# PREVALENCE AND DETERMINANTS OF MYOPIA AMONG PRIMARY SCHOOL CHILDREN IN BERBERA CITY, SOMALILAND

**BY**

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# DECLARATION

**Declaration by Candidate**

This thesis is my original work and has not been presented for examination in any other university. No part of this thesis may be reproduced without prior written permission of the author and or Moi University.

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## DEDICATION

This thesis is dedicated, first to Allah the Almighty and then to my beloved mother and father.

## ABSTRACT

**Background:** Myopia (short sightedness) is a refractive error where the visual acuity is good at near and poor at distance. According to WHO estimates, 12 million children are visually impaired due to refractive errors. Children with myopia face difficulties in schooling, stigmatization and discrimination leading to school drop outs and long-term health challenges at community level.

**Objective:** The overall of objective of this study was to establish the prevalence and determinants of myopia among primary school children in Berbera, Somaliland.

**Methods:** A cross-sectional study design was used to assess the presence and degree of myopia and its determinants. Simple random sampling was used to select schools to be sampled from list of private and public schools and stratified and systematic sampling methods were applied to identify proportions of sample size per school, gender, grades and individuals to be screened. A Snellen's E chart at 20ft were used for visual acuity. Only children with visual acuity less than the recommended normal vision (20/20) in at least one eye had to undergone further evaluation. Parents or guardians of the children were interviewed to assess the determinants with myopia. The data was entered and analysed in SPSS version 20.0. The univariate and bivariate analysis was performed on all variables and chi-square test or logistic regression were done to determine statistical associations between dependent variables and the key independent variables. The significance level was set at $p<0.05$ and 95% Confidence limits.

**Results:** A total of 382 children, from 4 primary schools, gave consent to participate in this study. The mean age of the children was 11 $\pm$ of 2.7 years. Out of these 382 children, 32 (8.4%) children were observed to have visual acuity less than 20/20 feet. Refractive error was the main reason (6.3%) that caused the reduction of the visual acuity of the children. This study established the prevalence rate of myopia as 3.4% (95% CI: 2 - 5%), which was the leading cause of refractive errors followed by Astigmatism of 1.6%. The degree of myopia varied from 20/30 – 20/200 which is equivalent to -0.5 to -2.0 diopters.

Statistical associations were observed between children with myopia and type of school children study ($\chi^2 = 5.101$, df = 1, P=0.024) (OR: 4.908; 95% CI: 1.07, 22.449, P=0.04). The majority (84.6%) of the myopic children in this study had either parent or sibling with history of myopia. Myopia was also associated with the duration that children played with computer/mobile phones games per day ($\chi^2$=6.135; df=1; P=0.013) (AOR=4.374, 95% CI: 1.143, 16.740, P-value=0.031) after adjusting for household income and level of education of parents/guardians, watching TV and children's involvement in outdoor games. In the multiple logistic analysis, no association was found between length of hours that children watched TV per day and myopia (AOR=3.440, 95% CI 0.877;13.490, P-value=0.076).

**Conclusion:** Myopia was the most common condition causing reduction in visual acuity among primary school children in Berbera, which went unnoticed until it was revealed by this study followed by Astigmatism.

**Recommendation:** The Somaliland Ministries of Health and Education should come up with a policy that will establish visual screening programme at primary schools for early detection of visual impairment in children, including myopia and other refractive errors that affect school children's vision and learning.

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## OPERATIONAL DEFINITIONS

These terms are useful and they may be used in this paper.

**Accommodation:** Increase in optical power by the eye in order to maintain a clear image (focus) as objects are moved closer (Barbara and Melvin 2011)**.**

**Amblyopia:** Also known to "Lazy eye" it is failure of vision to develop properly often due to squint. The eye fails to achieve normal visual acuity even with prescription eyeglasses or contact lenses (Gary, 2015).

**Astigmatism:** Refractive error due to irregular corneal surface. It occurs when parallel rays of light entering the non-accommodating eye are not focused on the retina (Wa Kaimbo, 2012)

**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).

**Diopter (D):** Unit to designate the refractive power of a lens (Barbara and Melvin 2011).

**Hyperopia (Hypermetropia):** Refractive error also known as "far-sightedness" or Hyperopia where visual acuity is good at distance but poor at near (Moore et al, 2008).

**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 "near-sightedness", where visual acuity is good at near and poor at distance (Goss *et al*, 2006)

**Prevalence:** The number of affected persons present in the population at a specific time divided by the number of persons in the population at that time who are at risk (Gordis, 2009). In this study, the prevalence will be calculated the number of children found to be myopic divided by the total number of children screened

**Refraction:** Determining the eye's refractive error and the best corrective lenses to be prescribed (Barbara and Melvin 2011).

**Refractive error:** Optical defect of the eye in which the light rays that enters through cornea, do not exactly focused on the retina but they may focus in front of the retina or beyond the retina or even both (American Academy of Ophthalmology, 2011)

**Snellen Chart:** Test chart used for assessing visual acuity (Barbara and Melvin 2011).

**20/20:** is a term used to express normal visual acuity (the clarity or sharpness of vision) measured at a distance of 20 feet. Upper number is the standard distance (20 feet) between an eye being tested and the eye chart; lower number indicates that a tested eye can see the same small standardized letters or symbols as a normal eye at 20 feet. If a person has 20/20 vision, he/she can see clearly at 20 feet what should normally be seen at that distance. On contrary, if a person has 20/40 vision, it means that he/she must be as close as 20 feet to see what a person with normal vision can see at 40 feet (Barbara and Melvin 2011).

**Visual acuity:** Assessment of the eye's ability to distinguish object details and shape, using the smallest identifiable object that can be seen at a specific distance (Barbara and Melvin 2011). In this study, visual acuity cut off point was referred to the ability to correctly identify letters in the Snellen Chart at a distance of 20 feet. The children with visual acuity less than the recommended normal vision (20/20) in at least one eye, had undergone further evaluation to determine the causes of the visual impairment and the degree in the case of presence of myopia.

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| **AOA** | American Optometric Association |
| **AOR** | Adjusted Odds Ratio |
| **CI** | Confidence Interval |
| **COOPI** | Cooperazione Internazionale |
| **D** | Dioptres. |
| **FGM** | Female Genital Mutilation |
| **HPA** | Health Poverty Action |
| **IAPB** | International Agency for the Prevention of Blindness |
| **MoH** | Ministry of Health |
| **NGO** | Non-governmental Organization |
| **OR** | Odds Ratio |
| **SPSS** | Statistical Package for Social Sciences |
| **TV** | Television |
| **UN-HABITAT** | United Nations Agency for Human Settlements |
| **UNICEF** | United Nations Children's Fund |
| **WHO** | World Health Organization |

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background

Myopia is a refractive error, also known as “short sightedness or near sightedness” where visual acuity is good at near and poor at distance. It is one of visual impairment conditions.

Vision 2020 “The right to sight” of World Health Organization (WHO) and International Agency for the Prevention of Blindness (IAPB) which is global initiative, aims at the elimination of avoidable blindness and impaired vision by the year 2020 (WHO, 2007).

Uncorrected refractive errors are believed to be the most significant cause of severely impaired vision all over the world (John, 2009). A basic eye examination can confirm myopia. The condition can easily be corrected with eyeglasses or contact lenses. Another treatment option for myopia is surgery. Myopia occurs when the eye is too long or the cornea is curved too steeply which causes the light rays entering each eye to focus in front of the retina, instead of on the retina, leading to blurry images. The exact reason for some people developing longer eyes is unknown, but it may be related to genetics or environmental conditions (Gretchyn and Gary, 2014).

The causes of myopia in children are believed to be genetic, socio-economic and environmental factors. Studies have shown that children, whose parents are myopic, may have higher risk to be myopic. In the environmental factors such as near or close work on a regular basis, limited engagement of outdoor activities and socioeconomic status could be associated with myopia (Pan et al, 2012). Population based prevalence studies in Singapore revealed higher prevalence of myopia in individuals with higher

levels of education, better housing, higher individual monthly income and occupations associated with near- work after adjusting for age and gender. As part of environmental factors, near-work activities, such as reading, writing, computer use, and playing video games, have been cited to be possibly responsible for the increase in the prevalence of myopia (Foster and Jiang, 2014). These environmental factors are also found in Berbera where this study was conducted.

Knowing children with visual acuity is a challenge and is often neglected by both the caregivers and the teachers. More often, children with severe learning and behavioural disabilities are only brought to eye care personnel for examination (Assefa et al, 2012).

The degree of myopia is measured in diopters by the strength or optical power of corrective lens that focuses distant images on the retina. It has also been classified by degree or severity in terms of low, medium and high (AOA, 2006).

In Somaliland, there are no either national preschool or school screening services for visual disorders. Therefore, the rate of myopia and other refraction errors among children is not known. This study shed light on the magnitude of myopia among primary school children in Berbera town in particular and Somaliland in general. Once the level of myopia and its associated factors are determined appropriate strategies can be taken to support the children with myopia who are suffering unnecessarily at schools.

### 1.2 Problem Statement

Myopia is a common refractive error and is a leading cause of visual impairment throughout the world, and its prevalence is on the increase (Okafor et al, 2009). It is a condition that exists from young age. According to WHO estimates, 19 million children are visually impaired and out of these, 12 million children are visually impaired due to refractive errors while 1.4 million are irreversibly blind for the rest of their lives and

need visual rehabilitation interventions for full psychological and personal development (WHO, 2014). About 90% of visually impaired children in developing countries face difficulties in schooling due to socio-economic and physical barriers such as discrimination and stigmatization in access to basic education and health services (WHO, 2007).

Like the other parts of the world, the prevalence of myopia is remarkably increasing among African children particularly those living in urban settings (Rudnicka et al, 2016).

A study done in Cape Coast Municipality of Central Region of Ghana among school children reported prevalence of myopia at 6.9% (Ovenseri-Ogbomo and Omuemu, 2010). A similar study carried out in the Kumasi Metropolis in the Ashanti Region of Ghana, reported higher prevalence of myopia of 7.2% (Kumah et al 2015). In Ethiopia, among primary school children myopia was found to be the most dominant refractive error (5.5%) followed by astigmatism (1.9%) and hyperopia (1.4%) in both sexes (Sewunet et al, 2014). A study among primary school children in Mogadishu, Somalia also found myopia to be the major refractive error. The overall prevalence rate of myopia accounted 7.5% (Dalmar, 2006). However, this study did not look at the possible factors of myopia.

The exposure to a common environmental factors such as reading, computer work, stress and personality may contribute to myopia prevalence (HUI-MIN WU et al, 2001). In this new era of technology, watching TV, use of mobiles and limited involvement in outdoor activities may further perpetuate the condition of myopia in children. If intervention is not done to slow the progress of myopia, the effects of myopia can be expected to exacerbate.

High myopia is associated with an increased risk of developing sight threatening conditions such as myopic macular degeneration, glaucoma, retinal detachment and other related visual morbidities (Holden et al, 2015). A study looking at the impact of Myopia Correction on academic achievement of school children found difference between experiment and control groups. Test scores of control group students in pre-test and post-test remained the same while the test scores of experimental group students in post-test are higher than the scores of pre-test (Prema, 2007).

The Somaliland government recognizes the importance of the ophthalmological services. It is part of the national health policy and the essential package of health services introduced by Ministry of Health for Somaliland (MoH, 2011). However, very little have been done in this area. Studies or surveys to establish the burden of visual impairment among Somaliland population including children with myopia, have not been conducted so far.

According to a report on Hadhwanaagnews, 32% of the children seen by an ophthalmologist working in Berbera hospital were suffering from “Keratoconus”. According to the report of the doctor (ophthalmologist), it is an abnormality of the cornea and it severely affects the vision resulting in distortion of images, and blurred vision (Obsiye, 2016). This is an indication that other refractive errors such as myopia may be prevalent among children in Berbera.

Therefore, this study sought to determine the prevalence and associated factors of myopia among children in primary schools in Berbera, Somaliland.

### 1.3 Justification the Study

One of the top priorities of the global initiative of Vision 2020 of WHO and International Agency for the Prevention of Blindness (IAPB) is the control of blindness

in children. It inspires nations to provide integrated primary health care with trained personnel and the provision of affordable optical correction and low-vision aids which can improve children's visual acuity to concentrate on learning and school performance (WHO, 2007).

It is apparent that uncorrected distance refractive error including myopia is already a major global health problem. It is the main cause of vision impairment and the second highest cause of blindness.

Uncorrected myopia in children has short and long-term effects. Some children may be regarded as failures in schools as well as at homes by the teachers, classmates, parents and siblings. This is a wrong decision taken by them without checking their visual acuity and it can be great stigma against children with visual impairments. Children with myopia are unable to read lessons from the blackboard if they miss to sit in the front rows of the class and they may not be able to copy the lessons at the speed of other children. If myopia is not detected and corrected, it can as adversely affect children's performance in education.

Myopia possess occupational and social challenges, with affected children being at risk of behavioural, psychological and emotional difficulties, impaired self-esteem and poor socio-economic status for life. Most often, parents and guardians hardly notice whether their children have myopia because of their limited awareness on myopia and the lack of children undergoing periodic eye checks. Myopia, like the other refractive error is easily manageable by provision of spherical or cylindrical spectacles. This study is designed to provide baseline information about the prevalence of myopia in children and its associated factors. The outcome of study will be of high relevance to trigger the enactment of policies and plans by the relevant government institutions of Somaliland

to prevent the avoidable causes of visual impairment in children. It is part of child health to screen and detect myopia before the visual acuity of children is impaired and as a result compromise children's performance in education.

Since similar studies have not been carried in Somaliland and the extent of myopia in children is not known hence this study will significantly contribute to shed light on the extent of the problem.

### 1.4 Research Questions

What is the status of visual acuity of the primary school children in Berbera?

### 1.5 Broad Objective

To determine the visual acuity of children in Berbera Primary schools.

#### 1.5.1 Specific objectives

1. To estimate the prevalence of myopia among children in Primary schools in Berbera
2. To assess the degree of myopia among children in Primary schools in Berbera
3. To determine the factors associated with myopia among children in Primary schools in Berbera

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Definition

Myopia or near-sightedness is a refractive error in the eye where the light that enters the eye does not focus properly. This results in a blurred vision when one looks at distant objects. Often, the front part of the eye refracts light, directing it to the back surface of the eye (the retina). Hence the retina sends light to the optic nerve where the brain processes the signal into images. When the person has myopia, the physical length of his/her eye is greater than its optical length which makes it difficult for the front part of the eye to focus directly on the retina (Jim, 2012).

## 2.2 Classifications of Myopia

The different kinds of myopia are classified based on the symptoms and their severity. There are various classification systems for myopia (Clinical, degree and age of onset). Clinical and degree are classifications are commonly used. The description of these classifications is summarized below:

**Table 2.1: Types and Description of Myopia**

| Type of classification | Classes of myopia |
|---|---|
| Clinical Entity | **Simple myopia:** This is indicative of an eye that is too long for its optical power. Genetics and environmental conditions are causes of this condition. |
| | **Nocturnal myopia:** This type of myopia is most apparent at night time where vision is normal during the day and one gets a hard time seeing things far when the lighting is low |
| | **Pseudo myopia:** This is temporary condition and it occurs when the ciliary muscle that controls focusing abilities of the eye spasms. This results in blurred images of objects far from individuals. |
| | **Degenerative myopia:** This condition shows the increment or progression of refractive error. The progressively growing distance between your outer eye and retina causes this. This can worsen over time and reaches a point in which it damages the macula area and in severe cases lacquer cracks, that can significantly impact vision. |
| | **Induced or Acquired myopia:** This condition may be caused by age-related nuclear cataracts, exposure to sulfonamides and other pharmaceutical agents and significant variability in blood sugar level |
| Degree | Low myopia (<3.00 D) |
| | Medium myopia (3.00 D-6.00 D) |
| | High myopia (>6.00 D) |
| Age of Onset | Congenital myopia (present at birth and persisting through infancy) |
| | Youth-onset myopia (<20 years of age) |
| | Early adult-onset myopia (2-40 years of age)<br>Late adult-onset myopia (>40 years of age) |

*Source: Optometric Clinical Practice Guideline by American Optometric Association, 2006*

**2.3 Prevalence**

Myopia is the common ocular disorder that requires people to use spectacles and/or contact lenses throughout their lives. Prevalence of myopia varies in different countries of the world and most of the authors cited in this study have taken myopia as $\leq$ -0.5 dioptres.

