visual impairment. One of the main causes of this confusion is the WHO definition of low vision - Appendix 1 (which ignores persons with category 3 of visual impairment who can lead a functional life with the right assessment and appropriate assistance) vis-à-vis the clinical modification - Appendix 2 - used by most low vision service providers (which includes and caters to this category as Profound Low Vision).

SA Khan[6] conducted a retrospective study of low-vision cases in Deshpande Centre for Sight Enhancement, L.V. Prasad Eye Institute, India. On reviewing the records of 410 patients, he found the main causes of low vision among adults, in descending order of frequency, were: retinal diseases, glaucoma, corneal scarring and opacification, optic atrophy and amblyopia. In children, the main causes were found to be optic atrophy, maculopathy, amblyopia and keratoconus.

In a study done by Shah and Minto et al[7] as part of the Pakistan National Blindness and Visual Impairment Survey[7], a nationally representative sample of 16507 adults was selected to establish prevalence and causes of functional low vision. The standardized prevalence of functional low vision was found to be 1.7% (95%CI, 1.5%-1.9%). Retinal conditions were the commonest cause in urban populations (39.8% versus 26.5% rural) compared with corneal opacity in rural areas (38.0% versus 25.5% urban).

Dandona et al[8] assessed the prevalence and causes of low vision in a representative population in Andhra Pradesh, Southern India for planning low vision services. Their definition of low vision was in keeping with the clinical modification of the WHO definition of low vision and, in a total of 10,293 persons of all ages, they found the prevalence of low vision to be 1.05% (95% CI, 0.82%-1.28%). The most frequent causes of low vision included retinal diseases, amblyopia, optic atrophy, glaucoma and corneal diseases.

Standardized Population Surveys in Asia, Africa, and Latin America covering six countries (India [2 locations]; China [2 locations]; Malaysia, Chile, Nepal, and South Africa) were conducted by Gilbert and Ellwein et al[9] to establish Prevalence and Causes of Functional Low Vision (FLV) in School-Age Children. The prevalence of FLV ranged from 0.65 to 2.75 in 1000 children, with wide confidence intervals. The overall prevalence was 1.52 in 1000 children (95%CI, 1.16-1.95). Retinal lesions and amblyopia were found to be the commonest causes.

Gothwal and Herse[10] conducted a cross sectional survey of consecutive records of 220 children presenting at a newly opened pediatric low vision center in a private eye hospital in Hyderabad. The four major causes of visual impairment were hereditary/genetic conditions mainly congenital glaucoma, hereditary macular degeneration, retinitis pigmentosa and albinism.

De Carvalho[11] et al conducted a study of the causes of low vision, the types of low vision aids prescribed and the follow up of their use in children younger than 14 years attended by the Low Vision Services of the State University of Campinas, Brazil. Congenital bilateral toxoplasma macular scars, optic atrophy, and residual amblyopia secondary to congenital cataracts were the major causes of low vision in this population.

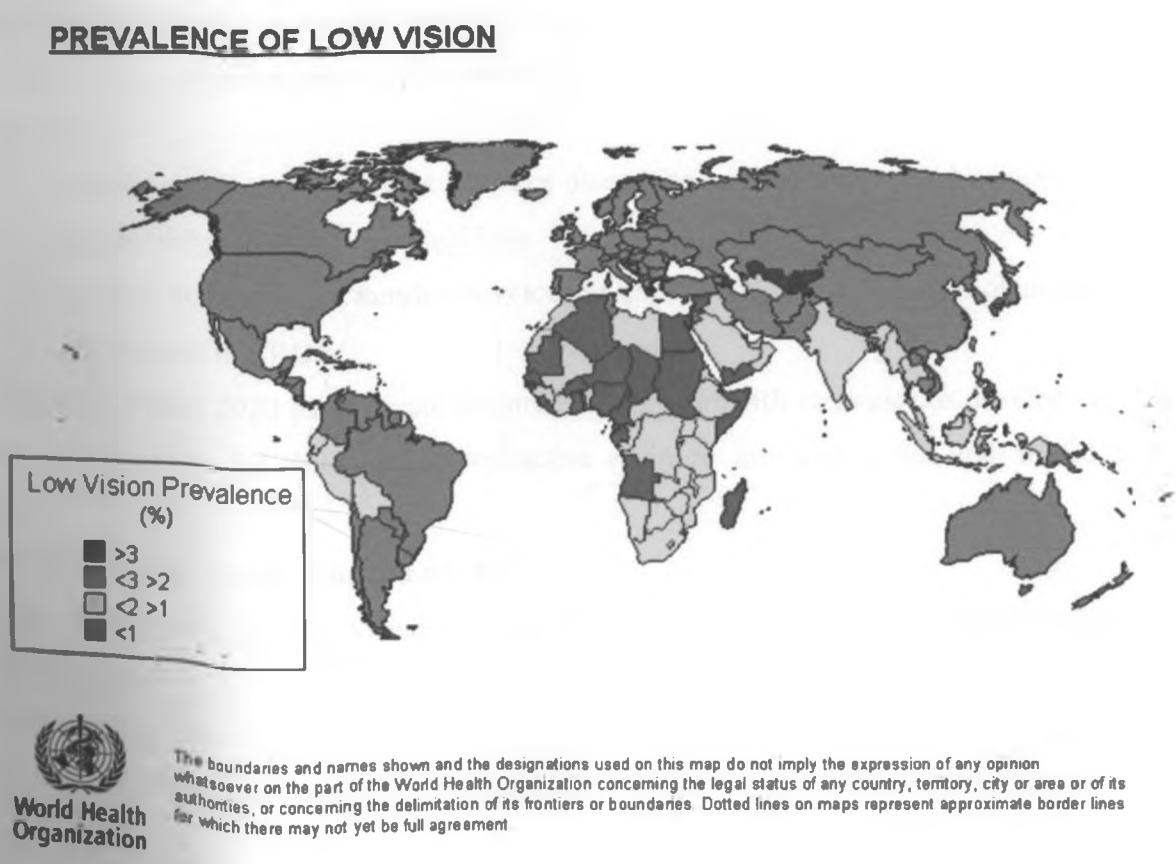
Haddad and Sei et al[12] studied causes of low vision in 3210 children at the Low Vision Service of the Ophthalmic Clinic at the University of São Paulo and at the Brazilian Association for the Visually Impaired People (Laramara), located in São Paulo, Brazil. The main causes were found to be toxoplasma macular retinochoroiditis, degenerative disorders of the retina and macula, retinopathy of prematurity, ocular malformation, congenital glaucoma, optic atrophy and congenital cataracts.

Kim and Joo et al[13] conducted a retrospective study to evaluate the characteristics and the changes in low vision patients over ten years in Korea, and to establish useful data for planning low vision services, active care and rehabilitation. They conducted a retrospective study of 681 low vision patients who visited two low vision clinics in Seoul from 1995 to 2008. Age and sex

distribution, cause of low vision, type of prescribed low vision aids, and changes of the characteristics were reviewed. In their results, males were more than females. The age group between 11 and 20 years (18.1%) was the largest age group. Optic atrophy (28.3%) was the main cause of low vision.

Locally, a study done by Munira M.A. Kaderdina et al[14] in 2009 to determine the characteristics of low vision patients presenting at Kikuyu Hospital Eye Unit found that more than half of the cases of low vision could have been avoided by early diagnosis, appropriate and timely intervention. Retinal diseases were the leading cause of low vision in adults (mainly diabetic retinopathy), while in children, optic atrophy was the commonest cause. In her study, adults were more likely to benefit from near optical aids, training in reading functional print and O&M training, while children were more likely to be given distance optical aids. She also found that eight out of 10 patients showed improvement with the use of Low Vision Aids.

Figure 1: Global Low Vision Map[15]



AVOIDABLE CAUSES OF VISUAL LOSS

VISION 2020 "The Right to Sight" was launched and ratified by the Ministry of Health in Kenya in the year 2001. A key requirement of this initiative is for the Governments to have National eye care plans. In developing this plan, the local context has been greatly assessed and the priority in Kenya will be to control the following major blinding diseases/conditions; Cataract, Trachoma, Glaucoma, Childhood blindness in addition to refractive errors and low vision.

The term 'avoidable' encompasses conditions that are preventable or potentially treatable. Conditions amenable to primary prevention (i.e. where the condition causing low vision could have been prevented) include congenital rubella syndrome, congenital toxoplasmosis, cerebral hypoxia. Conditions amenable to secondary prevention (where timely treatment could have prevented low vision) include glaucoma and ROP. Conditions where tertiary prevention could have prevented low vision (sight restoration) include cataract and selected cases of corneal scarring. Quarternary prevention involves rehabilitation and low vision services for conditions not amenable to treatment.

Avoidable causes of visual loss in children[3]

Major causes of visual loss in children in the African continent have been identified as corneal ulcers, congenital cataracts and hereditary disorders.

As part of the Global Initiative for Elimination of Avoidable Blindness[3], strategies are being put in place to:

- develop promotive and preventive eye disease programmes to stop childhood eye disease and conditions leading to visual loss.
- develop therapeutic or surgical services to treat children with cataract, glaucoma, corneal ulcers/scars and ROP.

