THE PREVALENCE AND PATTERN OF VISUAL IMPAIRMENT AND BLINDNESS AMONG PRIMARY SCHOOL PUPILS IN KITALE MUNICIPALITY, KENYA

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JUNE, 2011
DECLARATION

This thesis is my original work and has not been presented for a degree in any other University or any other award.

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DEDICATION

This thesis is dedicated, first to God Almighty and to my beloved wife Judith and children Joyce, Ruth and Lydia.
ACKNOWLEDGEMENTS

It gives me great pleasure to acknowledge the help, encouragement, and all forms of assistance received from different quarters in the course of my research process. In the first place, I register my gratitude to my family, especially my dear wife for her constant and unwavering encouragement at critical times when my enthusiasm for the project was on the decline. I acknowledge my supervisors, Dr. Syprine Otieno, Dr. Karimurio and Dr. Oirere for their guidance, constructive criticism and valuable advice. I also express my sincere thanks to the Government of Kenya for providing me with the necessary research facilities in particular, I thank the Municipal Education Officer, Kitale municipality, Mr. Sabwa and the District Medical Officer of Health, Trans-Nzoia West District, Dr. Lang’at. My warm gratitude also goes to all my research assistants who made various personal sacrifices and to my research subjects who sacrificed their study time for this research. My warm gratitude is also due to Operation Eyesight Universal and Sight Savers International for their financial support. I am unable to mention here all names of notable contributors but wish to single out Ms. Kwamboka, Ms Nganga and Mr. Juma for their typing services and Mr. Okatch and Mr. Mwaniki for data analysis. Lastly, I wish to appreciate the support of the staff at Kitale District Hospital at large.
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<tr>
<td>A/C</td>
<td>Anterior Chamber</td>
</tr>
<tr>
<td>ASK</td>
<td>Agricultural Society of Kenya</td>
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<tr>
<td>BERRL</td>
<td>Bilaterally Equal, Round and Reacting to Light</td>
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<tr>
<td>CBR</td>
<td>Community Based Rehabilitation</td>
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<tr>
<td>CBM</td>
<td>Christian Blind Mission</td>
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<tr>
<td>CDR</td>
<td>Cup Disc Ratio</td>
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<td>CF</td>
<td>Counting Fingers</td>
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<td>DALY</td>
<td>Disability Adjusted Life Years</td>
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<tr>
<td>EARC</td>
<td>Educational Assessment and Resource Centre</td>
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<td>FPE</td>
<td>Free Primary Education</td>
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<td>GOK</td>
<td>Government of Kenya</td>
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<tr>
<td>HIV/AIDS</td>
<td>Human immunodeficiency Virus/ Acquired Immunodeficiency Syndrome</td>
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<tr>
<td>H.M</td>
<td>Hand-Movement</td>
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<tr>
<td>IAPB</td>
<td>International Agency for the Prevention of Blindness</td>
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<td>ICD</td>
<td>International Classification of Diseases</td>
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<td>IOP</td>
<td>Intra Ocular Pressure</td>
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<td>KCPE</td>
<td>Kenya Certificate of Primary Education</td>
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<td>KDH</td>
<td>Kitale District Hospital</td>
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<td>KESSP</td>
<td>Kenya Education Sector Support Programme</td>
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<td>KIEP</td>
<td>Kenya Integrated Education Programme</td>
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<td>KSB</td>
<td>Kenya Society for the Blind</td>
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<td>LVT</td>
<td>Low Vision Therapist</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>MOE</td>
<td>Ministry of Education</td>
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<td>MOEST</td>
<td>Ministry of Education, Science and Technology</td>
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<td>MOFP</td>
<td>Ministry of Finance and Planning</td>
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<td>Ministry of Health</td>
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<td>MOMS</td>
<td>Ministry of Medical Services</td>
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<td>MOPHS</td>
<td>Ministry of Public Health and Sanitation</td>
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<td>NHSSP II</td>
<td>National Health Sector Strategic Plan II</td>
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<tr>
<td>NPL</td>
<td>No Perception of Light</td>
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<tr>
<td>OD</td>
<td>Ocular Dexter (Right Eye)</td>
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<td>OEU</td>
<td>Operation Eyesight Universal</td>
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<td>OS</td>
<td>Ocular Sinister (Left Eye)</td>
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<td>PL</td>
<td>Perception of Light</td>
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<td>ROP</td>
<td>Retinopathy of Prematurity</td>
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<td>SSI</td>
<td>Sight Savers International</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences (Version 13)</td>
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<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
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<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<tr>
<td>USA</td>
<td>United States of America</td>
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<tr>
<td>VAD</td>
<td>Vitamin A Deficiency</td>
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<td>VA</td>
<td>Visual Acuity</td>
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<td>VI</td>
<td>Visual Impairment</td>
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<td>WHO</td>
<td>World Health Organization</td>
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OPERATIONAL DEFINITION OF TERMS

**Accommodation:** The process of bringing light to focus on the retina through contraction and relaxation of the ciliary body, causing thinning and thickening of the lens.

**Amblyopia:** Failure of vision to develop properly often due to squint. Sometimes called “Lazy eye”

**Astigmatism:** Refractive error due to irregular corneal surface

**Blindness:** Visual Acuity of <3/60 in the better eye with best possible correction, or a visual field loss in each eye to less than 10 degrees from the point of fixation (Gordon *et al.*, 2003).

**Confrontation:** The subjective method for assessing visual field loss.

**Cycloplegic:** Drug which dilates the pupil and temporarily paralyses the ciliary body.

**Fundoscopy:** Examination of the posterior interior surface of the eye visible with an ophthalmoscopy, including the retina and optic disc.

**Hypermetropia:** Refractive error also known as “far-sightedness” or Hyperopia where visual acuity is good at distance but poor at near

**Low Vision:** Inability to perform everyday visual tasks, such as reading or recognizing faces, resulting from a visual impairment (Gary, 2003).

**Myopia:** Refractive error, also known as “nearsightedness” where visual acuity is good at near and poor at distance

**Nystagmus:** A medical condition that causes the eye to move back and forth, up and down, or in a circular motion.

**Ophthalmic:** Pertaining to the eye.
Ophthalmologist: Physician trained to perform medical and surgical treatment of the eye.

Ophthalmoscope: Instrument for examination of the eye, especially the ocular fundus

Pattern: The regular way in which something happens or is done (Weilhmeier et al., 2010).

Pattern of VI and blindness: The regular way in which VI and blindness occurs within the study population by age category, gender, class category, school type and zone.

Prevalence: The number of people with a disease at a particular time, divided by the total population at risk (Gordon et al., 2003).

Refractive error: Optical defect of the eye which prevents light from being brought to a sharp focus on the retina.

Refraction: Determining the refractive error of the eye.

Retinoblastoma: Highly malignant intra-ocular tumour of early childhood.

Strabismus: Misalignment of the eyes also called squint.

Tonometer: A precision ophthalmic instrument for measuring intraocular pressure.

Vision 2020: A global initiative: The right to sight established by WHO and International Agency for the Prevention of Blindness (IAPB), aimed at elimination of avoidable blindness and impaired vision by the year 2020.

Visual acuity: Degree of sharpness of central (macular) vision.

Visual Field: The space within which objects may be seen with one or both eyes.

Visual Impairment: Visual acuity <6/18 but equal to or better than 3/60 in the better eye with best possible correction. Category 1 (Visual impairment) is visual acuity less than 6/18 to 6/60. Category 2 (severe visual impairment) is visual acuity less than 6/60 to 3/60 (Gordon et al., 2003).
ABSTRACT

Visual impairment is defined as a corrected visual acuity of less than 6/18 to 3/60 in the better eye. Blindness on the other hand is defined as corrected visual acuity in the better eye of less than 3/60 or a constricted visual field of less than 10 degrees from the point of central fixation. Visual loss in childhood has implications in all aspects of the child’s development. It poses educational, occupational and social challenges, with affected children being at risk of behavioral, psychological and emotional difficulties, impaired self-esteem and poorer social integration. There is an estimated 1.5 million blind children worldwide, with an additional 5 million who are visually impaired. Among the blind and visually impaired children, 90% live in the developing countries. There are variations in the causes of blindness and visual impairment across countries and the pattern changes with time. The purpose of this study was to investigate the prevalence and pattern of visual impairment and blindness among primary school pupils in Kitale Municipality. This was a cross-sectional school-based study conducted in twenty-four randomly selected schools. The selected pupils were screened for visual acuity and those affected underwent a detailed ophthalmic examination. Data was collected using an examination protocol for the first part of the study. Semi-structured questionnaires were used to establish some factors associated with visual impairment and blindness among parents, pupils and teachers. Data was then analyzed using chi square and multiple logistic regression (SPSS Version 13.0). The prevalence of visual impairment was 4.77% while that of blindness was 0.13%. Girls contributed 35.14% of cases of visual impairment while boys contributed 64.86%. The age group most affected was 11-15 years (59.46%). There were higher chances of developing VI with increasing age. Public schools contributed 81.08% of cases of visual impairment while for private schools, it was 18.92%. Two zones (Grassland and Bidii) with peri-urban characteristics contributed 75.68% of VI cases while two purely urban zones (Milimani and Bondeni) contributed 24.31%. The only case of blindness was due to retinal disease in a standard one female pupil aged 8 years, in a public school within Bondeni zone. The leading cause of visual impairment was refractive error (81.08%). Other causes included albinism, corneal disease, disease of whole globe and strabismus. Majority of the pupils cited allergy as the leading cause of visual impairment and blindness (50.00%), early treatment as a leading means of prevention (70.83%) and 92.11% informed their parents or teachers whenever they had eye ailments. Majority of the teachers cited poor hygiene as the leading cause of VI and blindness (44.17%) and good nutrition as the leading means of prevention. There is need to enforce the school health policy on visual assessment before school admission and carry out annual school eye screening in order to enhance early detection and management of eye problems. There is need to provide subsidized spectacles since a large number of pupils with visual impairment had refractive error as the cause of impairment.
CHAPTER 1

INTRODUCTION

1.1 Background information

Vision is the ability to see with a clear perception of detail, colour and contrast and to distinguish objects visually. Like any other sense, vision tends to deteriorate naturally with age (Minto and Imran, 2004). In most cases, reduction in visual capability can be corrected with glasses, medicine and surgery. Many people around the world with permanent visual impairment (VI) have some residual vision which can be used with the help of low vision services, materials and devices (Minto and Imran, 2004). Children are said to have low vision or partial sight when they have a corrected visual acuity (VA) in the better eye of less than 6/18 to perception of light (PL) or a visual field of less than 10 degrees from the point of central fixation (Lynne, 1998).

With regard to education, a visually impaired child is one who has a corrected visual acuity of 6/18 or less in the better eye. Children with poor visual acuity who are unable to take advantage of ordinary educational methods are entered either in special schools for the blind where emphasis is upon learning by touch or preferably in integrated schools where facilities are available for special training but where the child is not deprived of all contact with normal persons within the same age group (Vaughan and Asbury, 1983). A blind child is an individual aged less than 16 years who has a visual acuity in the better eye of less than 3/60. This age bracket established by UNICEF has been used in other studies (Clare, 2001).
Many causes of childhood blindness and visual impairment are avoidable, being either preventable or treatable. Only three per cent of the world’s blind population is children. However, because children have a lifetime of blindness ahead of them, the number of blind years resulting from blindness starting in childhood is second only to cataract. Ideally, data on the causes of blindness should be obtained by examining children in the community not in schools for the blind (Parikshift and Clare, 2007). Children, who are blind or visually impaired need to be found as early as possible so they can be examined, treated, referred, or rehabilitated. This is crucial if they are to have the best possible chance of proper childhood development, education and participation in broader social life (Mohammad, 2007). At least eighty percent of the world’s visually impaired children live in low and middle-income countries, where less than ten percent of them have access to education. This sad fact almost guarantees that these children face a lifetime of poverty and illiteracy (Larry and Mani, 2007).

The importance of providing care for children with low vision is recognized by many initiatives, such as VISION 2020, the 2004 Oslo workshop on low vision and the United Nations global campaign, Education for all. Care for children with low vision involves diverse groups, such as eye hospitals, schools and community programmes. It should be provided in a structured and integrated way, known as comprehensive care (Kavin, 2007). Just like any other developing country, Kenya is faced with the problem of insufficient personnel with adequate knowledge to tackle the problem of significant refractive errors that are a major cause of visual impairment and blindness among younger populations. Majority of significant refractive errors manifest themselves during
teenage life (Holden et al., 2000). It is against this background that this study was
designed to investigate the prevalence of visual impairment and blindness among primary
school pupils in Kitale Municipality.

1.2 Problem statement
Visual impairment and blindness in childhood has implications in all aspects of the
child’s development. It possesses educational, occupational and social challenges, with
affected children being at risk of behavioral, psychological and emotional difficulties,
impaired self-esteem and poor social integration. Moreover, visual problems are an
important contribution to poor school performance (MOPHS and MOE, 2009). Blind
children have many years of blindness ahead of them: The number of “blind years”
resulting from blindness in children is more than half the number of “blind years” caused
by cataract in adults (Clare et al., 2003). There is an estimated 1.5 million blind children
worldwide, with an additional five million who are visually impaired. Among the blind
and visually impaired children, 90% live in the developing countries (Clare, 2001). In
Nigeria, the prevalence of blindness and VI among school children was estimated at
0.15% and 0.96% respectively (Ajaiyeoba et al., 2005). The prevalence of blindness in
Kenya ranges from 0.60% (Ndegwa et al., 2006) to 0.70% (Nyaga, 2007) while that of VI
among school children ranges from 5.6% (Muma et al., 2007) to 10.00% (Musa, 1998).