A nationwide surveys conducted in Taiwan in 1995 and 2000, showed increasing prevalence of myopia among children. (Lin *et al*, 1995). In 1995, the rates increased to 12% at the age 7, to 56% at age 12 and more than 76% at age 15. This survey also found difference between rural and urban communities where the myopia rates accounted 50% among rural children compared to 70% among children in urban areas (Lin *et al*, 1995,). Similarly, remarkable increase of prevalence rates of myopia was found in the last survey of 2000. The rates increased to 20% at 7 years, to 61% at 12 and 81% at the 15 years old (Lin et al, 2000). From these rates, the trend increased by almost 7 times, showing how serious the problem is Taiwan.

In America, a study of more than 2,000 children between the ages of 5 and 17 established an overall prevalence of myopia of 9.2% with significant variations among different ethnic groups in the study even after controlling for age and sex ($P<0.001$). Asian children had the highest prevalence rate of 18.5%, while children from Hispanic, African American and Caucasians had prevalence of 13.2%, 6.6% and 4.4% respectively (Robert *et al*, 2003).

A study conducted in urban school children (age range of 5-15 years) in India, Delhi found a prevalence of myopia of 13.1% where almost quarter (24.7%) of the children were aware of their visual acuity and were wearing appropriate spectacles (Saxena et al, 2015). According to the Indian population of 1.2 billion with more than 20% in 5-

15 years, the authors of this study concluded that myopia is a significant public health problem in India.

Another study conducted in Rural Areas of South India, Kollam, found higher prevalence of myopia of 51.7% among the students aged 10-12 years (Rajendran et al, 2014). The difference of prevalence in two studies could be associated to age, environmental and socio-economic factors in the two populations as last study covered rural setting. However, the results of both studies imply that myopia is public health concern India among the school children.

In China, high rate of myopia prevalence was observed in a study carried out in Beijing among school children. The overall prevalence rate accounted for 71% in all ages (7-18 years). However, the prevalence of myopia in children aged 7-12 years was 43.1%. In China, the age group of 7-12 years are primary schools while others are either in junior or senior secondary schools. The high rates of myopia among the children were also associated ($P<0.001$) with age and urban region of habitation (Qi et al 2014).

According to the speech by Mr Gan Kim Yong, the Minister for Health of Singapore at the Opening Ceremony of the 12th National Eye Care Week at the Pan Pacific Hotel Ballroom, 12 November 2011, the prevalence of myopia in Singapore is as high as 65% in primary school children.

In Saudi Arabia, a study conducted in Riyadh Province among primary school children by Al-Rowaily in 2010 revealed a prevalence of 2.5%. However, another study carried out in other two provinces; Al Hassa (Fahd et al, 2012) and Qassim (Yousef, 2014) reported higher prevalence as 9% and 5.8% respectively. These results give us an indication of increase of myopia among primary school children. Other countries in

the Gulf like Iran also reported higher prevalence of myopia among primary school children. For example, a study conducted in Iran among primary school children, the prevalence was established as 14.9% (Reza *et al*, 2015).

Another study conducted in Mopani district, Limpopo Province in South Africa among primary school children found a prevalence of myopia as 2.5% (Mabaso et al, 2006). A study executed in primary schools in Khartoum State, Sudan reported myopia of 1.5% (Rushood et al, 2013). Almost similar rate of myopia 1.7%) was reported by another study done in Kilungu Division of Makueni District, Kenya (Muma et al 2009).

A study done in Cape Coast Municipality of Central Region of Ghana among school children reported prevalence of myopia as 6.9% (Ovenseri-Ogbomo and Omuemu, 2010). A similar study carried out in the Kumasi Metropolis in the Ashanti Region of Ghana, reported higher prevalence of myopia of 7.2% (Kumah et al 2015). However, a study done in 53 private schools in Ghana found lower prevalence rate of 3.2% (Kumah, et al 2013).

A study conducted among primary school children in Gondar reported that myopia was the most refractive error which represented 3% (Assefa et al, 2012). Whereas similar studies carried out in Debre Markos and Goro districts in Ethiopia, found higher prevalence of myopia of 3.5% (Jafer and Abonesh, 2010) and 5.5% respectively (Sewunet, *et al*, 2014). Another research done by Zelalem and Abdirahman in 2013 in the primary schools in the rural of central Ethiopia, myopia was also the most prevalent refractive error, accounting for 6%. A study among primary school children in Mogadishu, Somalia found myopia to be major refractive error where the prevalence rate of myopia accounted 7.5% (Dalmar, 2006).

### 2.4 Factors Associated with Myopia

Substantial studies have been conducted to solicit the factors associated with myopia. Genetics and environmental factors were cited as the major factors related to Myopia. Greater prevalence of myopia was noted in children whose parents are myopic than in children of non-myopic parents.

#### 2.4.1 Age and gender

A study done in Amman, Jordan revealed significant relationship between gender and age. The prevalence of myopia was significantly higher in females (20.3%) than males (15.9%) (P=0.019). The youngest group had the lowest prevalence of myopia (7.8%) compared to the oldest age group (20.6%) (P=0.001) (Khader et al, 2006).

Fahd et al also reported that myopia was more prevalent among females (31.3%, compared to 26.8%, in males. Similar difference was also stated in age. Myopia was more common (23.4%, CI=21.5-25.2%) in the older age group (12-14 years) than in younger age groups of 6-8 years and 9-11 years who accounted a prevalence of 23.0% and 19.3% respectively (Fahd et al, 2013).

In a study looking at the factors associated with Myopia in School Children in China found that myopia to be significantly associated with higher age (OR: 1.39; 95% CI: 1.37, 1.41; P=0.001), female gender (OR:1.39; 95% CI: 1.27, 1.52; P=0.001) (Qi Sheng et al, 2012).

A study conducted in Makueni district in Kenya, reported that myopia more present in the pupils aged 14-15 years than those aged 12-13 years with OR 2.9 (0.1-9.2) which was statistically significant (p=0.022) (Muma et al, 2009).

Similar findings were also reported by a study in Ethiopia in which myopia was the most common refractive error. Females were about 3.9 times (CI: 1.556-10.092, P=0.004) more likely to experience refractive errors than male students. The prevalence of refractive errors in higher grade levels (5–8) was about 4.8 times (95% CI: 1.980-11.474, P=0.001) more likely than in lower grades (1–4) (Sewunet et al 2014). However, there are other studies which did not show any statistical relationship between myopia and gender for example the findings of Norhani *et al* (2007), Kumah *et al* (2013) and Uchenna *et al* (2017), myopia was not significantly associated with gender (P=0.26, 0.82 and 0.89).

### 2.4.2 Genetics and family history of Myopia

Quite number of studies cited that myopia is related to genetics. The risk of myopia is reported to be higher among children with myopic parents. A study determining the factors associated with Myopia in School Children in China, affirmed significant relationship between prevalence of myopia in children and parental myopia (OR: 1.47; 95% CI: 1.40, 1.54; P=0.001) (Qi Sheng et al, 2012).

Having two myopic parents pose a greater risk than one. A population based study done in Taiwan reported that children (OR=2.82, 95% CI=2.41-3.29, P=<0.001) with two myopic parents had higher risk of myopia compared to those with one myopic parent (OR=1.66, 95% CI=1.4-1.95, P=<0.001) (Chih-Chien et al, 2016). Similar study in Amman, Jordan stated that myopia in children was significantly correlated with family history. The children who had 2 myopic parents had higher prevalence of myopia than those who had 1 myopic parent with OR 3.37 (CI=1.77-6.42) (Khader et al, 2006). The findings of these studies suggest that the risk of myopia increases as the number of parents with myopia increase.

Enormous studies have shown that children with myopic parents are more likely to be myopic than those without myopic parents. According to the results of a study by Lisa et al, myopia was also strongly associated with hereditability. Compared to the children with no myopic parents, children one or both parents being myopic were 2.91 times (95% CI, 1.54-5.52) and 7.79 times (95% CI, 2.93-20.67) more like to have myopia respectively (Lisa et al, 2015).

According to Asmaa, et al, 2014, the children who had siblings with glasses had higher prevalence of myopia and it was statistically significant (P=0.02).

Although a large number studies have shown children with myopic parents have higher risk of getting myopia, there could also be interaction between genetics and environmental factors. Since siblings often tend to share same environment and of course same genes, the correlation could reflect either way (Ian and Kathryn, 2015). Parental genes may also be confounded with shared environments. However, one of the latest animal study reported that genetic factors are the major determinant of susceptibility to myopia; though the applicability of animal models of myopia to physiological human myopia was questioned (Chen-Wei et al 2012).

### 2.4.3 Socioeconomic and other environmental factors

Children's involvement in activities outside the school such as reading and writing, watching television, using computer and playing sports. The children who spent more time in reading and writing at home and using computer had higher risk of developing myopia where the odds of having myopia increased by 16% and 24% for each additional 1 hour spent on computer work and reading/writing outside of school respectively. Also playing sports was negatively associated with myopia where (P=0.0001) (Khader et al, 2006).

According to a study done in Malaysia by Syaratul et al, five variables were identified to have a statistical association with myopia in children. Children in the upper level of primary schools, longer time spent on reading books and presence of siblings with glasses, parent's educational level and household income were among the variables shown positive associations with myopia (P<0.005). In the same study, the odds ratio for development of myopia in children who read more than 2 hours per day was 2.7 (P-value=0.004) while the odds ratio of Siblings with glasses, Parental education level and Household income were 5.9, 3.4 and 1.7 (P-value=0.000) respectively (Syaratul et al, 2008).

It was reported that outdoor activity is protective factor against myopia, and they identified the link to the educational system. A prospective interventional study done in Taiwan found lower onset new cases and progression of myopia in the intervention group (Recess Outside Classroom) than in the control group (8.41% vs. 17.65%; P=0.001) (Wu et al 2013).

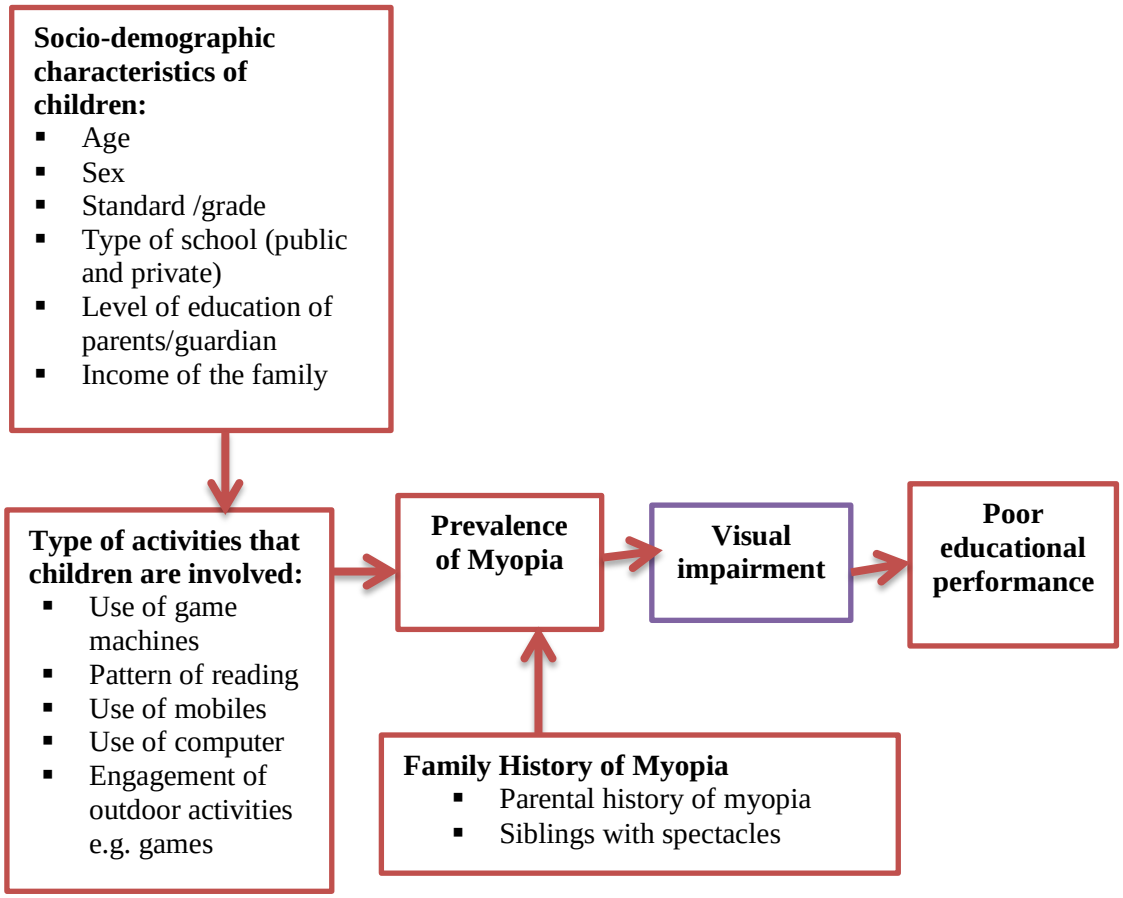
In a study looking at the factors associated with Myopia in School Children in China found that there was a relationship between myopia and type of school (key school versus non-key school) in which children study (OR: 0.72; 95% CI: 0.64, 0.81; P=0.001), their family income (OR: 1.06; 95% CI: 1.02, 1.09; P=0.001) and the duration they watch televisions (OR: 0.83; CI 95%: 0.79, 0.88; P=0.001). However, the study did not find significant association with either the educational level of the father (P=0.07) or maternal level of education (P=0.55) (Qi Sheng et al, 2012). But another studies found relationship between education level of parents and myopia in children. Children with mothers with lower education level were found to have significant higher risk of myopia (OR=1.24, 95% CI=1.13-1.38, P=<0.001) (Chih-Chien et al, 2016).

Statistically significant (P=0.04) was noted among myopic children whose fathers had myopia were also reported to have risk (Asmaa, et al, 2014). A significant positive correlation (P=0.04) was noted between myopia development with increasing more hours spent on reading (Asmaa, et al, 2014).

After controlling for age, sex, region of habitation and parental myopia, independent association was found myopia with distance from near-work (OR=1.48 , 95% CI=1.26-1.74, P<0.001) and longer time outdoors for leisure (OR=0.87, 95% CI=0.78-0.97, P<0.013) as protective factor (Li et al, 2015).

Another study done in Ethiopia reported that myopia was associated with computer use. Children using computers regularly were 4.5 times (95% CI: 1.589-12.968, P=0.005) more affected than non-users or irregularly users (Sewunet et al 2014).