In addition, Vision 2020 partners are required to come up with strategies to develop optical and low vision services for children with refractive errors or low vision, but with useful potential vision.

Avoidable causes of visual loss in adults[3]

Major causes of avoidable visual loss in adults worldwide include cataract, trachoma and onchocerciasis.

Cataract is the major cause of blindness in the world. In Africa, it is estimated that at least one person per 1000 population goes blind from cataract every year i.e.600,000 per year.

An estimated 5.9 million adults are blind from corneal scarring due to trachoma. Approximately 146 million people are estimated to have active infection with *Chlamydia trachomatis*, for which antibiotic treatment is indicated.

About 0.3-0.6 million people are blind from onchocerciasis while an estimated 17 million people are infected with onchocerciasis. The disease is endemic in 30 countries of Africa, with a few loci in Latin America and Yemen.

LOW VISION SERVICES

One of the aims of Vision 2020[3] is the elimination of VI (less than 6/18) and blindness due to refractive errors or other causes of low vision. This goes beyond elimination of blindness and also includes the provision of services for individuals with low vision.

In this regard, Vision 2020 partners must develop strategies to develop and make available low vision services and optical devices for all those in need, including children in blind schools and integrated education. Certain low vision devices can be manufactured locally, or purchased externally in bulk supplies to reduce cost.

People with low vision are, in principle, capable of using their vision and wish to do so. For patients with low vision, there is still hope for a better life. This is possible through the use of low vision devices and rehabilitation.

Low vision devices (such as magnifiers) help patients make the best use of whatever vision is available to them.

In rehabilitation, patients are taught how to adapt their environment appropriately in order to make the best use of their existing vision. Patients for whom low vision devices are prescribed, are also taught how to use these devices in their daily life.

In older people, low vision is usually accompanied by other physical disabilities, as these become more common with increasing age. Disabilities such as hearing or cognitive impairment mean that older people will find it more difficult to understand instructions in a health care setting; physical disabilities may also influence the suitability of certain low vision devices for older patients. It is important to cater for the specific needs of older people when setting up or managing low vision services – not least because they represent the vast majority of low vision patients who will be seen by eye care workers.

Indeed. it is estimated that 80 per cent (48 million) of all people who need low vision care are aged over 50 years[16]

The importance of providing appropriate low vision and rehabilitation services cannot be over-emphasized. Every person with low vision must be considered on an individual basis. The clinician must therefore ensure that the low vision devices they prescribe are acceptable in the home; the patient must also be motivated or interested enough to use them. In the future, integrated low vision and rehabilitation services for older people will assume more importance.

There is currently a lack of skills relevant to the care and rehabilitation of people with low vision. We need to act now and train the relevant practitioners (eye care and other); develop and include low vision services in existing eye care systems; and create awareness amongst all medical, social, and rehabilitation services.

LOW VISION AIDS/DEVICES

The purpose of low vision rehabilitation is to allow people to resume or to continue to perform daily living tasks, reading being one of the most important. This is achieved by providing appropriate non-optical devices and special training in the use of residual vision and low vision aids, which range from simple optical magnifiers to high power video magnifiers.

In a study of low-vision cases in Deshpande Centre for Sight Enhancement, L.V. Prasad Eye Institute, India, SA Khan[6] found that Visual rehabilitation was achieved using accurate correction of ametropia, approach magnification and telescopes for recognizing faces, watching television and board work. Spectacle magnifiers, hand/stand magnifiers, closed-circuit television, overhead illumination lamp and reading stand were prescribed for reading tasks. Light control devices were used for glare control, and cane and flashlight for mobility. Patients were trained in activities to improve their daily living skills; counseled in environmental modification and ancillary care for educational and vocational needs.

In a survey of consecutive records of 220 children presenting at a newly opened pediatric low vision center in a private eye hospital in Hyderabad, Gothwal and Herse[10] found that approach magnification was sufficient for required near tasks in all pre-school children and about 50% of school children.

In a retrospective study of the types of low vision aids prescribed to low vision patients between 1995 and 2008, Kim and Joo et al[13] found that 1,005 LVAs were prescribed for 681 patients

(1.46±0.62 aids for each patient). Near LVAs were prescribed more than distance LVAs. In most patients, the use of LVAs improved both near and distance visual function.

De Carvalho[11] in Brazil found that the optical aid most frequently prescribed for distance among children was a telescope.

There are several types of low-vision devices. Each works on particular form of low vision. Prescription is just the first step. It is also essential to motivate and train people to use the devices properly.

Optical aids

They include:

- Those that help people seeing things close up. These are particularly useful for reading and to help children whose education would otherwise suffer. These include hand-held magnifying glasses and specially made, powerful spectacles.

  Some magnifiers can be made relatively easily and cheaply in optical workshops. Sometimes people in poorer countries use 'modified' plastic drainpipes fitted with a lens which acts as an effective reading aid.
- Those that help people see things in the distance. These include telescopes.
- Technical enhancements such as closed circuit television, computer scanners and high tech image magnifiers.

Non-optical aids

Non-optical aids are often modifications to homes and everyday tools and equipment that make them low-vision friendly. These modifications are often quite cheap and easy to make.

Non-optical aids include:

- Tilted desks for children, meaning they don't have to bend over flat desks to read text close-up.
- Contrasting colors - A meal of rice and boiled fish can be difficult to distinguish for a low-vision person if served on a white plate. Certain colors and backgrounds can be combined to make text easier to read.
- Size - Providing large felt tip pens or charcoal for children to write with, or using a photocopier to enlarge printed materials.

- Lighting – people with low vision needing more light can sit closer to windows or have better-positioned artificial light. People needing less light can benefit from dark glasses or wide-brimmed hats.
- Lines - A good way to aid mobility is through well-defined, contrasting-colored lines to mark the edge of paths or steps.

Teachers can be trained to overcome educational challenges by:

- Providing 'adapted' print with large text
- Altering classroom seating so that children with low vision sit at the front or in a position with more light

In a study conducted by Shaaban and El-Lakkany et al[17] to assess the outcome of Low Vision Aids (LVA) provision for visually impaired Egyptian patients, they found that after training and prescription of suitable LVAs, the improvement in distance and near visual acuity was statistically significant ($p<0.001$). Fifty-six per cent of the patients ($n=28$) showed improvement in distance visual acuity of 5 lines or more, and 57% of the patients ($n=27$) could discern N8 print size or better. The most commonly used aids were high powered near adds.

The significant improvement in the visual performance of patients with low vision after the prescription and training on the use of LVAs, associated with patients' satisfaction, confirms the importance of expanding low vision rehabilitative services and increasing the public awareness of its existence and benefits.

The WHO 93.27[18] recommends assessment of vision in four main areas of functioning of children that exist in all cultures and in all age groups:

- Communication
- Orientation and movement
- Activities of daily living
- Sustained near vision tasks like reading and writing.

Visual functioning and abilities need to be assessed in each of these four areas so that we have a good foundation for planning early intervention and special education services.

RATIONALE/JUSTIFICATION

It is estimated that there are about 672,000 people with low vision in Kenya[5] with only a small percent accessing low vision services. There has been noted minimal focus on low vision compared to total blindness among the eye care workers with only three institutions providing specialized low vision services:

1. Kikuyu Hospital Eye Unit (in Central Province – caters to Central and Eastern part of Kenya)
2. Friends' Church Sabatia Eye Hospital (in Western Province – caters to Western part of Kenya)
3. Kwale District Eye Centre in Coast Province has a low vision center that caters to significant number of low vision patients (along the Coastal strip and parts of Eastern Kenya).

Data on the causes of functional low vision (FLV) in adults and children in Friends' Church Sabatia Eye Hospital and Kwale District Eye Centre is lacking but is important for planning low-vision services.

In most developing countries, it has been shown that causes of low vision are mostly avoidable[14] if diagnosed and managed appropriately and in good time.

The term avoidable encompasses conditions that are preventable or potentially treatable. Conditions amenable to primary prevention (where the condition causing low vision could have been prevented) include infections like congenital rubella, congenital toxoplasmosis, measles, other conditions like cerebral palsy due to hypoxia and genetic conditions where the pattern of inheritance is well documented. Conditions amenable to secondary prevention (where timely treatment could have prevented low vision) include glaucoma. Conditions where tertiary prevention could have prevented low vision (sight restoration) include keratoconus.

Studies are needed to determine the prevalence and causes of FLV in children and adults so that services can be planned that promote independence, improve quality of life, and increase access to education.

OBJECTIVES

Broad Objective

To determine the underlying causes of low vision in patients presenting at the Low Vision Clinic of Kwale District Eye Centre and Friends' Church Sabatia Eye Hospital.

To assess the type of Low Vision Aid given to each patient found to have low vision.

