CHARACTERISTICS OF LOW VISION PATIENTS PRESENTING AT KIKUYU EYE UNIT LOW VISION CLINIC

Dissertation in part fulfillment for the degree of Master of Medicine, Ophthalmology, University of Nairobi

(MMed Ophthalmology, U.O.N)

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

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TO

Zahrah: The apple of my eye.

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LIST OF ABBREVIATIONS

AION	Anterior ischaemic optic neuropathy
ARMD	Age related macular degeneration
BCVA	Best corrected visual acuity
CBM	Christoffel-Blindenmission
CCTV	Closed circuit television
DALYs	Disability adjusted life years
FLV	Functional low vision
ICD-10	International Statistical Classification of Diseases and Related Health Problems, 10^{th} Revision
KEU	Kikuyu Eye Unit
KNH	Kenyatta National Hospital
KSB	Kenya Society for the Blind
LVA's	Low vision aids
PCEA	Presbyterian Church of East Africa
PL	Perception of light
ROP	Retinopathy of prematurity
RP	Retinitis pigmentosa
SSI	Sight Savers International
VA	Visual acuity
VF	Visual field
WHO	World Health Organisation

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1.0 ABSTRACT

OBJECTIVES: The study was aimed at describing the characteristics of patients presenting at low vision clinic of the Kikuyu Eye Unit, with emphasis on the underlying causes of low vision, of which it would identify preventable and potentially treatable causes, to document any associated disability, and to assess the type of LVA's prescribed to these patients.

STUDY DESIGN: Retrospective case series

STUDY SETTING: P.C.E.A Kikuyu Hospital, Eye Unit, Low Vision Clinic, Kiambu District, 20km from Nairobi.

SUBJECTS: Any new patient assessed in the Low Vision Clinic from 1st January 2007 to 31st December 2007, and found to have low vision as per the low vision case definition.

MATERIALS AND METHODS: Copies of low vision assessment sheets of patients were scrutinized and records of eligible patients were retrieved from the hospital registry and analyzed. The data was collected on a structured questionnaire and entered into Microsoft access, then exported to Microsoft Excel and analyzed using the Statistical Package for Social Scientists (SPSS).

RESULTS: Two hundred and ninety nine files were reviewed, of which 190 patients were found to be eligible for this study. A hundred and twenty two (64.2%) were adults and 68 (35.8%) were children and the M:F ratio was found to be approximately 2:1 in both adults and children. 45.6% of adults were classified as low vision category IV patients, while 41.2% were category III. Only 1 adult was classified in category I. Children mainly belonged to category III (66.4%). The majority of patients had a logMAR BCVA of 0.5 to 1.0(69.7% adults and 57.4% children) with a range of 0.5 to 2.0. HVF was done for 11 patients (5.8%) and field defects within 10° of or involving the point of fixation were found in 7 of them (63.6%). Many of the patients hailed from Nairobi, Central and Rift Valley provinces and the main points of referral were in Nairobi in the files where it was recorded. Of the 122 adults, 64 had retinal disorders, mainly diabetic retinopathy, maculopathy, Stargardt's disease and retinitis Pigmentosa. The other common causes of low vision in adults were optic nerve disorders including glaucoma

and optic atrophy, and corneal scarring and opacification. In children, the main cause was optic atrophy, followed by maculopathy, amblyopia and keratoconus. Fifty six percent of low vision in children is preventable or potentially treatable. Of the causes of low vision found in adults, 16 were potentially treatable and 64 were preventable accounting for 80 of 122 adults (65.6%) in whom low vision could have been avoided. Associated disabilities were found in only 6 of the patients who presented at the Low Vision Clinic in 2007. LVA's were provided to 72.6% of patients, and it was found that near optical aids were more likely to be given to adults. For distance optical aids, the commonest given to adults was the 4x telescope while for children it was the 2x or the 4x telescope. In near optical aids, both adults and children were most likely to be provided with a +4 DS spectacle magnifier. The non-optical aids most commonly provided to adults were training in functional print reading and orientation and mobility training. Children were provided with CBM boxes, colour filter lenses and visual stimulation techniques. VA for near was found to improve significantly in adults with the use of LVA's and a significant number of children <16 yrs were introduced into the integrated programme/given school placements/vocational training. Eight patients refused LVA's at prescription.

CONCLUSIONS: Considering that the low vision project was geared towards children at inception, there were surprisingly more adults presenting at the low vision clinic than children. Centres in Nairobi referred a number of patients for low vision assessment and management, and patients at the clinic were usually from Nairobi, Central or Rift Valley province. Most of the patients were likely to be classified in category III/IV of low vision with a logMAR BCVA of 0.5-1.0, which bodes well for the project since this signifies that these patients can be assisted with appropriate aids. Visual field testing was done in fewer patients than necessary. Considering the underlying causes of low vision, diabetic retinopathy was the commonest cause in adults, and optic atrophy in children. More than half of the cases of low vision could have been avoided with appropriate prevention, or early diagnosis and appropriate, timely treatment. Associated disability was found in fewer patients than expected. 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. Eight out of 10 patients showed improvement with the use of LVA's. Four percent of patients, despite demonstrating improvement with LVA's on assessment, were resistant to the use of LVA's for various reasons.

RECOMMENDATIONS: Public Health education regarding magnitude of low vision preventable or potentially treatable with primary prevention, early diagnosis, early intervention; promotion of awareness of LVA's as an effective tertiary intervention; training of more low vision therapists and expansion of the integrated programme with establishment of more low vision clinics in the country; incorporating visual field testing in the low vision assessment compulsorily in patients in whom it is possible.

2.0 BACKGROUND

The terms 'low vision' and 'visual impairment' are often used interchangeably. Low vision is a clinical diagnostic term that refers to an inability to perform everyday visual tasks such as reading or recognizing faces, which results from a visual impairment. A common definition of low vision is a visual disability that cannot be corrected by wearing conventional spectacles or with medical or surgical treatment. Visual impairment, on the other hand, refers to a loss of organ function as defined by objective criteria such as reduced visual acuity or constricted visual field. [1] People with low vision often retain some portion of usable vision and are able to make use of assistive technology devices to perform activities of daily living.

The concept of low vision was popularized by Eleanor Faye in the 1970's to identify people who might benefit from vision rehabilitation services but would not be considered blind. The WHO subsequently adopted low vision as a classification of people with vision worse than normal but better than legal blindness.[1] In the WHO categories of visual impairment, category 1 includes BCVA of <6/18 – 6/60 and category 2 includes BCVA of <6/60 – 3/60 (Appendix 11.1). The term 'low vision' in category H54 of ICD-10 comprises these two categories. In Britain, this is referred to as 'partial sight.' However, in 1992, the WHO offered a new definition of 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 VA of less than 6/18 (20/60) to light perception, or a visual field of less than 10° from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task.[2] This definition has been found to be more suitable as far as diagnosis of true functional low vision is concerned. As a part of the Low Vision Project - Kenya by Christoffel BlindenMission (CBM), low vision has been classified into educational categories[5] which have been defined based on individual assessments. These cover refraction, visual acuity at distance and near, oculomotor functions and fitting of optical and non-optical low vision devices. These categories have been very useful when explaining the educational needs of children with low vision. In Kenya these Categories have now become a standard in

communication between medical and educational personnel when children's educational media and special educational needs are reported.

It is important to emphasize that fewer than 10% of visually impaired people are totally blind and over 75% can read newspaper headlines according to a UK survey.[3] Throughout the 1950's, visual rehabilitation was dominated by the sight-saving philosophy according to which the use of partial sight will hasten its demise. This interfered with the establishment and acceptance of low-vision rehabilitation. Even today, many optometrists and ophthalmologists view visual rehabilitation as a service worthy of little attention. Worldwide data on low-vision are scarce. The WHO estimates that there are 35 million people worldwide with irreversible visual impairment, many of whom are children or people of working age.[1]

Much of the available data on low-vision ignores the underlying cause of the visual disability. From the view-point of the low-vision service provider, it makes little difference whether the low-vision patient suffers from macular degeneration or cone dystrophy, glaucoma or optic neuritis. What does matter is how the disease has affected visual function. Thus there are few epidemiological data on the causes of low vision.[1]

There are many challenges to providing low-vision services in developing nations. Some countries lack the infrastructure for visual rehabilitation, having concentrated instead on services for the blind. India, for example, with an enormous burden of low vision caused by cataract, has a long history of providing education and rehabilitation services for the blind, but only recently has begun to train practitioners for low-vision services and to develop local resources for LVA's. China, with an estimated 10million people visually impaired, has had to rely on either imported LVA's or locally produced devices made of optical glass which are more expensive and less well suited to LVA design than modern plastics. [1] Low-vision services are available only in a few parts of Africa.[4] Recent efforts have included the training of low-vision therapists following a Finnish model[5], and the work of the CBM International of Germany and SSI of Great Britain to develop low-vision services and set up local

manufacturing of LVA's. For these efforts to have the maximum benefit, more epidemiological research is needed on the types of visual disability that most affect those with ocular disorders and the relative effectiveness of different models of low-vision care and LVA's.