1.3 Justification
Visual impairment and blindness have been recognized in several studies as major
problems affecting children. These problems therefore demand special attention and
justify inclusion in the VISION 2020 program as most causes are either preventable or
treatable. Knowledge about the prevalence, pattern and causes of these disorders is desirable for planning, monitoring and evaluation of eye care services. As the country gears itself towards implementation of the School Health Policy, the findings of this study will be crucial in informing planning. The School Health Policy emphasizes that visual impairment needs to be identified and managed as early as possible (MOPHS and MOE, 2009). The National Strategic Plan for Eye Care in Kenya (MOH, 2005) that is under review to pave way for the 2011-2015 plan will heavily benefit from these results. Although several studies have been carried out among general populations, there is little data on the prevalence, pattern and causes of VI and blindness among primary school children in Kenya. The proportion of children with VI and blindness in Trans-Nzoia West District was unknown. The result of this study brings to the pool of knowledge this missing information that will inform National policy on eye care service provision.

1.4 Significance of the study

The results of this study will help in making accurate estimates of the burden of visual impairment and blindness in primary schools. It will also document common causes that need to be addressed through appropriate referral, treatment, prevention and eye health promotion. The results will be utilized by the Kenya Integrated Education Programme (KIEP) as well as the local health authorities and Ministry of Education. This is in line with the National School Health Policy that directs visual acuity checks before admission to schools, annual school eye screening, vitamin A supplementation to children under five years and early detection and referral of those with injuries and poor vision (MOPHS and MOE, 2009). Some of the respondents already benefited during the study by
acquisition of free spectacles through sponsorship by CBM and KSB at the Sabatia Eye Hospital. This is anticipated to improve school performance among these pupils.

1.5 Research questions

a) What is the prevalence of visual impairment and blindness among primary school pupils in Kitale Municipality?

b) What are the patterns of visual impairment and blindness among primary school pupils in Kitale Municipality?

c) What are the causes of VI and blindness among primary school pupils in Kitale Municipality?

d) What factors are associated with VI and blindness among primary school pupils in Kitale Municipality?

1.6 Null hypothesis

Visual impairment and blindness do not affect primary school pupils in Kitale Municipality.

1.7 Objectives

1.7.1 General objective

To investigate the prevalence and pattern of visual and blindness among primary school pupils in Kitale Municipality.
1.7.2 Specific objectives

(a) To determine the visual acuity of primary school pupils in Kitale Municipality.

(b) To establish the patterns of visual impairment and blindness among primary school pupils in Kitale Municipality.

c) To determine the causes of visual impairment and blindness among primary school pupils in Kitale Municipality.

d) To investigate some factors associated with visual impairment and blindness among primary school pupils in Kitale Municipality.

1.8 Limitations and delimitations of the study

Due to limited time and resources, this study focused only on schools within Kitale Municipality, thus limiting my findings to an urban setting. The evaluation of the economic status among parents only focused on a limited number of economic indicators with the assumption that parents from private schools and the purely urban zones were of higher economic status than their counterparts in public and peri-urban zones.
CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews studies that have been conducted on visual impairment and blindness in Kenya and other parts of the world. However, the review is limited to the topics which form the major focus of the present research. These are; overview of visual impairment and blindness, the global prevalence of visual impairment (VI) and blindness, prevalence of VI and blindness in Kenya, ophthalmic examination, classification of VI and blindness, effects of VI and blindness, management of VI and blindness, and the prevention of VI and blindness.

2.2 Overview of visual impairment and blindness

The control of blindness in children is one of the main priorities of the World Health Organization’s VISION 2020 (The Right to Sight). There are several reasons for this; first, the causes of blindness in children are very different from the causes in adults, and the strategies to combat blindness in adults will not result in the control of blindness in children. Secondly, unlike in adults, a delay in treatment can lead to amblyopia. There is therefore a level of urgency about managing eye diseases in children. Thirdly, children’s eyes are not like small adult eyes- They respond differently to treatment, and specific expertise, equipment and training is required. Finally, blind children have many years of blindness ahead of them- The number of “blind years” resulting from blindness in children is more than half the number of “blind years” caused by cataract in adults (Clare et al., 2003).
2.3 Global prevalence of visual impairment and blindness

The prevalence of blindness in children varies from approximately 0.3/1000 children in wealthy regions of the world to 1.2/1000 in the poorer countries or regions (Clare, 2001). Globally, there are approximately 1.5 million children who are blind and around three quarters live in developing countries (Clare, 2001). Although the actual number of children who are blind is much smaller than the number of adults blind for instance due to cataract, the number of years lived with blindness is almost the same as the total number of blind years due to age related cataract. The high number of blind years resulting from blindness during childhood is one of the reasons why the control of childhood blindness is a priority of the WHO/IAPB Vision 2020 Programme (Clare, 2001). Of the people who are blind in the world today, 64% are female (Courtright and Lewallen, 2007).

An estimated 4/1000 children worldwide are visually impaired as a result of eye disease. Some of these children have nearly normal vision, some are totally blind, but the majority fall into a broad range in between these two points (Lynne, 1998). The global estimate of visual impairment by WHO regions in 2002 were 18 % for the African region, 7 % for the region of the Americas, 11 % for Eastern Mediterranean region, 7 % for the European region, 32 % for the South-east Asia region and 25 % for the West Pacific region. In USA, the prevalence of visual impairment in children is estimated to be 5-10% (Murthy, 2000). In a hospital-based cross-sectional study of all patients less than 16 years of age at the eye clinic of Obafemi Awolowo University teaching hospital complex, the prevalence
of severe visual impairment and blindness was 2.0 % and 1.4 %, respectively (Adegbebingbe, 2007).

2.4 Prevalence of VI and blindness in Kenya

A survey to determine the magnitude and etiology of visual and ocular handicaps amongst Standard one primary school children in Nairobi, Kenya, found that 330 out of 3,206 children had visual impairment which accounted for 10% of the study respondents (Musa, 1998). No such study has been carried out in Kitale Municipality within Trans-Nzoia West District, Kenya. In another community-based survey on the magnitude and pattern of eye diseases in Korogocho slum, Nairobi, the prevalence of severe visual impairment and blindness was 1.8 % and 0.7 % respectively (Nyaga et al., 2007). A cross-sectional school-based study in a rural district in Kenya found the prevalence of visual impairment was 5.6%. The main cause of visual impairment was refractive error, with a prevalence of 5.2 %. This accounted for 92.6 % of all cases of visual impairment. Hypermetropia, myopia and astigmatism were responsible for 62.67%, 32.00% and 5.33% of all cases of refractive errors, respectively (Muma et al., 2007). In another study, the prevalence of visual impairment and blindness in a Nairobi urban population at Kibera was found to be 6.2% and 0.6% respectively (Ndegwa et al., 2006).

The focus of this study was to investigate the prevalence and pattern of VI and blindness among primary school pupils in Kitale municipality. This will fill the gap of knowledge that exists with regard to VI and blindness among primary school pupils. Other studies done on VI and blindness either focused on a particular class, whole populations or
narrower age categories with limited or no documentation of patterns among age groups, gender, class category, zone or type of school.

2.5 Ophthalmic Examination

Ophthalmic examination of a child with visual loss aims to confirm the impairment, establish the diagnosis, identify the treatment required and describe the prognosis for the disorder(s) causing visual loss. The examination by ophthalmic professionals is an important component of the broader assessment of visual function and educational needs of the child, which forms the basis of the plan of management of that child and his/her family (Jugnoo, 1998). Identification of cases of visual impairment is carried out at eye clinics, school screening programmes, community-based rehabilitation (C.B.R) programmes or special schools for the visually impaired (Lynne, 1998). The single most important measurement in ocular examination is visual acuity. An accurate visual acuity can be performed using standard figures or optotypes (Appendix V).

The Snellen’s chart consists of letters or numbers in decreasing sizes according to the international standards. The notations on the Snellen’s VA chart may be in metres or feet. To measure VA, the patient is positioned 6 metres (20 feet) from the Snellen’s chart. The patient reads the lines of the smallest numbers or letters which he/she can see clearly while closing one eye with the palm of his hand at a time. This is recorded with the distance number (6m) first, and the smallest figures read second, separated by slash (/) e.g. 6/18 or 20/60. Where vision is so poor that figures in the chart cannot be read at six meters, the chart is moved closer to the patient and the vision recorded for example, as 3/60. If the patient cannot see the figures on the chart at close range of half a meter, the
examiner waves his hand before the patient’s eye to determine if the patient can see hand movement and thus recorded HM. If the patient cannot see hand movement, then it is determined if focal light from a torch may be projected by each of the four retinal quadrants and recorded as Perception of Light (PL) with accurate or inaccurate projection if projected in all four quadrants, or if projected in some or none respectively. If light from the torch cannot be seen, then VA is recorded as No Perception of Light (NPL). The interpretation for VA of 6/18 means that, a person standing at 6 metres from the chart is able to see what a normal person with normal sight should see at 18 metres (Schwab, 1987).

### 2.6 Classification of visual impairment and blindness.

Each country has its own definition of blindness for legal and social purposes. Because there are wide variations in the requirements, a WHO study group in 1972 recommended a standardized method of testing and uniform definition of blindness and VI so that global comparisons could be made (Gordon et al., 2003). This has now been incorporated into the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10). For the purposes of this research the following classification of VI and blindness will be used (Table 2.1)

<table>
<thead>
<tr>
<th>Visual acuity</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/6 – 6/18</td>
<td>Normal vision</td>
</tr>
<tr>
<td>&lt;6/18 – 6/60</td>
<td>Visual Impairment</td>
</tr>
<tr>
<td>&lt;6/60 – 3/60</td>
<td>Severe Visual Impairment</td>
</tr>
<tr>
<td>&lt;3/60</td>
<td>Blind</td>
</tr>
</tbody>
</table>

Table 2.1: Classification of VI and blindness (WHO, 2003)
This will be based on presenting VA since it has been realized that a large number of people in some countries had never been refracted or received correction for refractive errors, and were visually impaired or even blind as a result (Gordon et al., 2003). The WHO standard of best corrected VA excluded refractive errors by definition as a cause of VI, and information important for service planning was lost (Gordon et al., 2003). The presenting VA should be taken into consideration when assessing the magnitude of visual disability in the community (Taylor, 2000).

2.7 Causes of visual impairment and blindness

The major causes of blindness and visual impairment vary from region to region, although accurate data is difficult to obtain. In industrialized countries, blind registers are one possible source although these records often lack detail and do not necessarily include all eligible children. In developing countries where blind registers are not kept, an indication of the major causes of blindness in children can be obtained by examining children in schools for the blind (Clare, 1993). There are two different ways of classifying the causes of visual loss (VI and blindness). The first is a descriptive classification and the second classification depends on the time of onset of the condition leading to visual impairment or blindness.

2.7.1 Descriptive classification

This classification is based on the part of the eye that is affected e.g. whole eye, cornea, lens, uvea, retina or optic nerve. Information on descriptive classification can be collected from every child on the basis of visual function test and clinical examination. Lesions of the whole eye, for example microphthalmos (small eye) or anophthalmos (absence of
eye), will lead to blindness due to lack of refractive powers. Corneal disease like corneal scarring prevents light entry into the eye. Diseases of the lens such as cataract also prevent light entry into the eye, thus causing blindness. Uveal conditions, including aniridia (absence of the iris), leads to too much entry of light into the eye, thus causing glare. Retinal dystrophies affect vision by interfering with transmission of light messages into the brain. Optic nerve disease, for example optic atrophy, prevents transmission of light impulses into the brain. Glaucoma (increased intra-ocular pressure) destroys the retinal tissue while Meningococcal or TB meningitis causes cortical blindness (Gordon et al., 2003).

2.7.2 Classification according to the time of onset

This group categorizes causes of visual impairment and blindness according to the time of onset. This may be at conception, during pregnancy, peri-natal period or during childhood. Factors operating at conception, for instance, hereditary diseases and chromosomal abnormalities result in such diseases as retinoblastoma and Marfans’ syndrome. Intra-uterine factors such as congenital Rubella, and toxins such as alcohol can result in cataract and optic atrophy. Peri-natal factors like ophthalmia neonatorum and prematurity may lead to blindness due to corneal perforation and Retinopathy of Prematurity (ROP). Childhood factors including measles, Vitamin A Deficiency (VAD) and trauma can lead to corneal scarring and perforation thus resulting in visual impairment or blindness (Vaughan and Asbury, 1983). Information on causes of visual impairment and blindness according to time of onset depends on clear history, medical records and clinical investigations.
2.7.3 Causes of VI and blindness world wide

In West and South India, corneal scarring and phthisis bulbi were the main causes of blindness in children. In the majority, this was attributed to vitamin A deficiency (VAD) and measles (Clare, 1993). In Thailand and Philippines, the picture was mixed with almost a quarter of children being blind from corneal scarring and 20% from retinal conditions, 11% of which was due to Retinopathy of Prematurity (ROP). With increasing levels of socio-economic development, peri-natal events become more important causes of childhood visual loss, principally ROP. In less developed countries, childhood factors mainly VAD and measles are most important (Clare, 1993).

Visually disabling refractive error affects significant proportions of the global population, occurring in both genders, in all ages and ethnic groups. The most common cause of visual impairment and the second leading cause of treatable blindness is uncorrected refractive error. This has severe social and economic effects on individuals and communities. It restricts educational and employment opportunities of otherwise healthy people. Refractive error can account for twice as many blind-person years compared to cataract, due to the earlier age of onset. Refractive error is responsible for VI in 55% of children in Chile and 83% in urban India (Brien, 2002). In a study on VI and refractive errors in children in Shun Yi District of China, refractive error was responsible for 89.5% of the cases, Amblyopia 5%, other causes 1.5% and unexplained causes 4% (Zhao et al., 2000).
In a clinic-based survey of blindness in Kenya at Lighthouse for Christ eye Centre involving all age groups, age related cataract was the greatest single cause of treatable blindness (Jerry et al., 2001). Most glaucoma patients were first seen when they sought help because of vision loss, often very profound. Injuries were a major cause of unilateral blindness, especially among younger patients (Jerry et al., 2001). In a survey to determine the magnitude and aetiology of visual and ocular handicaps amongst Standard one primary school pupils in Nairobi, it was found that 4.8% of the study subjects had reduced VA, which improved with pinhole test hence indicating refractive error as a cause of impairment (Musa, 1998). In another study in Kibera slum of Nairobi among a population aged two years and above, refractive error was the cause of VI in 58.1% of the cases, while cataract accounted for 35.5%. For blindness, cataract was responsible for 37.5% and refractive error for 25.0% of cases (Ndegwa et al., 2006).