Specific Objectives

1. To determine the main causes of low vision in adults and children
2. To identify preventable or potentially treatable underlying causes of low vision
3. To document associated disabilities
4. To identify the form of LVA most commonly used

METHODOLOGY

Study definitions

For this study, the definition of low vision adopted, is the one used by the *Low Vision Services or Care Providers*[4]:

> Low vision: a person with low vision is one who has impairment of visual functioning even after treatment and/or standard refractive correction, and has a visual acuity of less than 6/18 to light perception, or a visual field less than 10 degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task for which vision is essential.

Child: individual less than 16 years of age

Avoidable cause of low vision: in reference to the better eye

Low Vision Categories[22] – Educational (Appendix 4) : guidelines used in the assessment of children with low vision, in regards to their educational needs.

Study area

Friends' Church Sabatia Eye Hospital, Low Vision Clinic. It is located in Vihiga District, Western Province 27km from Kisumu and 35km from Kakamega.

This Low Vision Unit serves the whole of Western Kenya (including Nyanza province, Western province, parts of Rift Valley province and parts of Eastern Uganda bordering Kenya)

Kwale District Eye Centre, Low Vision Clinic. Located in Kwale District of Coast Province, this Low Vision Unit serves the South Eastern part of Kenya (including most of Coast Province and parts of Eastern and North Eastern Province bordering Coast Province).

Study Design

Retrospective Case Series

Sample size determination and Sampling Methods

All records of patients seen at the Friends' Church Sabatia Eye Hospital Low Vision Clinic from 1st January 2007 to 31st January 2011 were scrutinized. The clinic was established in 2006 and has relatively few patients seen that year.

All records of patients seen at the Kwale District Eye Centre Low Vision Clinic from 1st January 2003 to 31st January 2011 were scrutinized. The centre was established in 2003.

Inclusion Criteria

All records of new patients with BCVA < 20/60(6/18) but ≥ light perception in the better eye OR visual field < 10^0 from the point of fixation even after appropriate treatment and/or standard refractive correction, seen at the Low Vision Clinic of Sabatia Eye Hospital and Kwale District Eye Centre or on outreach basis.

Exclusion Criteria

1. All re-visits
2. Patients with a BCVA of ≥ 6/18 or < light perception in the better eye.

Study period

.. . 2011 April

Data Collection And Processing

Data was collected by the principal investigator from low vision assessment sheets (and patient files where necessary) and entered into a structured questionnaire (Appendix 3).

It was then transferred into a database, cleaned, stored and analyzed using the Statistical Package for Social Scientists (SPSS Statistics version 17.0). Comparisons were done using appropriate statistical tests.

Proportions of various patient characteristics were described, giving confidence intervals where appropriate. Level of significance used was 95%.

The findings were presented in frequency tables, histograms and pie charts.

Ethical Considerations

Patients' identity and other personal information from their medical records were kept anonymous and did not appear anywhere in the study publication.

Patients' records did not leave the premises of Sabatia Eye Hospital or Kwale District Eye Centre and information collected was accessible only to the investigator, her supervisors and the biostatistician analyzing the data.

Ethical approval was sought and obtained from KNH/UON Ethics Committee.

RESULTS

A total of 1087 patient medical records were reviewed in the Low Vision Units in Kwale and Sabatia:

- 459 patient records in Kwale – from Jan 2003 to Jan 2011
- 628 patient records in Sabatia – from Jan 2007 to Jan 2011