Here, in Kenya, CBM initiated a Low Vision Programme in 1994 at Kikuyu Eye Unit, P.C.E.A Kikuyu Hospital with the aim of assisting children with low vision to access education through the optimal use of sight. The unit is fully equipped and well staffed with qualified low-vision care practitioners. Along with providing comprehensive low vision assessment, it provides optical and non-optical low vision devices at low cost, and networks with the Ministry of Education, District Educational Officers, Directors of City Education and head teachers of integrated schools to ensure the best school placement for the education of children with low vision. The Project also has a close working collaboration with SSI and the KSB. It serves a large population base and provides much needed expertise in a very poorly understood field of practice.

3.0 LITERATURE REVIEW

3.1 Prevalence of low vision

Relatively little attention has been given in literature to low vision and its characteristics. As a result, not many studies have been conducted in this specialty. Even when we read the studies that have been done on the topic, we see that many authors who begin with the intention of studying low vision end up doing studies on visual impairment under the guise of low vision. One of the main causes of this confusion is the WHO definition of low vision (appendix 11.1) in comparison to the clinical modification (appendix 11.2), which is used by most low vision units as the first definition ignores a large proportion of persons with low vision who can lead a functional life with the right assessment and assistance.

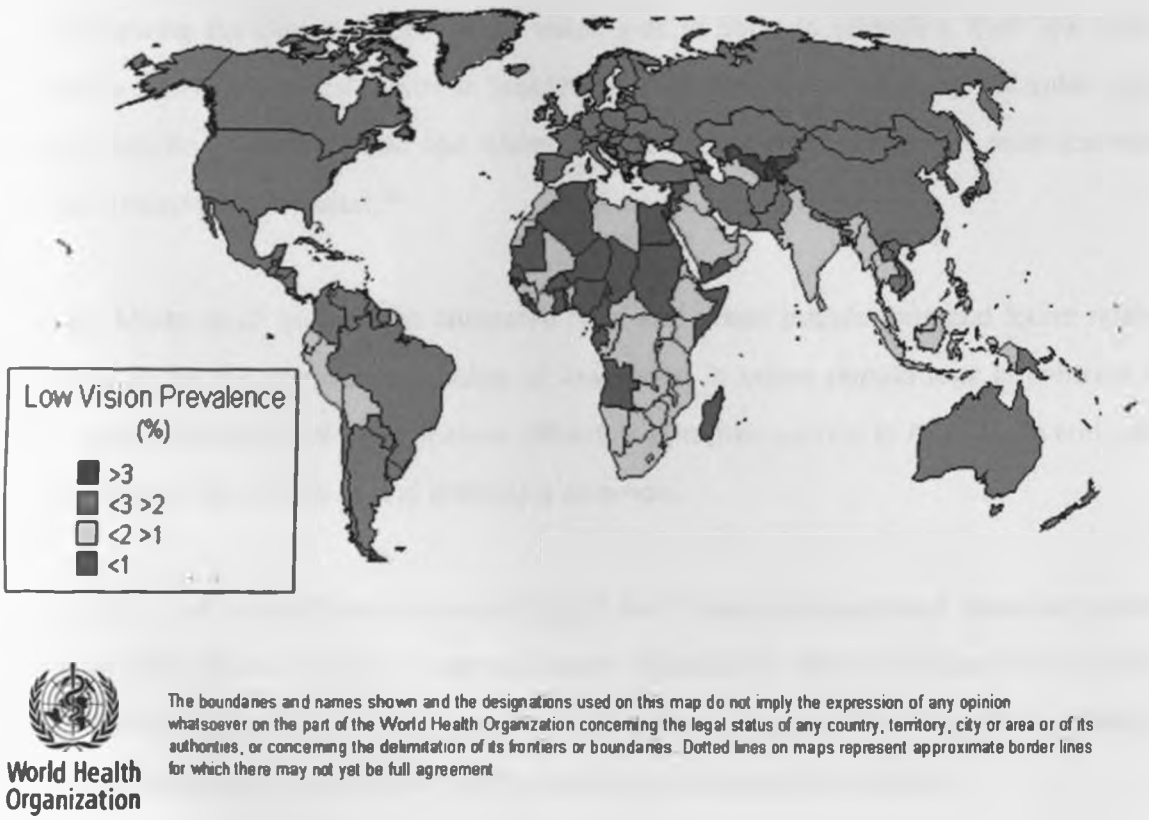
Dandona et al[6] assessed the prevalence and causes of low vision in a representative population in Andhra Pradesh, Southern India for planning low vision services. Their definition of low vision was in keeping with the clinical modification of the WHO definition of low vision and, in a total of 10,293 persons of all ages, they found the prevalence of low vision to be 1.05% (95% CI: 0.82%-1.28%).

As part of the Pakistan National Eye Survey Study Group, Shah and Minto et al selected a nationally representative sample of adults to determine the prevalence and causes of functional low vision and estimated the assessment needs for low vision services in Pakistan.[7] The standardized prevalence of FLV was found to be 1.7% (95% CI: 1.5%-1.9%) in a sample of 16,507 adults.

Results from standardized population surveys on prevalence and causes of FLV in school-age children from 6 countries in Asia, Africa and Latin America[8] revealed a prevalence of 0.65-2.75 in 1000 children with an overall prevalence of 1.52 in 1000 children (95% CI: 1.16-1.95).
Other studies on prevalence of low vision are available but they do not fit the definition of low vision, neither the WHO ICD 10 nor the clinical modification, since they include

uncorrected refractive errors and potentially curable causes like cataracts, or they are based in schools for the blind or schools for the handicapped.

Figure 1: **Map showing Global Prevalence of Low Vision**



3.2 Causes of low vision

In their Andhra Pradesh study for planning low vision services in India, Dandona et al[6] found that the most frequent causes of low vision included retinal diseases, amblyopia, optic atrophy, glaucoma and corneal diseases in descending order of frequency. At the LV Prasad Eye Institute in Hyderabad, Khan did a retrospective study of low vision cases reviewed at their hospital[9] and found retinitis pigmentosa, diabetic retinopathy, macular diseases and degenerative myopia to be the commonest causes of low vision in their setting.

When reviewing the clinical effect of low vision aids in patients attending their low vision clinic at the Samsung Medical Centre in Seoul Korea, Yong-Hoon Ji et al noted that optic nerve atrophy, diabetic retinopathy and age-related macular degeneration were the most common underlying causes of low vision.[10]

Shah and Minto et al[7] in Pakistan compared rural and urban populations and found retinal conditions to be the commonest causes of low vision in urban populations in contrast to corneal opacity found more in rural areas. Gilbert et al in their surveys in Asia, Africa and Latin America[8] found retinal lesions and amblyopia common.

De Carvalho et al[11] studied the characteristics of low vision retrospectively from the clinical records of 395 children <14 yrs of age who were attended by the Low Vision Service of the State University of Campinas in Brazil, and found the major causes of low vision to be bilateral congenital toxoplasmic macular scars, optic atrophy and congenital cataracts.

Two other studies have been done in Brazil, both by Haddad et al, the first on 385 patients[12]- children and adolescents – at one low vision centre, and the second an extension of this first study, this time a study of 3,210 cases from two centres.[13] They found the main causes in the first study to be congenital glaucoma, macular retinochoroiditis due to congenital toxoplasmosis, congenital cataract, retinal and macular inherited disorders and optic atrophy.

In the second study on the larger population, they had similar findings with toxoplasmic macular retinochoroiditis, retinal dystrophies, ROP, ocular malformation, congenital glaucoma, optic atrophy and congenital cataracts being the main causes of low vision. However, the main drawback with these two studies is the confusion with visual impairment, following the WHO ICD 10 classification.