In a study of VI in school children in Southern India, 109 out of 115 school children presented with VA less than 6/18 in the better eye, which improved with refractions equal to or less than 6/18 (Kalikivayi et al., 1997). External ocular infections like trachoma, bacterial infection, Herpes simplex, corneal disease and VAD acting alone or together are probably the second leading cause of blindness in developing countries. Recent studies have revealed that corneal scarring from these conditions account for 16% of blindness in Africa (Schwab, 1987).

Of all causes of low vision or blindness, refractive errors are the easiest to diagnose and cure, yet in India refractive errors are still the second cause of blindness (Hans, 1993). In
a study carried out in Chile to assess the prevalence of VI and refractive errors in school age children in a sub-urban area, refractive error was found to be responsible for 56.3% of VI and amblyopia, 6.5%. (Maul *et al.*, 2000). In yet another study in New Delhi on school age children, refractive errors were the cause of VI in 81.7%, amblyopia 4.4% and retinal disorder, 4.7%. (Leon, 2002). Uncorrected refractive errors are an important cause of VI in many countries. In developing countries, however, it is often difficult to provide an efficient refraction service (Murthy, 2000). Refractive error was also found to be the cause of poor vision among African children in South Africa and myopia was present in 2.9% of the population (Naidoo and Mashige, 2003).

A study done in Nepal to assess the prevalence of refractive error and related VI in school aged children showed that refractive error was the cause in 56% of the 2000 eyes with reduced uncorrected vision and amblyopia, 9%. (Pokharel and Munoz, 2000). Retinopathy of prematurity is an important cause of avoidable childhood blindness in industrialized countries (Andrea, 2001). It is also emerging as a problem in economically developing parts of the world because of the ever-increasing survival of low and very low birth weight infants especially in urban settings. Retinopathy of prematurity has been reported to be responsible for 4.1–38% of severe VI and blindness in Latin America (Andrea, 2001). Countries with intermediate mortality rates (10-60 per 1000 live births) seem to have the highest proportion of childhood blindness due to ROP (Andrea, 2001).

There are various forms of refractive errors with different causes but most are due to anatomical changes in the eye structures. Myopia is rare at birth but begins to develop as
the child grows. It is usually detected at around the age of 9-10 years and increases with age, culminating at mid-teenage life (Garcia and Pavan-Langston, 1991).

Astigmatism is caused by irregularity on the surface of the cornea where some meridians on the corneal surface become steeper than others. Corneal toricity astigmatism accounts for most of astigmatism in the eye. The vertical meridian and the horizontal meridian have different steepness. If the vertical meridian is steeper than the horizontal meridian this is called astigmatism “with the rule”. If the horizontal meridian is steeper than the vertical meridian it is known as astigmatism “against the rule”. The same difference in steepness of the meridian could happen obliquely (Vaughan and Asbury, 1983).

Several types of hypermetropia can be distinguished. Structural hypermetropia is based on the anatomical configuration of the eye such as the flattening of the cornea and the crystalline lens. In these two conditions, rays of light from distant objects are focused behind the retina (Garcia and Pavan-Langston, 1991). In axial hypermetropia, there is shortening of anterior-posterior diameter (from the front of the cornea to the retina) of the eye than the normal. The refracting portions like the lens and cornea are otherwise normal (Garcia and Pavan-Langston, 1991). Curvature hypermetropia results when either the crystalline lens or the cornea has a weaker than the normal curvature resulting to lower refractive power (Garcia and Pavan-Langston, 1991).

Index hypermetropia is the result of decreased index of refraction due to decreased density in some parts of the optic system of the eye, thus lowering the refractive power of
the eye (Garcia and Pavan-Langston, 1991). Accommodation hypermetropia arises when
the capacity of the natural lens in the eye elongates or shortens depending on the distance
where the object a person wants to see is. This elasticity of the lens is of great importance
than structural factors leading to it because accommodation is the key dynamic factor in
correcting at least part of refractive error. Accommodation hypermetropia is grouped into
three parts namely: Latent hypermetropia, Manifest facultative hypermetropia and
Manifest absolute hypermetropia (Vaughan and Asbury, 1983). In latent hypermetropia, a
portion of refractive error is completely corrected by accommodation. It is measurable
not by manifest refraction but with paralysis of accommodation through cycloplegic
refraction. Latent hypermetropia is the difference in measurement between manifest
hypermetropia and the results of cycloplegic refraction, which reveals total
hypermetropia of latent and manifest (Vaughan and Asbury, 1983). Manifest facultative
hypermetropia is that portion of hypermetropia that may be corrected by patient’s own
power of accommodation or by correction with lenses or both. Vision is normal with or
without corrective plus lenses, but the accommodation is not relaxed without the glasses
(Vaughan and Asbury, 1983). In manifest absolute hypermetropia, there is a portion of
hypermetropia which cannot be compensated for by the patient’s accommodation.
Distance vision is blurring despite the patients’ accommodation power. These patients
readily accept the aid of plus lenses because it makes distant objects clear (Vaughan and
Asbury, 1983). Retinoblastoma is a childhood cancer that is genetically transferred from
generation to generation. If left unattended, it can kill the victim, but if diagnosed early,
the victim can undergo enucleation (surgical removal of whole eyeball) in order to save
life.
2.8 Effects of visual impairment and blindness on children

Blindness and low vision are major causes of morbidity and have profound effects on the quality of life for many people. They inhibit mobility and economic wellbeing of the individuals affected as well as their families (Minto and Haroon, 2001). Childhood blindness is one of the challenges faced by the world generally and developing countries in particular. In industrialized countries, certain mechanisms for normal schooling and socio-economic rehabilitation of visually impaired children exist (Minto and Haroon, 2001). However, in developing countries, these children are rarely able to attend the normal education institutions due to scarce resources and traditional taboos.

VISION 2020 has recognized childhood blindness, low vision and refraction as important strategic themes for the control of avoidable blindness (Minto and Haroon, 2001). Apart from cataract, trachoma and onchocerciasis, which are specific diseases, the global initiative has also targeted childhood blindness. This is because childhood blindness is the second largest cause of blind-person years, following cataract. Globally, about 70 million blind-person years are caused by childhood blindness. Children are the most precious resource of families in developing countries and a blind child is a tragedy. A child whose blindness could have been prevented or cured is an even greater disaster. Approximately 40% of childhood blindness is avoidable (Yorston, 1999).

2.9 Management of visual impairment and blindness

Over the years, studies in child development, sociology and special education have led enlightened educators to the conclusion that blind children grow, flourish and achieve greater self and social fulfillment by being nurtured in the least restricted environment
(Mani, 1998). Blind children with additional disabilities require special school services. In countries like India where the numbers of children are staggering, integration emerges as the only alternative to reach the unreached children with visual disabilities (Mani, 1998). This is the essence of the Kenya Integrated Education Program (KIEP). People with low vision have residual vision with some light perception but their vision loss does not lend itself to improvement by standard spectacles, medical or surgical treatment. Such persons have the potential for enhanced functional vision if they receive appropriate low vision care services (Pararajasegaram, 2004).

During a routine screening of children in blind schools in Madurai India, a considerable number of children were found who could benefit by being given spectacles, simple magnifiers or by surgery (Vijayalakshmi, 1998). The education, employment prospects, independence and quality of life of a child with low vision can all be improved by enhancing vision by use of optical devices such as spectacles, magnifiers and telescopes (Lynne, 1998). The prevalence and distribution of corrective lenses among school age children in U.S.A. was estimated at 25.4% of the 52.6 million children in the age group 6–18 years. More girls had spectacle correction than boys (Kemper and Bruckmen, 2004).

2.10 The prevention of visual impairment and blindness

The global initiative to eliminate avoidable and treatable blindness by the year 2020 (VISION 2020) has created valuable and effective collaboration of organizations involved in a wide range of eye care and community health care activities, aimed at the elimination of avoidable blindness and impaired vision (Brien, 2002). Vision 2020’s
major priorities are cataract, trachoma, onchocerciasis, childhood blindness, refractive errors and low vision (Brien, 2002). The prevention of trachoma and other infections and nutrition programmes prevent blindness in populations. This is called primary prevention since it prevents diseases from occurring by promoting eye health and preventing eye disease. Correct diagnosis and therapy prevents blindness in individual patients. This is secondary prevention in that disease has already set in but prevention of blindness is achieved through treatment (Schwab, 1987).

The current study sought to establish factors associated with VI and blindness. These factors included the socio-economic characteristics of parents of the affected children, knowledge of pupils and teachers on prevention of VI and blindness and practices of both pupils and teachers in relation to visual problems. This was with the view to relating socio-economic status with occurrence of VI and blindness as well as advancing recommendations based on pupils and teachers knowledge on prevention and practices on VI and blindness.
CHAPTER 3
MATERIALS AND METHODS

3.1 Introduction.

This chapter presents materials and methods used in the study including: the study area, research design, target population, study population, inclusion criteria, exclusion criteria, sample size determination. Other aspects include; research instruments, pre-testing of research instruments, data collection techniques, ethical considerations and data management and analysis.

3.2 Study area

The study was carried out among subjects in primary schools within Kitale Municipality, Trans- Nzoia District of Kenya (Appendix I). The 26 public schools had an enrolment of 16,278 pupils while the 19 private schools had 6,601 pupils (Appendices II and III). Trans-Nzoia is one of the 18 districts of Rift Valley Province of Kenya, having a population 566,588 (KNBS, 1999). The National baseline survey on poverty for 1997 indicated that 44% of the people live below the poverty line (MFP, 2005). The mainstay of the district’s economy is agriculture, with 82% of the area being used for agricultural and livestock productivity and 18% for forest reserves. The district has only one eye unit based at Kitale District Hospital with mobile eye clinics conducted periodically in rural health facilities and schools.

There are 79 integrated primary schools for the visually impaired in the greater Trans-Nzoia District, 30 within Trans-Nzoia West District and 14 in Kitale Municipality. Kitale Municipality is located within a rich agricultural hinterland where diversified agricultural
production of crops and livestock farming are prominent activities. The town has great potential for agro-based industries and serves as a commercial service and distribution centre for the surrounding districts and parts of Uganda and Southern Sudan. It has a population of 165,000 and located on an area of 87km$^2$ (ASK, 2003).

The greater Trans-Nzoia District has a total 144km tarmac roads, 382.2km gravel and 581.2km earth roads with the municipality well served with tarmac roads. The industrial sector is largely based on agricultural and livestock activities that include manufacturing, processing, marketing of agricultural inputs and metal fabrication. In the manufacturing and processing, milk processing, tanning of hides and skins, seed production, oil extraction and fruit processing. Engineering enterprises specialize in repair and production of spare parts for agricultural machines and irrigation equipment (ASK, 1999).

While working at the Kitale district hospital, the principal researcher worked closely with the Kenya Integrated Education Programme (KIEP) in identifying children with visual disabilities, treating them and liaising with the KIEP programme for educational placement. A few of the pupils identified with blindness during practice were cases of retinoblastoma and keratoconnus, while the majority of those with VI had refractive error as the leading cause. With the municipality having 16 schools with integrated programmes, it was felt that knowledge of the prevalence of VI and blindness would inform on the magnitude of the problem and therefore help in planning future eye care
and educational interventions. The municipality was purposively selected as opposed to the rural areas due to cost implications in terms of transport for the research team.

3.3 Research design

Descriptive cross-sectional survey was used in the study to investigate the prevalence and pattern of visual impairment and blindness. This method was used because it explores relationships between different variables in their natural setting as they occur (Gall et al., 1996).

3.4 Target population

The target population for this study was 22,879 pupils from all primary schools within Kitale Municipality.

3.5 The study population

The study population was 776 pupils who consisted of sampled pupils in Standard 1-8 in 24 randomly selected primary schools in Kitale Municipality.

3.6 Inclusion criteria

All sampled pupils from the twenty four selected schools irrespective of age were included in the study.