Figure 2: Study flow chart - Kwale

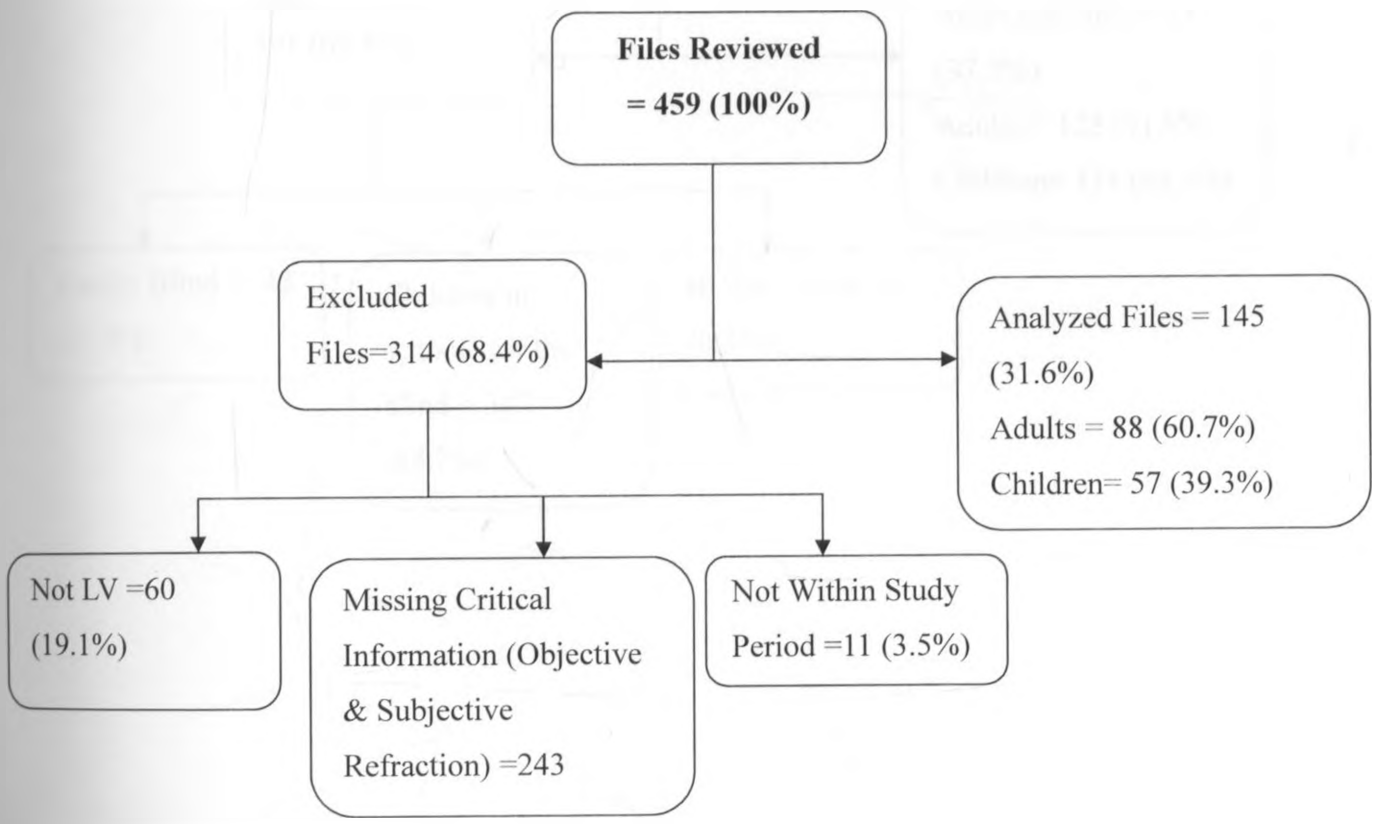


Figure 3: Study flow chart - Sabatia

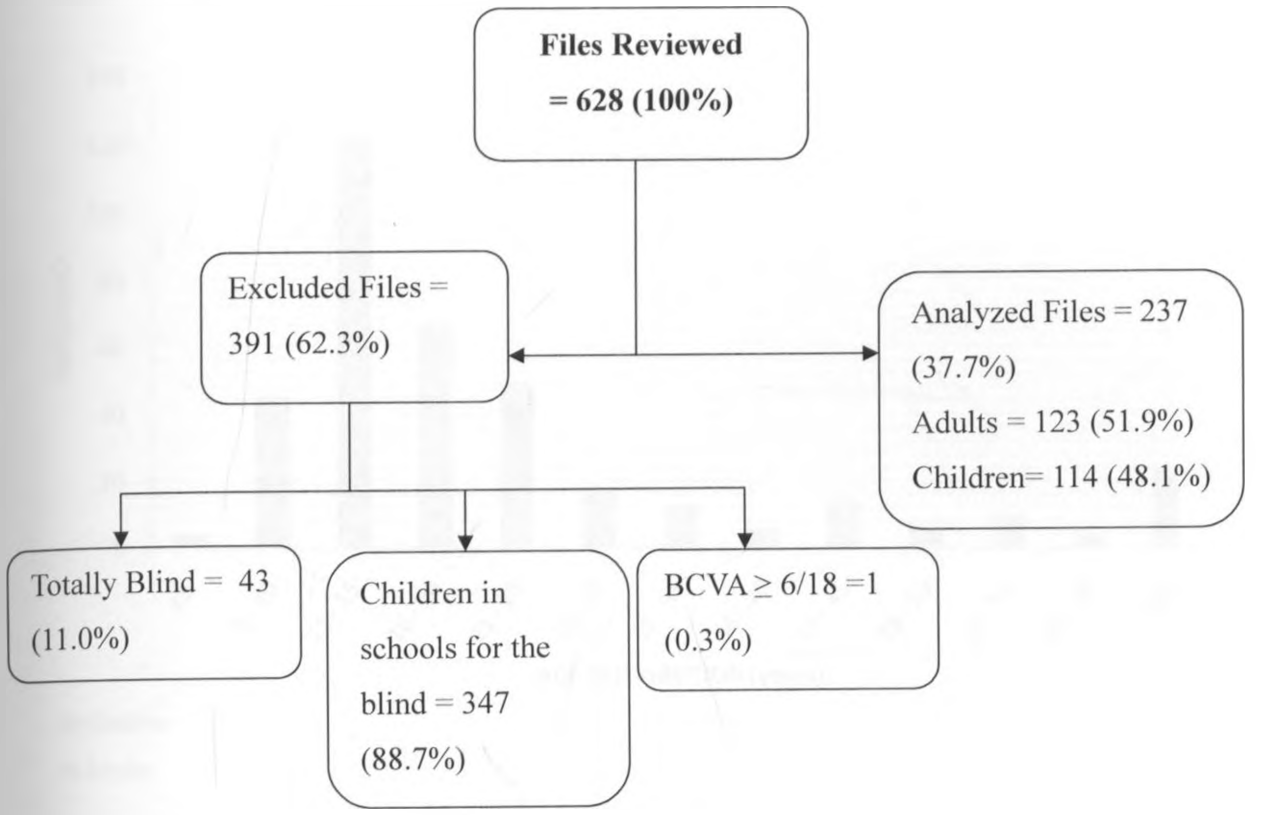
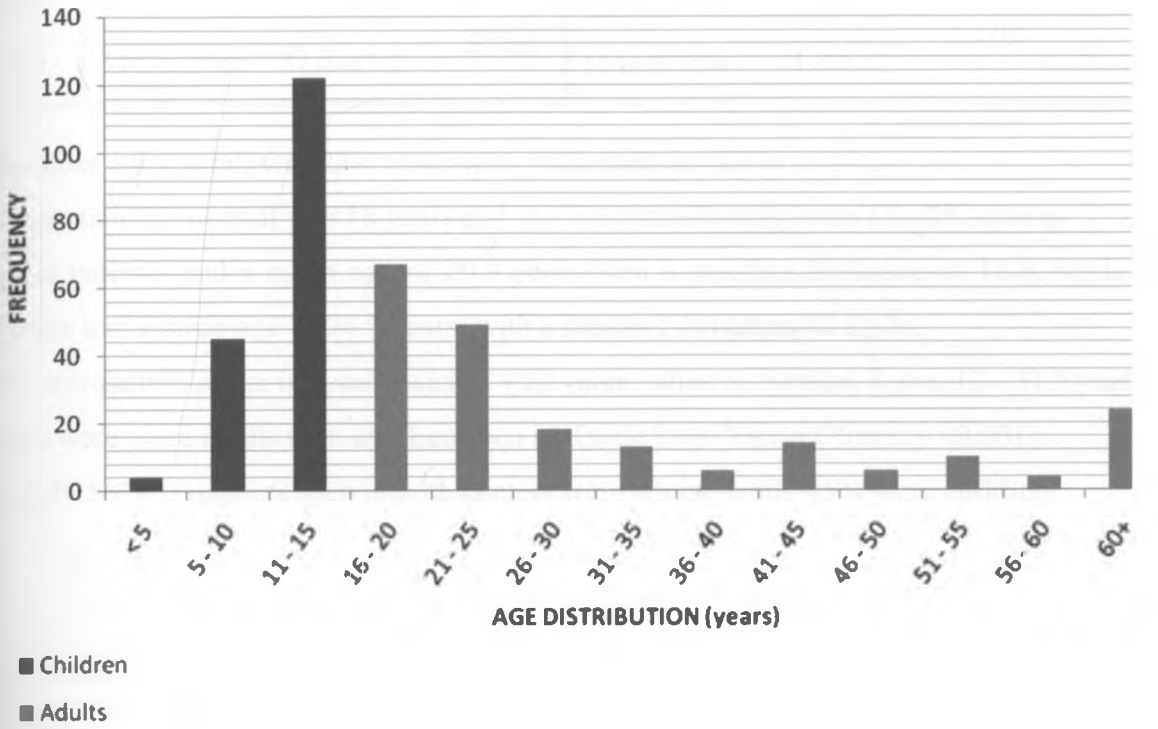


Figure 4: Age Distribution (n=382)



Overall age range was between 2 to 92 years.

Kwale patients had ages ranging from 2 to 74 years, while in Sabatia patients, the range was 2 to 92 years.

Table 1.1: Socio-demographic Factors – Age (n=382)

Factor	Kwale, n=145	95% CI	*p-value*	Sabatia, n=237	95% CI	*p-value*	Total n=382
Adult	88 (60.7%)	52.7-68.6	***<0.001***	123 (51.9%)	45.5-58.3	*0.408*	211 (55.2%)
Child	57 (39.3%)	31.4-47.2		114(48.1%)	41.7-54.5		171 (44.8%)

The mean age overall was 23.4 years with a standard deviation of 17.2.

The median age overall was 18 years and the interquartile range was 13 - 25.3 years.

Kwale patients had a mean age of 20.9 years with a standard deviation of 12.8, while Sabatia patients had a mean age of 24.9 years, with a standard deviation of 19.2.

The interquartile range in Kwale was 13 - 23 years, while in Sabatia, it was 12 - 31.5 years.

There were more adults than children seen in Kwale Low Vision Clinic ($p < 0.001$).

Overall, 55% of patients seen in both centers were adults, while 45% were children.

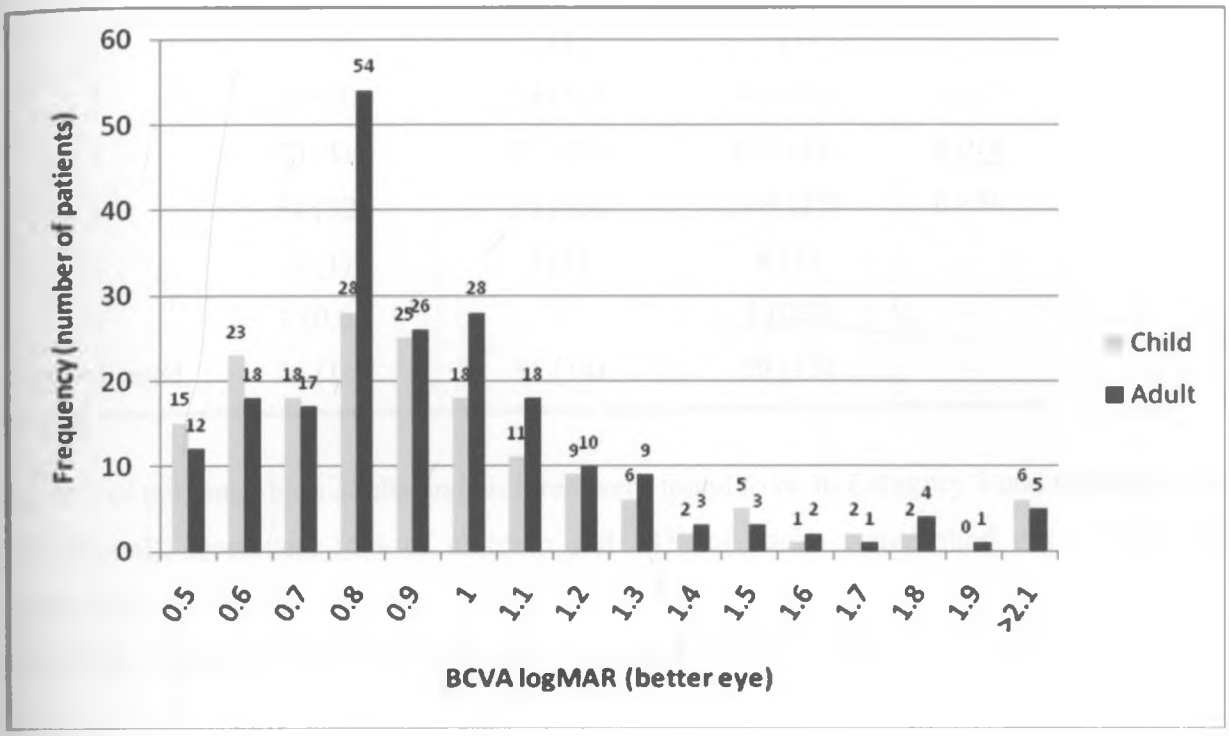
Table 1.2: Socio-Demographic Factors – Sex (n=382)

Factor	Kwale, n (%)	95% CI	*p-value*	Sabatia, n (%)	95% CI	*p-value*	Total, n (%)	*p-value*
Male	99 (68.3)	60.7-75.9	***<0.001***	138 (58.2)	51.9-65.5	***<0.001***	237 (62)	***<0.001***
Female	46 (31.7)	24.1-39.3		99 (41.8)	35.5-48.1		145 (38)	
Total	**145 (100)**			**237 (100)**			**382(100)**	

More males than females were seen in both Kwale and Sabatia low vision clinics (p<0.001)

Overall, Male to Female was 1.6:1

Figure 5: BCVA in the Better Eye (n=382)



Most patients had a BCVA ≤ 1.0 logMAR (74.2% children, 73.5% adults)

Mean BCVA was 0.90 (95%CI, 87.7-93.4)

Mode in BCVA was 0.9

Median BCVA was 0.80

BCVA was taken with low vision charts - Lea charts, LVRC charts - in logMAR format (see Appendix 5 for Visual Acuity Notations).