Similarly, Gothwal and Herse[14] did a cross-sectional survey of consecutive records of 220 children presenting at a paediatric low vision centre in a private eye hospital in Hyderabad, using the WHO ICD 10 classification. They found the four main causes of low vision to be congenital glaucoma, hereditary macular degeneration, retinitis pigmentosa and albinism. Ingelse and Steele did the same, studying the characteristics of the paediatric and adolescent low-vision population (n=260) at the Illinois School for the Visually Impaired.[15] Optic atrophy, cataracts and ROP were significant aetiologies of low vision.

3.3 Low Vision Aids

The vast majority of patients who attend a low vision clinic for the first time have a significant degree of visual impairment; almost 8 out of 10 are unable to read normal print and almost 7 out of 10 have a binocular visual acuity below 6/18. This finding is of some concern because people with such poor vision are likely to experience considerable difficulty in performing many daily tasks.[16] There is light at the end of this tunnel though, as is evidenced by studies done to demonstrate the different types of optical and non-optical LVA's prescribed and the effectiveness of these LVA's. Tom Margrain, in his study in Cardiff (n=168)[16], concluded that low vision aids are an effective means of providing visual rehabilitation, helping almost 9 out of 10 patients to read. The LVA's provided to his study population included high power reading additions, hand magnifiers with and without illumination, and stand magnifiers with and without illumination. Other LVA's formed a small percentage. This has also been demonstrated by Yong-Hoon Ji et al in their study on the clinical effect of LVA's[9] where they demonstrated marked improvement in visual acuity and patient satisfaction with the use of LVA's, mainly hand magnifiers, high powered spectacle lenses and stand magnifiers for near vision, and Galilean and Keplerian telescopes for distant vision. Rohrschneider et al studied satisfaction with low vision aids. When comparing the LVA's provided, most patients with ARMD were supplied with magnifiers. Thirty percent of patients supplied with CCTV's used them daily. They concluded that the majority of low vision patients are very satisfied with the prescription of LVA's and frequently use them.[17]

In the study by Khan[9], visual rehabilitation was achieved by using accurate correction of ametropia; approach magnification and telescopes for recognizing faces and board work; Spectacle magnifiers, hand/stand magnifiers, CCTV's, overhead illumination lamps and reading stands were prescribed for reading tasks; light control devices were used for glare control; and cane and flashlight were prescribed for mobility. Patients were trained in activities to improve their daily living skills, counseled in environmental modifications and ancillary care for educational and vocational needs.

Gothwal and Herse[14] found approach magnification sufficient for near tasks in pre-school and school children with appropriate spectacles forming the mainstay of distant vision. Haddad et al[12] concluded that the most widely used optical aids for distance were telescopic systems while that for near was the 2xmagnifying bar. In the Ingelse and Steele Illinois study[15], hand-held telescopes, bifocals/high adds and tinted lenses were the major low vision devices prescribed.

4.0 RATIONALE

It has been estimated that 7 million children worldwide have low vision due to ocular disease.[14] A WHO report on the global burden of disease in 2004 placed the total DALYS for Africa at 376,525,000. The number of DALYS contributed to this by Sense Organ Disorders is 9,403,000. Of this, glaucoma contributes 1,061,000, cataracts contribute 3,915,000, Refractive errors contribute 1,394,000 and macular degeneration and related disorders contribute 826,000. Other causes of low vision have not been mentioned. Considering that children have a higher DALYS because of more life years, this translates into a serious problem, and more studies need to be done focusing on the causes of low vision in children. According to Gilbert and Foster[18], due to their life expectancy, VI in children has social and economic impacts comparable to those of the elderly.

Prevalence of low vision increases dramatically with advancing age. Provision of low vision services to this age group is important since it would help increase the duration of their economic productivity and reduce the burden of their support on their carers and the government. A survey of the causes of low vision in the elderly and the type of low vision aids provided would provide valuable information.

In these studies, it would be important to identify the underlying causes of low vision which are preventable or treatable so that future generations of children have a better chance at a life unhindered by disability. Also, knowledge of the causes of VI is crucial in designing efficient preventive measures and visual habilitation and rehabilitation services to promote independence, improve quality of life, and increase access to education to improve productivity.

Many of the studies that have been done focus on causes of severe visual impairment along with blindness (SVI/BL) and are usually done among children in schools for the blind. This gives a skewed perspective and is not representative of the population. Low vision encompasses more than just SVI and people with low vision can have functional vision with the right assistance. We felt that a study done at a specialist low vision clinic, although still

not representative of the population, would give a more accurate picture of the characteristics of low vision, and the solutions available to address the problem.

5.0 OBJECTIVES

5.1 Main Objective

1. To determine the underlying causes of low vision in patients presenting at the Low Vision Clinic of Kikuyu Eye Unit (KEU)
2. To assess the type of LVA given to each patient found to have low vision

5.2 Specific Objectives

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

6.0 METHODOLOGY

6.1 Study Definitions

1. **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 VA of less than 6/18 (20/60) to light perception, or a visual field of less than 10° from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task.
2. **Child** → individual <16 yrs of age

6.2 Study Area

P.C.E.A Kikuyu Hospital, Eye Unit, Low vision Clinic. Located 20km northwest of Nairobi in Kikuyu town, Kiambu District.

6.3 Study Design

Retrospective case series

6.4 Sample Size and Sampling Methods

All records of patients seen at the Low Vision Clinic from 1st January 2007 to 31st December 2007 were scrutinized. An average of 70 low vision cases is recorded per month. Comprehensive records are not available prior to 2006.

Minimum sample size was found to be = 151 using the formula:

$$n = \frac{t^2PQW}{E^2 + \frac{t^2PQW}{N}}$$

Whereby:

t = 1.96 (95% CI) – fixed value

P = assumed population prevalence = 1.05% = 0.00105

Q = 1 – P = 0.99895

W = likely design effect (for simple random sampling is close to 1.0)

E = acceptable sampling error (± 0.005 for smaller expected prevalence)

N = 70 patients per month x 33mths (Jan 2006 to Sept 2008) = 2,310

6.5 Inclusion Criteria

All records of new patients with BCVA <6/18-PL/VF<10° even after treatment and/or standard refractive correction, seen at the low vision clinic, KEU

6.6 Exclusion Criteria

All records of patients seen by the low vision clinic of KEU on outreach basis; re-visits; patients with a BCVA ≥ 6/18

6.7 Data Collection and Processing

A copy of every low vision assessment sheet is kept in the Low Vision Clinic and filed per year. The assessments for 2007 were checked and eligible cases as per case definition were identified and a list made. These files were retrieved with the help of records personnel at KEU with approval from the director of KEU.

Data was collected in the form of a structured questionnaire (appendix 11.3) and entered into a database designed in Microsoft Access. It was then exported to Microsoft Excel as a database and analyzed using the Statistical Package for Social Scientists software (SPSS). The data was cleaned and validated before actual analysis which was done using appropriate statistical tests with the aid of a biostatistician

The findings have been presented in the form of tables, graphs and pie charts where appropriate.

These findings have been discussed, logical conclusions drawn and recommendations made, then submitted to the University of Nairobi Department of Ophthalmology and the Low Vision Clinic at Kikuyu Eye Unit.

6.8 Sources of error

For patients who were assessed at the clinic then placed in special schools or introduced into the integrated programme as a part of their management, the main file is kept at the specific school for ease of follow-up on outreach basis. For these patients, data was obtained from their low vision assessment sheet only and not from the actual file since the investigator had no access to it.