3.7 Exclusion criteria

Sampled pupils from the twenty four selected schools who for any reason were absent from school were excluded from the study and replaced by the next pupil in the class register.
3.8 Sample size determination

Sample size was determined by the formula used by (Fisher et al., 1998) for a population > 10,000.

\[ n = \frac{Z^2pqD}{d^2} \]

Where,

\( n = \) Minimum sample size

\( Z = \) Standard normal deviation usually set at 1.96

\( p = \) Assumed population prevalence in %

\( q = 1-p \)

\( D = \) The likely design effect

\( d = \) Maximum acceptable random sampling error in %

In this case,

\( P = 10\% = 0.1 \)

\( q = 1-0.1 = 0.9 \)

\( D = 5 \)

\( d = 5\% = 0.05 \)

Therefore,

\[ n = \frac{(1.96)^2(0.1)(0.9)(5)}{(0.05)^2} \]

\[ = 692 \]

The minimum sample size for the study was therefore 692.
3.9 Sampling procedure

Multistage and systematic random sampling procedures were used. Schools were stratified by four existing educational administrative zones. At least 50% of the schools in each zone both public and private were sampled by simple random sampling using the table of random numbers. Fourteen public and ten private schools with populations of 8,226 and 3,317 respectively, (total 11,543) were sampled. The school populations were the total enrolment as per the records at the Municipal Education Office. Each school was assigned a sample proportional to its population. There were four public schools in Bondeni zone, three in Milimani, four in Grassland and three in Bidii. Private schools were three in Bondeni zone, two in Milimani, three in Grassland and two in Bidii, (Table 3.1). The sample proportional to population was calculated as \( n/11,543 \times 692 \), where \( n \) = School population.
Table 3.1: Sampling proportions by school

<table>
<thead>
<tr>
<th>No.</th>
<th>School</th>
<th>Zone</th>
<th>Type</th>
<th>population</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tuwani</td>
<td>Bondeni</td>
<td>Public</td>
<td>1,016</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>Township</td>
<td>Bondeni</td>
<td>Public</td>
<td>759</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>Trans-Nzoia</td>
<td>Bondeni</td>
<td>Public</td>
<td>653</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>Kaloleni</td>
<td>Bondeni</td>
<td>Public</td>
<td>448</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>Milimani</td>
<td>Milimani</td>
<td>Public</td>
<td>722</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>Kitale Forest</td>
<td>Milimani</td>
<td>Public</td>
<td>523</td>
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<tr>
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<td>Hill school</td>
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<td>Public</td>
<td>539</td>
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<td>8</td>
<td>St. Joseph’s</td>
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<td>9</td>
<td>Chetoto</td>
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<td>10</td>
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<td>Private</td>
<td>304</td>
<td>24</td>
</tr>
<tr>
<td>17</td>
<td>Fairway Academy</td>
<td>Bondeni</td>
<td>Private</td>
<td>223</td>
<td>16</td>
</tr>
<tr>
<td>18</td>
<td>Kitale Family</td>
<td>Milimani</td>
<td>Private</td>
<td>193</td>
<td>16</td>
</tr>
<tr>
<td>19</td>
<td>Legacy</td>
<td>Milimani</td>
<td>Private</td>
<td>692</td>
<td>48</td>
</tr>
<tr>
<td>20</td>
<td>Crane Academy</td>
<td>Grassland</td>
<td>Private</td>
<td>146</td>
<td>16</td>
</tr>
<tr>
<td>21</td>
<td>Mt. Emmoru</td>
<td>Grassland</td>
<td>Private</td>
<td>193</td>
<td>16</td>
</tr>
<tr>
<td>22</td>
<td>Huruma</td>
<td>Grassland</td>
<td>Private</td>
<td>406</td>
<td>24</td>
</tr>
<tr>
<td>23</td>
<td>Mary Immaculate</td>
<td>Bidii</td>
<td>Private</td>
<td>564</td>
<td>40</td>
</tr>
<tr>
<td>24</td>
<td>Aquinoe</td>
<td>Bidii</td>
<td>Private</td>
<td>170</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>11,543</td>
<td>776</td>
</tr>
</tbody>
</table>

The school sample was divided equally among the eight classes and individual respondents selected from class registers by systematic random sampling. The first case however, was selected by simple random sampling. Absent pupils were substituted by the next pupil in the register. In seeking to determine factors associated with visual impairment and blindness, either parent or guardians of the affected pupils were sampled for the second part of the study. All affected pupils and all class teachers were also
sampled for this part of the study. The class teachers were purposefully sampled to represent all teachers of the 8 classes. Two zones Milimani and Bondeni had purely urban characteristics while Bidii and Grassland had peri-urban characteristics. This formed the basis of comparison of the socio-economic characteristics of parents of the affected pupils between urban status.

Economic characteristics of the parents of the blind and visually impaired pupils were analyzed using the following indicators; Occupation, level of monthly income, monthly expenditure on food, type of residential house used, number of meals taken per day and type of cooking fuel used. Each indicator was graded on Likert scale as follows;

1. Occupation
   - Formal employment, business or farmer = 2 points
   - House wife or casual worker = 1 point

2. Level of monthly income
   - Over 10,000 = 4 points
   - 5,000-10,000 = 3 points
   - 2,000-5,000 = 2 points
   - 0-2,000 = 1 point

3. Money spent on food monthly
   - > 5,000 = 4 points
   - 2,000-5,000 = 3 points
   - 1,000-2,000 = 2 points
   - 0-1,000 = 1 point
4. Type of house
   Permanent = 4 points
   Semi-permanent = 3 points
   Temporary = 2 points
   Make shift = 1 point

5. Number of meals per day
   Three = 3 points
   Two = 2 points
   One = 1 point

6. Type of cooking fuel
   Electricity and gas =3 points
   Kerosene = 2 points
   Firewood = 1 point

The minimum achievable points were 6 and the maximum 20.

3.10 Research instruments

A specially designed examination protocol (Appendix IV) was used for data collection. Both guided and self-administered, closed and open ended Questionnaires were used on pupils, parents and teachers (Appendices V, VI and VII). Data was stored in the computer hard disc and flash discs. Other instruments required included Snellens charts (Appendix VIII), torches, batteries, a 6 metre tape measure, an ophthalmoscope, a trial set, a retinoscope, Applanation tonometer, dark curtains, stationery, a vehicle for transport and drugs. The drugs used were Mydriatic Cocktail for pupillary dilatation before fundoscopy and Cyclopentolate for Cycloplegic refraction.
3.11 Pre-testing of research instruments

Training of six research assistants was carried out by the principal researcher one week prior to the study. Research assistants were drawn from itinerant teachers and one ophthalmic clinical officer who already had training and experience in assessing the VA of the subjects. The research instruments were pre-tested prior to the main study on 8 pupils for the first part of the study on prevalence and pattern of VI and blindness. The research instruments for the second part of the study on factors affecting VI and blindness were pre-tested on 2 teachers, 1 parent and 1 pupil. This was done in one purposively sampled school that did not participate in the main study. The instruments and materials were understood by the respondents except for minor adjustments on some questions. The key and crucial tests in this study included: Determination of VA, visual field, fundoscopy and retinoscopy. All these tests utilize internationally accepted standard tools including the Snellens Charts, Ophthalmoscope, trial set and Retinoscope, apart from visual field determination. The confrontation method was used for visual field determination, due to lack of perimetry machines.

3.12 Data collection techniques

Visual acuity of all the sampled pupils in the twenty four schools was tested by four trained research assistants. Section A of the questionnaire and study protocol was completed by the six research assistants. Those pupils presenting with VA equal to or greater than 6/18 in the better eye were given free treatment for simple ailments where necessary but were excluded from the rest of the examination procedures (Figure 3.1). Those pupils presenting with VA less than 6/18 in the better eye were tested with spectacles if worn and if VA improved to 6/18 or better were also excluded from the rest
of the procedures. Section B of the questionnaire and study protocol was filled by the principal researcher after a detailed examination of pupils whose presenting VA was less than 6/18 in the better eye. The detailed examination included VA with Pinhole (PH), cycloplegic refraction for refractive errors, external ocular examination by use of natural light and torch, fundoscopy by use of an ophthalmoscope, and estimation of visual fields by use of the confrontation method. Causes of visual impairment and blindness were established purely by physical examination of the respondents using standard procedures and equipment and respondent’s medical history. Difficult cases were referred to the ophthalmologist at Kitale District Hospital (KDH) with necessary follow up organized to record the findings (Appendix IX).

Figure 3.1: Procedure for the examination of study Subjects
An ophthalmic prescription was issued to children with refractive errors to be used to acquire free spectacles from Sabatia Eye Hospital through the ongoing sponsorship of Christian Blind Mission (CBM) and Kenya Society for the Blind (KSB) (Appendix X). The Questionnaire for parents and teachers were self administered while that for the visually impaired and blind children was interviewer assisted. A few parents, who could not be reached, however, were interviewed on telephone using numbers deposited with the schools administration.

### 3.13 Ethical consideration

Clearance for research was sought from Graduate School, Kenyatta University and the research permit from the Ministry of Science and Technology (Appendix XIII). General consent for research participants was sought from the Municipal Education Officer. A written consent however would be taken for anybody who needed this (appendices XII and XII). Verbal consent was received from teachers and parents who participated. All information received was treated with confidentiality. The research findings will be disseminated to the office of the District Education Officer, District Medical Officer of Health and the respective schools. Research participants were treated for minor ailments and referred appropriately where necessary.

### 3.14 Data management and analysis

The collected data were entered into a data base designed in Ms-Access. This was considered ultimate since entry errors could be controlled and validation of the same was possible. Data was cleaned before the actual analysis then exported to SPSS version 13.0 for analysis. The dependent variables in this study were prevalence of VI and blindness.
The independent variables in the study were age category, sex, class category, school type, zone, urban status and the economic status of parents. The results were presented in tables and figures where applicable. Descriptive statistics such as percentages, means and standard deviations were used to organize, describe and summarize the data. Chi-Square test of independence was applied to establish the associations between prevalence of VI and age category, gender, class category, type of school and zone. Associations were also sought between the economic characteristics of parents of the affected children and prevalence of VI between types of school and urban status. The probability of visual impairment distribution was further analyzed by multiple logistic regression involving age category, sex, class category, type of school and zones as predictors. A p-value of equal or less 0.05 was considered significant.
CHAPTER 4

RESULTS

4.1 Introduction

This chapter discusses the demographic characteristics of the study population including: age, gender and class distribution of the respondents, distribution of the respondents by zone and type of school. It also presents the study results including: prevalence of VI and blindness, patterns of VI and blindness among the respondents by age category, sex, class category, school type and zone. Further results are presented on the causes of VI and blindness, economic characteristics of parents and factors associated with VI and blindness.

4.2 Demographic characteristics of the respondents

A total of 776 pupils participated in this study, out of which 51.80% were boys and 48.20% were girls drawn from 14 public and 10 private schools. The mean age of the population was 10.81 ± 2.93 years while the median age was 11 years. The modal age was 12.00 years with a range of 5-22 years.

4.2.1 Age distribution of the respondents

The age groups most represented were 11-15 and 6-10 years at 47.68% and 46.39% respectively. The age groups least represented were above 20 and below 6 years respectively (n = 776) (Table 4.1). The ages recorded were as at the last birth day with a few of the children falling below six years. Children with chronic eye ailments like Nystagmus and Albinism were generally slow learners who repeated several classes and therefore the extremes of ages 16 to over 20 years.
Table 4.1: Percentage distribution of the respondents by age category

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6</td>
<td>4</td>
<td>0.52</td>
</tr>
<tr>
<td>6-10</td>
<td>360</td>
<td>46.39</td>
</tr>
<tr>
<td>11-15</td>
<td>370</td>
<td>47.68</td>
</tr>
<tr>
<td>16-20</td>
<td>41</td>
<td>5.28</td>
</tr>
<tr>
<td>20 +</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td>Total</td>
<td>776</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.2.2 Gender distribution of the respondents

Males comprised of 51.80% of the respondents while for females, this was 48.20% (Figure 4.1).

Figure 4.1: Distribution of the study population by sex (%)
4.2.3 Class distribution of the respondents

The class category 3-4 had the highest proportion of respondents among public schools as was the class category 7-8 among private schools at 17.92% and 8.24% respectively. Overall, the class category 3-4 had the highest proportion of respondents followed by class category 7-8 at 25.77% and 25.13% respectively (Table 4.2). The higher proportion of respondents in lower classes in public schools could be linked to the high enrolment due to the free primary education while the higher participation in upper classes in private schools could be due to the shift of pupils with the hopes of better performance at Kenya Certificate of Primary Education (KCPE).

Table 4.2: Percentage distribution of respondents by class category

<table>
<thead>
<tr>
<th>Class category</th>
<th>Public n =528</th>
<th>Private n = 248</th>
<th>Total n = 776</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>16.37</td>
<td>7.86</td>
<td>24.22</td>
</tr>
<tr>
<td>3-4</td>
<td>17.92</td>
<td>7.86</td>
<td>25.77</td>
</tr>
<tr>
<td>5-6</td>
<td>16.89</td>
<td>7.99</td>
<td>24.87</td>
</tr>
<tr>
<td>7-8</td>
<td>16.88</td>
<td>8.24</td>
<td>25.13</td>
</tr>
<tr>
<td>Total</td>
<td>68.04</td>
<td>31.96</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.2.4 Distribution of the respondents by zone and type of school

Most of the respondents were from Bondeni (38.15%) and Milimani (22.81%) zones which are purely urban as compared to Grassland (20.49%) and Bidii (18.56%) which have peri-urban characteristics. Public schools contributed to 68.04 % of the respondents while private schools contributed 31.97 % (Table 4.3).
Table 4.3: Distribution of respondents by zone and type of school

<table>
<thead>
<tr>
<th>Zone</th>
<th>Public</th>
<th>Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bondeni</td>
<td>28.87</td>
<td>9.28</td>
<td>38.15</td>
</tr>
<tr>
<td>Milimani</td>
<td>14.56</td>
<td>8.25</td>
<td>22.81</td>
</tr>
<tr>
<td>Grassland</td>
<td>13.27</td>
<td>7.22</td>
<td>20.49</td>
</tr>
<tr>
<td>Bidii</td>
<td>11.34</td>
<td>7.22</td>
<td>18.56</td>
</tr>
<tr>
<td>Total</td>
<td>68.04</td>
<td>31.97</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.3 Prevalence of visual impairment and blindness

A total of 95.10% of the respondents had normal visual acuity while 4.77% had visual impairment (VI). There was no case of severe visual impairment (SVI) but 0.13% of the respondents were blind (Table 4.4). The single case of a blind pupil was in a public integrated school where assistance is provided by special teachers, with necessary tools and equipment both for mobility and learning purposes.

Table 4.4: Prevalence of visual impairment and blindness among the respondents

<table>
<thead>
<tr>
<th>V.A Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/6- 6/18 (Normal)</td>
<td>738</td>
<td>95.10</td>
</tr>
<tr>
<td>&lt; 6/18- 6/60 (V.I)</td>
<td>37</td>
<td>4.77</td>
</tr>
<tr>
<td>&lt;6/60- 3/60 (S.V.I)</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>&lt; 3/60 (Blind)</td>
<td>1</td>
<td>0.13</td>
</tr>
<tr>
<td>Total</td>
<td>776</td>
<td>100.00</td>
</tr>
</tbody>
</table>
4.4 Patterns of visual impairment and blindness among the respondents

The pattern of visual impairment and blindness was sought among age category, gender, class category, type of school and zone.

4.4.1 Visual impairment, blindness and age category

The age group most affected by VI was 11-15 years at 59.46% followed by 6-10 years at 27.03%. The age group least affected was over 20 years at 2.70% followed by 16-20 years at 10.81% (Figure 4.2). The differences in age distribution of VI was statistically significant ($\chi^2 = 27.973$, df = 3, $p = 0.001$). The only blind pupil was in the age category 6-10 years.