No visual field tests were encountered in the records that were reviewed.

Table 2: Low Vision Category – Educational (see Appendix 4)

	Child, n = 171	Adult, n = 211	Total, n=382	
Category	**Freq. (%)**	**Freq. (%)**	**Freq. (%)**	***p-value***
1	-	2 (1)	2 (1)	-
2	16 (9)	24 (11)	40 (10)	*0.192*
3	70 (41)	97 (46)	167 (44)	***0.018***
4	54 (32)	55 (26)	109 (29)	*0.680*
5	2 (1)	2 (1)	4 (1)	-
6	1 (0.6)	-	1 (0.3)	-
Not Indicated	28 (16)	31 (14)	59 (15)	-

Majority of patients –both adults and children were found to be in Category 3 and 4 of low vision (Educational). However, 16% of children and 14% of adults were found not to have been categorized.

More adults than children were found to be in Category 3 of low vision ($p = 0.018$)

Table 3: Causes of Low Vision (n=382)

	Child, n=171		Adult, n=211		Total		
Diagnosis	**Freq.**	**(%)**	**Freq.**	**(%)**	**Freq.**	**(%)**	**p-value**
Retinal Disorders	62	(36.3)	112	(53.1)	174	(45.5)	***<0.001***
Optic Nerve Disorders	24	(14.0)	40	(19.0)	64	(16.8)	***0.037***
Lens Disorders	33	(19.3)	17	(8.1)	50	(13.1)	***0.019***
Corneal Disorders	5	(2.9)	8	(3.8)	13	(3.4)	0.401
Amblyopia	9	(5.3)	8	(3.8)	17	(4.5)	0.806
Refractive Disorders	17	(9.9)	18	(8.5)	35	(9.2)	0.863
Uveal Disorder	8	(4.7)	6	(2.8)	14	(3.7)	0.794
Conjunctival Disease	1	(0.6)	0	(0.0)	1	(0.3)	-
Other	12	(7.0)	2	(0.9)	14	(3.7)	-

Retinal disorders were the main culprit causing low vision in both adults and children, followed by lens disorders in children and optic nerve disorders in adults.

Table 3.1: Retinal Disorders (n=174)

Retinal Disorders	Child Frequency	(%)	Adult Frequency	(%)
Albinism	33	(53.2)	34	(30.4)
ARMD	-	-	5	(4.4)
Chorioretinal Scars	1	(1.61)	3	(2.7)
Macula holes	2	(3.23)	1	(0.9)
Macula Scarring	1	(1.61)	6	(5.3)
Maculopathy	20	(32.3)	45	(40.2)
Neuroretinal Disease	1	(1.61)	-	-
Retinal Degeneration	1	(1.61)	4	(3.6)
Retinitis Pigmentosa	1	(1.61)	12	(10.7)
Toxic Retinopathy	1	(1.61)	-	-
X-linked retinoschisis	1	(1.61)	-	-
Diabetic Retinopathy	-	-	1	(0.9)
Toxoplasma Chorioretinitis	-	-	1	(0.9)
Total	**62**	**(100.0)**	**112**	**(100.0)**

Among patients with retinal disorders, maculopathy was the leading cause of low vision in adults while albinism was the leading cause in children. The cause of the maculopathy was not identified in most of the cases.

Table 3.2: Optic Nerve Disorders (n=64)

Optic Nerve Disorders	Child Frequency	(%)	Adult Frequency	(%)
Optic Atrophy	19	(79.2)	26	(65.0)
Glaucoma	5	(20.8)	13	(32.5)
Hypoplastic disc	-	-	1	(2.5)
Total	**24**	**(100.0)**	**40**	**(100.0)**

Optic atrophy was the leading cause of low vision in both children and adults with optic nerve disorders, followed by glaucoma. One case of bilateral optic atrophy in the adult records was due to meningitis. The underlying cause of optic atrophy was not identified in the remaining records.

Table 3.3: Lens Disorders (n=50)

Lens Disorder	Child Frequency	(%)	Adult Frequency	(%)
Aphakia	4	(12.1)	8	(47.05)
Pseudophakia	23	(69.7)	8	(47.05)
Lens subluxation	6	(18.2)	1	(5.9)
Total	**33**	**(100.0)**	**17**	**(100.0)**

Children with lens disorders were found to have pseudophakia listed as the main cause of low vision, even after appropriate correction, suggesting an amblyopic component.

Table 3.4: Corneal Disorders (n=13)

Corneal Disorders	Child		Adults	
	Frequency	(%)	Frequency	(%)
Corneal dystrophy	1	(20)	2	(25.0)
Keratoconus	4	(80)	1	(12.5)
Corneal scars and opacities	-	-	5	(62.5)
Total	**5**	**(100.0)**	**8**	**(100.0)**

Keratoconus was the major cause of low vision among children, while corneal scars and opacities were the leading cause among adults, in patients in whom corneal disorders were the main cause of low vision.

Table 3.5: Amblyopia and Refractive Disorders (n=52)

Clinical Diagnosis	Child		Adult	
	Frequency	(%)	Frequency	(%)
Refractive Amblyopia	9	(34.6)	8	(30.7)
Myopia	13	(50.0)	15	(57.7)
Hypermetropia	1	(3.9)	1	(3.9)
Degenerative Myopia	3	(11.5)	2	(7.7)
Total	**26**	**(100.0)**	**26**	**(100.0)**

Among both adults and children, myopia was found to be the leading cause of low vision, even after refraction, suggesting retinal changes or an element of amblyopia.

Table 4: Avoidable causes of low vision in children (n=171)

CONDITION CAUSING LOW VISION	PREVENTABLE	POTENTIALLY TREATABLE
Retinal disorders		
Fundus Dystrophies (oculocutaneous albinism)	33	-
Macular holes	-	2
Toxic Retinopathy	1	-
X-linked Retinoschisis	1	-
Optic Nerve Disorders		
Glaucoma	-	5
Lens Disorders		
Aphakia	4	-
Pseudophakia	23	-
Lens subluxation	-	6
Corneal Disorders		
Corneal dystrophy	-	1
Keratoconus	-	4
Amblyopia & Refractive Disorders		
Refractive Amblyopia	9	-
High myopia	-	13
High hypermetropia	-	1
TOTAL	**71 (41.5%)**	**32 (18.7%)**
Children with unavoidable causes of low vision = 68 (39.8%)		

60.2% of the causes of low vision in children were found to be avoidable (preventable or potentially treatable).

Table 5: Avoidable causes of low vision in adults (n=211)

CONDITION CAUSING LOW VISION	PREVENTABLE	POTENTIALLY TREATABLE
Retinal disorders		
Fundus Dystrophies (oculocutaneous albinism)	34	-
Macular holes	-	1
Stargardt's maculopathy	5	-
Diabetic Retinopathy	-	1
Toxoplasma Chorioretinitis	-	2
Optic Nerve Disorders		
Glaucoma	-	13
Optic atrophy (post-meningitis)	1	-
Lens Disorders		
Pseudophakia (due to congenital cataracts)	1	-
Lens subluxation	-	1
Corneal Disorders		
Corneal dystrophy	-	2
Keratoconus	-	1
Corneal scars and opacities	-	4
Amblyopia & Refractive Disorders		
Refractive Amblyopia	9	-
High myopia	-	15
High hypermetropia	-	2
TOTAL	**50 (23.7%)**	**42 (19.9%)**
Adults with unavoidable causes of low vision = 119 (56.4%)		

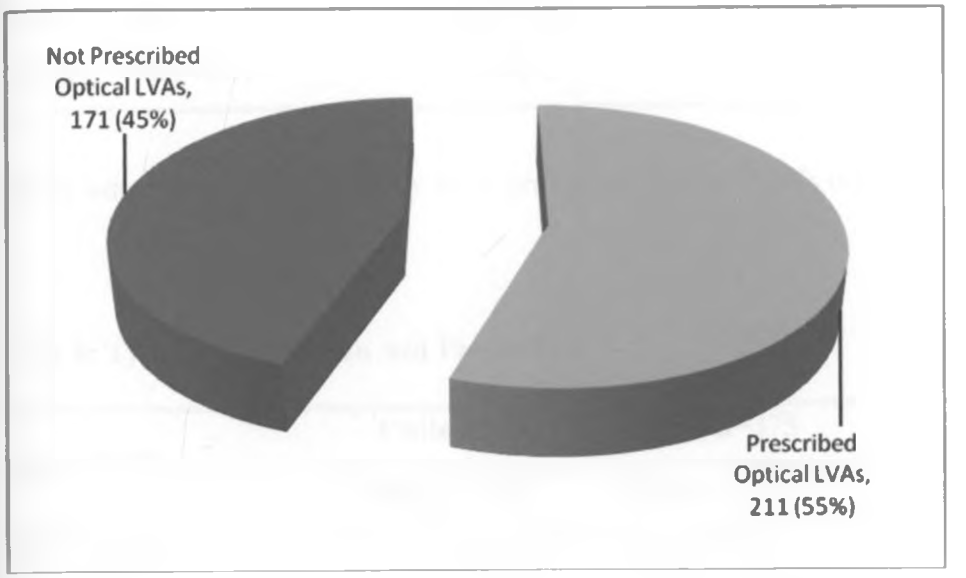
43.6% of the causes of low vision in adults were found to be avoidable.