6.9 Ethical Considerations

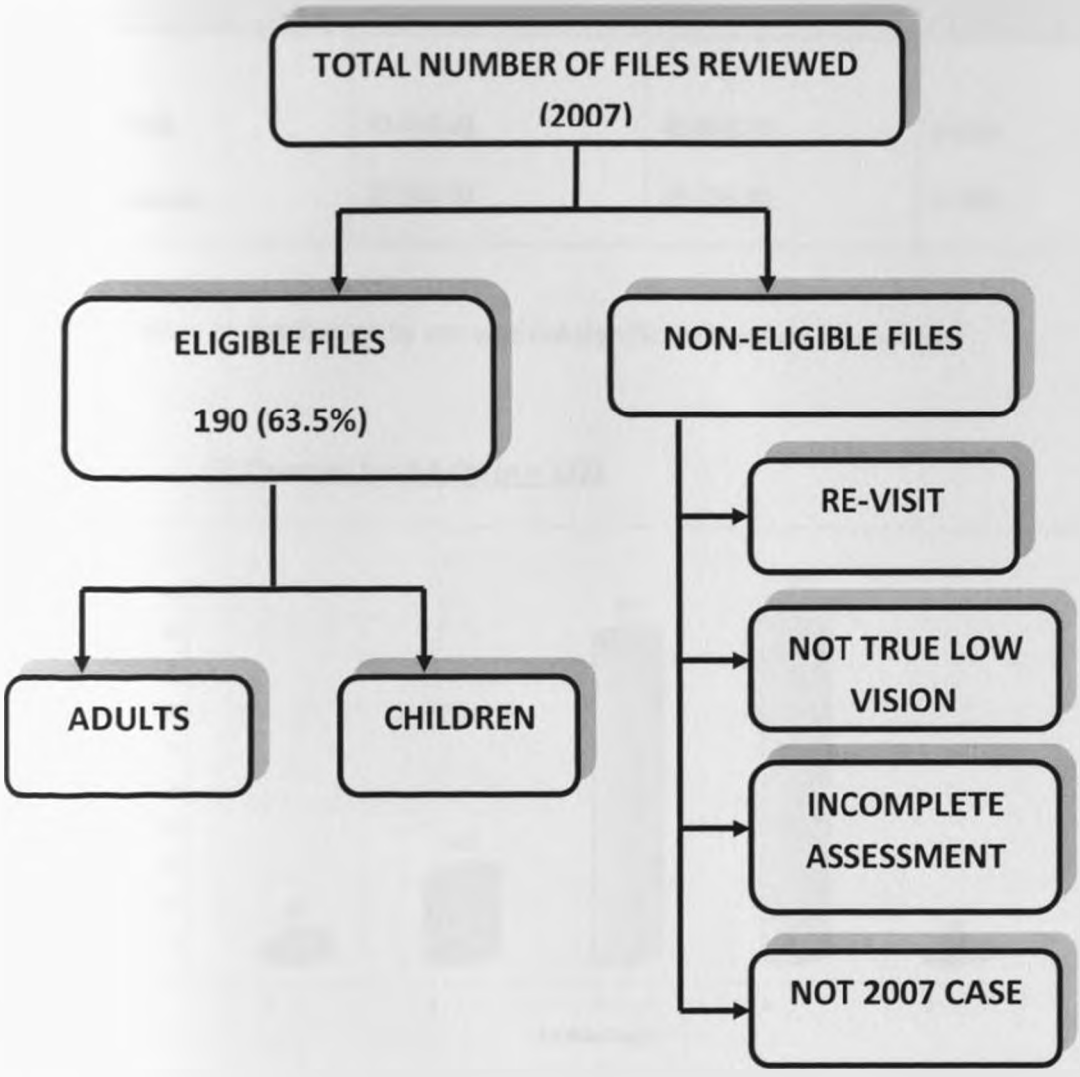
A written, signed consent was obtained from the director of KEU to do this study on their premises and to allow access to medical records of patients presenting there (appendix 11.4)

Patients' identity and any other personal information from their records were kept anonymous by the principal investigator, and will not appear in any publications. Patients' records did not leave the premises of KEU and information collected was accessible only to the investigator, her supervisors and the biostatistician analyzing the data.

A copy of the proposal was also submitted to the Kenyatta National Hospital Ethics Committee for approval, and the study was approved.

7.0 RESULTS

Figure 2: Study Flow Chart



*The cases which were not true low vision cases had a presenting BCVA ≥6/18 (11), uncorrected refractive errors (5) which improved to VA ≥ 6/18 after appropriate correction, un-operated cataracts (4) and 1 was malingering.

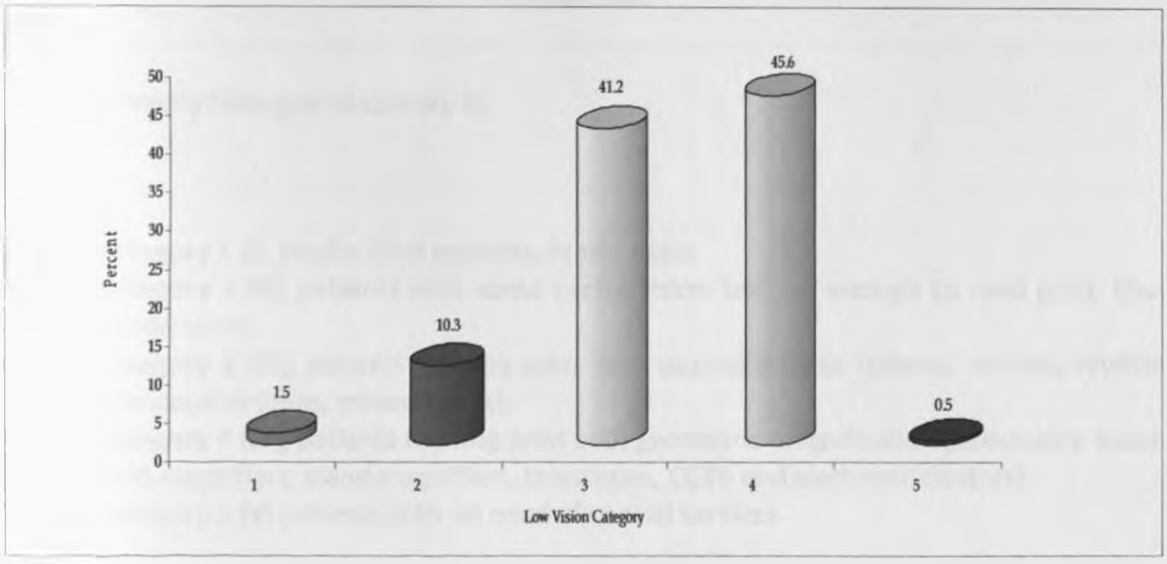
*Of the files reviewed, 1 was from 2006 and 2 were from 2008, mistakenly filed with 2007 records.

Table 1: **Distribution by Sex (n = 190)**

Factor	Adults (122), n (%)	Children (68), n (%)	P-value
Sex			
• Male	83 (68.0)	43 (63.2)	0.504
• Female	39 (32.0)	25 (36.8)	0.504

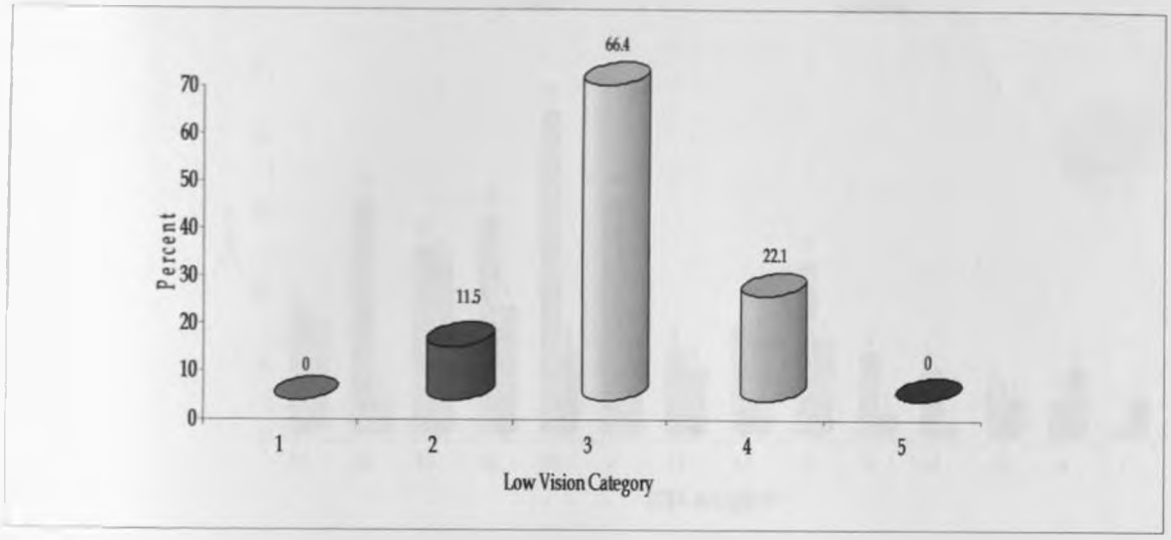
The difference in distribution by sex was not significant in adults or children.

Figure 3: **LV Category for Adults (n = 122)**



Most adults were classified as category IV or category III cases.