![Figure 4.2: Percentage distribution of VI by age category](image)

4.4.2 Visual impairment, blindness and gender

Males contributed 64.86% of VI while for females, this was 35.14% (Figure 4.3). The difference in distribution of VI among gender was not statistically significant
(χ² = 3.270, df = 1, p = 0.071). The only blind pupil was a female.

The class category 5-6 contributed 43.24% of the VI cases while category 7-8 contributed 27.03% (Figure 4.4). Lower class categories had lower proportions of the visually impaired. The difference in distribution of VI by class category was significant (χ² = 8.081, df = 3, p = 0.044). The only blind pupil was in class category 1-2.
4.4.4 Visual impairment and blindness by zone and type of school

Grassland and Bidii zones had the highest proportion of VI cases at 37.84% each. Milimani and Bondeni zones had 13.51% and 10.81% of VI cases respectively (Figure 4.5). The difference in distribution of VI among zones was statistically significant ($\chi^2 = 9.811$, df = 3, p = 0.020). The only blind pupil was in Bondeni zone. In all zones, public schools had higher proportions of VI than private. Among the public schools, two zones, Grassland and Bidii (Peri-urban) had the highest proportions of VI cases at 37.84% and 24.32% respectively. Milimani and Bondeni (Urban) zones had 10.81% and 8.11% respectively of VI cases. Among private schools, Bidii zone had 13.51% of VI cases while Milimani and Bondeni both had 2.7% of the cases. Private schools in Grassland zone had no cases of VI. The difference in the distribution of VI among public and private schools was statistically significant ($\chi^2 = 14.30$, df = 1, p = 0.001). The female pupil who was blind was from a public school in Bondeni zone (Urban).
The probability of visual impairment distribution was further analyzed by multiple logistic regression involving age category, sex, class category, type of school and zones as predictors. Predictive significance of these variables is shown in Table 4.5. Age, type of school and zones had significant predictive values for VI occurrence. For age, VI is likely to be found in ages 11-15 and above 16 years, in zones VI was likely to be found in Grassland and Bidii (Peri-urban zones) while for type of schools, VI was likely to be found in public schools. Private schools had only 0.3 as much likelihood of having children with VI as the public schools. Sex and class category did not have significant predictive value for the occurrence of VI among school children. These results compare well with the Chi Square results which indicated significant association between VI occurrence with age, type of school and zone while there was no significant association between VI and gender. While there was significant association between VI and class categories with Chi Square results, there was no significant predictive value under multiple logistic regression.
Table 4.5: Probability distribution of VI using Multiple Logistic Regression

<table>
<thead>
<tr>
<th>Factor</th>
<th>Est.</th>
<th>se</th>
<th>ODDS</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 6</td>
<td>ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 – 10</td>
<td>17.0</td>
<td>.</td>
<td>0.0</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>11-15</td>
<td>17.2</td>
<td>0.6</td>
<td>0.0</td>
<td>0.000</td>
<td>15.9</td>
</tr>
<tr>
<td>16+</td>
<td>17.1</td>
<td>0.9</td>
<td>0.0</td>
<td>0.000</td>
<td>15.2</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>-0.7</td>
<td>0.4</td>
<td>0.5</td>
<td>0.063</td>
<td>-1.4</td>
</tr>
<tr>
<td>Class Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>-0.5</td>
<td>0.6</td>
<td>0.6</td>
<td>0.466</td>
<td>-1.7</td>
</tr>
<tr>
<td>5-6</td>
<td>0.7</td>
<td>0.7</td>
<td>2.0</td>
<td>0.322</td>
<td>-0.7</td>
</tr>
<tr>
<td>7-8</td>
<td>0.2</td>
<td>0.8</td>
<td>1.2</td>
<td>0.820</td>
<td>-1.4</td>
</tr>
<tr>
<td>School Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>-1.1</td>
<td>0.5</td>
<td>0.3</td>
<td>0.020</td>
<td>-2.0</td>
</tr>
<tr>
<td>Zones</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bondeni</td>
<td>ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Millimani</td>
<td>0.9</td>
<td>0.7</td>
<td>2.4</td>
<td>0.208</td>
<td>-0.5</td>
</tr>
<tr>
<td>Grassland</td>
<td>2.1</td>
<td>0.6</td>
<td>7.8</td>
<td>0.000</td>
<td>0.9</td>
</tr>
<tr>
<td>Bidii</td>
<td>2.2</td>
<td>0.6</td>
<td>8.7</td>
<td>0.000</td>
<td>1.0</td>
</tr>
<tr>
<td>Constant</td>
<td>-21.1</td>
<td>0.6</td>
<td>-</td>
<td>0.000</td>
<td>-22.4</td>
</tr>
</tbody>
</table>

4.6 Causes of visual impairment and blindness among the respondents

4.6.1 Causes of visual impairment

Ocular assessment showed that refractive error was the leading cause of VI (81.08%). Other causes were albinism (5.1%), corneal disease (5.1%), disease of whole globe (2.70%), strabismus (2.70%) and Nystagmus (2.70%) (Table 4.6).
Table 4.6: Percentage distribution of respondents with various causes of VI

<table>
<thead>
<tr>
<th>Causes</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refractive Error</td>
<td>30</td>
<td>81.08</td>
</tr>
<tr>
<td>Albinism</td>
<td>2</td>
<td>5.41</td>
</tr>
<tr>
<td>Corneal disease</td>
<td>2</td>
<td>5.41</td>
</tr>
<tr>
<td>Disease of whole globe</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Strabismus</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Nystagmus</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.6.2 Causes of blindness

The cause of blindness in the single case was retinal disease in both eyes (Retinoblastoma) in early childhood. This was established from the medical history given by the coordinating itinerant teacher. It was also established by physical examination which showed that the respondent had empty sockets following enucleation (removal of eye balls), a procedure usually done to do away with the tumour to save the life of the victim.

4.6.3 Types of refractive errors

The most common refractive error among the respondents was Hypermetropia (66.67%). Other refractive errors observed were Myopia (30.00%) and Astigmatism (3.33%) see Figure 4.6.
4.7 Factors associated with visual impairment and blindness

4.7.1 Economic characteristics of parents

The computed mean economic status among all parents was 13.50 with a standard deviation of 3.7985 and a median of 13.00. The mode was 12.00. This represents a moderate economic status for all parents in schools in Kitale Municipality. There were more parents representing the affected pupils from public than private schools. There was statistical difference in the economic status of the parents representing public and private schools ($\chi^2 = 6.88$, df = 2, $p = 0.032$) (Table 4.7).
Table 4.7: Economic characteristics of parents of the affected pupils in public and private schools.

<table>
<thead>
<tr>
<th>Level of economic status</th>
<th>No. of parents in public</th>
<th>% in Public schools</th>
<th>No. of parents in private</th>
<th>% in Private schools</th>
<th>Total No. of parents</th>
<th>Total % economic status</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.00-10.00</td>
<td>9</td>
<td>29.03</td>
<td>0</td>
<td>0.00</td>
<td>9</td>
<td>25.00</td>
</tr>
<tr>
<td>11.00-15.00</td>
<td>15</td>
<td>48.39</td>
<td>1</td>
<td>20.00</td>
<td>16</td>
<td>44.44</td>
</tr>
<tr>
<td>16.00-20.00</td>
<td>7</td>
<td>22.58</td>
<td>4</td>
<td>80.00</td>
<td>11</td>
<td>30.56</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100.00</td>
<td>5</td>
<td>100.00</td>
<td>36</td>
<td>100.00</td>
</tr>
</tbody>
</table>

There were more parents representing the affected pupils from peri-urban than purely urban zones. There was statistical difference in the economic status of the two groups of parents ($\chi^2 = 6.55$, df = 2, p = 0.038) (Table 4.8).

Table 4.8: Economic characteristics of parents of pupils in urban and peri-urban schools.

<table>
<thead>
<tr>
<th>Level of economic status</th>
<th>No. of parents in Urban</th>
<th>% in Urban</th>
<th>No. of parents in peri-urban</th>
<th>% in peri-urban</th>
<th>Total No. of parents</th>
<th>Total % economic status</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.00-10.00</td>
<td>0</td>
<td>0.00</td>
<td>9</td>
<td>37.50</td>
<td>9</td>
<td>25.00</td>
</tr>
<tr>
<td>11.00-15.00</td>
<td>8</td>
<td>66.67</td>
<td>8</td>
<td>33.33</td>
<td>16</td>
<td>44.44</td>
</tr>
<tr>
<td>16.00-20.00</td>
<td>4</td>
<td>33.33</td>
<td>7</td>
<td>29.17</td>
<td>11</td>
<td>30.56</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>100.00</td>
<td>24</td>
<td>100.00</td>
<td>36</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.7.2 Knowledge by pupils on causes of VI and blindness

About half of the pupils affected by VI and blindness cited allergy as the main cause of VI. However, still a good proportion of the pupils do not have an idea of what causes VI or blindness (Table 4.9). These observations were based on individual perceptions.
Table 4.9: Pupils knowledge on causes of VI and blindness

<table>
<thead>
<tr>
<th>Cause</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetic factors</td>
<td>1</td>
<td>2.60</td>
</tr>
<tr>
<td>Allergy</td>
<td>19</td>
<td>50.00</td>
</tr>
<tr>
<td>No idea</td>
<td>18</td>
<td>47.40</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.7.3 Knowledge by pupils on ways of preventing VI and blindness

Early treatment was considered as a means of preventing VI and blindness by 70.83% of the respondents. The pupils also cited use of spectacles (16.67%) and staying in dust free environment (12.50%) as other means of prevention (Table 4.10).

Table 4.10: Pupils knowledge on prevention of VI and blindness

<table>
<thead>
<tr>
<th>Means of prevention</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early treatment</td>
<td>17</td>
<td>70.83</td>
</tr>
<tr>
<td>Use of spectacles</td>
<td>4</td>
<td>16.67</td>
</tr>
<tr>
<td>Dust free environment</td>
<td>3</td>
<td>12.50</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.7.4 Action taken by pupils when they have eye ailments

Majority of the pupils (92.11%) reported that they informed their parents or teachers whenever they had eye problems (Table 4.11). A few of the pupils (7.89%) did not inform either parents or teachers whenever they had eye problems.
Table 4.11: Pupils practice when they have eye ailments

<table>
<thead>
<tr>
<th>Practice</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Inform</td>
<td>35</td>
<td>92.11</td>
</tr>
<tr>
<td>Do not inform</td>
<td>3</td>
<td>7.89</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.7.5 Knowledge by teachers on causes of VI and blindness

Majority of the teachers cited poor hygiene as the leading cause of VI and blindness (44.17%). Other causes cited were poor nutrition (31.07%), other diseases (13.11%) and genetic factors (11.65%) (Table 4.12).

Table 4.12: Teachers knowledge on causes of VI and blindness

<table>
<thead>
<tr>
<th>Causes</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetic causes</td>
<td>24</td>
<td>11.65</td>
</tr>
<tr>
<td>Poor nutrition</td>
<td>64</td>
<td>31.07</td>
</tr>
<tr>
<td>Poor hygiene</td>
<td>91</td>
<td>44.17</td>
</tr>
<tr>
<td>Other diseases</td>
<td>27</td>
<td>13.11</td>
</tr>
<tr>
<td>Total</td>
<td>206</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.7.6 Knowledge by teachers on prevention of VI and blindness

Majority of the teachers (29.47%) cited good nutrition as a means of prevention of VI and blindness. The teachers also cited good personal hygiene (26.32%), good lighting
(13.68%), and early treatment (10.53%) as ways of prevention. Another 20.00% cited regular screening and environmental hygiene as other ways of prevention (Table 4.13).

Table 4.13: Teachers knowledge on prevention of VI and blindness

<table>
<thead>
<tr>
<th>Ways of prevention</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good nutrition</td>
<td>28</td>
<td>29.47</td>
</tr>
<tr>
<td>Good personal hygiene</td>
<td>25</td>
<td>26.32</td>
</tr>
<tr>
<td>Good lighting</td>
<td>13</td>
<td>13.68</td>
</tr>
<tr>
<td>Early treatment</td>
<td>10</td>
<td>10.53</td>
</tr>
<tr>
<td>Other (Regular screening and Environmental hygiene)</td>
<td>19</td>
<td>20.00</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100.00</td>
</tr>
</tbody>
</table>

4.7.7 Promotion of eye health by teachers

Teachers reported that they teach lessons on eye health promotion in primary schools.

Among these lessons are personal hygiene by 36.21% of teachers, good nutrition by 29.31%, care of the visually impaired and blind by 20.69% and emphasis for early treatment by 13.79% (Table 4.14).
Table 4.14: Teachers practices on eye health promotion

<table>
<thead>
<tr>
<th>Lesson taught</th>
<th>Frequency of responses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal hygiene</td>
<td>21</td>
<td>36.21</td>
</tr>
<tr>
<td>Good nutrition</td>
<td>17</td>
<td>29.31</td>
</tr>
<tr>
<td>Care of the VI and blind</td>
<td>12</td>
<td>20.69</td>
</tr>
<tr>
<td>Emphasis on early treatment</td>
<td>8</td>
<td>13.79</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>100.00</td>
</tr>
</tbody>
</table>
CHAPTER 5
DISCUSSION

5.1 Introduction

This chapter discusses the demographic characteristics of the respondents by age category, sex, class category, type of school and zone. It further discusses the prevalence and pattern of VI and blindness by the above listed variables in relation to other studies. The causes of VI and blindness in this study are also discussed in the light of findings of other related studies. The socio-economic characteristics of parents in relation to school type and urban status are also discussed. Finally, findings on knowledge and practices among affected pupils and class teachers on VI and blindness are discussed.

5.2 Demographic characteristics of the respondents

Demographic characteristics among the respondents were recorded by age, sex, class, zone, and type of school.