## 2.5 Conceptual Framework




**Note:** This Conceptual Framework has been crafted by me as the researcher and the Primary Dependent Variable of this study is "Prevalence Myopia" while visual impairment and poor educational performance are the consequences of myopia in children

# CHAPTER THREE

# STUDY METHODOLOGY

## 3.1 Study Area

### 3.1.1 Somaliland

Somaliland was a British Protectorate from 1884 until 26th June 1960 when it gained its independence from the British. Immediately after independence an amalgamation was formed with Italian Somalia to form the Somali Republic. This union failed because of differences in the aspirations of the people which consequently led to a collapse and eventually civil war in the early 80s. Somaliland regained its sovereignty on May 18th, 1991 after a congress held in Burao, the capital city of Togdheer region. Though not recognized as a sovereign state, Somaliland has adopted a Republican system of government with a legislative assembly comprising two chambers – an elected elder's chamber, and a house of representatives. Somaliland is ruled by a president and a vice, both of whom are elected through general election every 5 years. The legislative comprises a government and two opposition parties.

#### 3.1.1.1 Berbera

Berbera is the capital city of Sahil region. It is located at the coastline on the north western part of country and borders Hargeisa district to the southwest, Zeila district to the west, Sheikh District to the south and Erigavo and Eilafweyn districts to the east. Berbera consists of four villages or sectors, namely Barwaaqo, Wadajir, Daaroole and Burao-sheikh.

Berbera’s deep seaport, serves as the Somaliland’s main commercial harbour and one of the most important entry points for goods heading to other regions of Somaliland, Somalia and Ethiopia.

Berbera features a hot desert climate. It has long, extremely hot summers and short hot winters as well as very little rainfall. Averages high temperatures consistently exceed 40 °C (104 °F) during nearly four months of summertime (June, July, August and September). During the least hot month of the year, average high temperatures remain above 29 °C (84.2 °F). Although Berbera is located on desert terrain, the relative humidity is very high throughout the year and the atmosphere is simultaneously moist. The combination of the desert heat and the excessive moisture make apparent temperatures reach extremely high levels. Annual average rainfall is minimal, with only 52 mm (2.05 in) of precipitation. There are between 5 and 8 rainy days on average annually.

The population of Berbera is estimated at around 107,740 people. The average population growth rate is 3.1%. The average life expectancy is 48 years with male to female ratio of 50:55 years. The birth rate is 45 births/1,000 population while infant and under-five children 72 and 91/1000 children respectively. English and Arabic are the other official languages.

There is one regional hospital and two health centres in Berbera run by the Ministry of Health and supported by Health Poverty Action (HPA) an International organization, UNICEF, and WHO. Numerous private pharmacies are also operating in the town. For eye care, the community depend on Manhal speciality hospital in Hargeisa. This hospital which provides subsidized ophthalmology services for Somaliland people and beyond, was funded by WHO, Arab medical unions, Manhal's own charity organization.

There are 8 Governmental Primary Schools, 2 Secondary and one University in Berbera. Two (2) private primary schools also exist. The table below summarizes the types of schools and number of children enrolled in each school as of April 2017.

**Table 2: Types of Primary schools and Number of Children enrolled per gender**

| S/No. | Name of the School | Type of the schools (Public/Private) | Gender | | Total Number children |
|---|---|---|---|---|---|
| | | | Boys | Girls | |
| 1. | Omer toori | Public | 162 | 160 | 322 |
| 2. | Mohamoud Handule | Public | 132 | 138 | 270 |
| 3. | Omer Binu Khadaab | Private | 128 | 109 | 237 |
| 4. | Imaamu shaafi'i | Public | 334 | 268 | 602 |
| 5. | Ajab (Hasan Ali Awale) | Public | 217 | 122 | 339 |
| 6. | Sahil (Said Daa'uud) | Public | 216 | 190 | 406 |
| 7. | Hassan Ali Henri | Public | 56 | 64 | 120 |
| 8. | Hira | Private | 224 | 168 | 392 |
| 9. | Alkhaliij | Private | 85 | 109 | 194 |
| 10. | Abdicasiis girls | Public | 0 | 184 | 184 |
| **Total** | | | **1554** | **1512** | **3066** |

*Sources: Sahil Regional Education Office, 2017*

### 3.2 Study Population

The study population were children in Primary schools in Berbera.

### 3.3 Study Design

A cross-sectional study design was used to assess prevalence of myopia and its determinants in Primary school children in Berbera.

### 3.4 Sample Size Determination

The following formula was used to determine the sample size of the study. This formula applied when the parameter intended to be measured is the proportion.

$$n = \frac{Z^2 pq}{d^2}$$

Where:

n= desired sample size of study population

p= the proportion of target population estimated to have particular characteristics, in this case, 50% was used since of the prevalence of myopia of Somaliland is not known

q= 1-p

Z= the standard normal deviation usually set at 1.96 and corresponds to 95% confidence level

d= degree of accuracy desired. In this case 0.05

n=385

**3.5 Sampling Procedure**

The study was carried out in the Primary schools in Berbera city. At the beginning, simple random sampling techniques was used to select two government (public) and two private schools from the primary schools' list which was obtained from Sahil Regional education office. Then stratified sampling method was used to determine the number of children to be sampled for each school with their grades based on the total number of children with gender proportions in the respective schools as shown in table 3 below. A systematic random sampling was also used to identify study subjects from each of the selected grades. This was done by obtaining the lists of the children in each class in the selected schools from the school's management. The sampling interval was calculated by dividing the total number of children per grade by the desired sample size of the same grade. The first case was selected using the lists generated during the systematic random sampling procedure using the formula of =rand between (1,

sampling interval) in Microsoft Excel. This sampling process was done both for boys and girls separately until the sample size of 385 students was completed.

In order to determine factors associated with myopia, either parents or guardians of the students were interviewed. They were invited to come into the schools for interview through the school principals.

**Table 3: Stratification of Sample Size by Schools and gender**

| Name of School | Grade | Number of Children per Grade and Gender | | Sampling Size per Gender | | |
|---|---|---|---|---|---|---|
| | | Boys | Girls | Boys | Girls | Total |
| HIRRA | Grade 1 | 44 | 34 | 12 | 11 | 23 |
| | Grade 2 | 39 | 26 | 10 | 9 | 19 |
| | Grade 3 | 44 | 45 | 12 | 15 | 27 |
| | Grade 4 | 42 | 0 | 11 | 0 | 11 |
| | Grade 5 | 0 | 27 | 0 | 9 | 9 |
| | Grade 6 | 0 | 15 | 0 | 5 | 5 |
| | Grade 7 | 38 | 14 | 10 | 5 | 15 |
| | Grade 8 | 17 | 7 | 5 | 2 | 7 |
| | **Total** | **224** | **168** | **60** | **55** | **115** |
| ALKHALEEJ | Grade 1 | 19 | 36 | 7 | 9 | 16 |
| | Grade 2 | 20 | 17 | 7 | 4 | 11 |
| | Grade 3 | 30 | 34 | 11 | 8 | 19 |
| | Grade 4 | 16 | 22 | 6 | 5 | 11 |
| | **Total** | **85** | **109** | **30** | **27** | **57** |
| OMER TOORI | Grade 1 | 33 | 25 | 9 | 8 | 17 |
| | Grade 2 | 24 | 26 | 7 | 8 | 15 |
| | Grade 3 | 21 | 15 | 6 | 5 | 10 |
| | Grade 4 | 21 | 18 | 6 | 5 | 11 |
| | Grade 5 | 0 | 28 | 0 | 9 | 9 |
| | Grade 6 | 20 | 18 | 6 | 5 | 11 |
| | Grade 7 | 22 | 12 | 6 | 4 | 10 |
| | Grade 8 | 20 | 19 | 6 | 6 | 11 |
| | **Total** | **161** | **161** | **45** | **49** | **94** |
| SAHIL (SAEED DAA'UUD) | Grade 1 | 31 | 29 | 9 | 8 | 18 |
| | Grade 2 | 14 | 9 | 4 | 3 | 7 |
| | Grade 3 | 23 | 17 | 7 | 5 | 12 |
| | Grade 4 | 35 | 23 | 10 | 7 | 17 |
| | Grade 5 | 0 | 14 | 0 | 4 | 4 |
| | Grade 6 | 36 | 23 | 11 | 7 | 17 |
| | Grade 7 | 31 | 38 | 9 | 11 | 20 |
| | Grade 8 | 46 | 37 | 14 | 11 | 24 |
| | **Total** | **216** | **190** | **64** | **55** | **119** |
| **GRAND TOTAL** | | **686** | **628** | **199** | **186** | **385** |

### 3.6 Inclusion Criteria

- Children currently enrolled in Berbera primary schools and who were present at the time of the study
- Primary school children aged 6 to 18 years whose parents had endorsed informed consent by signing a consent form.

### 3.7 Exclusion Criteria

The children with following characteristics were excluded in the study:

- Children who were unwilling to undergo the examination due to fear, even though the parents had authorized the examination
- Children who were absent due to sickness

### 3.8 Data Collection Instruments and procedures

The data collection process was done in three phases as shown figure 1 below:

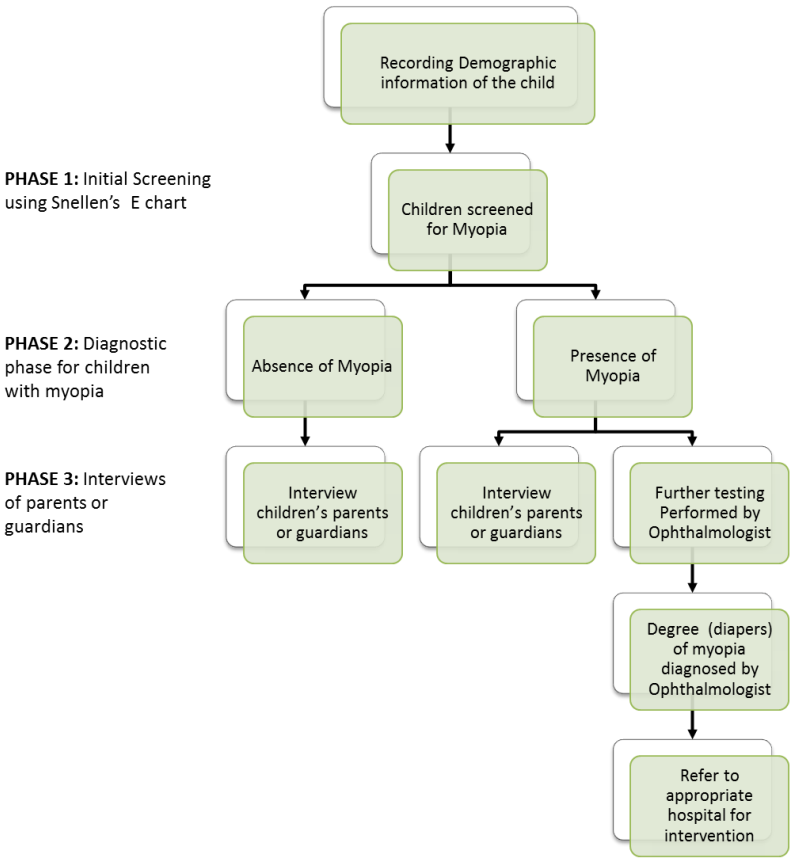



**Figure 1: Study process**

A Data Collection Form with dual language in English and Somali was designed and administered to collect demographic data, class grades and ocular history from each pupil followed by an eye examination. Other instruments required included torches, batteries, a 6 metre or 20 feet tape measure, a Snellen's E chart, an ophthalmoscope, a retinoscope, trial frame and lens, stationery and a vehicle for transport. Data were stored in the computer hard disc and flash discs.

The visual acuity of the sampled children whose parents/guardians consented for their participation in the study, was tested by two optometrists and an ophthalmologist at 20ft or 6m in a well-lit rooms. In the initial screening phase, a Snellen's E chart was used to assess the visual acuity of the children by the optometrists. Those children presenting with visual acuity equal to 20/20 in the better eye who had no any other

abnormalities in their eyes, were excluded from the rest of the examination procedure. This was done after the initial screening (Phase 1) where the presence or absence of myopia was determined. However, all the children screened were used (n=382) as denominator to calculate the prevalence of myopia in children. During the second phase, those children presenting with visual acuity less than 20/20 in the better eye, a detailed examination was performed by the ophthalmologist which included visual acuity with Pinhole, trial lenses, retinoscopy, ophthalmoscope and external ocular examination by use of natural light and torch.

In both phases, each eye was tested separately, and results were recorded in the Data Collection Form (appendix 4).

Another semi structured questionnaire was administered to the parents or guardians of the students. The questionnaire contained the socio demographic and economic characteristics of the parents or guardian, parental history of myopia, siblings with spectacles, child's engagement in near-work or outdoor activities, use of electronics and use of vegetables in meals and type of cooking fuel used.

### 3.9 Training of Field Research Assistants

Field Research Assistants with some experience of research methodologies and optometrists/ophthalmologists who have the knowledge and the skills of the subject matter were carefully recruited to support the principal investigator during the data collection. Two days training was conducted for the research assistants to enable them to explain properly the purpose of the study to the participants. The contents of the training included the objectives of the study, how to obtain consent from the participants, sampling procedures, practical sessions on the use of the questionnaires and interview techniques. The principal investigator shared and explained to the

research assistants including optometrists the Data Collection Form (appendix 3), in which results of visual acuity and diagnosis of the refractive errors were recorded.

### 3.10 Pre-Testing of the Research Instruments

A pre-testing exercise was conducted on 20 children in Omer Binu Khadaab primary school which was not selected for the main study. The questionnaire was also pre-tested. The research assistants used this opportunity to familiarize themselves with the questionnaire and test their interviewing skills. Moreover, instruments were tested to check whether they generate the intended results. Errors noted in the pre-test exercise including the interview procedures were corrected before the actual data collection. However, the findings from the pre-testing were not included in the main study. The plan was to examine 39 children for pre-testing but this did not happen due to time constraint. Nonetheless, the results of all the 20 children were almost consistent and accurate which granted the start of the main study.

### 3.11 Data Management and Quality Control

The Researcher managed the overall study with the help of optometrists and research assistants. Two qualified optometrists and an Ophthalmologist performed visual acuity examinations using Snellen Chart, Retinoscopy, Pinhole and Trail lens to ensure the quality of the examination and establish the degree of myopia and other refractive errors. During the examination, one of the Optometrist was performing the visual acuity of children with the Snellen chart while other optometrist and the ophthalmologist were doing further testing for the children with myopia and those with other visual abnormalities using Retinoscopy, Pinhole and Trial lenses. This was done to avoid any inter-examination variability and biases. The school principals were indirectly involved

in the study by providing the relevant assistances and information during sampling and inviting the parents or guardians for interview.

Filled questionnaires were checked for completeness at the end of each data collection day within the field to identify any missing data before leaving the field. At the end of each data collection day, all field questionnaires were handed over to the researcher of the study for safe storage. Upon the completion of the data analysis, the information in the data collection tools were kept safely in a store in cabinet that were locked and that only the principal researcher had access to.

### 3.12 Data Analysis

The data was entered; cleaned and analysed using the Statistical Package for Social Sciences (SPSS Statistics Version 20.0). Descriptive statistics such as frequency distributions, percentages, means and standard deviations were used to summarize and describe the data. The frequencies of key independent variables, were cross tabulated with the dependent variable (presence or absence of myopia in children). Chi-Square test was applied to establish the associations between prevalence of myopia and key independent variables such as gender, age of students, type of the school (government or private), grades family history of myopia, use of electronic devices, and economic characteristics of parents/guardians. The results of chi-square test were reported along with p-value for significance. Fisher's exact test was used where data violated chi-square test. Association of predictor variables such as age, sex, type of school, family history of myopia, use of electronic devices, and economic characteristics of parents/guardians with the dependent variable (presence of myopia) was analysed using logistic (bivariate and multivariate) regression. Crude and adjusted Odds ratios were computed for each explanatory variable to determine the strength of association with

outcome variable and to control the effect of confounding factors. P value < 0.05 was considered statistically significant.

