THE PREVALENCE OF REFRACTIVE ERRORS, VISUAL IMPAIRMENT AND SPECTACLE UPTAKE AMONG PAEDIATRIC PATIENTS IN ABUJA, NIGERIA

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DECLARATION

I hereby declare that the work contained in this mini-thesis is original. This body of work was conceptualized and executed by me with assistance and guidance from my supervisor. It has neither been submitted to any university for the award of a degree nor submitted elsewhere for publication.

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DR. BITTO, SEWUESE

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Background: Uncorrected refractive errors can lead to severe visual impairment and blindness. There is a worldwide prevalence of visual impairment from uncorrected refractive errors in children of 0.97%. In children, loss of education and vocational chances can ensue, negatively impacting their quality of life despite the remedy with spectacle correction, as barriers do exist.

Aim: This research aimed to determine the prevalence of refractive errors and visual impairment, spectacle uptake and reasons for spectacle refusal among paediatric patients attending a public-private partnership hospital in Abuja, Nigeria.

Methodology: This was a cross-sectional descriptive retrospective study carried out at the eye clinic of a tertiary hospital in Abuja; among children aged 3 to 17 who attended the clinic between January 2015 and December 2019. This study used a systematic random sampling method to select the potential study participants based on inclusion, exclusion and strict case definition criteria following sample size calculation. Data from the electronic medical records of the study participants was extracted into a data extraction sheet and analyzed to assess the set variables. SPSS software, version 20, was used for the analysis.

Results: A total of 348 paediatric medical records were reviewed in this study, 142 (40.8%) males and 206 (59.8%) females, with a mean age of 11.28 (SD = 3.47). The prevalence of refractive errors and visual impairment was 38.8%. The spectacle uptake rate was 79.3%, while, barriers to uptake included cost constraints, cultural and religious reasons. There was a statistically significant association between grade of refractive errors and previous spectacle use in patients, spectacle use in parents and visual impairment. A prior history of spectacle use was associated with 4.54 times greater odds (OR, 4.54; 95% CI, 1.44-14.30) of moderate refractive error and 5.64 times greater odds (OR, 5.64; 95% CI, 0.78-40.73) of severe refractive error.

Conclusion: Uncorrected refractive errors are still a common cause of visual impairment among children from this study. Poor spectacle uptake can worsen the burden of refractive errors in children.

***Recommendations*:** Full insurance coverage for children to include spectacles under the National Health Insurance Act; and strengthening of the school eye health system for efficient identification of children in need of ophthalmic care.

CHAPTER ONE: INTRODUCTION

Refractive errors refer to the inability of the eye to form clear images of an object on the retina (WHO, 2004). They consist of myopia, hypermetropia and astigmatism as the main types; and are easy to assess, quantify and correct with optical devices, of which spectacles are the commonest (Resnikoff, Pascolini, Mariotti and Pokharel, 2008). Globally, uncorrected refractive errors are the commonest cause of moderate to severe visual impairment, estimated to affect 123.7 million people (WHO, 2019). Among school-aged children in Africa, uncorrected refractive errors were the leading cause of disability (Wedner, Masanja, Bowman, Todd and Gilbert, 2008, as cited in Megbelayin, 2013).

Visual impairment refers to presenting visual acuity in the better eye of less than 20/40 – 20/400 (less than 6/12 – 3/60) (WHO, 2004). It can be grouped into mild, moderate and severe visual impairment. Globally, avertable visual impairment can be seen in about 1 billion people out of 2.2 billion who have vision impairment or blindness as of 2019 (WHO, 2019). According to the Nigerian National Blindness and Visual Impairment Survey, uncorrected refractive errors were the highest cause of mild and moderate visual impairment (77.9% and 57.1%, respectively) and responsible for visual impairment in 2.46 million adults in Nigeria (Kyari et al., 2009).