5.2.1 Age distribution of the respondents

The age groups most represented in this study were 11-15 and 6-10 years. The normal school age children (5-19 year olds) are reflected in the National Health Sector Strategic Plan (NHSSP II) as well as Kenya Education Sector Support Programme (KESSP), (MOPHS and MOE, 2009). Majority of the respondents therefore were within the expected age category for primary schools. The age groups of over 20 and less than 6 years are not normally expected in primary schools either because they are over age or under age (MOPHS and MOE, 2009). The children on the upper extreme of age (over 20 and 16-20) had chronic ocular ailments including albinism, corneal disease, disease of
whole globe, strabismus and nystagmus that rendered them slow learners hence repeating several classes in the process. Lateness in begging school could also lead to over age.

5.2.2 Sex distribution of the respondents

The ratio of male: female participation in this study was 1:1.07 which is almost equal participation between gender. The schools enrolment however showed a ratio of 1: 0.98 respectively (n = 22,879). Normal demographic distribution in Kenya indicates the ratio of males to females being 1:1 in the whole population (UN, 2008). With the start of the Free Primary Education (FPE) in Kenya in 2003, a gross enrolment ratio of 104% for both boys and girls was achieved, an increase of 21% from the previous year (MOEST, 2004).

5.2.3 Class distribution of the respondents

There was equal representation of respondents among all the four class categories of between 24.22% and 25.77%. Among public schools the class categories had between 16.37% and 17.92% respondents which again were relatively equal. Among private schools, the representation was between 7.86% and 8.24%. This equal representation between class categories was because the school samples were divided equally among all the eight classes. There were however lower enrolments among private compared to public schools. This is because under the Free Primary Education, enrolment in public schools rose considerably from 86.8% in 2002 to 101.5% in 2004. This enabled some 1.3 million poor children to benefit for the first time through the abolishment of fees and levies for tuition (UNESCO, 2006).
5.2.4 Zone distribution of the respondents

Bondeni and Milimani zones had higher proportions of respondents. These zones have pure urban characteristics and are more densely populated. Grassland and Bidii zones on the other hand had lower proportions of respondents. The latter zones have peri-urban characteristics and were less densely populated. The allocation of school samples and hence zonal samples was proportional to the school population. The peri-urban areas have developed on farms which were bought from white settlers by land buying companies and cooperatives and sub-divided into smaller plots and distributed among shareholders and members. They are thus located on land which was until recently classified as agricultural, but now urban following municipal boundary expansion (Majale, 2009).

5.2.5 Distribution of the respondents by type of school

Majority of the respondents were from public schools as compared to private schools. This is because of the Free Primary Education that has resulted in higher enrolment in public schools. Furthermore, pupils in private schools pay colossal sums of money as fees, a reason for lower enrolment in these schools. Free Primary Education (FPE) introduced in Kenya in 2003, has enabled 1.3 million poor children to benefit from primary education for the first time through the abolishment of fees and levies for tuition. Despite having consequences on other areas of education including early childhood development, FPE improved the enrolment rate in primary education from 86.8% in 2002 to 101.5% in 2004 (UNESCO, 2006).
5.3 Prevalence of visual impairment and blindness

5.3.1 Prevalence of visual impairment

The prevalence of visual impairment in this study was 4.77%. This is far above the global estimate of 0.40% (Lynne, 1998), and therefore of public health importance. A similar study conducted among standard one pupils in Kibera slums of Nairobi, Kenya found a prevalence of VI to be 10.00% (Musa, 1998). The lower prevalence in the current study compared to the Kibera study is explained by the difference in the socio-economic status of the two groups. Most parents of the visually impaired children in this study had moderate economic status (13.50 ± 3.7985) while 33.00 % respondents in the Kibera study did not seek for treatment of eye ailments due to lack of money (Karimurio et al., 2008). In another study in Kibera slums of Nairobi, the prevalence of VI was 6.20% (Ndegwa et al., 2006). This was slightly higher than in the current study because of the category of the sampled population (Two years and above). The prevalence of VI and blindness increases with age with majority of those affected being the elderly. The prevalence of VI in Makueni was 5.60% (Muma et al., 2007). This compares well with the findings of this study though the Makueni study was among primary school pupils aged twelve to fifteen years.

In Nigeria, the prevalence of VI in children less than 16 years in a hospital based study was 2.0% (Adegbehingbe, 2007). These are children presented to a hospital to seek treatment. The current study however was cross sectional and was bound to identify more cases of VI. In USA, the prevalence of VI in children is estimated to be 5-10% (Murthy, 2000). This is a national estimate and given regional variations that may be found in the
Kenyan setting, the Kenyan national figure could be much higher because of the socio-economic differences between the two countries. Furthermore Retinopathy of prematurity is an important cause of childhood visual impairment and blindness in industrialized countries like the USA (Andrea, 2001). This is because of the ever increasing survival of low and very low birth weight infants. The global estimate for VI by WHO of 18% (WHO, 2002) is much higher above the findings of this study because this estimate is based on whole populations. The current study only focused on primary school children.

5.3.2 Prevalence of blindness

The prevalence of blindness in this school based study was 0.13%. This is much lower than the National figure for Kenya of 0.70% (MOH, 2005). However, the national prevalence was based on whole population that includes all age groups. Generally, the prevalence of VI and blindness increases with age due to conditions such as cataract, trachoma, glaucoma and age related macular degeneration. The prevalence would therefore be higher if a whole population survey was done. Globally, the prevalence of childhood blindness varies from approximately 0.03% in wealthy countries to 0.12% in the poorer countries (Nyaluke et al., 2008). The finding of this is study is slightly above the global figure for poorer countries and therefore blindness of 0.13% is of public health importance. In Kibera slums in Nairobi, the prevalence of blindness was 0.60% (Ndegwa et al., 2006). This was higher than in the current study since the Kibera study was among a wider range of population two years and above. Another study in Korogocho slums in Nairobi found the prevalence to be 0.70% (Nyaga et al., 2007) which compares well with the National figure. This was a whole population study.
The only case of blindness in this study was based at a school with an integrated education programme. There were sixteen integrated schools within Kitale Municipality (Eleven public and five private). Nine of these schools were sampled for the study (eight public, one private). This is the essence of the Kenya Integrated education programme based on the understanding that blind children grow, flourish and achieve greater self and social fulfillment by being nurtured in the least restricted environment. It is only those blind children with additional disabilities that require special school services (Mani, 1998). The only neighbouring school admitting blind children was St. Francis’ school for the blind in Kapenguria municipality, 40 kilometres from Kitale. The school had a total enrolment of about 200 pupils drawn from the North Rift region of Kenya and parts of the neighbouring Western province. This school could have admitted most of the blind children from Kitale municipality.

5.4 Pattern of visual impairment and blindness among the respondents

5.4.1 Visual impairment, blindness and age category

In Kenya, children aged 5-19 years constitute 48% of the total population. This age group suffers varying but significant degrees of ill health, nutritional deficiencies and morbidity that unequivocally impede effective learning and realization of their full productive potential (MOPHS and MOE, 2009). The leading cause of VI in this study was refractive error. The age category most affected by visual impairment (11-15 years) is the period when refractive errors usually manifest. This age category is characterized by rapid growth that includes rapid anterior- posterior diameter of the eye (from the posterior corneal surface to the retina, normally 22 to 26mm). This growth in the size of the eye has a bearing on the development of refractive errors. Majority of significant refractive
errors manifest themselves during teenage life (Holden et al., 2000). Majority of the children with visual impairment in Nigeria were in the age category 0-5 years (37.40%) and 11-15 years (35.10%). This is partly in agreement with the findings of this study where the most affected age category was 11-15 years. The only blind pupil was in the age category 6-10 years, the blindness being caused by retinal disease. Retinoblastoma is the most common primary ocular malignancy of childhood. It is caused by retinoblastoma gene, which is a mutation in the long arm of chromosome 13. Retinoblastoma is diagnosed in patients at an average age of 18 months, with 90% of cases diagnosed in patients younger than five years (Marichelle, 2009).

5.4.2 Visual impairment, blindness and gender

In this study, males were more affected by VI than females. Though more males than females were affected, the difference was not statistically significant (p = 0.071). There is not enough population-based data to evaluate the issue of gender and VI among children. Use of eye care services could be un-equal between genders at this age and can be a subject for further research. In a study carried out among children 12-15 years within a hospital setting in Nigeria, males were also more affected by VI at 31.60% than females at 22.20% (Adegbehingbe, 2007). Generally, females are more affected by VI and blindness than males. Of the people who are blind in the world, 64% are female (Courtright and Lewallan, 2007). A study in USA revealed that the prevalence and distribution of corrective lenses among school age children with refractive errors was 25.40% with more girls having corrective spectacles than boys (Kemper and Bruckmen, 2004). This therefore implies that accessibility to refractive services is still a challenge even in developed countries and the fact that more girls than boys had corrective
spectacles needs to be explored further through research. Perhaps Majority of the girls in the current study already had corrections and that is why more boys were still visually impaired than girls.

In this current study, the only blind pupil was female. Of the people who are blind in the world, 64% are female (Courtright and Lewallan, 2007). Blindness being a low prevalence condition requires very large samples for study especially among children. The public health implications of even one case of blindness however are very immense. The fact that there was no case blindness among males is an indication that there are lesser chances of getting blindness among males. Studies show no significant difference in the incidence of retinoblastoma by sex for children aged 0-14 years. An estimated 250-500 new cases of retinoblastoma occur in USA yearly (Marichelle et al., 2009) Worldwide an incidence of 1 case of retinoblastoma per 18,000 to 30,000 live births occurs. No racial predilection appears to exist and there is no difference in incidence among blacks and whites. Only 5-10% of patients who develop the disease have a positive family history. Common presenting signs and symptoms include leukocoria (white pupillary reflex), strabismus (squint), proptosis and secondary changes e.g. glaucoma, retinal detachment and inflammation (Marichelle et al., 2009).

5.4.3 Visual impairment, blindness and class category

The class category most affected in the current study by visual impairment was class 5-6. Pupils of the age category 11-15 years that was most affected are usually in this class category. The only blind pupil was in standard one and at age of 8 years was ordinarily expected to be in standard three. The lag in class can be explained by the time used to
seek medical and surgical interventions to address the illness that resulted in blindness. The start age for primary education in Kenya is six years and primary education takes eight years (MOEST, 2004).

5.4.4 Visual impairment, blindness and zone

Grassland and Bidii zones with peri-urban characteristics had higher proportions of visually impaired cases compared to Milimani and Bondeni with urban characteristics. This difference could be explained by differences in economic characteristics among parents of the VI cases. In ordinary circumstances, it would be expected that good economic status facilitates access and affordability of eye care services and hence reduce the burden of VI and blindness.

Kitale’s annual population growth rate of 12% is higher than the national urban average of 7%. This population upsurge occasioned by rural-urban migration has overstretched the capacity of the municipal council to effectively plan and manage the town’s growth. This in effect has outstripped the supply of planned and serviced land, infrastructure provision, formal housing development and employment creation and as a result, 65% of the 220,000 population live in slums and informal settlements. These are characterized by insecure tenure, inadequate infrastructure and social services, poor quality housing, overcrowding, unemployment and socio-economic marginalization. (Majale, 2009). The only blind pupil was in Bondeni, an urban zone perhaps chosen for having an integrated education programme.
5.4.5 Visual impairment and blindness by type of school

Public schools contributed to 81.08% of the cases of VI while for private schools, this was 18.92%. The economic status of the parents of the visually impaired and blind, could explain this difference (p = 0.113). Parents from public schools had lower economic status and hence majority were not able to meet the costs of acquiring spectacles for their children. Parents from private schools on the other hand had better economic status and hence were more likely to purchase spectacles. The only blind pupil was in a public school with integrated education service. Since she had no other disability, it was not necessary for her to be in a special school for the blind.

Most pupils attending public schools stay in slums and informal settlements. These are characterized by insecure tenure, inadequate infrastructure and social services, poor quality housing, overcrowding, unemployment and socio-economic marginalization (Majale, 2009). These factors predispose to vulnerability to eye infections, nutritional deficiencies and lack of capacity to access eye care services. Ignorance on the part of pupils, parents and teachers on the causes of VI and blindness and how they can be prevented can also explain the high predilection in public schools. It is presumed here that majority of parents from public schools are less educated and therefore less informed. On the part of teachers and the pupils, there is a general lack of eye health education. Only “parts of the eye” is contained in the schools curriculum. This applied to both public and private schools. In as study on perceptions amongst primary school teachers of visual problems affecting their pupils in Quetta, there is lack of any training about primary health care or primary eye care teaching in the syllabus of primary teachers.
(Mohammad, 2005). The implementation of the school health policy will therefore go a long way in addressing this gap.

5.5 Causes of visual impairment and blindness among the respondents

In the current study, refractive error was responsible for 81.08% of visual impairment. Other causes of visual impairment were albinism, corneal disease, disease of whole globe, strabismus and Nystagmus. This is in agreement with similar studies conducted in urban India where 83.00 % of cases were due to refractive error (Brien et al., 2002). In southern India, it was reported that refractive error was responsible for 94.80% of cases of visual impairment among school children (Kalikivayi et al., 1997). In Shun Yi district of China, Zhao found that refractive error was the cause of visual impairment in 89.50 % of all cases of VI (Zhao et al., 2000).

Refractive error was responsible for 81.70 % of visual impairment among children in New Delhi India (Leon, 2002). A study of standard one pupil in Nairobi Kenya found refractive error in only 4.80% of cases of VI (Musa, 1998). This illustrates the influence of age on visual impairment. Refractive error was a major cause of visual impairment in this study. There are various forms of refractive errors with different causes but most are due to anatomical changes in the eye structures.

Myopia in this study was responsible for 30.00 % of all refractive errors largely in the age category 11-15 years. In a study on the prevalence of significant refractive errors in primary school children of a rural district of Kenya, Myopia was responsible for 32.00% of all refractive errors (Muma et al., 2007). Myopia is rare at birth but begins to develop
as the child grows. It is usually detected at around the age of 9-10 years and increases with age, culminating at mid-teenage life (Garcia and Pavan-Langston, 1991). Astigmatism in this study was responsible for 3.33% of all refractive errors largely in the age category 11-15 years. In the study on the prevalence of significant refractive errors in primary school children of a rural district of Kenya, Astigmatism was responsible for 5.33% of all refractive errors. The later study was among pupils 12 to 25 years of age.