**Table 4: Variables that were Analyzed**

| Dependent Variables | Independent Variables |
|---|---|
| **Prevalence of myopia among children**<br>➢ Proportion of children with myopia<br>➢ Degree of myopia | **Demographic characteristics of the children and parents/guardians**<br>➢ Age<br>➢ Sex<br>➢ Occupation of parents or guardians<br>➢ Level of education<br>➢ Level of income |
| | **Type of activities that children are involved:**<br>➢ Use of game machines<br>➢ Pattern of reading<br>➢ Use of mobile<br>➢ Use of computer<br>➢ Engagement of outdoor activities e.g. games |
| | **Other characteristics**<br>➢ Parental history of myopia<br>➢ Siblings with spectacles<br>➢ Use of vegetables in meals |

### 3.13 Ethical Consideration

The research proposal was presented to the Moi University Ethical Clearance Committee for approval. Prior to the commencement of the study, permission was obtained from the relevant authorities of Somaliland government to conduct the study. The nature and rationale for the study was explained at a meeting with the Director Generals of the Somaliland Ministries of Health and Education as well as the Director of Planning and Policy department of the Somaliland Ministry of Health .To conduct the study in the schools an approval was acquired from the Regional Education Officer of Sahil. Permission was sought from school principals and parents or guardians of the students. Consent forms translated into Somali were sent to the parents/guardians two

weeks before the start of the study so that they have sufficient time to read and comprehend the essence of the study. Each parent/guardian signed the consent form to confirm his/her child's participation in the study.

Detailed information about the objectives of the study and the procedures was given to the respondents in Somali language to obtain the consent of their child to participate in the study before commencement of a visual acuity examination and interview. The information provided to the participants during the consent process was presented in a balanced way. For example, there was no over emphasis of the benefits or under-emphasis of the risks.

Equally, caution was taken as much as possible during the interview to ensure that anonymity of the participants was strictly observed. The researcher ensured that the names of the participants were not indicated in the questionnaire or in the reports but instead, the study employed unique codes or numbers as a way of identifying the participants. Moreover, all information gathered was handled confidentially. The researcher explained to the participants that the information collected would only be used for the research.

The participants were given freedom and choice to answer some of the questions or end the interview at any time if they so wish. Students with myopia or any other visual problems were referred to either Berbera, Hargeisa or Manhal Hospital for treatment. The participants were informed that the data collected will be kept safely in a store in cabinets that are locked and that only the principal researcher will have access to the data collected.

Similarly, the participants were informed that care will be taken to ensure that when findings are being published, participants are not identifiable by not using their names but rather using pre-determined numbers or codes.

# CHAPTER FOUR

# FINDINGS

## 4.1 Socio-Demographic Characteristics of Participants (children)

A total of 385 children from 4 primary schools were investigated of which 382 agreed to be involved in the study and were screened for myopia and other refractive errors as well as any other visual defects. This made a response rate of 99.2%. The children who were not screened were those whose parents or guardians did not consent to participate in the study.

More than half (55.2%) of the children were in the government schools and 44.8% were from private schools.

Slightly more than half (51.6%) of the children were males and 48.4% females. The mean age of the children was 11 years with $\pm$ of 2.7 years. The youngest child was 6 years while the oldest child was 18 years. Around one-third (33.8%) of the children were in first and second class of the primary classes.

**Table 5: Demographic characteristics of children (n=382)**

| | Frequency | Percent |
|---|---|---|
| **Sex of Children** | | |
| Males | 197 | 51.6 |
| Females | 185 | 48.4 |
| **Total** | **382** | **100.0** |
| **Age Group (in years)** | | |
| 6-9 | 89 | 23.3 |
| 10-13 | 204 | 53.4 |
| 14-18 | 89 | 23.3 |
| **Total** | **382** | **100.0** |
| Mean age | 11.4 | |
| Standard deviation (+) | 2.7 | |
| **Grades of students (in groups)** | | |
| 1-2 | 129 | 33.8 |
| 3-4 | 114 | 29.8 |
| 5-6 | 74 | 19.4 |
| 7-8 | 65 | 17.0 |
| **Total** | **382** | **100.0** |

### 4.2 Socio-Demographic Characteristics of Parents/Guardians of the Children

Almost two-third (65.7%) of the parents/guardians were males while 34.3% were females. The mean age of the parents/guardians was 37 years with ± 10.5 years with minimum age of 20 years and maximum age of 70 years. Slightly less than one-third (32.5%) of the parents/guardians interviewed had secondary education level where 41.4% completed primary education. Those who had not gone to school were 17.8%.

In terms of the occupation, the majority (63.1%) of the parents/guardians were formally employed. Less than twenty percent (19.4%) were merchant/traders. As indicated in table 10 below, the median monthly income of households of the children was 210 USD and with the range of 50-1200 dollars. Nearly 48% of the respondents stated that they earn an income of 100-251 dollars per month while more than one-third (35.6%) earn 251-400 dollars per month.

**Table 6: Demographic Characteristics of the Parents/Guardians**

| Characteristics | Frequency | Percent |
|---|---|---|
| **Sex of Parents/Guardians** | | |
| Males | 251 | 65.7 |
| Females | 131 | 34.3 |
| **Total** | **382** | **100** |
| **Parents/Guardians Age group (in years)** | | |
| ≤29 | 98 | 25.7 |
| 30-34 | 95 | 24.9 |
| 35-39 | 60 | 15.7 |
| 40-44 | 45 | 11.8 |
| 45-49 | 21 | 5.5 |
| ≥50 | 63 | 16.5 |
| **Total** | **382** | **100** |
| Mean age | 37.2 | |
| Standard deviation (+ ) | 10.5 | |
| **Education level of parents or Guardians** | | |
| None | 68 | 17.8 |
| Madarasa (Quranic school) | 9 | 2.4 |
| Primary | 158 | 41.4 |
| Secondary | 124 | 32.5 |
| College/University | 23 | 6.0 |
| **Total** | **382** | **100** |
| **Occupation of the Parents or Guardians** | | |
| Formal Employment | 241 | 63.1 |
| Merchant/Trader | 74 | 19.4 |
| Casual worker | 28 | 7.3 |
| No Employment | 39 | 10.2 |
| **Total** | **382** | **100.0** |
| **Household Income in USD per month** | | |
| <100 | 33 | 8.6 |
| 100-250 | 182 | 47.6 |
| 251-400 | 136 | 35.6 |
| 401-550 | 15 | 3.9 |
| >550 | 16 | 4.2 |
| **Total** | **382** | **100** |
| Mean income | 241 | |
| Median | 210 | |
| Standard deviation (+ ) | 131 | |

### 4.3 Children's Visual Screening

#### 4.3.1 Visual Acuity Results

Three hundred and eighty-two children, whose parents/guardians consented, were visually screened. Out of these 382 children, 32 (8.4%) children were observed to have visual acuity less than (20/20 feet or 6/6 metre). This means that these children were unable to read 20/20 feet in Snellen's chart. Of these 32 children, 20 (62.5%) were boys and 12 (37.5%) were girls. One girl child was missing her right eye. Most of the children had normal visual acuity (20/20ft). However as shown in table 6, there was a slight difference between the two eyes in the visual acuity. Children whose visual acuity were below the normal range in the *right eye* were 21 children (5.5%) as compared to 29 (7. 6%) children with below normal range in the *left eye*.

Only two (2) children were using spectacles out of the 382 children whose visual acuity was examined.

**Table 7: Children's visual acuity results in both eyes (n=382)**

| Category of visual acuity | Visual Acuity Results of the Right Eye (OD)* | Visual Acuity Results of the Left Eye (OS) |
|---|---|---|
| | Number (%) | Number (%) |
| 20/20 | 360 (94.5%) | 353 (92.4%) |
| 20/30 | 1 (0.3%) | 6 (1.6%) |
| 20/40 | 5 (1.3%) | 8 (2.1%) |
| 20/50 | 4 (1.0%) | 3 (0.8%) |
| 20/70 | 1 (0.3%) | 0 (0.0%) |
| 20/100 | 4 (1.0%) | 6 (1.6%) |
| 20/150 | 5 (1.3%) | 3 (0.8%) |
| 20/200 | 1 (0.3%) | 3 (0.8%) |
| **Total** | **381 (100%)** | **382 (100%)** |

**1 girl child was missing the right eye*

### 4.3.2 Reasons for Reduced Visions

The reasons that caused low visual acuity to the children were examined. Refractive error was the main reason that caused the reduction of the visual acuity of the children. As shown in figure 2 below, three-quarters (75%) of the children who had impaired vision were due to refractive errors followed by those who had retinal defects (12.5%) and amblyopia (9.4%).

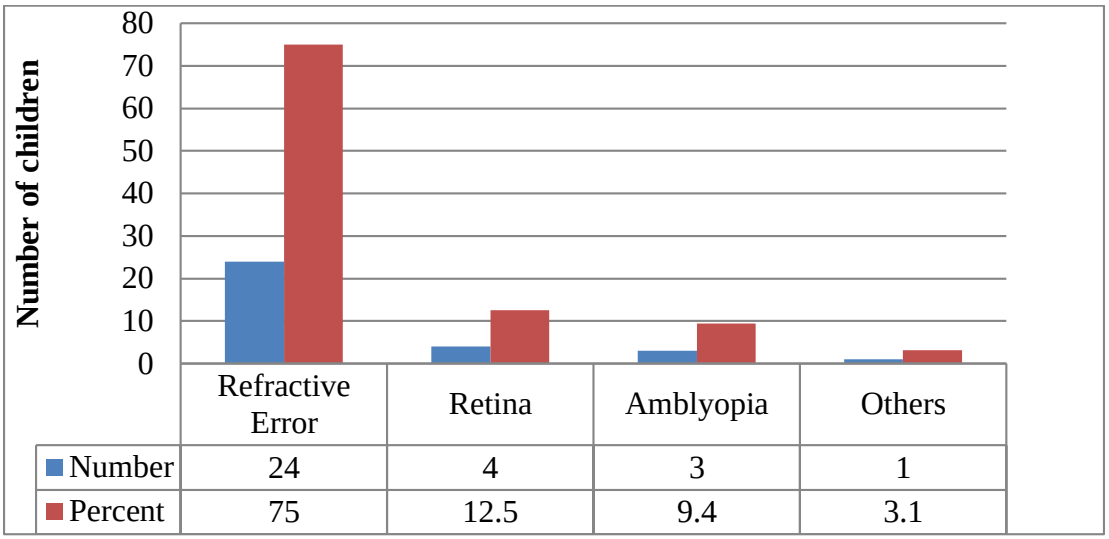



**Figure 2: Distribution of reasons for reduced visions among the children with impaired visual acuity (n=32)**

### 4.3.2 Prevalence of Myopia

The overall prevalence of myopia among the children was 3.4% (95% CI: 2 - 5%) followed by Astigmatism of 1.6%. As shown in figure 3, myopia was the leading cause of refractive errors which is the most common problem causing reduced visual acuity in children.

Over fifty four percent (54.2%) of the children who had refractive errors, had myopia and 25% had astigmatism. Of those with myopia, 9 children (69.2%) were boys and 4 (30.8%) were girls.

Other health problems observed during screening included Vernal kerato-conjunctivitis (VKC). It is a recurrent and seasonal ocular inflammatory condition that affects children in the dry and warm climate areas. More than five percent (5.2%) of the children were suffering from this disease which could be severe if not treated and can lead to visual loss due to keratoconus and corneal scars.

All children who had impaired vision and ocular diseases were referred to Berbera and Hargeisa Group Hospitals and Manhal Charity Hospital in Hargeisa for correction and treatment.

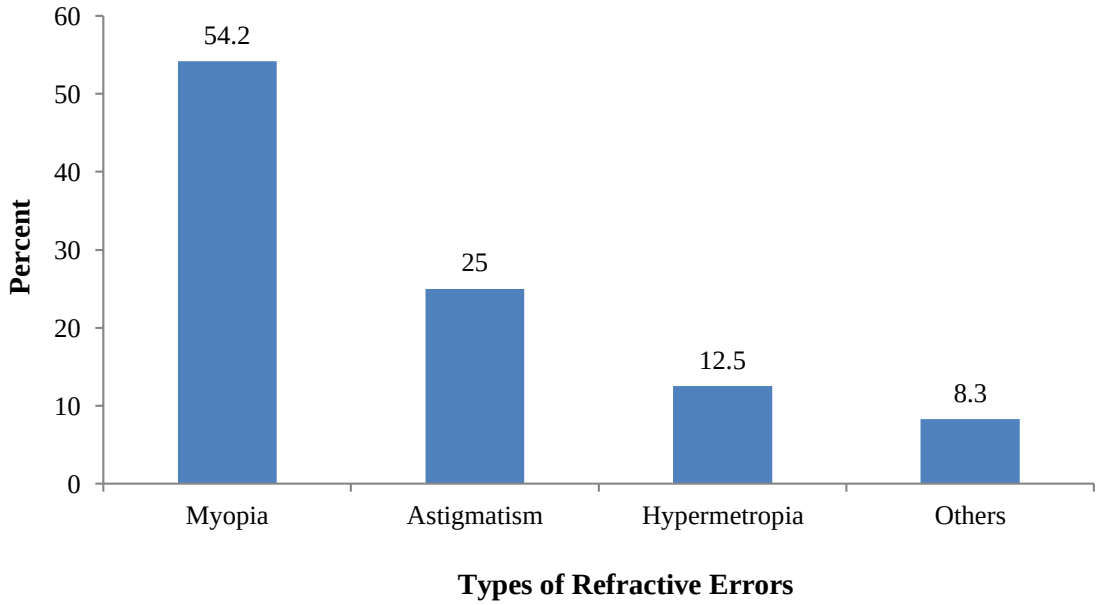



**Figure 3: Percent distribution of the refractive errors (n=24)**

### 4.3 Degree of Myopia among Children

The degree of myopia was examined and Anisometropia was observed. It is a condition in which the two eyes have unequal refractive power. Among the children with myopia, less than a quarter (23.1%) of them had bilateral myopia of 20/100 (-1.5D) in both eyes and 15.4% had a degree of 20/30 (-0.5D) in both eyes while the rest varied from 20 /40 to 20/150 (-0.75 to -2.0D) as shown in figure 4. In general, more than half (58%) of the children were suffering from myopia between 20/50 to /20/150 (-1 to -2.0D).