Globally, 19 million children below the age of 15 are visually impaired. About 12 million of these visually impaired children are secondary to uncorrected refractive errors (Pascolini and Mariotti, 2012). Among children presenting to the hospital, refractive errors are one of the common eye diseases as reported by various studies (Oladigbolu, Abah, Chinda and Anyebe, 2012; Opubiri, Adio and Emmanuel, 2013; Isawumi, Agboola and Ayegoro, 2016; Felix, 2017; Olusanya, Ugalahi, Ogunleye and Baiyeroju, 2019). Olusanya et al. (2019) reported that a third of the children presenting to the eye clinic had refractive errors, with myopia as the most typical conducted in a government tertiary hospital.

PROBLEM STATEMENT

Ophthalmological services at this hospital in Abuja were incorporated fully as a major health care service delivered to patients in 2015, since its commencement in 2007 as the first public-private partnership (PPP) health facility in Nigeria (Wada, 2019). As a medical service delivered through private funding with government infrastructure, the services are readily available compared to pure government health facilities (Wada, 2019). This intended review of optical services among children over a five year period from the commencement of ophthalmic services with a view of determining the prevalence of refractive errors and visual impairment among these children will benefit ophthalmological auditing services and serve as a template under the PPP scheme to plan eye care services for children. No study yet exists describing this, as no other Consultant Ophthalmologist has covered this clinic since the inception of ophthalmic service delivery. Particularly, in the wake of the COVID-19 pandemic, considering the reduced hospital attendance and recurrent civil restrictions imposed by the government within communities, this study was appropriate.Nigerians, on average, prefer to access public health facilities as the only choice because private health facilities, on the contrary, are pricier comparatively, further widening the disparities in access to quality healthcare (FMOH, [Nigeria], 2016). This disparity is what the PPP framework in healthcare service delivery sought to address, thereby improving access to quality healthcare at an affordable cost (Wada, 2019). There is a paucity of studies that reflect the impact of eye care service delivery, the burden of refractive errors and spectacle uptake among paediatric patients attending PPP health facilities in Nigeria.

RATIONALE

Prior to the concession of this hospital, there was no ophthalmological service available to residents of the Federal Capital Territory (FCT) from this health facility. Ophthalmological services commenced in 2015 for adults as well as paediatric patients. The outcome of this study will assist eye care professionals in appropriate counselling before offering spectacle correction to children and in paediatric ophthalmic care planning. Moreover, it will guide policy advocacy regarding school eye health and strengthen the need for more standard paediatric ophthalmic units within the FCT. The results of this proposed study will be presented to the Federal Capital Territory Authority, the Infrastructural Concession Regulatory Commission of Nigeria and the Federal Ministry of Health to enable these bodies to understand the need for policy advocacy and

implementation in relation to reducing visual impairment from refractive errors in paediatric patients.

AIMS AND OBJECTIVES

STUDY AIM:

To determine the prevalence of refractive errors and visual impairment, spectacle uptake, and reasons for refusal of spectacles among paediatric patients attending a public-private partnership hospital in Abuja.

STUDY OBJECTIVES:

1. To determine the prevalence of refractive errors among paediatric patients.
2. To determine the prevalence of visual impairment among paediatric patients.
3. To determine the spectacle uptake rate.
4. To assess the possible reasons for refusal of spectacle uptake among parents or caregivers of paediatric patients.
5. To determine the factors associated with refractive errors among these paediatric patients.

OUTLINE OF CHAPTERS

Chapter one commences with an introduction to the study title, followed by the problem statement, study rationale, study aim and objectives, and concludes with the outline of the chapters.

Chapter two expounds on relevant published literature related to this study.

Chapter three outlines the methodology - highlighting the study setting, design, population and sampling, data collection and analysis, validity and reliability, and ethical considerations.

Chapter four presents the results of this study.

Chapter five discusses the findings of this study in relation to relevant previous studies.

Chapter six comprises the study conclusion and proposed recommendations.