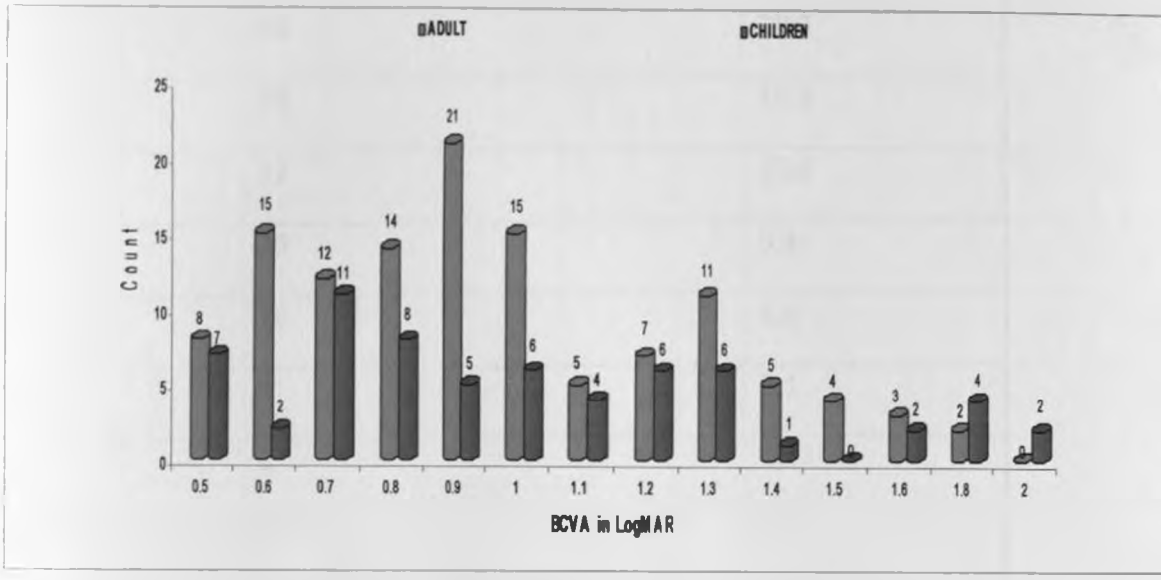
Figure 4: **LV Category for Children (n =68)**



Children mainly belonged to cateory III.

- Category 1 (I), totally blind patients, Braille users
- Category 2 (II), patients with some useful vision but not enough to read print, thus Braille users
- Category 3 (III), patients reading print with optical devices (prisms, mirrors, reverse telescope systems, minus lenses)
- Category 4 (IV), patients reading print with geometric magnification (spectacles, hand-held magnifiers, stand magnifiers, telescopes, CCTV and electronic devices)
- Category 5 (V) patients with no need of special services

Figure 5: **Presenting BCVA (n =186)**



Most patients had a logMAR BCVA of 0.5 to 1.0 (69.7% adults, 57.4% children).

Note: *VA for 4 patients was not recorded.

*BCVA taken with low vision charts (Lea line, Lea symbols, LVRC charts) and converted to logMAR for ease of comparison

- HVF was done for 11 patients of the 190, usually the ones who were diagnosed with glaucoma, and field defects within 10°/involving the point of fixation were found in 7 of them.
- Nine patients were noted to have field defects on confrontation but no quantification by HVF/Goldmann perimetry was recorded.

Table 2: **Distribution by Province (home district)**

Province	Frequency	Percent
Nairobi	38	20.0
Central	29	15.3
R/Valley	22	11.6
Nyanza	10	5.3
Eastern	16	8.4
N/Eastern	4	2.1
Coast	2	1.1
Western	3	1.6
Total	124	65.3
Not Recorded	66	34.7
Total	190	100.0

Most patients hailed from Nairobi, Central and Rift Valley province.

*** The point of referral was found to be recorded in 43 patients of the 190, the main referrals being from Nairobi (14-KNH 4, schools 4,others from Lion's Sight First Eye Hospital, Gertrude's, St. Mary's, 2 ophthalmologists and an optometrist), Machakos (5), Nakuru PGH (4), Meru (3) and Mombasa (3-all from LHFC). Other referrals were from Kisumu (2), Sabatia (2) and, of the remaining 11 patients, 1 patient was from Laikipia, 1 from Kiambu, 1 from Bungoma, 1 from Eldoret, 1 from Garissa DH, 1 from Thika, 1 from Kisii, 1 from Murang'a, 1 from Nyeri and 1 from KSB Kericho.

Table 3: Clinical Diagnosis

Diagnosis	Adults	Children	Total
1. Not recorded	7	3	10
2. Congenital anomalies	9	11	20
3. Retinal disorders	64	15	79
4. Optic nerve disorders	22	9	31
5. Lens disorders	0	5	5
6. Corneal disorders	12	8	20
7. Amblyopia	6	6	12
8. Refractive disorders	2	5	7
9. Disorders of visual cortex	0	3	3
10. Phthisis bulbi	0	2	2

Diabetic retinopathy was the main culprit causing low vision in adults and optic atrophy was the leading cause in children.

Table 4: **Preventable and Potentially Treatable Causes**

Diagnosis	Adults	P	PT	Children	P	PT
1. Not recorded	7	-	-	4	-	-
2. Congenital anomalies	9	3	1	11	4	3
3. Retinal disorders	64	41	3	15	2	2
4. Optic nerve disorders	22	4	9	9	2	-
5. Lens disorders	0	-	-	5	-	3
6. Corneal disorders	12	10	2	8	3	5
7. Amblyopia	6	6	-	6	6	-
8. Refractive disorders	2	-	1	5	-	3
9. Disorders of visual cortex	0	-	-	3	3	-
10. Pthisis bulbi	0	-	-	2	2	-
	122	**80(65.6%)**		**68**	**38(55.9%)**	

P = Preventable

PT = Potentially Treatable

Fifty six percent of low vision in children is preventable or potentially treatable. Of the causes of low vision found in adults, 16 were potentially treatable and 64 were preventable accounting for 80 of 122 adults (65.6%) in whom low vision could have been avoided. The breakdown of the different clinical diagnoses obtained in each category of anatomical diagnosis, and whether preventable or potentially treatable is given in the following tables:

Table 5: Congenital Anomalies

Clinical Diagnosis	Adults	P	PT	Children	P	PT
1. Ocular albinism	3	3	-	3	3	-
2. Congenital nystagmus	-	-	-	1	-	-
3. Congenital Glaucoma(Rxed)	1	-	1	3	-	1
4. Uveal coloboma involving optic disc	3	-	-	3	-	-
5. X-linked retinoschisis	-	-	-	1	1	-
6. Optic nerve hypoplasia	1	-	-	-	-	-
7. Peter's anomaly	1	-	-	-	-	-

Table 6: **Retinal Disorders**

Clinical Diagnosis	Adults	P	PT	Children	P	PT
1. Maculopathy	12	1	-	7	2	-
2. Macular scarring	3	-	-	4	-	-
3. Retinitis pigmentosa	9	9	-	2	2	-
4. Retinal detachment	3	-	3	1	-	1
5. Retinal vasculitis	-	-	-	1	-	1
6. Diabetic retinopathy	15	15	-	-	-	-
7. Stargardt's disease	9	9	-	-	-	-
8. ARMD	5	-	-	-	-	-
9. Toxoplasma Chorioretinitis	4	4	-	-	-	-
10. Macular holes	3	3	-	-	-	-
11. Neuroretinal disease	1	-	1	-	-	-

*Two children and 1 adult had chloroquine-related Bull's eye maculopathy

Table 7: **Optic Nerve Disease**

Clinical Diagnosis	Adults	P	PT	Children	P	PT
1. Optic Atrophy	8	4	-	9	2	-
2. Glaucoma	9	-	9	-	-	-
3. Optic Neuropathy	5	-	-	-	-	-

* Of the optic atrophy noted in children, 1 was post-traumatic after a fall from a height and 1 developed after meningitis. In adults, 1 was found to have optic atrophy after kala azar infection, 1 after carotid occlusion, 1 after optic neuritis and 1 after AION

* One patient was diagnosed with Leber's optic neuropathy

*** Two children had subluxated lenses as part of the disease spectrum of Marfan's syndrome; 3 children were found to have low vision after surgery for congenital cataracts.