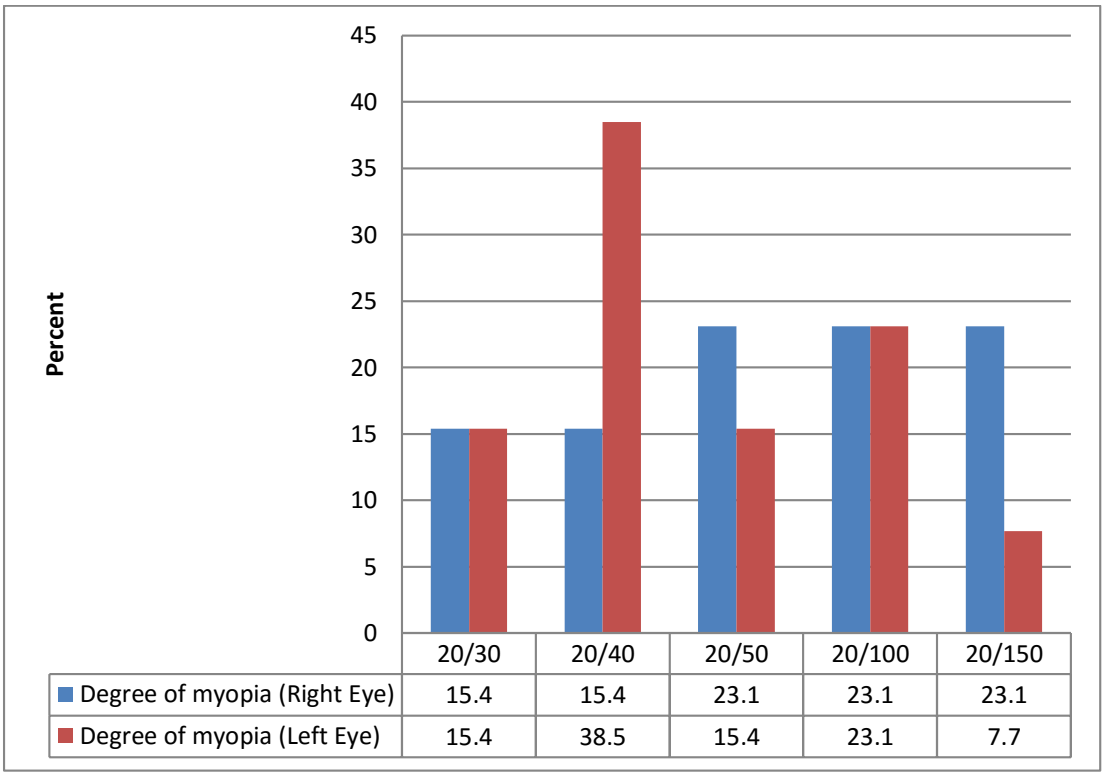



**Figure 4: Distribution of degree of myopia among children (n=13)**

### 4.4 Factors Associated with Myopia

To establish the potential factors associated with myopia, the parents or guardians were interviewed. The socio demographic and economic characteristics of the parents or guardians, parental and sibling's history of myopia, child's engagement in near-work or outdoor activities and use of vegetables in meals were assessed.

#### 4.4.1. Socio-economic status of the parents/guardians and Myopia in children

This study investigated socio-economic status and myopia. Socio-economic status was operationalized as education level of parents/guardians, occupation of the parents/guardians of the child and household income. In cross tabulation analysis, it was noted that the majority (61.5%) of the myopic children were having parents/guardians who had either secondary or tertiary education. Likewise, 84.6% of

the myopic children were from households with an income of more than USD200 per month.

### 4.4.2 Family History of myopia and Myopia in Children

During the interview, it was discovered that 16% of the children's parents use spectacles. When probed further on who uses the spectacles among the parents, the "fathers only" are the majority at 81% while the "mothers only" was at 12%.

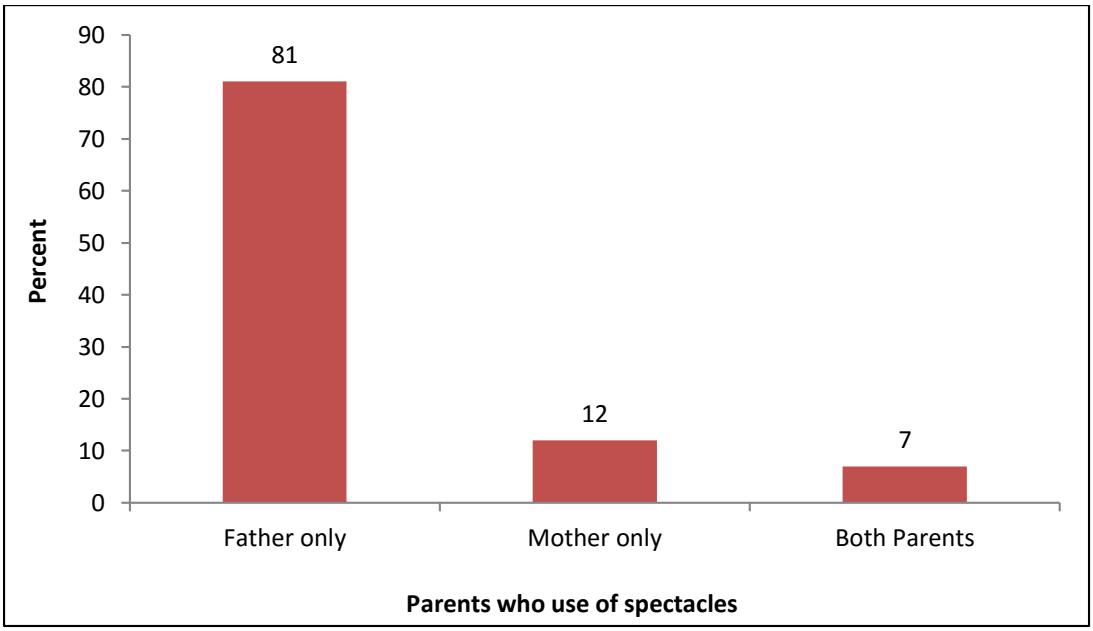



**Figure 5: Percent distribution of parents who uses spectacles (n=60)**

In addition to this, among the parents who use spectacles, 61.7% of them cannot see objects at short distances or small objects e.g. when reading books, while 21.7% of the parents use the spectacles because they cannot see far objects e.g. when walking, driving, etc. It was also found that 5% (n=19) of the children's siblings were using spectacles. In contrast to the parents, the majority (73.7%) of the children's siblings were using the spectacles because they could not see far objects which shows that they have myopia, while the other 26.3% of the children's siblings were using the spectacles because they were unable to see objects at short and long distances.

**Table 8: Distribution of parents who use spectacles and for what purposes (n=60)**

| Reasons parent use spectacles | Frequency | Percent |
|---|---|---|
| Parents with Can't see objects at short distances or small objects e.g. when reading books (**Hyperopia**) | 37 | 61.7 |
| Can't see long distances or far objects e.g. when walking, driving, etc. (**Myopia**) | 13 | 21.7 |
| Can't see short and long distances (**Astigmatism)** | 10 | 16.7 |
| Total | 60 | 100.0 |

### 4.4.3 Environmental Factors and myopia in children

According to the parents/guardians that were interviewed, more than half (53.7%) of the children spent one hour a day reading books while about 42% of the children spend an average of two hours per day reading books. Over 69% of the parents/guardians stated that the children played either computer or mobile phone games between one to two hours a day. On the contrary, the parents/guardians mentioned that the majority (80.6%) of the children played sports outside the house between one to two hours a day.

The majority (75.9%) of parents/guardians that had TV at homes which their children had access to watch on daily basis. Slightly less than half (48.6%) of the respondents acknowledged that their children watched TV for an hour per day. A significant percent (44.8%) of the respondents reported that their children watched TVs for a period of two hours per day.

**Table 9: Children's involvement in outdoor activities, reading books, playing with electrics and watching TVs**

| No. of Hours per day | Frequency | Percent |
|---|---|---|
| **Time a child spends in reading books per day** | | |
| One | 205 | 53.7 |
| Two | 160 | 41.9 |
| Three | 16 | 4.2 |
| Four | 1 | 0.3 |
| **Total** | **382** | **100** |
| **Time a child spends in playing computer/mobile games per a day** | | |
| None | 112 | 29.3 |
| One | 104 | 27.2 |
| Two | 161 | 42.1 |
| Three | 5 | 1.3 |
| **Total** | **382** | **100** |
| **Time a child spends in playing sports outside the house per day** | | |
| None | 63 | 16.5 |
| One | 168 | 44.0 |
| Two | 140 | 36.6 |
| Three | 11 | 2.9 |
| **Total** | **382** | **100** |
| **TV at home** | | |
| Yes | 290 | 75.9 |
| No | 92 | 24.1 |
| **Total** | **382** | **100** |
| **Time a child watches the TV** | | |
| One | 141 | 48.6 |
| Two | 130 | 44.8 |
| Three | 15 | 5.2 |
| Four | 4 | 1.4 |
| **Total** | **290** | **100** |

### 4.4.4 Use of vegetables and fruits by the children

As per the responses of the parents/guardians, the most consumed vegetables and fruits by the children are Salads (69%), Bananas (53%), Papayas (20%), Water melons (15%) and Carrots (11%). However, the majority (84%) of the parents/guardians reported that

the children seldom used these fruits and vegetables. Only 16% of them mentioned that the children have access to fruits and vegetables on daily basis.

### 4.4.5 Bivariate Analysis on the Factors Associated with Myopia

As summarized in table 10, bivariate analysis were performed to assess associations between key independent variables such as age and gender of children, children's use of electronic devices (mobile phone, computer), children's involvement in outdoor activities, family history of myopia, level of education and level of income parents/guardians and dependent variable (presence or absence of myopia in children).

Even though, boys were more myopic than girls in the study, no significant associations were noted between myopia and gender of the children ($\chi^2$ = 1.681, df = 1, P=0.195) and age of the children (Value=0.483; df=1; P=0.487).

The majority (76.9%) of the children with myopia were from private schools as opposed to public (government) schools. There were more myopic children in private schools as opposed to public (government) schools and this difference was statistically significant ($\chi^2$ = 5.629, df = 1, P=0.018) (OR: 4.306; 95% CI: 1.166, 15.905, P=0.028). A similar associations were observed between children with myopia and household income ($\chi^2$ = 5.101, df = 1, P=0.024) (OR: 4.908; 95% CI: 1.07, 22.449, P=0.04). But no statistical associations were noted between educational level of parents/guardians and myopic children in this study ($\chi^2$ =3.022; df=1; P=0.082) (OR: 2.647; 95% CI: 0.849, 8.253; P=0.093).

According to the cross-tabulation analysis, it was found that 61.5% and 71.4% of the myopic children in this study have parents and siblings with history of myopia

respectively. When combined the parents and siblings with myopia against number of children with myopia in this study, the percent was even higher (84.6%). Fisher's exact test was used to assess whether there is a statistical relationship between children with myopia and family history of myopia. This was done after the data violated chi-square test (one of the cells had an expected count less than 5). The Fisher's Exact test revealed statistical relationship between having parents and siblings with history of myopia and myopic children in this study (P=0.000) which was an indication that children who had family history of myopia had higher risk of developing myopia.

Both chi-square and Logistic regression analysis revealed statistical significance between the time children spent on computer/mobile phone games and myopia ($\chi^2$=6.135; df=1; P=0.013) (OR: 4.6; 95% CI: 1.23, 16.81; P=0.023). Equally, significant relationship was also found between children's play sports outside the house and myopia ($\chi^2$=5.706; df=1; P=0.017) (OR: 0.12; 95% CI: 0.02, 0.94; P=0.044). This relationship was protective.

Moreover, children who watched TV more than 2 hours a day and myopia were statistically associated ($\chi^2$= 8.133; df=1; P=0.004) (OR: 5.5; 95% CI: 1.49, 20.39; P=0.010). This indicated that the children who watched TV more than 2 hours a day had higher risk of developing myopia than those who watched TV less than 2 hours a day holding all other factors constant.

**Table 10: Bivariate Statistical analysis of dependent variable (presence or absence of myopia) and Independent variables of interest**

| Independent Variables | Presence Myopia (n=382) | | Chi-square ($\chi^2$) Test | Logistic Regression Analysis | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 95% C.I. for OR | |
| | Yes | No | | Regression Coefficient | P-value. | Odds Ratio (OR) | Lower | Upper |
| **Sex of Children** | | | | | | | | |
| Male | 9 (4.6%) | 188 (95.4%) | Value=1.681; df=1; P=0.195 | -.773 | .205 | .462 | .140 | 1.526 |
| Female | 4 (2.2%) | 181 (97.8%) | | | | | | |
| **Total** | **13 (3.4%)** | **369 (96.6%)** | | | | | | |
| **Age (in years)** | | | | | | | | |
| 6-10 | 4 (2.6%) | 149 (97.4%) | Value=0.483; df=1; P=0.487 | .421 | .490 | 1.524 | .461 | 5.039 |
| >10 | 9 (3.9%) | 220 (96.1%) | | | | | | |
| **Total** | **13 (3.4%)** | **369 (96.6%)** | | | | | | |
| **Type of school** | | | | | | | | |
| Public or gov't school | 3 (1.4%) | 208 (98.6%) | Value=5.629; df=1; P=0.018 | 1.460 | .028 | 4.306 | 1.166 | 15.905 |
| Private | 10 (5.8%) | 161 (94.2%) | | | | | | |
| **Total** | **13 (3.4%)** | **369 (96.6%)** | | | | | | |
| **Household income (in USD)** | | | | | | | | |
| <$200 | 2 (1.1%) | 174 (98.9%) | Value=5.101; df=1; P=0.024 | 1.591 | .040 | 4.908 | 1.073 | 22.449 |
| >$200 | 11 (5.3%) | 195 (94.7%) | | | | | | |
| **Total** | **13 (3.4%)** | **369 (96.6%)** | | | | | | |
| **Level of education of parents/guardians** | | | | | | | | |
| Primary and lower | 5 (2.1%) | 230 (97.9%) | Value=3.022; df=1; P=0.082 | .974 | .093 | 2.647 | .849 | 8.253 |
| Secondary and higher | 8 (5.4%) | 139 (94.6%) | | | | | | |
| **Total** | **13 (3.4%)** | **369 (96.6%)** | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **An approximate time a child plays computer/mobile phone games in a day**<br>0-1 hour<br>>1 hour<br>**Total** | 3 (1.4%)<br>10 (6%)<br>**13 (3.4%)** | 213 (98.6%)<br>156 (94%)<br>**369 (96.6%)** | Value=6.135; df=1; P=0.013 | 1.515 | .023 | 4.551 | 1.232 | 16.811 |
| **An approximate time a child plays outside games in a day**<br>0-1 hour<br>>2 hours<br>**Total** | 12 (5.2%)<br>1 (0.7%)<br>**13 (3.4%)** | 219 (94.8%)<br>150 (99.3%)<br>**369 (96.6%)** | Value=5.706; df=1; P=0.017 | -2.106 | .044 | .122 | .016 | .946 |
| **An approximate time a child watches TV in a day**<br>0-2 hours<br>>2 hours<br>**Total** | 3 (1.3%)<br>10 (6.7%)<br>**13 (3.4%)** | 230 (98.7%)<br>139 (93.3%)<br>**369 (96.6%)** | Value=8.133; df=1; P=0.004 | 1.708 | .010 | 5.516 | 1.492 | 20.386 |

### 4.4.6 Results of Multivariable Analysis

The variables with a p-value <0.05 at bivariate analysis such as: type of school, household income, playing with computers, watching TV and Playing games at outdoors were entered in a multiple logistic regression. In the multivariable logistic regression analysis, type of school a child studies (AOR=4.404, 95% CI: 1.119, 17.334, P-value=0.034), an approximate time a child plays with computers/mobile phone games in a day (AOR=4.374, 95% CI: 1.143, 16.740, P-value=0.031), an approximate time in a child plays outdoor games a day (AOR= 0.097, 95% CI: 0.012, 0.778, P-value=0.028) were the independent factors associated with myopia after adjusting for household income and level of education of parents/guardians, watching TV and children's involvement in outdoor games.

In the multiple logistic analysis, no association between an approximate time a child watched TV in a day and myopia was found (AOR=3.440, 95% CI 0.877;13.490, P-value=0.076) after adjusting other predictor variables such as type of school the child studied, household income, level of education of parents/guardians, approximate time a child played computer/mobile phone games in a day and approximate time a child played outside games in a day.

According to these analysis, children who play with computer/mobile phone games more than one hour a day, have 4.3 times higher risk of myopia (P=0.031). Similar adjusted odds ratio (AOR=4.4) was found among the children who study in the private schools and presence of myopia and the difference was statistically significant (P=0.034). Children who play outdoor games approximately for more than two hours a day are less like to be myopic.