Table 6: Associated Disability (n=382)

Disability	Child, n =171		Adult, n=211	
	Freq.	(%)	Freq.	(%)
Mental handicap	1	(0.6)	6	(2.8)
Hearing	0	(0.0)	1	(0.5)
Physical	1	(0.6)	0	(0.0)
Other disability	1	(0.6)	1	(0.5)
No disability	168	(98.2)	203	(96.2)

Associated disabilities were found in only 11 (2.9%) of the 382 patient records.

Figure 6: Provision of Optical Low Vision Aids (n=382)



From the study findings, 211 patients (55%) were prescribed optical LVA's while 171 patients (45%) were not.

Table 7: Distribution of Optical Low Vision Aids (n=382)

Age	Prescribed, n=211	Not Prescribed, n=171	OR (95% CI)	p-value
	Freq. (%)	Freq. (%)		
Adult	125 (59.2)	86 (50.3)	1.4 (0.9-2.2)	0.080
Child	86 (40.8)	85 (49.7)		

Adults were 1.4 times more likely to be prescribed optical LVA's (CI = 0.9-2.2).

Table 8: Type of Low Vision Aid Prescribed

Type of LVA	Child, n=263		Adult, n=375		p-value
	Freq.	(%)	Freq.	(%)	
Far Optical	77	(29.3)	82	(21.9)	1.0
Near Optical	26	(9.9)	78	(20.8)	***<0.001***
Non-Optical	78	(29.7)	83	(22.1)	0.997
Far+Near	21	(8.0)	39	(10.4)	0.075
Far+non-optical	43	(16.3)	47	(12.5)	0.970
Near+non-optical	11	(4.2)	29	(7.7)	***0.022***
Far+Near+Non-optical	7	(2.7)	17	(4.5)	0.092

Adults were much more likely to be prescribed optical LVA's for near (p = <0.001).

Table 9: Type of Low Vision Device for Far (n=159)

LV Device for Far	Child, n=77		Adult, n=82	
	Freq.	(%)	Freq.	(%)
x2 telescope	**33**	**(42.9)**	16	(19.5)
x2.8 telescope	2	(2.6)	17	(20.7)
x3 telescope	11	(14.3)	10	(12.2)
x4 telescope	23	(29.9)	**23**	**(28.0)**
x4.2 telescope	3	(3.9)	2	(2.4)
x6 telescope	5	(6.5)	12	(14.6)
x8 telescope	-	-	1	(1.2)
x10 telescope	-	-	1	(1.2)

The commonest LVA for distance prescribed to children was the x2 telescope followed by the x4 telescope, while for adults the x4 telescope was mostly prescribed followed by the x2.8 telescope.

Table 10: Type of Low Vision Device for Near (n=107)

LV Device for Near	Child, n=26		Adult, n=81	
	Freq.	(%)	Freq.	(%)
Readers (+0.5DS to +3DS)	3	(11.5)	17	(20.9)
+3 spectacle magnifier	-	-	1	(1.2)
+4 spectacle magnifier	4	(15.4)	10	(12.3)
+4.5 spectacle magnifier	-	-	1	(1.2)
+6 spectacle magnifier	-	-	7	(8.6)
+8 spectacle magnifier	3	(11.5)	**12**	**(14.8)**
+10 spectacle magnifier	-	-	1	(1.2)
+11 spectacle magnifier	-	-	1	(1.2)
+12 spectacle magnifier	1	(3.8)	9	(11.1)
+14 spectacle magnifier	-	-	1	(1.2)
+16 spectacle magnifier	1	(3.8)	3	(3.7)
x1 magnifier	2	(7.7)	1	(1.2)
x1.25 magnifier	-	-	1	(1.2)
x2 dome magnifier	**9**	**(34.6)**	2	(2.5)
x3 handheld/stand magnifier	3	(11.5)	5	(6.2)
x4 handheld magnifier	-	-	2	(2.5)
x6 stand magnifier	-	-	1	(1.2)
x7 stand magnifier	-	-	2	(2.5)
x8 hand held magnifier	-	-	1	(1.2)
x10 stand magnifier	-	-	1	(1.2)
x15 peak loupe	-	-	2	(2.5)

The commonest LVA for near prescribed for children was the x2 dome magnifier while for adults it was the +8D spectacle magnifier.

Table 11: Non-Optical Low Vision Aids (n=161)

Non-Optical LVA	Child, n=78		Adult, n=83	
	Freq.	(%)	Freq.	(%)
CBM Box	2	(2.6)	2	(2.4)
Functional Print	9	(11.5)	5	(6.0)
Illumination	10	(12.8)	8	(9.6)
O&M	-	-	17	(20.5)
Reading Distance	**48**	**(61.5)**	**40**	**(48.2)**
Reading Stand	1	(1.3)	1	(1.2)
Rehab	3	(3.8)	2	(2.4)
Sun Glasses	5	(6.4)	8	(9.6)

The commonest Non-Optical Low Vision recommendation for both children and adults was reduced reading distance (for children in reference to distance work – blackboard; for adults in reference to near work).

STUDY POPULATION

We reviewed 459 records at KDEC Low Vision Clinic, and 628 records at Sabatia Low Vision clinics (Figure 2 &3). Children in schools for the blind were excluded as they had been studied by Njuguna et al[19]. In KDEC low vision unit, 243 files were excluded due to missing refractions (objective and subjective). This is because the unit does not have a trained refractionist

Children comprised 45% of patients reviewed at both Low Vision Clinics (Table 1.1). Munira et al[14] found that children comprised only 33% of patients reviewed. This could be explained by the difference in period covered by the studies. Another plausible explanation may lie in the field based approach of KDEC Low Vision Unit. This unit which primarily targets children has trained community based workers who identify children with poor vision within the community and local schools and bring them to the attention of the Low Vision Therapist. The Low Vision Therapists in Kwale spend 60% of their time in the field, visiting schools and homes.

The male to female ratio in our study was 1.6:1 (Table 1.2). Munira et al[14] found the male to female ratio to be 2:1. This could be explained by the results of The Kenya National Census 2009,[23] which showed more females in the younger population – first three decades (male to female ratio of 0.9-0.95:1), and more males in the older population (Male to Female ratio of 1-1.2:1). Khan[6] found 72% of patients with low vision to be males while Haddad[12] in Brazil found 51% of children with low vision to be males. Kim and Joo et al[13] in Korea also found that more male patients were seen. Another possible explanation for our study finding is that a significant number of fundus dystrophies have X-linked inheritance patterns[24] and this may partially account for the larger number of males presenting with low vision.

Best Corrected Visual Acuity

Median BCVA was found to be 0.80 with most patients (73.8%) ranging from 0.5 to 1.0 logMAR (Figure 4). Munira et al[14] had similar findings. Khan[6] in India found that 49.3% of patients had BCVA between 0.5 to 1.0 logMAR. These results are in agreement with our study findings.

Low Vision Categories

In the Low Vision Clinics, the degree of low vision is classified into educational categories (Appendix 4), which are very useful when assessing the educational needs of children with low vision and determining appropriate interventions. According the study findings, most of the

patients were in category 3 and 4 (Table 2), signifying that these patients have sufficient functional vision for independent day to day tasks and can read regular print with appropriate interventions. These categories of patients are the most likely to benefit from use of low vision aids.

CAUSES OF LOW VISION

Determination of the causes of low vision in our setting is important as it allows us to identify avoidable causes, if any, and institute appropriate preventive/therapeutic interventions where applicable, as well as plan strategies to reduce the burden of avoidable visual loss, in line with Vision 2020.

Causes of Low Vision in Adults

Retinal disorders (53.1%) were the leading cause of low vision in adults, followed by optic nerve disorders (19.0%), refractive (8.5%) and lens disorders (8.1%) – Table 3.

Munira et al[14] found the leading cause of low vision in adults to be retinal diseases, followed by optic nerve disorders and corneal disorders.

Khan[6] in a retrospective study of 410 low vision patients found that the main causes of low vision among adults, in descending order of frequency were retinal diseases, glaucoma, corneal scarring and opacification, optic atrophy and amblyopia.

Dandona et al[8] in India, found that the causes of low vision in a population of 10,293 individuals in order of decreasing frequency were retinal diseases, amblyopia, optic atrophy, glaucoma and corneal diseases.