Table 8: **Corneal Disorders**

Clinical Diagnosis	Adults	P	PT	Children	P	PT
1. Corneal dystrophy	-	-	-	3	-	3
2. Keratoconus	3	3	-	3	3	-
3. Corneal scars and opacities	-	-	-	1	-	-

* One child had corneal scarring after severe vernal keratoconjunctivitis. Two adults developed corneal scars 2° to herpes simplex virus keratitis, 1 after chronic keratitis, 1 after trichiasis (cause not specified). One had a failed corneal graft with complete opacification.

Table 9: **Amblyopia and Refractive Disorders**

Clinical Diagnosis	Adults	P	PT	Children	P	PT
1. Refractive amblyopia	4	4	-	5	5	-
2. Deprivational amblyopia	2	2	-	1	1	-
3. High myopia	-	-	-	3	-	3
4. High hyperopia	1	1	-	-	-	-
5. Degenerative myopia	1	-	-	2	-	-

* The patients with high myopia and high hyperopia even after appropriate correction did not have good VA suggesting an amblyopic component

*** Two children were diagnosed with cortical blindness, 1 of which was secondary to meningitis.

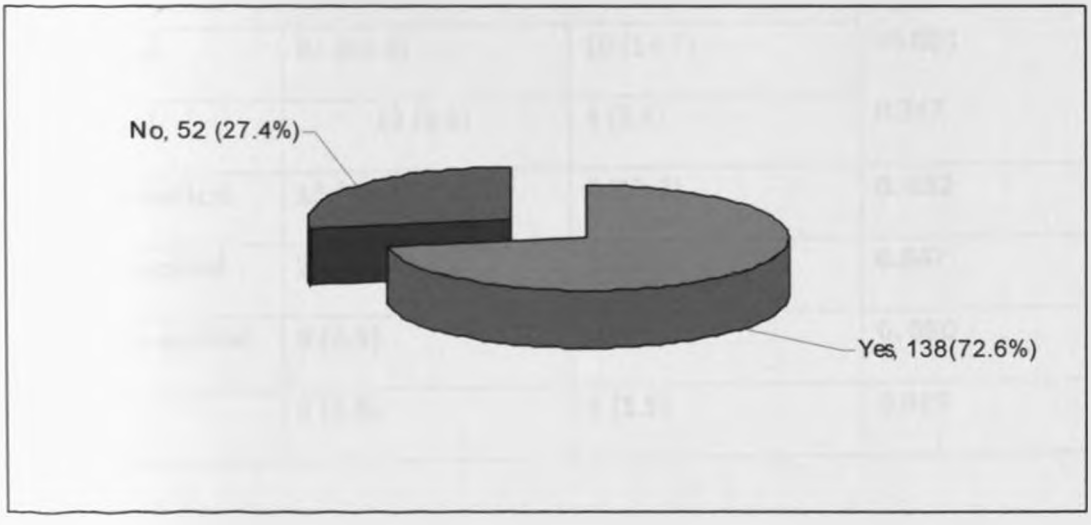
*** Two children had phthisis bulbi, 1 due to toxoplasmosis and 1 due to keratoconus

Table 10: **Associated disability**

Disability	Status	
	Adult, n (%)	Children, n (%)
None	118 (96.7)	65 (95.6)
Hearing Impairment	2 (2.5)	0
Mental Handicap	0	1 (1.5)
Physical Handicap	1 (0.8)	1 (1.5)
Learning Disability	0	1 (1.5)

Associated disabilities were found in only 6 of the 190 patients.

Figure 6: **LVA given (n =190)**



LVA Far = 65/138, LVA near = 91/138, Non-Optical LVA = 16/138

Table 11: LVA provided

Status	LVA given		OR (95%CI)	p-value
	Yes, n (%)	No, n (%)		
Adults	101 (73.2)	21 (40.4)	4.0 (2.1 – 7.9)	<0.001
Children	37 (26.8)	31 (59.6)		
Total	138 (100.0)	52 (100.0)		

Adults were 4 times more likely to be prescribed LVA's.

Table 12: Type of LVA given

LVA	Status		p-value
	Adult, n (%)	Children, n (%)	
Far optical	32 (26.2)	33 (48.5)	0.002
Near Optical	81 (66.4)	10 (14.7)	<0.001
Non-Optical	12 (9.8)	4 (5.9)	0.347
Far + near optical	**15 (12.3)**	**9 (13.2)**	**0. 852**
Far + non-optical	**3 (2.5)**	**2 (2.9)**	**0.842**
Near + non-optical	**9 (2.5)**	**1 (1.5)**	**0. 080**
All	**2 (1.6)**	**1 (1.5)**	**0.929**

Adults were more likely to be prescribed LVA's for near.

Table 13: LVA for Far (n = 65)

LVA Far	Frequency			Percent
	Adults	Children	Total	
+10D spectacle magnifier	0	1	1	1.5
2x telescope	2	10	12	18.5
3x telescope	3	4	7	10.8
4x telescope	12	10	22	33.9
6x telescope	10	6	16	24.6
8x telescope	5	2	7	10.8
Total	**32**	**33**	**65**	**100.0**

The commonest LVA for distance provided to adults was the 4x telescope, while for children it was the 2x or the 4x telescope.

The +4 DS spectacle magnifier was most likely to be provided for near vision (Table 14).

Table 14: LVA for Near (n = 91)

LVA Near	Frequency			Percent
	Adults	Children	Total	
+4D spectacle magnifier	14	3	17	18.7
+6D spectacle magnifier	13	0	13	14.3
+8D spectacle magnifier	12	0	12	13.2
+9D spectacle magnifier	0	1	1	1.1
+10D spectacle magnifier	9	2	11	12.1
+12D spectacle magnifier	4	0	4	4.4
+13D spectacle magnifier	2	0	2	2.2
+14D spectacle magnifier	7	0	7	7.7
+16D spectacle magnifier	4	0	4	4.4
+20D spectacle magnifier	3	2	5	5.5
+28D spectacle magnifier	1	0	1	1.1
10X stand magnifier	1	0	1	1.1
15x peak loupe	4	0	4	4.4
3x stand magnifier	1	0	1	1.1
3x/5x hand magnifier	1	0	1	1.1
7x hand held magnifier with illumination	1	0	1	1.1
7x stand magnifier	3	1	4	4.4
9x stand magnifier	1	1	2	2.2
Total	81	10	91	100.0

Table 15: **Non-Optical LVA (n = 16)**

LVA Non-Optical	Frequency			Percent
	Adults	Children	Total	
CBM box	2	1	3	18.8
Filter lenses	0	1	1	6.3
Functional print	3	0	3	18.8
Illumination	1	0	1	6.3
O & M training	3	0	3	18.8
Reading Stand	1	1	2	12.5
Reduced reading distance	2	0	2	12.5
Visual Stimulation	0	1	1	6.3
Total	12	4	16	100.0

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Table 16: **Outcome of assessment**

Comment	Adults	Children	Total
No comment	8	8	16
VA near Improves with LVA	79	9	88
VA far Improves with LVA	31	31	62
Integrated programme/School place/Vocational training	12	26	38
Counseling/Rehabilitation	12	3	15
Braille training	4	2	6
No improvement with LVA	5	2	7
Improvement with correct Refraction	8	16	24

Eight out of 10 patients showed improvement wit the use of LVA's.

Eight patients refused LVA's at prescription for various reasons.

8.0 DISCUSSION

According to the records department at KEU, the estimated number of patients attending the Low Vision Clinic was 70 per month in 2008. However, the total number of files found for patients reviewed in 2007 was 299, which is an average of 25 patients per month. This could be because of an increase in the number of patients at KEU in 2008 compared to 2007 – i.e more people reaching out for low vision services. Another explanation is that at KEU only the patients believed to potentially benefit from low vision evaluation and assistance actually undergo the full evaluation. Illiterate patients are not assessed for low vision – the LVA's are geared more towards those who can read. Patients undergo a screening and those for rehabilitation and counseling are usually sent directly for the same to their own rehabilitation centre, or KSB's nearest facility.

Of the files screened, 190 patients were found to be eligible for the study. One hundred and nine were excluded because of various reasons. Eight four were returning patients, visiting the clinic in 2007 on follow-up basis. Twenty one patients did not fit the study definition for low vision – 11 patients had a BCVA of $\geq$ 6/18 in the better eye even if the other eye was at low vision level or at no light perception; 5 patients were found to improve to VA of $\geq$ 6/18 in the better eye after appropriate refraction; 4 patients had un-operated cataracts – low vision assessment and evaluation can be done only after the standard appropriate treatment, i.e. cataract surgery, has been provided; 1 patient was malingering and, after assessment, was found to have a true BCVA of 6/5. Three records had been mis-filed with 2007 records. One was from a patient seen in 2006 and 2 were of 2008 patients.