**Table 11: Multivariable Statistical analysis of dependent variable (presence or absence of myopia) and Independent variables of interest**

| Variable | P-Value | Adjusted Odds Ratio (AOR) | 95% CI | | Regression Coefficient (β) |
|---|---|---|---|---|---|
| | | | Lower | Upper | |
| Type of school **(Public vs Private**) | 0.034 | 4.404 | 1.119 | 17.334 | 1.483 |
| An approximate time a child plays computer/mobile phone games in a day **(0-1-hour vs >1 hour**) | 0.031 | 4.374 | 1.143 | 16.740 | 1.476 |
| An approximate time a child plays outside games in a day **(0-1-hour vs >2 hours**) | 0.028 | 0.097 | 0.012 | 0.778 | -2.335 |
| An approximate time a child watches TV in a day (0-2 hours vs >2 hours) | 0.076 | 3.440 | 0.877 | 13.490 | 1.235 |

# CHAPTER FIVE

# DISCUSSION

This chapter describes in detail the study findings in relation to the objectives and in comparison, with other literatures related to myopia in primary school children. The chapter will begin by discussing the prevalence of Myopia among primary schools in Berbera, the degree of myopia among pupils in Primary schools in Berbera, to be followed by a discussion on the factors associated with myopia among pupils in Primary schools in Berbera.

## 5.1 Prevalence of Myopia among primary schools in Berbera

This study set out to determine the prevalence of myopia among pupils in Primary schools in Berbera. According to the findings of this study, the overall prevalence of myopia among primary school children in Berbera was 3.4% (95% CI: 2 - 5%) followed by Astigmatism of 1.6%. Based on the results of this study, myopia is the leading cause of refractive errors which is the most common problem responsible for reduced visual acuity in children. The prevalence rate in this study is lower than what other comparable studies reported. For example, Dalmar (2006) who did a similar study in Mogadishu, Somalia, found myopia being the major refractive error where the prevalence rate of myopia showed 7.5%. In Dalmar's study, age difference was observed. The age group of Dalmar's study was 5-29 years while the age group of this study is 6-18 years. The variation could also be due to sample size differences and the protracted civil war that ravaged Mogadishu and other parts of Southern Somalia. Children may not have a conducive environment to freely play as some of the studies reported that outdoor activities were protective factor against myopia (Wu et al, 2013). The finding of this study is in agreement with what Jafer and Abonesh (2010) and Kumah et al (2013) reported in studies conducted in Ethiopia in Debre Markos and in Ghana, which stated

a prevalence of 3.5% and 3.2% respectively. Other comparable studies demonstrated lower proportion rates than this study such as the one conducted by Mabaso et al (2006) in Mopani, South Africa (2.5%), Muma et al (2009) in Makueni district in Kenya (1.7%), Al-Rowaily (2010) in Saudi Arabia (2.5%) and that by Assefa et al (2012) in Gondor, Ethiopia (3%).

Lastly, it is worth to note that the prevalence rate in this study is less than that found by Saxena et al (2015) in India 13.1%, in Iran by Reza et al (2015) 14.9% and that reported in China by Qi et al (2014). This could be attributed to the difference in race, environmental and socio-economic set up. One important thing to note here is that 24.7% of the children in India were wearing appropriate spectacles while in this study less than 1% were aware of their visual acuity. This could be attributed to the limited knowledge of the parents/guardians and teachers on the importance of child's vision and unavailability of eye care programme in Somaliland schools.

Even though this study did not find statistical significant relationship between both gender and age and prevalence of myopia, myopia was more common in males (69.2%) compared to females ($\chi^2$ = 1.681, df = 1, P=0.195) and children in older ages (>10 years) ($\chi^2$ = 0.483, df = 1, P=0.487). The findings of this study are comparable with the findings of Norhani et al (2007), Kumah et al (2013) and Uchenna et al (2017), where myopia was not significantly associated with gender (P=0.26, 0.82 and 0.89). However, there are some other studies which found statistical relationship between gender, age and prevalence of myopia in children. For instance, Khader et al (2006) in Jordan, Muma et al, (2009) in Makueni district in Kenya, Fahd et al (2013) in Saudi Arabia and Qi Sheng et al (2012) in China, found significant relationship between gender, age and prevalence of myopia. According to the findings of these studies myopia was higher

in females than males and the older ages had the higher prevalence of myopia compared to the younger age group.

### 5.2 The Degree of Myopia among Pupils in Primary schools in Berbera

The degree of myopia was also determined using Snellen chart, retinoscopy, pinhole and trail lens. The degree of myopia among the children in this ranged from 20/30 to 20/150 or -0.5 to -2.0 diopters. According to the Optometric Clinical Practice Guideline by American Optometric Association (2006), the degree of myopia is classified as Low (<3.00 D), Medium (3.00 - 6.00 D) and High myopia (>6.00 D). This study did not observe children with either medium or high degree of myopia but more than half (58%) of the children were suffering from myopia between 20/50 to /20/150 (-1 to -2.00D) which indicated Moderate to Severe Distance Vision Impairment (WHO, 2018). Individuals with high myopia can develop pathological changes in the retina known as generative myopia (WHO, 2015a). And this is one of the reasons why WHO recommends the detection and management of myopia to be an integral part of eye care service provision due to its increased prevalence and its pathological consequences (WHO, 2015b).

### 5.3 Factors Associated with Myopia among pupils in Primary schools in Berbera

#### 5.3.1 Genetics and Family History of Myopia

This study looked at the possible relationships between parental myopia and presence of myopia among the children in this study. Around 16% of the interviewed parents/guardians stated that children's parents used spectacles and more than one-fifth (21.7%) of them used the spectacles because they could not see long distances or far objects e.g. when walking, driving, etc. which is almost related to myopia. This percent rose to 38.4% when those who could not see long and short distance or objects were

included. Among the children with myopia in this study, 61.5% of their parents and 71.4% of their siblings had history of short sightedness (myopia). However, no statistical relationship was noted between children with myopia and their myopic parents and siblings which disagrees with the studies done in Northern Ireland (Lisa et al, 2015), China (Qi Sheng et al, 2012), Taiwan (Chih-Chien et al, 2016) and Jordan (Khader et al, 2006). These studies cited that the children with myopic parents were more likely to be myopic than those without myopic parents with notable associations (P=0.001). This study also found that children whose siblings use spectacles had higher risk of being myopic than the children whose siblings were not using eye-glasses (OR: 12.17; CI: 3.31, 44.71; P=0.000). A similar association (P=0.02) was reported by Asmaa, et al (2014) in a similar a study done in Egypt. In addition, this study has not observed any difference between a child having one or two myopic parents as opposed to the study done in Taiwan by Chih-Chien et al (2016) which revealed that having two myopic parents pose a greater risk than one (OR=2.82, 95% CI=2.41-3.29, P=<0.001) compared to those with one myopic parent (OR=1.66, 95% CI=1.4-1.95, P=<0.001). A similar risk difference was also reported by Khader et al (2006) where the children who had 2 myopic parents had higher prevalence of myopia than those who had 1 myopic parent with odds ratio of 3.37 (CI=1.77-6.42). The reason that the results of this study differ from these other studies in regard to the number of parents with myopia, could be due to the methods used. This study has not done eye test for parents but used historical information. The other reason is that Somali women do not check their visual acuity since most of them are house wives or that their involvement in duties requiring visual acuity test is limited compared to men who are involved in activities such as driving, office work (use of computers), etc. This difference was clear in the findings

of this study where more than 80% of the parents who were using spectacles were fathers.

In summary, even though, this study did not find statistical association between children with myopia and family history of myopia, the cross-tabulation results of this study and the literatures outlined in this study suggest that myopia might be associated with hereditability.

### 5.3.2 Socioeconomic and other environmental factors

Some of the environmental factors that this study looked at were children's involvement in activities outside the school such as reading, watching television, playing with computers/mobile phones games and playing outdoor sports. This study found that 54% of the children spent one hour a day in reading books while 42% spent two hours a day on average, reading books. Even though statistical significance was not noted between presence of myopia in children and the time they spent in reading books, 61.5% of the myopic children were spending their time reading books for more than one hour a day compared to those who spent their time reading books for an hour. This study did not find statistical association between the development of myopia and time spent on reading, compared with the results from studies in Malaysia (Syaratul et al, 2008) and in Egypt (Asmaa et al, 2014). Syaratul et al, (2008) reported that children who read more than 2 hours a day were 2 times more likely to develop myopia (P=0.004) while the study done by Asmaa et al (2014), found significant positive correlation (P=0.04) between development of myopia with increasing hours spent on reading. This could be attributed to the effect of continuous light reflecting on the eyes and the type of lights used. Using dim or low illuminating lights may strain one's eyes and eventually may lead to visual problems such as near-sightedness.

Likewise, the presence of myopia and the time children spent in watching television, playing computer/mobile phone games in a day were also assessed. In bivariate and Multiple logistics regressions analysis in this study, it was found that the children who played computer/mobile phone games had higher risk of having myopia than those who did not play with computer/mobile phone games (OR:4.6; 95% CI: 1.23,16.81; P=0.023), (AOR=4.374, 95% CI: 1.143, 16.740, P-value=0.031) after adjusting for household income and level of education of parents/guardians, watching TV and children's involvement in outdoor games. This means that children who play with computer/mobile phone games more than one hour a day, are more than 4 times likely to develop myopia. Similarly, according to the findings of this study, children who watched TV more than 2 hours had higher risk of developing myopia (OR:5.5; 95% CI: 1.49, 20.39; P=0.010) even though, in the multiple logistic analysis, no association between an approximate time a child watched TV in a day and myopia was found after adjusting other predictor variables which suggested confounder factors.

The findings of this study concurred with the results of comparable studies which revealed statistical relationships between myopia and use of computers and watching Television. According to Qi Sheng et al (2012), myopia was associated with the duration that the children watch television (OR: 0.83; CI 95%: 0.79, 0.88; P=0.001). Sewunet et al (2014) reported similar results among children who regularly use computers to be 4.5 times (95% CI: 1.589-12.968, P=0.005) more likely to suffer from myopia compared to non/irregular users of computers.

Many children are addicted and glued to the TV where they watch different types of sports, cartoon programmes and other entertainment programmes for children. Nowadays children can also access similar programmes from computers and mobile

phones. These electronic devices may not only endanger the visual acuity of the children, but they can also limit their physical exercises which leads to obesity and other health risks associated with sedentary lifestyle.

From the semi-structured interview conducted with parents/guardians of the children, it was found that more than 78% of the children played sports outside homes on average of 1-2 hours a day. Among the myopic children in this study, 92.3% of them engaged in outdoor sports around an hour while 7.7% of them were engaged for more than one hour. Therefore, from this analysis, children who were involved in outdoor sports more than one hour were less likely to develop myopia which showed protective factor. This relationship was also statistically significant ($\chi^2$=5.706; df=1; P=0.017) (AOR= 0.097, 95% CI: 0.012, 0.778, P-value=0.028) after adjusting for household income and level of education of parents/guardians and watching TV. This indicates that the children who played outdoor games are less likely to develop myopia. The findings of this study were in line with the findings of Li et al (2015), Wu et al (2013) and Khader et al, (2006). The results of these studies showed statistical protective associations with children's engagement in outdoor activities and myopia (P=0.013, P=0.001 and P=0.001).

In Berbera where this study was conducted, there was adequate space where children could have outdoor sports unlike other Somaliland big towns or cities which are populated and congested.

According to the responses of the interview from the children's parents/guardians, the median income of households was USD 210 per month and nearly one-third (32.7%) of the families earned 300 US dollars per month. The study also found that almost half (49.7%) of the interviewed families were formally employed in Berbera (seaport city),

where this study was conducted, this indicated that the residents in Berbera had better job opportunities compared to the rest of other urban towns in Somaliland.

In the bivariate logistic regression analysis, significant associations with household income and myopia in children were found (OR:4.908; 95% CI: 1.07, 22.449; P=0.04). These results agree with what Syaratul et al (2008) reported, where household income were positively associated with myopia. According to Syaratul et al (2008), the odd ratio was 1.7 (P-value=0.000). Similar findings on family income and statistical relationships with myopia in children were reported by Qi Sheng et al (2012) (OR: 1.06; 95% CI: 1.02, 1.09; P=0.001). The later did not find significant association with either the educational level of the father (P=0.07) or maternal level of education (P=0.55). Although it is difficult to pinpoint the relationship between prevalence of myopia in children and socio-economic and educational factors of the family because of numerous inter-related factors, for example, children whose parents were educated might had better jobs and higher incomes compared to those with lower level of education. Another scenario is that the children from higher income families may have limited time to engage in outdoor activities and instead they may spend more time using electronic devices at homes.

According to the findings of this study, children studying in the private schools were more myopic (5.8%) compared to those children in public schools (1.4%). Both bivariate and multivariable analysis showed statistical difference between children studying in the private and public schools. The risk of myopia among the children in the private schools were more than four times higher than those children in the public schools (OR: 4.306, 95% CI: 1.17;15.91, P=0.028) (AOR=4.404, 95% CI: 1.119,

17.334, P-value=0.034). The results of this study concurred with what Qi Sheng et al (2012) reported in a study done in China (OR: 0.72; 95% CI: 0.64, 0.81; P=0.001).

In this study, the children's consumption of vegetables and fruits were found through parents/guardian's interviews. The most consumed vegetables and fruits by the children were Salad (69%) and Banana (53%) followed by Papaya (20%). Water melon (15%) and Carrots (11%) were also reported. According to the interview responses, the frequency of consumption of these vegetables and fruits were seldom (84%). Only 16% of them mentioned that the children consume these fruits and vegetables on daily basis. This implied that the children did not consume enough vegetables and fruits that contained Vitamin A and Vitamin C such as carrots and citrus fruits to maintain their visual health.

# CHAPTER SIX

# CONCLUSION AND RECOMMENDATIONS

## 6.1 Conclusion

In conclusion, the study revealed that:

- Myopia is the most common condition causing reduced visual acuity in children. The overall prevalence of myopia among the children is 3.4% followed by Astigmatism of 1.6%. In terms of gender, myopia was more common in males compared to females. However, no statistical differences were found.
- Children in the private schools had higher risk of myopia (76.9%) compared to the children in public schools and this difference was statistically significant (P=0.028).
- The degree of myopia, among the primary school children in this study, varied from 20/30 (-0.5D) to 20/150 (-2.0D). And the majority of the children and parents/guardians were not aware of the children's eye condition.
- The study found that family history, use of electronic devices such as computer and mobile phone games and watching TV for long hours were among factors associated with myopia in children.
- The intake of vegetables and fruits, containing essential vitamins and minerals which are necessary for the improvement of visual acuity and eye health in general, was limited.

## 6.2 Recommendations

Based on the findings and conclusions, the following recommendations were made from this study:

### 6.2.1 Policy and strategic level

- Somaliland government particularly ministries of health and education should jointly develop a policy that provides a framework in which primary eye care is integrated into a school health programmes.
- As part of school health programme, ministries of Health and Education carry out a regular school screening programme at primary schools for early detection of visual impairment including myopia and other refractive errors that affect school going children.
- Ministry of education should incorporate primary eye care and vision screening using the "Snellen Chart" for visual acuity test in the teachers training curricula
- The Ministry of health should increase the support and expand the eye clinic initiatives such as the one in Hargeisa Group Hospital to the other regional hospitals to support the school health programmes in the country including the provision of low cost spectacles for the children.

### 6.2.2 School Management Level

- School management should ensure that the teachers are trained on how to identify and deal with visually impaired children and those with other special needs.
- School management should consider performing visual testing during new admissions and after holidays. This can be done by establishing First Aid posts at schools managed by a nurse.
- Parents/guardians should be educated to curtail the excessive use of electronic devices (computer, mobile phone, TVs, etc.) in order to avoid their detrimental effects to the children's eye sights.