Hypermetropia in this study was responsible for 66.67% of all refractive errors largely in the age category 11-15 years. In the study on the prevalence of significant refractive errors in primary school children of a rural district of Kenya, Hypermetropia was responsible for 62.67% of all refractive errors. This compares well with the findings of this study.

The only blind pupil had retinal disease (Retinoblastoma) as the cause of blindness. This is a childhood cancer that is genetically transferred from generation to generation. If left unattended, it can kill the victim, but if diagnosed early, the victim can undergo enucleation (surgical removal of whole eyeball) in order to save life. The single case of blindness in this study was diagnosed at the age of 5 years and underwent enucleation of both eyes within 3 months according to the medical records at the school.

5.6 Factors associated with visual impairment and blindness

5.6.1 Economic characteristics among parents

The purpose of this investigation was to provide insight into the factors associated with VI and blindness among primary school pupils in Kitale municipality. Majority of parents in public schools had economic status in the category 11.00-15.00 while those in private
schools, 16.00-20.00. The mean economic status for all the parents was $13.50 \pm 3.7985$. There was statistical difference between the economic status of parents from public and private schools ($p = 0.032$). Socio-economic status therefore had influence on the prevalence VI and blindness between types of schools. A comprehensive review of the literature revealed no information in literature on VI and parental economic status among public and private schools.

Socio-economic status again had influence on the prevalence of VI and blindness between urban status since there was statistical difference between the economic status of parents from urban and peri-urban zones ($p = 0.038$). Majority of parents in urban zones had economic status in the category 11.00-15.00 while those in peri-urban in the category 6.00-10.00. A comprehensive review of the literature again revealed no information in literature on VI and parental economic status among urban and peri-urban schools.

Those in the peri-urban areas are settled on farms bought from white settlers by land buying companies and cooperatives and then sub-divided into smaller plots and distributed among shareholders and members. They are thus located on land which until recently was classified as agricultural, but is now urban following municipal boundary expansion. This present a significant challenge for urban planning and development control as well as service delivery (Majale, 2009).
5.6.2 Pupils’ knowledge on causes and prevention of VI and blindness

The purpose of this investigation was to provide insight on the knowledge pupils have on the causes and prevention of VI and blindness. This may have influence on the practices adopted to avert the problems of VI and blindness. In the current study, allergy and genetic factors were cited as the main causes of VI and blindness but a large number of respondents too did not have an idea on how these problems come about. Whereas allergy is the commonest ailment in the community studied (KDH, 2008) and has the potential to cause visual loss, it is probably not a major cause of visual impairment and blindness as the results of the current study indicates otherwise. The cause of blindness in this study was retinoblastoma while VI was due to refractive error, albinism, corneal disease, disease of whole globe, strabismus and nystagmus.

The leading diagnoses at the Kitale District Hospital’s eye unit were allergic conjunctivitis (39.25%), other refractive errors (12.19%) and other diagnosis (11.40%) (KDH, 2008). Five children below 5 years were diagnosed at the clinic for retinoblastoma during the year and 2 were 16 years and above both having normal visual acuity of 6/6 to 6/18 in the un-affected eye (KDH, 2008).

On prevention, early treatment, use of spectacles and dust free environments were cited as key preventive measures. Early treatment is essential in averting disease conditions that could worsen over time and cause irreversible damages. Some of the children for whom spectacles had previously been prescribed had not acquired them. The prevention of trachoma and other infections and nutrition programmes prevent blindness in
populations. This is called primary prevention since it prevents diseases from occurring by promoting eye health and preventing eye disease. Correct diagnosis and therapy prevents blindness in individual patients. This is secondary prevention in that disease has already set in but prevention of blindness is achieved through treatment (Schwab, 1987).

In developing countries, the relevant primary preventive strategies such as nutrition education, vitamin A supplementation and measles immunization can be provided through child survival programmes. Secondary preventive measures require early identification of neonates and children with treatable conditions and referral to centres that provide the appropriate ophthalmic care. Tertiary prevention is more problematic in children with early onset disease because of amblyopia. Useful vision can usually be restored to children blind from unoperated congenital cataract, and occasionally optical iridectomy or keratoplasty can restore sight to a child blind from corneal scarring (Clare, 1993).

5.6.3 Pupils practices towards eye ailments

Majority of the pupils (92.11%) inform either their parents or teachers whenever they had any eye ailment. This is a good step towards positive health seeking behaviour. In practice such information needs to be followed up by relevant actions like seeking medical attention but often such information is neglected. A study in Kibera and Dagoreti divisions in Nairobi found that 49% of the participants did not seek treatment for ocular disorders because they did not perceive the need as the problems did not bother them. Another 33.00% did not have money, 7.50% did not know where to go, 6.80% had no
time to seek treatment, and 1.00% said eye facilities were far while 2.70% had other unspecified reasons (Karimurio et al., 2008).

### 5.6.4 Teachers’ knowledge on causes and prevention of VI and blindness

In the current study, poor hygiene, poor nutrition, other diseases and genetic factors were cited as the leading causes of VI and blindness by teachers. These were based on responses to the teacher questionnaire subject to the teachers’ personal views. These factors have a bearing in promoting eye morbidity but are not the key causes based on the causes identified in this study through physical examination. The cause of blindness in this study was retinoblastoma while VI was due to refractive error, albinism, corneal disease, disease of whole globe, strabismus and nystagmus.

According to literature, Descriptive causes of visual impairment and blindness include, microphthalmos, anophthalmos, corneal scarring, keratoconnus, cataract and aphakia. Others include aniridia, uveitis, retinal dystrophies, buphthalmos and glaucoma. Finally optic atrophy, optic nerve hypoplasia, cortical blindness and amblyopias (Clare et al., 2003). Causes according to time of onset include, genetic disease, chromosomal abnormalities, rubella, toxoplasmosis and retinopathy of prematurity. Others include vitamin A deficiency, measles and injury among others (Clare et al., 2003).

On prevention, good nutrition, good hygiene, good lighting and early treatment are recognized by teachers as major means of prevention of VI and blindness. Knowledge of teachers on eye health promotion and prevention is based on common knowledge, personal experience and journals. There is lack of training about primary eye care in the
syllabus of primary teachers though they are enthusiastic to work for the betterment of the health of school children (Mohammad, 2005).

5.6.5 Promotion of eye health by teachers

The main practice by teachers on eye health promotion are lessons on personal hygiene, good nutrition, care of the VI and blind as well as emphasis on early treatment. Such lessons coupled with activities outlined in the Kenya school health policy (MOPHS and MOE, 2009) will go a long way in averting VI and blindness among primary school pupils.

The National school health policy identifies eye care as an integral part of health as visually impaired children have a right to education just like the sighted. The policy also appreciates that visual problems are an important contribution to poor school performance and therefore these children need to be identified and managed early. The policy therefore directs that VA check shall be done before admission to school, annual school eye screening conducted by relevant ministries and partners and vitamin A supplementation every six months to all children less than five years. The policy also directs that schools shall refer children incase of eye injury or children with poor vision (MOPHS and MOE, 2009).
CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

a) Visual impairment among primary school pupils aged 5-22 years occur at a prevalence of 4.77% while blindness stands at 0.13% in Kitale Municipality.

b) The age group most affected by visual impairment among primary school pupils in Kitale Municipality is 11-15 years at 59.46% while the only blind pupil was 8 years. More male pupils are affected by visual impairment than females among the study population at a ratio of 1.85:1. Only one pupil (female) was blind in the study population. Public schools were more affected by VI than private schools at 81.08% and 18.92% respectively with the only blind pupil being from a public school. Peri-urban zones of Grassland and Bidii had more proportions of the VI cases (75.68%) than the purely urban zones of Bondeni and Milimani (24.32%). The only blind pupil was from Bondeni zone.

c) The leading cause of visual impairment in the study population was refractive error (81.1%) with hypermetropia accounting for most of the cases (67.9%). Other causes of visual impairment were albinism, corneal disease, lesions of the whole globe, strabismus and nystagmus. The only case of blindness was due to Retinal disease (Retinoblastoma) in early childhood.

d) Allergy was cited as the main cause of VI and blindness by majority of the pupils (50.00%) while teachers cited poor hygiene (44.17%) and poor nutrition (31.07%) as the leading causes. Early treatment was cited as the leading means of prevention of VI and blindness by 70.83% of pupils while majority of teachers cited good nutrition
(29.47%) and good hygiene (26.32%). Majority of pupils (92.11%) informed their parents or teachers when they had eye ailments. Majority of teachers on the other hand teach lessons on eye health promotion on personal hygiene (36.21%) and good nutrition (29.31%). There was no association between the economic status of parents of the affected children with school type ($p = 0.113$) and urban status ($p = 0.53$).

6.2 Recommendations

a) There is need to enforce the school health policy (2009) on visual assessment before school admission as well as carry out annual school eye screening by the MOPHS, MOMS, MOE and partners in order to enhance early detection and management of eye problems.

b) There is need for collaboration between the Ministry of Medical Services and eye care development partners to provide subsidized spectacles since a large number of pupils with visual impairment had refractive error as the cause of impairment.

c) There is need for concerted efforts by the Ministry of Medical Services and Ministry of Public Health and Sanitation to provide eye health education to pupils, teachers and parents on major blinding and visually disabling conditions in order to enhance early detection and take appropriate actions.

d) There is need for the Ministry of Public Health and Sanitation to carry out a National visual impairment and blindness survey in order to provide empirical data for planning eye care service delivery.
6.3 Suggestions for further research

a) Other than the diseases identified in this study, there could be other disease conditions with the potential to cause visual impairment and blindness that need to be studied in different geographic locations. A study on eye diseases affecting primary school pupils is therefore necessary.

b) Since refractive error was the leading cause of visual impairment in this study, a study on the prevalence of significant refractive errors among primary school pupils need to be undertaken in order to establish the national burden and plan appropriate actions to address the problem.

c) A similar study on the prevalence and pattern of visual impairment and blindness among primary school pupils could be carried out in other parts of Kenya for comparative purposes. This is because studies carried out in Kenya on visual impairment and blindness are usually small scale whole population studies targeting a narrow section of the population.
REFERENCES


APPENDIX I

MAP OF KITALE MUNICIPALITY SHOWING ITS LOCATION IN KENYA

Source: www.ilriitis\usersdata\kenyamaps.com
APPENDIX II

LIST OF REGISTERED PUBLIC PRIMARY SCHOOLS IN KITALE

MUNICIPALITY

<table>
<thead>
<tr>
<th>Zone</th>
<th>No.</th>
<th>Name of School</th>
<th>No. of Boys</th>
<th>No. of Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bondeni</td>
<td>1.</td>
<td>Tuwani</td>
<td>496</td>
<td>520</td>
<td>1016</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>Township</td>
<td>359</td>
<td>400</td>
<td>759</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>Central</td>
<td>581</td>
<td>617</td>
<td>1198</td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td>Kitale Union</td>
<td>583</td>
<td>615</td>
<td>1198</td>
</tr>
<tr>
<td></td>
<td>5.</td>
<td>St. Columbas</td>
<td>264</td>
<td>290</td>
<td>554</td>
</tr>
<tr>
<td></td>
<td>6.</td>
<td>Trans-Nzoia</td>
<td>324</td>
<td>329</td>
<td>653</td>
</tr>
<tr>
<td></td>
<td>7.</td>
<td>Kaloleni</td>
<td>217</td>
<td>231</td>
<td>448</td>
</tr>
<tr>
<td></td>
<td>8.</td>
<td>Kaloleni Annex</td>
<td>396</td>
<td>353</td>
<td>749</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>3,220</td>
<td>3,355</td>
<td>6,575</td>
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<tr>
<td>Milimani</td>
<td>1.</td>
<td>Milimani</td>
<td>361</td>
<td>361</td>
<td>722</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>Shimo la Tewa</td>
<td>204</td>
<td>253</td>
<td>457</td>
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<tr>
<td></td>
<td>3.</td>
<td>Kitale Forest</td>
<td>253</td>
<td>270</td>
<td>523</td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td>Show Ground</td>
<td>161</td>
<td>158</td>
<td>319</td>
</tr>
<tr>
<td></td>
<td>5.</td>
<td>Hill School</td>
<td>279</td>
<td>260</td>
<td>539</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>1,258</td>
<td>1,302</td>
<td>2,560</td>
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<tr>
<td>Grassland</td>
<td>1.</td>
<td>St. Joseph’s</td>
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<td>337</td>
<td>654</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>Lukhuna</td>
<td>459</td>
<td>531</td>
<td>990</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>Top Station</td>
<td>266</td>
<td>266</td>
<td>532</td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td>Chetoto</td>
<td>303</td>
<td>302</td>
<td>605</td>
</tr>
<tr>
<td></td>
<td>5.</td>
<td>Soil Conservation</td>
<td>208</td>
<td>225</td>
<td>433</td>
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<tr>
<td></td>
<td>6.</td>
<td>G.K. Remand</td>
<td>131</td>
<td>144</td>
<td>272</td>
</tr>
<tr>
<td></td>
<td>7.</td>
<td>Muliro</td>
<td>326</td>
<td>386</td>
<td>712</td>
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<tr>
<td></td>
<td></td>
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<td>2,010</td>
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<td>4,198</td>
</tr>
<tr>
<td>Bidii</td>
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<td>Lessos</td>
<td>334</td>
<td>297</td>
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<tr>
<td></td>
<td>2.</td>
<td>Makunga</td>
<td>365</td>
<td>356</td>
<td>721</td>
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<tr>
<td></td>
<td>3.</td>
<td>Naisambu</td>
<td>198</td>
<td>225</td>
<td>413</td>
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<td></td>
<td>4.</td>
<td>Section 6</td>
<td>174</td>
<td>185</td>
<td>359</td>
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<tr>
<td></td>
<td>5.</td>
<td>Bidii</td>
<td>281</td>
<td>270</td>
<td>551</td>
</tr>
<tr>
<td></td>
<td>6.</td>
<td>Kibomet</td>
<td>125</td>
<td>132</td>
<td>257</td>
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<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>1,477</td>
<td>1,465</td>
<td>2,942</td>
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</table>