Contrary to expectations, children formed only 1/3 of the new patients reviewed at the Low Vision Clinic in 2007. Since the project was originally geared towards improving the lives of children, this finding might be confusing, but there are many factors which could be contributory. First, the Low Vision Clinic has an extensive outreach programme serving many

centres in different parts of Kenya. It is involved in the Integrated Programmes in Kitui, Nairobi, Embu and Nyeri, and the low vision staff assesses patients at the institutionalized schools for the blind including Thika Primary, Thika High School, Likoni, St. Oda, St. Lucy's Kibos, and St. Lucy's Igeji. Thus, most children are reviewed on outreach basis at the schools where they've been placed, negating the need for them to report to the main clinic for review and assessment. Another factor is that adults are finding an avenue for them to "regain" whatever they have lost to a certain degree as far as vision is concerned, and this leads them to seek the service more than they have been doing before. There is also the fact that it is a relatively new field of practice so the novelty factor plays a role.

In both adults and children, the M:F ratio was found to be ≈ 2:1 (Table 1). The difference in distribution by sex was not found to be significant. This could be because males usually get priority in accessing treatment for cultural reasons.

As mentioned in our background, in the Low Vision Project at KEU, low vision has been classified into educational categories[5] which have been very useful when explaining the educational needs of children with low vision. In the study, most of the patients were classified in categories III/IV of low vision (Fig. 3, Fig. 4), which bodes well for the project since this signifies that these patients can be assisted with appropriate aids. Again, the filtering system in place for patients at the Low Vision Clinic alluded to previously in this discussion could be a factor in determining the pattern of distribution of low vision categories.

VA for all patients was done using different charts including Snellen notations, Lea numbers, Lea symbols, Low Vision Resource Center (LVRC) Bailey-Lovie charts and amblyopia testing charts. Objective and subjective refractions were done in all patients and the BCVA recorded. All VA has been converted to logMAR for introducing uniformity and ease of analysis. The vision in the better eye has been considered in keeping with the definition of low vision, and considering the patient as a whole, not the eyes individually.

Along with VA testing, contrast and glare sensitivity testing, colour vision assessment, ocular motility and binocular vision assessment, visual field assessment and ocular health assessment are necessary for a comprehensive low vision assessment. Since some of these are difficult to quantify, the definition of low vision only mentions VA and visual field parameters for diagnosis. When collecting data, it was noted that all other assessment was performed thoroughly. However, visual field charts were found in only 11 patients of the 190, usually the ones diagnosed with glaucoma, and field defects with 10°of or involving the point of fixation were found in 7 of them. Nine patients were found to have field defects on confrontation visual field testing but no quantification by HVF/Goldmann was recorded. Research has shown that visual field integrity may be as important as visual acuity to reading ability, and it is certainly a critical factor with respect to independent travel concerns. Visual field findings should be correlated with the patient's visual functioning, and peripheral field losses should be quantified to determine whether the patient is a candidate for visual field enhancement devices.[19]

When considering the patients' districts of origin (Table 2), most patients were from around Kikuyu, the majority being from Nairobi (20%). However, all the provinces in Kenya featured in the patient database, signifying the extent of the service the low vision unit at KEU provides. Points of referral were documented in only 43 of the 190 files.

In their Andhra Pradesh study for planning low vision services in India, Dandona et al[6] found that the most frequent causes of low vision in a population of 10,293 individuals included retinal diseases, amblyopia, optic atrophy, glaucoma and corneal diseases in descending order of frequency. At the LV Prasad Eye Institute in Hyderabad, Khan did a retrospective study of low vision cases reviewed at their hospital[9] (n = 410) and found retinitis pigmentosa, diabetic retinopathy, macular diseases and degenerative myopia to be the commonest causes

of low vision in their setting. In this study, the patient base was divided into adults and children, and the causes were documented for each group separately to note the pattern in each, and to identify any differences. For adults the main causes of low vision in descending order of frequency were retinal diseases, specifically, diabetic retinopathy, maculopathy, Stargardt's disease and retinitis pigmentosa, glaucoma, corneal scarring and opacification, optic atrophy and amblyopia. In children, the main cause was optic atrophy, followed by maculopathy, amblyopia and keratoconus (Table 3). The pattern of causes obtained here for both adults and children is comparable to the Andhra Pradesh study.[6]

Congenital glaucoma and cataract are conditions where the prognosis for vision is good if the intervention is early. Hereditary conditions can be prevented primarily by genetic counseling.

Three patients of the 190 (2 children and 1 adult) had chloroquine-related Bull's eye maculopathy which is of concern since it implies negligence on the side of healthcare professionals or abuse of medications in the form of un-restricted over-the-counter sale of anti-malarials.

Retinal detachments have a good visual prognosis after surgery if detected early enough.

Retinitis pigmentosa and Stargardt's disease are hereditary retinopathies which could be prevented by appropriate genetic counseling although this applies more to Stargardt's than to RP, because RP has a less predictable pattern of inheritance and can appear sporadically without any family history.

Diabetic retinopathy (DR) is preventable if the diabetes is diagnosed and controlled early preventing complications like DR from occurring. Loss of vision even when DR develops is preventable by keen screening and early laser treatment.

Macular holes can be prevented by laser treatment around an impending or occult hole if detected, or satisfactorily treated (VA $\geq$ 6/12) by surgery within one year of a hole developing.

Hereditary corneal dystrophies can be prevented primarily by genetic counseling.

Of the children with corneal scars, 1 was due to severe vernal kerato-conjunctivitis, which could have been prevented by appropriate treatment. In adults, 2 were secondary to HSV keratitis, 1 after chronic keratitis and 1 was post-trichiasis. No cases of trachomatous corneal scarring, or corneal scarring 2° to vitamin A deficiency were recorded.

Definitive treatment for keratoconus is penetrating keratoplasty.

Two children presented with subluxated lenses as part of the disease spectrum of Marfan's syndrome. Un-operated congenital cataracts form a large part of the burden of VI in studies done in schools for the blind etc, but do not figure markedly in low vision because the definition of low vision excludes conditions which have a standard treatment. These children can be assessed for low vision only if their VA is poor after cataract surgery and appropriate refraction. Three children were found to have low vision after surgery for congenital cataracts.

Six children were found to have amblyopia which was refractive in 5 of them. This could have been prevented by early diagnosis and appropriate refractive correction. Three other children had high myopia which even after appropriate correction did not give good VA suggesting an amblyopic component, which could have been prevented. Similarly, in adults, 6 were diagnosed with amblyopia, of whom 4 were refractive amblyopia and 2 were deprivational, all of which is preventable. Two patients had refractive disorders, one with high hyperopia and the other with degenerative myopia.

Two children were diagnosed with cortical blindness, 1 of which was 2° to meningitis. Two children had phthisis bulbi, 1 due to toxoplasmosis and 1 due to keratoconus. Low vision could have been prevented in all these patients with close follow-up and early intervention.

From this study, it was estimated that low vision could have been avoided in 55.9% of children and 65.6% of adults with appropriate prevention or early and adequate treatment (Table 4). There is a paucity of literature available to compare rates of preventable or potentially treatable causes of low vision.

Associated disabilities were found in only 6 of the cases who presented at the low vision clinic in 2007 (Table 10). The proportion of associated disability is expected to be higher because the factors contributing to low vision also contribute to other impairments. Seventy eight percent of the children diagnosed with uncorrectable visual loss in the United Kingdom over a 1 year period had impairments in addition to severe visual loss or blindness. The associated disorders were motor, sensory, or cognitive impairments or chronic serious disorders that affected development, education, or independent living.[20] However, this is data from a developed country where accessibility to health care services and better interventions ensure a greater chance of survival. Genetic and chromosomal abnormalities, as well as ROP, are commoner. The spectrum of disabilities found in these children is different in comparison to

developing countries where many of the conditions associated with blindness in children are also causes of child mortality (e.g. premature birth, measles, congenital rubella syndrome, vitamin A deficiency, and meningitis), [18] and these children probably do not survive in early childhood. Another explanation for this finding could be the fact that the other impairments could be considered to be more disabling than low vision per se and patients or their parents concentrate on those areas rather than rehabilitating for low vision. Furthermore, patients with multiple disabilities are considered to be beyond assistance and no help is sought.