- The schools' management should organize nutritional health education sessions at the schools targeting the parents/guardians on the importance of vegetables and fruits intake for the children's vision acuity. The schools can collaborate with regional education and health authorities to facilitate the sessions
- School management should consider establishing First Aid Post at schools run by school nurses who could test children's vision during admission and on yearly basis particularly upon the children's return from holidays

### 6.2.3 Research Level

Further study should be done to establish the relationship between educational performance of the children and myopia in children.

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# APPENDICES

## Appendix 1: Permission Letter to the Parents/Guardians the of child

Date: _____

Child Code _____Grade #: _____ Class #:_____

To: _____ (The code of the Parent/Guardian)

Address: _____ Telephone Number: _____

Subject: **Seeking permission for eye sight test of your child in (school name)**

### Introduction

I, Hassan Abdi Jama, am pursuing a master's degree in Public Health in Moi University in Nairobi, Kenya. I am studying the vision status of school children in Berbera town. Determining prevalence of myopia (short sightedness) and associated factors is my research project as the part of the study of masters of the university.

In children it is quite common that a number of them may have impaired or low vision and may not be able to see the blackboard clearly in a class room. Such child may not be able to perform well in studies because of this impaired vision. Many children or parents may not know about the presence of such problems. Impairment because of myopia, or short sightedness, can easily be corrected by wearing appropriate devices such as glasses.

In Berbera, we do not have data on the magnitude of this problem. After examining a significant number of school children as part of this study; we will know the extent of the problem. This will help our government in planning eye service for school children.

**Purpose of the study**: The aim of this study is to find out the magnitude of myopia (short sightedness) and its associated factors among students in Berbera Primary schools

**Types of interventions in the study:**

- The child's visual acuity will be measured using reading chart with letters and retinoscopy to confirm the degree of short sightedness of the child.
- You, the parents or guardian of the child, will be asked questions using a Questionnaire to find out some of the possible factors associated with myopia (short sightedness)
- You, the parents or guardian, will be given prescriptions for the child diagnosed with myopia to acquire appropriate spectacles or eyeglasses

**Benefits:** This examination will not make any harm of your school child. The examination will detect if your child has any visual abnormalities. If your child has defective vision, I will share with you the results and prescription for appropriate intervention and the child will be referred to relevant hospital.

**Confidentiality:** The examination information will be kept confidential and will not be given to anyone outside the study. Your name and your child's name will never be used in any reports.

**Right to refuse or withdraw**: Your child's participation is voluntary, and he/she can withdraw from the study after having agreed to participate. Your child is free to refuse any aspect of the examination. If you have any questions you may ask any time during the study.

If you have questions or need clarification about the study, please do not hesitate to call or email the principal investigator through: Mobile: +252 634417229; email: hassan.ajama@gmail.com

Therefore, I am earnestly requesting to you to allow me to examine the eye of your child and oblige thereby. If you agree, please sign at the bottom or print the thumb.

Yours sincerely,

Hassan Abdi Jama
The Principle researcher----------

**Declaration Statement by the Parent or guardian (caregiver) of the child**

I have read or have had read to me the description of the research study. The investigator or his/her representative has explained the study to me and has answered all of the questions I have at this time. I have been told of the potential risks, discomforts and side effects as well as the possible benefits (if any) of the study. Therefore, I, the undersigned parent or guardian of the above-named child, hereby give consent for my son/daughter to participate fully in the study stated above.

Signature or thumbprint of the parent/guardian: _____

Date: _____

**Appendix 2: Assent Form for the Children**

To: _____

I, Hassan Abdi Jama, am a student at Moi University pursuing Master of Public Health. As part of the program, I am required to conduct a research in partial fulfillment for Master of Public Health program.

The research purpose is to find out the extent of short sightedness among primary school children in Berbera. You and your school has been selected during the sampling processes. Therefore, you are invited to participate in this study by letting us to measure your visual acuity. If at any point you feel uncomfortable with the examination and would like to withdraw, you are free to do so without any repercussions.

The examination will be done by professional or trained health workers. The information provided will be treated as confidential and will not be used for any other purpose other than for this study.

Although you may not benefit directly from participating in the study, your contribution will make a major impact to the knowledge known in this area of study.

A research assistant will keep a record of all the forms/questionnaires in a closed cabinet. Only the principal investigator and his research assistants will know the identity of study participants.

If you feel that you have been affected as a result of participating in the study directly, please contact Mr Hassan Abdi Jama through the phone: +252 63 4417229 or email hassan.ajama@gmail.com

Your signature on this form means that you understand the information presented, and that you want to participate in the study. You understand that participation is voluntary, and you may withdraw from the study at any time.

| | | |
|---|---|---|
| …… | | ……. |
| The participant's signature/thumbprint | | Date and Time |
| …… | …….... | ……. |
| Name of investigator | Signature | Date |

## Appendix 3: Informed Consent Form for Parent/Guardians or Caregiver of the Child

**Study Title:** Prevalence of Myopia and Associated Factors among Primary School Children in Berbera City, Somaliland

**Name of Principal Investigator(s):** Hassan Abdi Jama

**Part A: Information Sheet**

**Introduction:**

I, Hassan Abdi Jama, am pursuing a Master's degree in Public Health in Moi University in Nairobi, Kenya. I am studying the vision status of school children in Berbera town. Determining prevalence of myopia (short sightedness) and associated factors is my research project as the part of the study of masters of the university.

**Purpose of the study:** The purpose of the study is to find out the magnitude of myopia (short sightedness) and its associated factors among students in Berbera Primary schools.

You were selected through during the sampling processes of this study. Hence, you are invited to participate in this study by letting us to ask you few questions related to the possible factors associated with myopia (short sightedness) that your child may or may not be suffering. Taking part in this research study is entirely voluntary and therefore there will not be reimbursement.

You may choose not to take part in the study if you feel uncomfortable. You are also free to withdraw from this study at any time. You have the right to ask questions about this study and to have those questions answered by me (investigator) or his/her assistant before, during or after the research.

The interview will continue about 30 minutes. There is no risk associated with this study. The risk or side effect is very less like to happen.

The benefits to taking part in this study is that the outcome will be of high relevance to trigger the enactment of policies and plans by the relevant government institutions of Somaliland to prevent the avoidable causes of visual impairment in children. It is part of child health to screen and detect myopia before the visual acuity of children is impaired and as a result compromise children's performance in education.

The information provided will be treated as confidential and will not be used for any other purpose other than for this study.

Please read this form carefully. You will be given a chance to ask questions. If you decide to be in the study, you will be given a copy of this consent form for your records.

Your signature below indicates that you have decided to volunteer as a research participant for this study and that you have read and understood the information provided above.

If you have questions or need clarification about the study, please do not hesitate to call or email the principal investigator through:
Mobile: +252 634417229; email: hassan.ajama@gmail.com

## Part B: Consent of Subject

I have read or have had read to me the description of the research study. The investigator or his/her representative has explained the study to me and has answered all of the questions I have at this time. I have been told of the potential risks, discomforts and side effects as well as the possible benefits (if any) of the study. I freely volunteer to take part in this study.

| _____ | _____ |
|---|---|
| The participant's signature of subject/thumbprint (Witness to print if the subject is unable to write | Date & Time |

| _____ | _____ | _____ |
|---|---|---|
| Printed name of Investigator | Signature of Investigator | Date & Time |

## Appendix 4: Data Collection Form

Name of the school: _____

School ID Number:_____

Study Number:_____

Date:_____

School provider: Government 1:_____ Private2 :_____

Code of the child:_____

Age of the child:_____years: Sex of the child: Male_____Female :_____

Class (Grade):_____ Using Spectacles: Yes:_____
No:_____

**Results from Eye Examination**

| **Visual Acuity Results (Tick Appropriate column)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 20/20 | 20/30 | 20/40 | 20/50 | 20/70 | 20/100 | 20/150 | 20/200 | >20/200 |
| | | | | | | | | |

**Reasons for reduced vision (if any):**

1. Refractive Error 2. Corneal Problem 3. Lens 4. Glaucoma 5. Retina 6. Macula

7. Amblyopia

**Prescription for Opticians**:

| **Eye** | **Spherical** | **Cylindrical** | **Axis** | **IPD** |
|---|---|---|---|---|
| RE | | | | |
| LE | | | | |

**Diagnosis of Type of refractive Error**

1. Myopia 2. Hypermetropia 3. Astigmatism 4. Emetropia 5. Others 6 No Refractive Error

## Appendix 5: Referral Form

The child did not pass the test:

Name of the child:

_____

Age: _____

Name of the school: _____

Name of the teacher/class: _____

Parent name: _____

Address: _____

Telephone number: _____

Date of school screening test (dd/mm/yy): _____

Referred to: _____

Follow-up: _____

Referred by:

Name:_____

Title:_____

Signature:_____

**Appendix 6: Questionnaire for Parents/Guardians**

1. Age: _____
2. Sex: _____
3. Level of Education: _____
4. Occupation of the Father: _____Occupation of the Mother: _____
5. Occupation of the Guardian: _____
6. Household Income: _____

   Do parents use spectacles? Yes ☐ No ☐

7. If yes, who uses? Father Only ☐ Mother Only ☐ Both ☐
8. If yes, for what purpose?
   a) Can't see short distances or short objects e.g. when reading books ☐
   b) Can't see long distance or far objects e.g. when walking, driving, etc. ☐
   c) Can't see short and long distances ☐
9. Does the child's siblings use spectacles? Yes ☐ No ☐
10. If yes, for what purpose?
    a) Can't see short distances or short objects e.g. when reading books ☐
    b) Can't see long distance or far objects e.g. when walking, driving, etc. ☐
    c) Can't see short and long distances ☐
11. How long does your child spend his/her time in the following activities on average?
    a) Reading books after school: _____Hours per day?
    b) Playing computer/mobile games in a day: _____Hours per day?
    c) Playing sports outside the house: _____Hours per day?
12. Is there a TV at home? Yes ☐ No ☐
    a) How long does your child watch the TV on average? _____Hours per day

13. Please list down the types of vegetables the child eats and how often

| No. | Types of vegetables | How often |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# ANNEXES:

## Annex 1: Translated Appendixes

**Warqada 1aad: Oglaanshaha Waalidka ama qofka ka masuulka ilmaha (Appendix 1: Permission Letter to the Parents/Guardians the of child)**

Taariikhda:_____

Sumada Ilmaha:_____Fasalka uu ku jiro (Grade):_____ fasalka #:_____

Ku:_____(Magaca waalidka/Masuulka)

Ciwaanka:_____ Telefoonka:_____

**Ujeedo: In aad ogolaansho ii siiso ilmahaaga in laga qaado tijaabo dhinaca araga ah (Magaca Dugsiga)**

**Hordhac**

Aniga oo ah, Xasan Cabdi Jaamac, kana diyaarinaya shahaadada heerka labaad (Master) Jaamacada Moi oo ku taalla magaalada Nayroobi ee dalka Kiiniya. Waxaa aan daraasad ka diyarinayaa xaalada araga ee carruurta wax ka barata dugsiyada ku yaala magaalada Berbera. Si loo ogaado tirada carruurta qabta araga gaaban iyo waxyaabaha kale saameeya iyadoo oo qayb ka ah waxbarashadayda heerka 2aad (Master) ee jamacadeed.

Waxa inta badan la arka in tiro badan oo carruur ah ay leeyihiin araga gaaban isla markaana ayna wax ka arag sabuuradda marka ay fadhiyaan fasalada. Carruurta caynkan ah waxa ku adkaata in ay si fiican u gutaan waxbarashadooda iyada oo ay sababto dhibaatada ka haysata dhinaca araga. Carruur badan ama waalidkooduba waxa laga yaaba in aanay ogayn dhibaatadan xaaladan keenaysa. Xaaladan aragtida gaaban waa mid si fudud loo sixi karo iyada oo carruurta loo xidhi karo muraayad kordhiya araga gaban.

Magaalada Berbera, kama hayno xog dhab ah in ay le'eg tahay baaxada dhibaatadu. Kadib, marka baadhitaan lagu sameeyo tiro ka mid ah ardayda dhigata dugsiyada taas oo qayb ka ah daraasadan, waxa ka soo bixi doona in lagu ogaado inta ay le'eg tahay baaxada dhibaatadu. Tani waxa ay ka caawinaysaa in dawlada in ay qorshaha ku darsato adeegyada carruurta araga gaaban qabta ee dugsiyada dhigata.

**Ujeedadda daraasadan:** ujeedada daraasadani waa in la ogaado inta ay le'eg tahay baaxada araga gaaban ee ardayda wax ka barata dugsiyada Berbera iyo waxyaabaha sababi kara.

**Qaabka loo sameeynayo daraasadan:**

- Sax naanta araga ilmaha waxa lagu cabirayaa warqad ay ku sawiran yihiin xarfo and qalabka logu eego indhaha si loo xaqiijiyo heerka ay gaadhsiisan tahay arag gaabnida ilmuhu.
- Adiga, waalid ahaan ama masuulka ilmaha, waxaa lagu waydiin doonaa su'aalo si loo ogaado waxyaabaha saamaynaya aragtida gaaban ee ilmaha
- Waalid ahaan ama masuulka ilmaha, waxa lagu siin doona natiijada ku saabsan badhitaanka ilmaga lagu sameeyey si loogu helo muraayado ku habboon.

**Faa'iidada ku jirta:** Badhitaanka lagu samaynayo ilmaha uma keenayso wax dhibaato ah. Badhitaanka waxa lagu ogaanayaa uun in ilmuhu wax dhibaato ah ka qabo dhinaca araga gaaban. Haddii, ilmahaga lagu arko wax dhibaato ah oo dhinaca araga khuseeya waa lagula socodsiinayaa isla markaana waxa lagu siin qoraal ku saabsan waxyaabaha ku haboon ee loo qaban karo ilmahaaga iyo in lagula xidhiidhiyo xarunta caafimaad/cisbitaal ee wax kala qaban karta arintan.

**Ilaalinta xogta:** xogta ka soo baxda baadhitaanka ilmahaaga waa mid qarsoodi ah cid kalena lala wadaagi maayo oo ka baxsan daraasadan. Magacaaga iyo ka ilmahagaba marnaba lagu soo bandhigi maayo natiijadda ka soo baxda daraasadan.

**Xuquuqda aad u leedahay in aad diido ama kaga ka baxdo daraasadan:** in uu ilmahaagu ka qayb qaato daraasadan waa mid ikhtiyaari ah, waxana laga saari karaa marka la doono inta ay socoto darasadani kadib intii lagu heshiiyey in uu ka qayb qaato daraasadan. Ilmahaagu waxa uu xaq u leeyahay in uu diido wax kasta oo aanu jeclaysan inta ay socoto baadhistiisu. Hadii aad qabto wax su'aal ah xilli kasta waa aad nala socodsiin kartaa.

Haddii aad su'aal qabto ama aad u baahato macluumaad dheeraad ah oo ku saabsan daraasadan, waxa aad igala soo xidhiidhi karta telefoonka: +252 634417229; ama email: hassan.ajama@gmail.com

Sidaas darteed, waxaa aan si xushmad iyo Sharaf leh kaaga codsanayaa in aad ii ogolaato in baadhitaan lagu sameeyo araga ilmahaaga oo ah waajibaad ku saran. Haddii aad ogoshahay, fadlan saxeex oo Suulka saar halka hoose ee warqadan.

Waan kuu mahad celinayaa,

Xasan Cabdi Jaamac
Cilmibaadhaha----------

==========

**Weedha ogolaashaha waalidka ama masuulka ilmaha**

Waxa aan akhriyey ama la ii akhriyey macluumaadka ku saabsan daraasadan. Cilmibaadhaha ama wakiilkiisu waxa uu ii sharaxay daraasadan igana jawaabay wixii aan su'aalo ka qabay wakhtigan. Waxa la i fahansiiyey khataraha ku xeeran inta ay leeg yihiin iyo waxyaabaha ka iman kara iyo faa'iidadaa ay leedahayba amaba khatarta ku jirta (haddii ay jirto) daraasadani. Sidaas darteed aniga oo ah waalidka ama masuulka ilmaha magaciisu hoos ku xusan yahay, waxa aan halkan ku cadaynayaa in aan ogolaansho buuxda kuu siiyey in uu ilmahaygu si buuxda uga qab qaato daraasadan.