Source: MOE Report August, 2008
APPENDIX III

LIST OF REGISTERED PRIVATE PRIMARY SCHOOLS IN KITALE MUNICIPALITY

<table>
<thead>
<tr>
<th>Zone</th>
<th>No.</th>
<th>Name of School</th>
<th>No. of Boys</th>
<th>No. of Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidii</td>
<td>1.</td>
<td>Mary Immaculate</td>
<td>278</td>
<td>286</td>
<td>564</td>
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<tr>
<td></td>
<td>2.</td>
<td>All Saints</td>
<td>801</td>
<td>809</td>
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<tr>
<td></td>
<td>3.</td>
<td>Aquinoe</td>
<td>77</td>
<td>93</td>
<td>170</td>
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<td></td>
<td>4.</td>
<td>Kitale Progressive</td>
<td>139</td>
<td>120</td>
<td>259</td>
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<tr>
<td></td>
<td></td>
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<td>1,308</td>
<td>2,603</td>
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<tr>
<td>Bondeni</td>
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<td>Mt. Elgon</td>
<td>215</td>
<td>211</td>
<td>426</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>Bondeni</td>
<td>143</td>
<td>161</td>
<td>304</td>
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<tr>
<td></td>
<td>3.</td>
<td>Purpose Driven</td>
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<td>141</td>
<td>281</td>
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<tr>
<td></td>
<td>4.</td>
<td>Benam</td>
<td>104</td>
<td>129</td>
<td>233</td>
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<td></td>
<td>5.</td>
<td>Fairway</td>
<td>112</td>
<td>111</td>
<td>223</td>
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<td></td>
<td>TOTAL</td>
<td>714</td>
<td>753</td>
<td>1,467</td>
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<tr>
<td>Milimani</td>
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<td>Barbs Academy</td>
<td>73</td>
<td>46</td>
<td>119</td>
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<tr>
<td></td>
<td>2.</td>
<td>Green Fields</td>
<td>68</td>
<td>58</td>
<td>126</td>
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<td></td>
<td>3.</td>
<td>Kitale Family</td>
<td>109</td>
<td>84</td>
<td>193</td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td>Legacy</td>
<td>354</td>
<td>338</td>
<td>692</td>
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<td></td>
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<td>604</td>
<td>526</td>
<td>1,130</td>
</tr>
<tr>
<td>Grassland</td>
<td>1.</td>
<td>Crane Academy</td>
<td>78</td>
<td>68</td>
<td>146</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>Jack &amp; Jill</td>
<td>229</td>
<td>250</td>
<td>479</td>
</tr>
<tr>
<td></td>
<td>3.</td>
<td>Savat Academy</td>
<td>59</td>
<td>48</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td>4.</td>
<td>Mt. Emoru</td>
<td>108</td>
<td>85</td>
<td>193</td>
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<tr>
<td></td>
<td>5.</td>
<td>Huruma</td>
<td>197</td>
<td>209</td>
<td>406</td>
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<tr>
<td></td>
<td>6.</td>
<td>Bahati</td>
<td>49</td>
<td>21</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>720</td>
<td>681</td>
<td>1,401</td>
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</table>

Source: MEO Report August, 2008
APPENDIX IV

QUESTIONNAIRE/OCULAR EXAMINATION PROTOCOL FOR THE
PREVALENCE AND PATTERN OF VISUAL IMPAIRMENT AND BLINDNESS

SECTION A

1. Study identification Number …………………………………………………

2. Age………………………………………………………………………

3. Sex □ Male □ Female

4. Name of Zone □ Bondeni □ Milimani
   □ Grassland □ Bidii

5. Name of School ……………………………………………………………..

6. School status 1- Public 2- Private

7. Class □ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □

8. Child’s complaint if any ……………………………………………………
   ………………………………………………………………………

9. Presenting V.A.
   O.D……………………………………
   O.S……………………………………

10. V.A. with spectacles if worn
    O.D……………………………………
    O.S……………………………………
**Section B**

11. V.A. with P.H

<table>
<thead>
<tr>
<th></th>
<th>O.D.</th>
<th>O.S.</th>
</tr>
</thead>
</table>

12. Refraction results

<table>
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<tr>
<th></th>
<th>O.D.</th>
<th>O.S.</th>
</tr>
</thead>
</table>

13. Other Examination findings

<table>
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<tr>
<th>Type of examination</th>
<th>O.D.</th>
<th>O.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye lids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conjunctiva</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cornea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pupil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lens</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitreous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retina</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macula</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optic Disc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.O.P. where necessary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
   O.D.   □ Normal    □ Constricted
   O.S.   □ Normal    □ Constricted

15. Diagnosis
   O.D. ...........................................................................................................
   O.S. ...........................................................................................................

16. Cause of V.I. or blindness
   O.D. ...........................................................................................................
   O.S. ...........................................................................................................

17. Action taken

<table>
<thead>
<tr>
<th>Action</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reassurance</td>
<td></td>
<td></td>
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<tr>
<td>Treatment given</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spectacles prescribed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery prescribed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Referred to E.A.R.C.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Referred to K.D.H.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX V

PUPILS’ QUESTIONNAIRE ON VISUAL IMPAIRMENT AND BLINDNESS

Note: This Questionnaire is formulated for study purposes only and all information given will be handled with total confidentiality.

Socio-demographic information
1. What is your age?.................................................................
2. Sex
   a) Male..............
   b) Female.......... 
3. Zone............................................................... 
4. School............................................................ 
5. Class............................................................... 

Knowledge on visual impairment and blindness
6. What do you think are the causes of visual impairment and blindness?
   ..........................................................................................
   ..........................................................................................
   ..........................................................................................
   ..........................................................................................
   ..........................................................................................
7. How can visual impairment and blindness be prevented?
   ..........................................................................................
   ..........................................................................................
   ..........................................................................................
   ..........................................................................................
   ..........................................................................................

Practices on visual impairment and blindness
8. Do you inform your parents or teachers whenever you have an eye problem?
   a) Yes.............
   b) No.............
APPENDIX VI

PARENTS’ QUESTIONNAIRE ON VISUAL IMPAIRMENT AND BLINDNESS.

Note: This Questionnaire is formulated for study purposes only and all information given will be handled with total confidentiality.

Socio-demographic information

1. Age………………………………………………………………………………
2. Sex
   a) Male…………………….
   b) Female…………………..
3. School represented………………………………………..
4. School type
   a) Public…………………
   b) Private………………..
5. Zone represented
   a) Bondeni…………………
   b) Bidii…………………….
   c) Milimani…………………
   d) Grassland………………

Socio-economic information

6. What is your Occupation?
   a) Formal employment………………………………………..
   b) Business…………………………………………………..
   c) Farmer…………………………………………………..
   d) Housewife………………………………………………
   e) Casual worker……………………………………………

7. What is your level of monthly income?
   a) 0-2000 ksh.…………………
   b) 2000-5000 ksh………………
   c) 5000-10000 ksh……………..
   d) Over 10000 ksh………………

8. What amount of money do you spent on family food each month?
   a) 0-1000 ksh…………………
   b) 1000-2000 ksh………………
   c) 2000-5000 ksh………………
   d) Over 5000 ksh………………

9. Which type of house do you stay in?
   a) Permanent…………………
   b) Semi permanent…………….
c) Temporary………………
d) Make-shift………………

10. How many meals do you normally take in your family per day?
   a) Three………………
   b) Two………………
   c) One………………

11. Which type of fuel do you use for cooking?
   a) Electricity and gas………………
   b) Firewood………………
   c) Kerosene………………
APPENDIX VII

TEACHERS’ QUESTIONNAIRE ON VISUAL IMPAIRMENT AND BLINDNESS

Note: This Questionnaire is formulated for study purposes only and all information given will be handled with total confidentiality.

Socio-demographic information
1. Age……………………………………………………………………
2. Sex……………………………………………………………………
   a) Male………………..
   b) Female……………….
3. Zone represented …………………………………………………
   a) Bondeni……………….
   b) Bidii………………
   c) Milimani…………..
   d) Grassland………..
4. Class represented………………………………………………
   1……2……3……4……5……6……7……8………..

Knowledge on Visual impairment and blindness

5. What factors do you think contribute to visual impairment and blindness among primary school pupils?
   a) ............................................................................................................
   b) ............................................................................................................
   c) ........................................................................................................
   d) ........................................................................................................................
   e)............................................................................................................

6. How can visual impairment and blindness be prevented?
   a) ...............................................................................................
   b) .....................................................................................................
   c) ........................................................................................................
   d) ........................................................................................................................
   e)............................................................................................................

Practices among teachers on visual impairment and blindness

7. Do you teach any lessons on eye health promotion to your pupils?
   a) Yes…………………..
   b) No…………………
If yes, on what aspects?
   a).............................................................................................
   b).............................................................................................
   c).............................................................................................
   d).............................................................................................
APPENDIX VIII: MODEL OF SNELEN’S CHART

A model of distant sight-testing chart
APPENDIX IX: REFERRAL FORM

Date ………………………………………

The ophthalmologist

……………………………………………………………………………………………………

Dear Sir,

REF REFERRAL FOR INVESTIGATION AND FURTHER MANAGEMENT

This pupil …………………………………………………………….., who had an eye examination today was found to have

…………………………………………………………………………………………………… I refer him/her for …………………………………………………………………………………………………

Please furnish us with your findings.

Thank you.

ERNEST B. WANYAMA
APPENDIX X: OPHTHALMIC PRESCRIPTION

Name of pupil……………………………………………………………….
Age ..........................................................................................
Class ..................................................................................
School .............................................................................
Date ....................................................................................
R,E ....................................................................................
L,E .....................................................................................
Pd =

........................................

ERNEST B. WANYAMA
APPENDIX XI: CONSENT FORM FOR RESEARCH

Name of Head teacher/Parent/Guardian ............................................................

Name of child .....................................................................................................

Name of school .................................................... Class .................................

Date ....................................................................................................................

Mr. Ernest Barasa of Kenyatta University has requested me to allow my child to participate in a study to find out the prevalence and pattern of visual impairment and blindness among Primary School pupils. Having understood what the study involves, I ........................................................................ agree that my child takes part in the study.

Sign/Left Thumbprint ....................................................................................

Date ..................................................................................................................

Witness (Head teacher/Class teacher) ..............................................................
APPENDIX XII: KIBALI CHA UTAFITI

Jina la mzazi/mlezi .................................................................

Jina la mtoto .................................................................

Jina la shule .................................................................

Darasa .................................................................Tarehe .................................

Bwana Ernest Barasa wa Chuo Kikuu cha Kenyatta, ameniomba kibali cha kumuruhusu mtoto wangu ahusike katika utafiti wa kuchunguza Upofu na Upungufu wa kuona kati ya wanafunzi wa shule za msingi katika Manispaa ya Kitale.

Baada ya kuelewa makusudi ya utafiti huo, Mimi ........................................
nimekubali mtoto wangu ahusike.

Sahihi/Alama ya kidole ya mkono wa kushoto ..........................................................

Tarehe ..........................................................................................

Shahidi: Mwalimu Mkuu/Mwalimu wa darasa .........................................
APPENDIX XIII: RESEARCH PERMITS

REPUBLIC OF KENYA

MINISTRY OF SCIENCE AND TECHNOLOGY

Telephone: +254020318581
Fax: +254020251991
Email: scienceandtechnology@kema.go.ke
Website: www.scienceandtechnology.go.ke

OFFICE OF THE PERMANENT SECRETARY
JOGO HOUSE “B”
HARAMBEE AVENUE
P.O. Box 9583 00200
NAIROBI

REF: MOST13/001/37C797/2

ERNEST BARASA WANAYAMA
KENYATTA UNIVERSITY
P.O. BOX 43844
NAIROBI

28th November 2007

Dear Sir

RE: RESEARCH AUTHORIZATION

Following your application for authority to conduct research on “The prevalence, pattern and causes of visual impairment and blindness among primary school pupils in Kitale Municipality, Kenya” This is to inform you that you have been authorized to carry out research in Kitale Municipality in Trans-Nzoia district for a period ending 31st December 2008.

You are advised to report to the District Commissioner, District Education Officer, Trans-Nzoia district before embarking on your research.

On completion of your research, you are expected to submit two copies of your research report to this office.

Yours faithfully,

[Signature]

M.O. ONYERE
OFFICE OF THE PERMANENT SECRETARY

CE:

THE DISTRICT COMMISSIONER
TRANS-NZOIA DISTRICT

THE DISTRICT EDUCATION OFFICER
TRANS-NZOIA DISTRICT
NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

REF: NCST/5/002/R/007-C/2(2)  5th December, 2008.

Mr. Ernest Wanyama Barasa,
P.O. Box 4577 - 30200,
KITALE.

Dear Sir,

RESEARCH PERMIT EXTENSION

Following your application for Authority to continue Conducting research on:- “The Prevalence Pattern and Causes of Visual Impairement and Blindness among Primary School Pupils in Kitale Municipality,” I am pleased to inform you that you have been Authorized to continue Conducting Research in Primary Schools in Kitale Municipality, Trans-Nzoia West District for a further period of eight (8) months ending 30th June, 2009.

You are required to report to the District Commissioner, The District Education Officer, Trans-Nzoia West District and Municipal Education officer in Kitale Municipal Council before embarking on your Research.
On completion you are expected to submit two copies of your Research Report to this office.

Yours Faithfully,

Jane L. Chokaa
FOR: EXECUTIVE SECRETARY

cc: -The District Commissioner,
    Trans-Nzoia West District,

    -The District Education Officer,
    Trans-Nzoia West District,

    -The Municipal Education Officer,