In the study by Khan[9], visual rehabilitation was achieved by using accurate correction of ametropia; approach magnification and telescopes for recognizing faces and board work; Spectacle magnifiers, hand/stand magnifiers, CCTV's, overhead illumination lamps and reading stands were prescribed for reading tasks; light control devices were used for glare control; and cane and flashlight were prescribed for mobility. Patients were trained in activities to improve their daily living skills, counseled in environmental modifications and ancillary care for educational and vocational needs. Gothwal and Herse[14] found approach magnification sufficient for near tasks in pre-school and school children. Haddad et al[12] concluded that the most widely used optical aids for distance were telescopic systems while that for near was the 2x magnifying bar. In the Ingelse and Steele Illinois study[15], hand-held telescopes, bifocals/high adds and tinted lenses were the major low vision devices prescribed.

In this case series, LVA's were provided to 76.2% of patients (Fig. 6), and it was found that near optical aids were more likely to be given to adults (Table 12). For distance optical aids, the commonest given to adults was the 4x telescope while for children it was the 2x or the 4x telescope (Table 13). In near optical aids, both adults and children were most likely to be provided with a +4DS spectacle magnifier (Table 14). The non-optical aids most commonly provided to adults were training in functional print reading, and orientation and mobility training. Children were provided with CBM boxes, colour filter lenses and visual stimulation techniques (Table 15).

Eight out of 10 patients found an improvement in their reading with the use of LVA's (Table 16). This is comparable what Margrain found in his study in Cardiff (n=168)[16], where he concluded that low vision aids are an effective means of providing visual rehabilitation, helping almost 9 out of 10 patients to read. The LVA's provided to his study population included high power reading additions, hand magnifiers with and without illumination, and stand magnifiers with and without illumination. Yong-Hoon Ji et al, in their study on the clinical effect of LVA's[9] on 118 patients, demonstrated marked improvement in visual acuity and patient satisfaction with the use of LVA's, mainly hand magnifiers, high powered spectacle lenses and stand magnifiers for near vision, and Galilean and Keplerian telescopes for distant vision.

Of note in the above study, of the patients assessed, 3 found LVA use cumbersome (2 took them on trial basis only); 2 showed marked improvement but said they would come for them later (probable financial constraints); 2, despite having considerable improvement with LVA's, were adamant that they did not need them, and were comfortable without; and 1 patient insisted on refractive correction which was not helping as much as the LVA prescribed. Three patients were advised on procurement of CCTV's.

9.0 CONCLUSIONS

Despite the Low Vision Project was geared towards children at inception, there were more adults presenting at the low vision clinic than children.

Centres in Nairobi referred a number of patients for low vision assessment and management, and patients at the clinic were usually from Nairobi, Central or Rift Valley province.

Most of the patients were likely to be classified in category III/IV of low vision with a logMAR BCVA of 0.5-1.0, which bodes well for the low vision programme since this signifies that these patients can be assisted with appropriate aids.

Visual field testing was done in fewer patients than necessary.

Considering the underlying causes of low vision, diabetic retinopathy was the commonest cause in adults, and optic atrophy in children.

More than half of the cases of low vision could have been avoided with appropriate prevention, or early diagnosis and appropriate, timely treatment.

Associated disability was found in fewer patients than expected.

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.

Eight out of ten patients showed improvement with the use of LVA's.

Four percent of patients, despite demonstrating improvement with LVA's on assessment, were resistant to the use of LVA's for various reasons.

10.0 RECOMMENDATIONS

Public Health education regarding the magnitude of low vision which is preventable or potentially treatable with primary prevention, early diagnosis or early intervention. The Vision 2020 programme aims for *'a world in which no one is needlessly blind and where those with unavoidable vision loss can achieve their full potential.'* Low vision is one of the target disease areas in the Vision 2020 initiative and this in itself indicates that it is a significant problem worldwide. Vision 2020 intensively advocates for increased awareness of the need for low-vision services, and courses to train national focal persons in low - vision programme management have been conducted in four regions. A low - vision resource centre is operating from Hong Kong, Special Administrative Region, China, to distribute high-quality, affordable low-vision devices and equipment to all regions. Low - vision services have been set up in some tertiary paediatric eye centres and often serve as national models.

Promotion of awareness of LVA's as an effective tertiary intervention. Persons with low vision are often unaware that they can be helped. Communication and referral between eye-care, special education, rehabilitation and low-vision services are often inadequate. One of the Vision 2020 strategies is to advocate for the inclusion of low-vision care as part of eye-care, education and rehabilitation services, and for awareness about low vision and low-vision services in the community and among health, education and rehabilitation professionals. Another strategy is to include low vision in the curriculum of ophthalmologists and other eye-care personnel.

Training of more refractionists and low vision specialists, and expansion of the integrated programme with establishment of more refraction and low vision clinics. Vision 2020 targets for low vision state that, in countries with no provision, establish at least one low - vision centre by 2011. For countries that already have low - vision services, expand the provision

with a target of one tertiary low-vision service for every 10 million population, or at least one per country, by the year 2020.

Incorporating visual field testing in the low vision assessment compulsorily for patients in whom it is possible. As mentioned earlier, visual field findings should be correlated with the patient's visual functioning, and peripheral field losses should be quantified to determine whether the patient is a candidate for visual field enhancement devices.

The need for low - vision services is often not fully recognized, owing to inadequate epidemiological data on the prevalence and causes of functional low vision. This information is needed for planning services. Thus, we need to **do more studies in this field of practice** to provide evidence on the prevalence and causes of functional low vision.

11.0 APPENDICES

11.1 WHO categories of visual impairment

Table 1.1 *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' categories 3, 4 and 5; and the term 'unqualified visual loss' category 9.

If the extent of the visual field is taken into account, patients with a field no great than 10° but greater than 5° around central fixation should be placed in category 3 and patients with a field no greater than 5° around central fixation should be placed in category 4, even if the central acuity is not impaired.

11.2 Levels of Visual Impairment

Classification		Levels of Visual Impairment	Additional Descriptors That May Be Encountered
"Legal"	WHO	Visual Acuity (VA) and/or Visual Field (VF) Limitation (Whichever is Worse)	
	(NEAR-) 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 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 20 degrees or less	Severe low vision, "Legal" blindness
	BLINDNESS (WHO)	PROFOUND VISUAL IMPAIRMENT 20/500 20/630 20/800 20/1000 0.04 0.03 0.025 0.02 CF at: less than 3m (10 ft.) VF: 10 degrees or less	Profound low vision, Moderate blindness
	one or both eyes	NEAR-TOTAL VISUAL IMPAIRMENT VA: less than 0.02 (20/1000) CF at: 1m (3 ft) or less HM: 5m (15 ft.) or less Light projection, light perception VF: 5 degrees or less	Severe blindness, 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 impairment)

VA = visual acuity (refers to best achievable acuity with 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

11.3 Data Collection Sheet

Name		
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:
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		

11.4 Consent Letter from Kikuyu Eye Unit

P.C.E.A Kikuyu Hospital

P.O. Box 45-00902 Kikuyu, Tel:(020)2044765-68, (020)2044769-72,(020)3005645/46
Fax: (020)2044765/772 Mobile:0722-207636 / 0733-606133 / 0736-270192.

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5 November 2008.

To Whom It May Concern:

Re: Dissertation on "Characteristics of Low Vision Patients presenting at Kikuyu Eye Unit Low Vision Clinic"

This is to confirm that the Eye Unit is aware of and has agreed to allow Dr. Munira Mohammed Akram Kaderdina – a post graduate Ophthalmology student from the University of Nairobi's Dept. of Ophthalmology – to conduct her study on the above mentioned topic at the PCEA Kikuyu Eye Unit

This consent permits her access to medical records or records which contain intimate personal information regarding the concerned patients only with the agreement that the researcher will maintain patient confidentiality at all times and only use the records for the said purpose

It is also agreed that she will only present and publish her results of the study after approval of the supervisor identified from Kikuyu Eye Unit i.e. Dr. Dan Gradin. It is also understood and agreed that the same results will have the final approval and consent for presentations and publication after her appointed supervisors from the Department of Ophthalmology University of Nairobi i.e. Prof. Sajabi Masinde and Dr. Margaret Njuguna have approved the results

Dr. Dharminder Singh Walia
Director Clinical Services – Eye Unit.

Copy for Dr Gradin.

12.0 REFERENCES

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