Among retinal disorders, maculopathy (40.2%) was the leading cause of low vision in adults, followed by oculocutaneous albinism (30.4%) and retinitis pigmentosa (10.7%) – Table 3.1. The aetiology of maculopathy was not indicated in most records, though 20% of maculopathy patients had strong family history, suggesting the aetiology to be hereditary.

Munira et al[14] found the major retinal diseases causing low vision in adults to be maculopathy followed by diabetic retinopathy and retinitis pigmentosa.

Khan[6] found the four major causes of low vision among retinal disorders were retinitis pigmentosa; macular diseases including heredomacular and age-related macular degeneration and diabetic retinopathy.

Dandona et al[8] found the retinal diseases that accounted for most low vision included age-related maculopathy, macular degeneration caused by myopia and retinitis pigmentosa.

Our study findings of hereditary retinal diseases causing most of the low vision resulting from retinal disorders is consistent with other study findings.

However, our study results showed very few cases of age-related macular degeneration and diabetic retinopathy. This could be explained by the demographics of the our study population which is skewed towards the younger population (only 15% of patients were over 40 years), unlike the study by Dandona et al[8] where 78% of patients were over 40 years of age.

Optic atrophy (65%) and glaucoma (32.5%) were found to be the leading causes of optic nerve disorders among adults – Table 3.2, findings consistent with Munira[14], Khan[6] and Dandona et al[8].

Among the patients with corneal disorders, corneal scars and opacities were leading cause of low vision (62.5%) – Table 3.4. This finding was also consistent with the findings of the study by Khan[6].

Causes of Low Vision in Children

Causes of low vision among children, in decreasing order of frequency, were retinal disorders (36.3%), lens disorders (19.3%) and optic nerve disorders(14.0%) – Table 3.

Among retinal disorders, oculocutaneous albinism (53.2%) was found to be the leading cause of low vision in children, followed by maculopathy (32.3%) - Table 3.1. Macular dystrophies comprised 15% of the cases of maculopathy. The aetiology of maculopathy was not indicated in the remaining records.

Children with lens disorders were found to have pseudophakia (69.7%) listed as the main cause of low vision, even after appropriate correction, suggesting an amblyopic component.

Low vision from lens disorders in our study may be due to residual amblyopia after delayed surgery for congenital cataracts (deprivational amblyopia); and/or delayed, inadequate or inappropriate refractive correction following definitive cataract surgery (refractive amblyopia). The underlying cause of low vision in these pseudophakic/aphakic children is therefore likely to be amblyopia.

Optic atrophy was the leading cause of low vision (79.2%) among optic nerve disorders, followed by glaucoma (20.8%) – Table 3.2.

Keratoconus was the main cause of low vision among children with corneal disorders (80%) – Table 3.4.

Munira et al[14] found the leading causes of low vision in children to be retinal disorders (maculopathies and macular scars, ocular albinism, retinitis pigmentosa) and optic nerve disorders (optic atrophy and glaucoma).

Khan[6] in India, found that among children, the main causes of low vision were optic atrophy, maculopathy, amblyopia and keratoconus.

De Carvalho[11] in Brazil found the main cause of low vision in children to be from retinal pathology (toxoplasmic macular scars) and optic atrophy. Haddad et al[12] in Brazil also found retinal disorders (toxoplasmic macular retinochoroiditis, retinal dystrophies) and optic nerve disorders (congenital glaucoma, optic atrophy) to be the leading causes of low vision in children and Gilbert et al[9] also found retinal diseases (mainly retinal dystrophies) and amblyopia to be the main causes of low vision in children.

Gothwal[10] in India found the four major causes of visual impairment were the hereditary/genetic conditions of congenital glaucoma, hereditary macular degeneration, retinitis pigmentosa and albinism.

The findings in our study, of retinal disorders, amblyopia and optic nerve disorders as leading causes of low vision in children, are consistent with other study findings.

PREVENTABLE AND POTENTIALLY TREATABLE CAUSES OF LOW VISION

From this study it was estimated that low vision could have been avoided in 60.7% of children (Table 4) and 43.6% of adults (Table 5). Munira et al[14] found that 56% of causes of low vision in children and 66% in adults could have been avoided. Khan[6] found that the causes of low vision in their study were not amenable to treatment. This large number of avoidable causes of low vision in our setting, especially among children and young adults, is unacceptable, and urgent steps must be taken to establish the possible reasons behind it and institute appropriate remedial measures.

Primary prevention may be done by genetic counseling for diseases with known patterns of inheritance (albinism, Stargardt's maculopathy, X-linked retinoschisis). This is especially relevant among communities that permit intermarriage between close blood relatives (resulting in parental consanguinity). The importance of genetic counseling cannot be over-emphasized in this context, where 40% of new children seen and 25% of new adult patients seen at KDEC Low Vision Unit during the duration covered by the study had oculocutaneous albinism.

This is in contrast to Sabatia Low Vision Unit where children with oculocutaneous albinism comprised 8.8%, while adults comprised 9.8% of new patients. Munira et al[14] found that children with oculocutaneous albinism comprised 2.5% while adults comprised 0.04% of new patients. It is thought that consanguineous marriages, which are common among some indigenous Coastal communities, may contribute to the high rate of oculocutaneous albinism in this population.

Toxic retinopathy is preventable and its occurrence suggests negligence by healthcare professionals or unrestricted over-the-counter sale of potentially retinotoxic drugs.

Optic atrophy due to meningitis is preventable with early diagnosis and adequate control of intracranial pressure to prevent this devastating complication.

Deprivational amblyopia can be avoided by timely surgery and early initiation of active amblyopia preventive/therapeutic interventions following surgery.

Secondary prevention is relevant with respect to toxoplasmosis, diabetic retinopathy and macula holes, which are potentially treatable with good outcomes if diagnosed early.

Glaucoma is potentially controllable if diagnosed early and with good patient compliance.

Keratoconus can be managed conservatively in the early stages; keratoplasty, a form of tertiary prevention, is reserved for the more advanced stages of the disease.

ASSOCIATED DISABILITIES

Associated disabilities were found in only 11 (2.9%) patients who presented at the low vision clinics (Table 6). Munira et al[14] had comparable findings. Haddad et al[12] in Brazil found 43% of patients had associated disability. Keefe J[20] over a 1 year period found that 78% of children diagnosed with uncorrectable visual loss had associated impairments.

The proportion of disability was expected to be higher as factors that contribute to loss of vision may also contribute to other impairments. One explanation may be that patients with other disabilities are handled by multiple handicap therapists. Another explanation may be that many of these multisystem disorders may be causes of infant or early childhood mortality due to the ignorance, poverty and general state of healthcare in developing countries like Kenya. In addition, such patients with multiple disabilities may be considered beyond help, hence no assistance is sought.

LOW VISION AIDS

Optical LVA's were prescribed for 55% of patients (Figure 5). Adults were 1.4 times more likely (CI=0.9-2.2) to be prescribed a near optical LVA (Table 7). Munira et al[14] found that adults were four times more likely to receive an optical LVA for near.

Children were more likely to benefit from a x2 telescope for distance while for adults, the x4 telescope was mostly prescribed (Table 9). Munira et al[14] had similar findings. Khan[6] in India and De Carvalho[11] in Brazil found that telescopes were the most commonly prescribed LVA for distance.

For near optical aids, children were most likely to be prescribed a x2 dome magnifier while adults mostly benefited from the +8D spectacle magnifier (Table 10). Munira et al[14] found that both adults and children were mostly prescribed the +4D spectacle magnifier. Haddad et al[12] showed that the x2 magnifying lens was the most widely used LVA for near among children.

The non-optical aid provided for both groups was mostly reduced reading distance, followed by illumination for children and O&M training for adults (Table 11). Khan[6] found that the non-optical aids given were mostly reading lamps, light control devices (absorptive lenses, wide brimmed hats) and mobility canes.

The Ingelse and Steele[21] Illinois study found that hand held telescopes, bifocals with high adds and tinted lenses were the major low vision devices prescribed .

Provision of optical devices by government and stakeholders for all those in need, is an expensive undertaking. Certain low vision devices can be manufactured locally or purchased externally in bulk supplies to reduce costs. In this regard, the information on the most frequently prescribed devices can guide stakeholders in the procurement of appropriate devices that will actually benefit the intended recipients.

CONCLUSIONS

- More males (62%) than females were seen in the two low vision clinics, and majority were adults (55%).
- A large number of records (243 out of 459) were excluded –mostly in Kwale LV Clinic- due to absence of a recorded refraction (objective and subjective).
- Retinal diseases were the commonest cause of low vision in both children and adults, mainly maculopathy in adults and oculocutaneous albinism in children.
- Lens disorders were the second most common cause of low vision in children; while in adults it was optic nerve disorders
- Potentially avoidable causes of low vision were 43.6% in adults and 60.2% in children.
- Adults were more likely to benefit from near optical aids
- Associated disabilities were found in only a small minority of patients (2.9%)
- Most of the patients were in category 3 and 4 of low vision, and therefore likely to benefit from low vision devices.
- Majority of patients (55%) were found to benefit from use of optical Low Vision Aids and were therefore prescribed with the same.