Sumada waalidka/masuulka:_____

Saxeexa/Suulka waalidka/masuulka:_____

Taariikhda:_____

**Warqadda 2aad: Ogolaanshaha Carruurta (Appendix 2: Assent Form for the Children)**

Ku: _____

Anigoo ah Xasan Cabdi Jaamac, ahna arday dhigta jaamacada Moi, kana barta cilmiga caafimaadka bulshada ee shahaada labaad; waxaa layga rabaa inaan diyaariyo cilmi baadhis ama daraasad ka mid ah aqoonta jaamacadda lagu barto isla markaana arday walba waajibka ku aha inuu sameeyo. Ujeedada daraasadan waa inaan wax ka ogaano heerka araga gaaban ee carruurta dhigata dugsiyada hoose ee Berbera.

Dugsigiina ayuu na siibku ku dhacay markii la kala dooranayey dugsiyada daraasaddan laga sameynayo. Sidaa darteed, waxaa lagu marti gelinayaa inaad ka qayb qaadato daraasadan adigoo noo ogolaanaya inaan cabirno heer aragga indhahaaga.

Haddii aad wax uun saluugto inta cabiridu socoto, waxaad xaq u leedahay inaad ka baxdo oo waayo waxba laguuma raacayo ama lagugu ma samaynayo. Cabirista ama baadhitaanka waxaa samaynaya dad takhasus u leh ama dhakhaatiir u tababaran hawsha. Xogta cidkale loo gudbin maayo. Cilmi baadhistan uunbaa loo isticmaalayaa xogta ee wax kale looma isticmaalayo.

In kasta oo laga yaabo inaadan toos wax uga faa'iidin ka qayb galka daraasadan, hadana xogta halkan ka soo baxda wax weyn ayey ka taraysaa aqoonta loo leeyahay arrinta.

Kalkaaliyaasha cilmi baadhuhu waxan ku xafidayaan dhammaan warbixinta kabadh qufulan. Cilmi baadhaha iyo kalkaaliyaashiisa uun baa fahmi kara cidda xogta iska leh.

Haddii aa dareento in daraasadani dhib kuu geysatay fadlan soo garaac Xasan Cabdi Jaamac oo telefoonkiisu yahay: +252 63 4417229 ama emailkiisa hassan.ajama@gmail.com

Saxeexidda warqaddan waxay ka dhigan tahay inaad fahamtay macluumaadka daraasaddan isla markaana aad aqbashay ka qayn galka daraasaddan. Ka qayb galka daraasadani waa ikhtiyaari markasta oo aad doonatana waad ka bixi kartaa.

…… …… …….

Sumada ka qayb galaha Saxeexa/suulka Taariikhda iyo wakhtiga

…… ……... …….

Magaca Cilmi baadhaha Saxeexa Taariikhda

**Warqadda 3aad: Warqadda ogolaanshaha waalidka/masuulka ilmaha** (**Appendix 3:** Informed Consent Form for Parent/Guardians or Caregiver of the Child)

**Cinwaanka Cilmi baadhista:** Heerka Arag-dhinaanta ee carruurta dhigata dugsiya hoose ee Berbera (**Study Title:** Prevalence of Myopia and Associated Factors among Primary School Children in Berbera City, Somaliland)

**Magaca cilmi baadhaha (Name of Principal Investigator(s):** Hassan Abdi Jama

**Qaybta 1aad: Warbixin** (Part A: Information Sheet)

**Hordhac (Introduction):**

Anigoo ah Xasan Cabdi Jaamac, waxaan ku jiraa jaamacadda Moi ee Nayroobi halkaas oo aan ka dhigto caafimaadka bulshada gaar ahaan shahaada mastarka. Waxaan cilmi baadhis ku samaynayaa heerka aragtida indhaha ee carruurta dhigata dugsiyada hoose ee magaaladda Berbera. Cilmi baadhistan waxaan ku ogaan doonaa heerka arag-dhinaanta ee carruurta iyo waxyaabaha ka qayb qaata. Cilmi baadhistani waa qayb ka mid ah waxbarashadayda jaamadda ee shahaadada labaad (Master degree).

**Ujeedad Cilmi baadhista:** Ujeedada cilmi baadhistani waa in aan ogaano heerka arag-dhinnaanta carruurta dhigata dugsiyada magaaladda Berbera iyo waxyaabaha ka qayb qaata ama sababi kara.

Waxaan si nasiiba laguugu doortay inaad ka qayb gasho cilmi baadhistan. Sidaa darteed, waxaanu doonaynaa inaan ku weydiino su'aalo ku saabsan waxyaabaha sababi kara heerka aragti dhinaanta carruurta kaasoo laga yaabo in ilmahaagu qabo ama aanu qabin. Ka qayb galka cilmi baadhistan waa mutadawacnimo sidaa darteed wax lacag ah laguma bixinayo.

Waxaad xaq u leedahay inaad iska diido haddii aanad rabin inaad ka qayb qaadato. Waxaa kale oo aad xaq u leedahay inaad su'aalo na weydiiso oo aanu kaaga jawaabo.

Waraysigu wuxuu soconayaa ilaa 30 daqiiqo. Wax dhib ah ma keenayso cilmi baadhistani.

Ka qayb galka cilmi baadhistani waxay waxtar weyn u leedahay in la abuuro sharciyo iyo siyaasad laga hortagayo indho la'aanta carruurta. In la baadho heerka aragtida carruurtu waa wax ka mid ah barnaamijyada caafimaadka carruurta si wax looga qabto ka hor intaan aragtida carruurtu lumin ama aanay indho darrayn waxbarashadooduna hoos u dhicin.

Warbixintaada cidkale looma gudbin doono cilmi baadhistan waxaan ahayna loo isticmaali maayo.

Fadlan si taxadir leh u akhri oo weydii haddii aad su'aalo ka qabto. Haddii aad ogolaato inaad ka qayb gasho, lifaaq ka mid ah warqadan ayaa lagu siin doonaa si aad u xafidato ogolaansha haagan.

Saxeexaaga hoos ku xusani wuxuu caddeynayaa inaad si mutadawacnimo ah aad uga qayb qaadanayso cilmi baadhistan isla markaana aad si fiican u akhriday oo aad u fahamtay warbixinta kor ku xusan.

Haddii aad su'aalo qabto, fadlan naga la soo hadal telefoonkan ama emailka:

Mobile: +252 634417229; email: hassan.ajama@gmail.com

**Qaybta 2aad: Ogolaanshaha (Part B: Consent of Subject)**

Waan akhriyey/waa lay akhriyey xogta ku saabsan cilmi baadhistan. Cilmi baadhaha iyo caawiyaashiisu waxay si fiican ugu balbalaadhiyeen ujeedada cilmi baadhistan iyo wixii su'aalo aan qabayba. Sharaxaad ayaa layga siiyey dhib iyo dheef wixii ku jira cilmi baadhistan. Sidaa darteed, waxaan si mutadawacnimo leh ku aqbalay inaan ka qayb qaato cilmi baadhistan.

| _____ | _____ | _____ |
|---|---|---|
| Sumada ka qayb qaataha (cidda u saxeexday haddii ka qayb qaatuhu wax qori Karin) | Saxeexa/suulka | Taariikh & wakhtiga |

| _____ | _____ | _____ |
|---|---|---|
| Magaca cilmi baadhaha | Saxeexa cilmi baadhaha | Taariikh & wakhtiga |

**Warqadda 6aad: Su'aal sidaha waalidka iyo masuulka ilmaha (Appendix 6: Questionnaire for Parents/Guardians)**

14. Da'da (Age): _____
15. Jinsiga (Sex):_____
16. Heerka Waxbarasho (Level of Education):_____
17. Shaqada Aabaha (Occupation of the Father):_____Shaqada hooyada (Occupation of the Mother):_____Shaqada masuulka ilmaha (Occupation of the Guardian):_____

18. Dakhliga qoyska (Household Income):_____

19. Waalidku miyuu isticmaal muraayad?
    (Does parents use spectacles?) Haa (Yes) ☐ Maya (No) ☐

20. Haddii ay haa tahay, yaa istimaala? (If yes, who uses?)
    Aabaha oo kaliya (Father Only) ☐ Hooyada oo kaliya (Mother only) ☐
    Labadaba (Both) ☐
21. Haddii ay haa tahay, waa maxay sababtu? If yes, for what purpose?
    d) Ma arki karo/karaan waxyaabaha dhow sida akhriska buugaagta (Can't see short distances or short objects e.g. when reading books) ☐

    e) Ma arki karo/karaan waxyaabaha fog-fog sida socodka, ka baabuur ka xaynta, iwm.
    (Can't see long distance or far objects e.g. when walking, driving, etc.) ☐

    f) Ma arki karo/karaan waxyaabaha dhow iyo kuwa fogba ☐
    (Can't see short and long distances)

22. Ilmaha walaaladii miyey isticmaalaan muraayad?
    (Does the child's siblings use spectacles?) Haa (Yes) ☐ Maya (No) ☐

23. Haddii ay haa tahay, waa maxay sababtu? (If yes, for what purpose?)
    a) Ma arki karo/karaan waxyaabaha dhow sida akhriska buugaagta (Can't see short distances or short objects e.g. when reading books) ☐

b) Ma arki karo/karaan waxyaabaha fog-fog sida socodka, ka baabuur ka xaynta, iwm.
(Can't see long distance or far objects e.g. when walking, driving, etc.) ☐

c) Ma arki karo/karaan waxyaabaha dhow iyo kuwa fogba ☐
(Can't see short and long distances)

24. Imisa saacadood ayuu ilmahaagu ku qaataa cel-celis ahaan arrimahan soo socda: (How long does your child spend his/her time in the following activities on average):

d) Akhrinta buugaagta dugsiga ka dib:_____saacadoo maalintii ?
(Reading books after school:_____Hours per day?)

e) Ku ciyaarista ciyaaraha ku jira kubuyuutarka ama mobaylka:_____saacadood maalintii?
( Playing computer/mobile games in a day:_____Hours per day?)

f) Ku ciyaarista guriga debediisa:_____saacadood maalintii?
(Playing sports outside the house:_____Hours per day?)

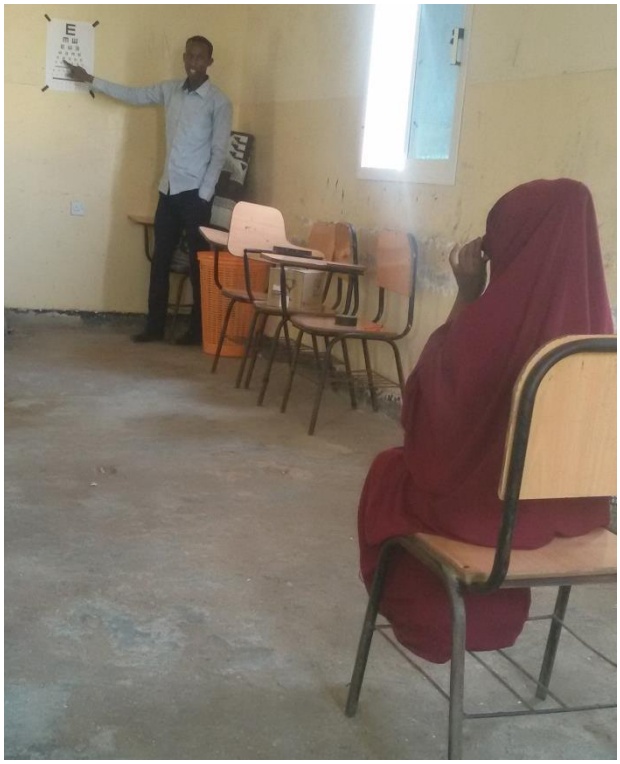
25. Guriga TV ma yaalaa? (Is there a TV at home? Haa (Yes) ☐ Maya (No) ☐

b) Imisa saacadood ayuu ilmahaagu daawadaa TV-ga maalintii?:_____saacadood maalintii?
(How long does your child watch the TV on average?:_____Hours per day)

26. Fadlan ku qor noocyada khudaareed ee uu cuno ilmahaagu iyo inta jeer ee uu cuno (Please list down the types of vegetables the child eats and how often)

| No. | Noocyada Khudradda (Types of vegetables) | Inta jeer (How often) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

**Annex 2: Photos**



## Annex 3: Ethical Approvals

**INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)**

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2016/227
***Approval Number: 0001842***

30th March, 2017

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
30 MAR 2017
APPROVED
P. O. Box 4606-30100 ELDORET

Hassan Abdi Jama,
Moi University,
School of Public Health,
P.O. Box 4606-30100,
**ELDORET-KENYA.**

Dear Mr. Jama,

**RE: FORMAL APPROVAL**

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

***"Prevalence of Myopia and Associated Factors among Primary School Children in Berbera City, Somaliland".***

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 1842*** on 30th March, 2017. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 29th March, 2018. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

**PROF. E. WERE**
**CHAIRMAN**
**INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE**

cc CEO - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD

Republic of Somaliland | Jamhuuriyada Somaliland

**Ministry of Health** | **Wasaaradda Caafimaadka**

وزارة الصحة المدير العام

Director General

Ref: MoH/DG 3961 4 1 2017 Date: 13/04/2017

To: Hassan Abdi Jama

Subject: **Letter of Permission to Conduct Research in Primary Schools in Berbera**

After reviewing the proposed study, titled **"Prevalence of Myopia (short sightedness) and Associated Factors among Primary School Children in Berbera City, Somaliland"**, yourrequest letter dated on 10th April 2017 and the attached data collection tools. presented by Hassan Abdi Jama, from Moi University,Ministry of Health of Somaliland is granting permission for the study to be conducted at Primary Schools in Berbera.

You are expected to collaborate with the Regional Officers in Berbera to provide you necessary information and the support that you may require during the data collection.

Best Regard

Dr. Faisa H Ahmed Ibrahim
Acting Director General of MoH

Tel. +252 2 523368 Email: mohsomaliland@gmail.com

JAMHUURIYADDA SOMALILAND
WASAARADDA WAXBARASHADA
& TACLIINTA SARE

REPUBLIC OF SOMALILAND
MINISTRY OF EDUCATION
& HIGHER EDUCATION

Director General

Tell: Land 528140, 304063, Mobile: 4420140 Email: dg.moe@hotmail.com

JSL W/WAXBARASHADA
Received 16/4/2017
Protocol 003945
W.X.DHEGGA

Ref: MoE/DG/04/01/17 Date:16/04/2017

**To: Hassan Abdi Jama**

**Cc: Regional Education Officer in Sahil Region, Berbera**

**Cc: Primary Schools Principals in Berbera**

Ref: **Permission letter to undertake research in Primary Schools in Berbera**

The purpose of this letter is to inform you that MEO and HE has given Hassan Abdi Jama (Principal Investigator) a permission to conduct the research titled **"Prevalence of Myopia (short sightedness) and Associated Factors among Primary School Children in Berbera City, Somaliland".**This permission is based on Investigator's request letter dated on 10th April 2017 and other annexed research documents. Upon completion of the study, the Ministry of Education and Higher Education expects to share results of the study.

Finally, please ensure that all ethical considerations related to this research fully observed throughout the study process.

Thank you very much and good luck.

**Regards**

**Abdi Ali H. Jama**
**Director General**
**Ministry of Education & Higher Education**

MINISTRY OF EDUCATION
REPUBLIC OF SOMALILAND