RECOMMENDATIONS

- Majority of patients were found to benefit from Low Vision Aids and therefore eye care workers should be encouraged to refer all low vision patients without exception, to the nearest Low Vision Unit, for assessment and management.
- Most the causes of low vision in children were found to be avoidable. A study to investigate the reasons why children are unnecessarily ending up with low vision would be useful in order to guide subsequent interventions.
- Procurement of optical Low Vision Aids for adults should place emphasis on the near optical devices, while more far optical devices should be procured for the children.

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APPENDICES

Appendix 1: WHO Categories Of Visual Impairment

Category of Visual Impairment	Visual Acuity with best possible correction	
	Maximum less than:	Minimum equal to or better than:
1	6/18	6/60
2	6/60	3/60
3	3/60	1/60 (finger counting at 1 meter)
4	1/60 (finger counting at 1 meter)	Light perception
5	No light perception	
9	Undetermined or unspecified)	

The term 'low vision' in category H54 of ICD-10 comprises categories 1 and 2 of the table

The term 'blindness' comprises categories 3,4 and 5

The term 'unqualified visual loss' comprises category 9

If the extent of the visual field is taken into account, patients with a field no greater than 10^0 but greater than 5^0 around central fixation should be placed in category 3

Patients with a field no greater than 5^0 around central fixation should be placed in category 4, even if the central acuity is not impaired.

Appendix 2: Levels Of Visual Impairment

Classification (WHO) (refers to the better eye with best correction)	**Levels of Visual Impairment**		**Additional Descriptions that may be encountered**
	Visual Acuity(VA) and/or Visual Field(VF) whichever is worse		
Normal Vision	Range of normal vision	20/10 20/13 20/16 20/20 20/25 2.0 1.6 1.25 1.0 0.8	
	Near normal vision	20/28 20/30 20/40 20/50 20/60 0.7 0.6 0.5 0.4	
Low Vision	Moderate visual impairment	20/70 20/80 20/100 20/125 20/160 0.29 0.25 0.20 0.16 0.12	Moderate low vision
	Severe visual impairment	20/200 20/250 20/320 20/400 0.10 0.08 0.06 0.05 VF $\leq 20^0$	Severe low vision ("Legal" blindness)
Blindness	Profound visual impairment	20/500 20/630 20/800 20/1000 0.04 0.03 0.025 0.02 CF at < 3m(10ft) VF $\leq 10^0$	Profound low vision
	Near Total visual impairment	VA < 0.02 (20/1000) CF at $\leq$ 1m(3ft) HM at $\leq$ 5m(15ft) Light perception +/- accurate projection VF $\leq 5^0$	Near total blindness
	Total visual impairment	No light perception (NLP)	Total blindness

CF = counts fingers (without designation of distance may be classified as profound impairment)

HM = hand motion (without designation of distance may be classified as near total visual impairment)

VA = Visual Acuity) refers to best achievable acuity with appropriate correction

VF = Visual Field (measurements refer to the largest field diameter for a 1/100 white test object)

Modified from the International Classification of Diseases, 9th rev. Clinical Modification

Appendix 3: Data Collection Sheet

NAMES		
PATIENT NO.		
AGE		
SEX	MALE	FEMALE
PROFESSION		
HOME DISTRICT		
POINT OF REFERRAL		
DATE OF FIRST VISIT		
PRESENTING COMPLAINTS(SUBJECTIVE)		
PRESENTING VA (DISTANCE)	RE	LE
PRESENTING VA (NEAR)	RE	LE
REFRACTION (OR)	RE	LE
REFRACTION (SR)	RE	LE
BCVA (with refractive correction)		
VA (DISTANCE) WITH NEW RX	RE	LE
VA (NEAR) WITH NEW RX	RE	LE
VISUAL FIELD TEST USED		
LOW VISION CATEGORY (WHO/EDUCATIONAL)		
DIAGNOSIS (CLINICAL)	RE	LE
OTHER IMPAIRMENTS	MENTAL HANDICAP	
	HEARING IMPAIRMENT	
	PHYSICAL HANDICAP	
	OTHER	
LOW VISION DEVICE (FAR)		
LOW VISION DEVICE (NEAR)		
NON-OPTICAL AIDS		
COMMENTS		

Appendix 4: Categories Of Low Vision (Educational)[22]

- Category 1- totally blind, recommended to use Braille. Needs Orientation and Mobility.
- Category 2 – useful vision present but not sufficient to use print, recommended to use Braille
- Category 3 – patients can be trained to use their sight to read and write print. Require magnification to cope with regular print.
- Category 4 – patients can be educated in print using special techniques and methods to read and write regular print efficiently without magnification.
- Category 5 – children with sight better than 6/18 without a severe visual field defect. Do not really need special education as long as their sight is constant.
- Category 6 – at LV clinic – children not possible to classify due to age or mental impairment)

Appendix 5 : Visual Acuity Notations[25]

EQUIVALENT NOTATIONS		TRUE SNELLEN FRACTIONS (numerator = test distance)					*MA*gnification *R*equirement		Visual Acuity Score (letter count)
Decimal	US	6.3 m	6 m (Britain)	5 m (Europe)	4 m (ETDRS)	1 m (Low Vision)	MAR (1/V)	Log MAR	
1.6	20/12.5	6.3/4	6/3.8	5/3.2	4/2.5	1/0.63	0.63	–0.2	110
1.25	20/16	6.3/5	6/4.8	5/4	4/3	1/0.8	0.8	–0.1	105
1.0	**20/20**	**6.3/6.3**	**6/6**	**5/5**	**4/4**	**1/1**	**1.0**	**0**	**100**
0.8	20/25	6.3/8	6/7.5	5/6.3	4/5	1/1.25	1.25	+0.1	95
0.63	20/32	6.3/10	6/9.5	5/8	4/6.3	1/1.6	1.6	0.2	90
0.5	20/40	6.3/12.5	6/12	5/10	4/8	1/2	2.0	0.3	85
0.4	20/50	6.3/16	6/15	5/12.5	4/10	1/2.5	2.5	0.4	80
0.32	20/63	6.3/20	6/19	5/16	4/12.5	1/3.2	3.2	0.5	75
0.25	20/80	6.3/25	6/24	5/20	4/16	1/4	4	0.6	70
0.20	20/100	6.3/32	6/30	5/25	4/20	1/5	5	0.7	65
0.16	20/125	6.3/40	6/38	5/32	4/25	1/6.3	6.3	0.8	60
0.125	20/160	6.3/50	6/48	5/40	4/32	1/8	8	0.9	55
0.10	**20/200**	**6.3/63**	**6/60**	**5/50**	**4/40**	**1/10**	**10**	**+1.0**	**50**
0.08	20/250	6.3/80	6/75	5/63	4/50	1/12.5	12.5	1.1	45
0.063	20/320	6.3/100	6/95	5/80	4/63	1/16	16	1.2	40
0.05	20/400	6.3/125	6/120	5/100	4/80	1/20	20	1.3	35
0.04	20/500	6.3/160	6/150	5/125	4/100	1/25	25	1.4	30
0.03	20/630	6.3/200	6/190	5/160	4/125	1/32	32	1.5	25
0.025	20/800	6.3/250	6/240	5/200	4/160	1/40	40	1.6	20
0.02	0/1000	6.3/320	6/300	5/250	4/200	1/50	50	1.7	15
0.016	20/1250	6.3/400	6/380	5/320	4/250	1/63	63	1.8	10
0.0125	20/1600	6.3/500	6/480	5/400	4/320	1/80	80	1.9	5
0.01	**20/2000**	**6.3/630**	**6/600**	**5/500**	**4/400**	**1/100**	**100**	**+2.0**	**0**
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No Light Perception (NLP)									

KENYATTA NATIONAL HOSPITAL
Hospital Rd. along, Ngong Rd.
P.O. Box 20723, Nairobi.
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP", Nairobi.
Email: KNHplan@Ken.Healthnet.org

Ref: KNH-ERC/ A/72

30th March, 2011

Dr. Judy Ndiritu
Dept of Ophthamology
School of Medicine
University of Nairobi

Dear Dr. Ndiritu,

RESEARCH PROPOSAL: **"CHARACTERISTICS OF LOW VISION PATIENTS PRESENTING AT KWALE DISTRICT EYE CENTRE AND SABATIA EYE HOSPITAL" (P428/12/2010)**

This is to inform you that the KNH/UON-Ethics & Research Committee has reviewed and **approved** your above revised research proposal for the period 30th March 2011 – 29th March 2012.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimens must also be obtained from KNH/UON-Ethics & Research Committee for each batch.

On behalf of the Committee, I wish you a fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of the data base that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely,

PROF A N GUANTAI
SECRETARY, KNH/UON-ERC

c.c. The Deputy Director CS, KNH
The HOD, Records, KNH
The Dean, School of Medicine, UON
The Chairman, Dept of Ophthamology, UON
Supervisors: Dr. Sheilla Marco, Dept of Ophthamology, UON
Dr. Margaret Njuguna, Dept of Ophthamology, UON