CHAPTER TWO: LITERATURE REVIEW

This chapter elucidates the global burden of uncorrected refractive errors in children and the burden of uncorrected refractive errors and visual impairment among children in Nigeria. Furthermore, it highlights the factors affecting the utilization of paediatric eye care services in relation to spectacle uptake and barriers. Considering that children primarily depend on caregivers for their eye health care, mention is made about the knowledge, attitude and practices of caregivers, which may negatively impact paediatric eye care accessibility.

GLOBAL PREVALENCE OF UNCORRECTED REFRACTIVE ERRORS

Refractive errors, if left uncorrected or not fully corrected, can lead to severe visual impairment, low vision and blindness in some cases (Resnikoff, Pascolini, Mariotti and Pokharel, 2008). In children, as well as adults, the consequences of visual impairment from uncorrected refractive errors range from lack or loss of education and vocational chances; to lost purchasing power for individuals and communities; to diminished quality of life (Resnikoff et al., 2008). In 2004, the global prevalence of children aged 5 – 15 who were visually impaired from uncorrected refractive errors was 0.97% accounting for 12.8 million children in 2004 data from the World Health Organization (Resnikoff et al., 2008). Of this data, only Mali, Mauritania and South Africa among African countries met the incision criteria constituting a prevalence of visually impaired children from uncorrected refractive errors of 0.24% (Resnikoff et al., 2008). In 2012, Pascolini and Mariotti of the World Health Organization reported that an estimated 19 million children are visually impaired, and approximately 1.44 million children are blind. Burton et al. (2021) projected that 22.16 million children aged 0 - 14 have moderate to severe visual impairment, and; 46.60 million children have mild visual impairment globally. This increasing burden of visual impairment is worrisome, considering that shorter life spans and longer disability years are consequences of childhood visual impairment and blindness (Pascolini and Mariotti, 2012). The leading causes of moderate to severe visual impairment and blindness in children include uncorrected refractive errors, cataracts, retinopathy of prematurity, congenital ocular anomalies, corneal scarring, and cerebral visual impairment (Burton et al., 2021). A more significant proportion of this burden of visually impaired and blind children live in low-income countries, aggravated by rural communities, migration and children living with some types of disabilities (WHO, 2019). This is evidenced by over 90% of blind and moderately to severely visually

impaired people residing in low and middle-income countries (Pascolini and Mariotti, 2012). Children with severe visual impairment and blindness in low- and middle-income countries are five times less likely to get formally educated by the Lancet Global Health Commission (Burton et al., 2021). With marked differences across the regions of the world, high-income North America has the lowest prevalence of blindness (0.12%, 0.11-0.14), while; Western sub-Saharan Africa has the highest prevalence of (1.11%, 0.95-1.26) (Burton et al., 2021). In a systematic review by Hashemi, and colleagues (2018), the estimated prevalence of myopia, hypermetropia, and astigmatism was 11.7% (95% CI: 10.5 – 13.0), 4.6% (95% CI: 3.9 – 5.2) and 14.9% (95% CI: 12.7 – 17.1) respectively, among participants 20 years and below following cycloplegic refraction.

UNCORRECTED REFRACTIVE ERROR AND VISUAL IMPAIRMENT BURDEN IN NIGERIA

There is no national data concerning visual impairment in children from uncorrected refractive errors. However, uncorrected refractive errors were the most typical cause of mild and moderate visual impairment (77.9% and 57.1%, respectively) among adults aged 40 and above, responsible for visual impairment in 2.46 million adults in Nigeria (Kyari et al., 2009). Furthermore, the prevalence of blindness in children aged 10 – 15 in Nigeria was 0.6% (Kyari et al., 2009). The scarcity of population-based data on visual impairment and blindness prevalence in children is mainly due to the uniqueness and technicalities involved in assessing visual acuity in children alluded to by Burton et al. (2021); hence, the reliance on data from school and hospital studies.

In South-Western Nigeria, among children aged 1 – 15 presenting to the eye clinic of the University College Hospital, Ibadan, refractive errors accounted for 34.6%, with a female preponderance and myopia at 23.3% being the most frequent type of refractive error (Olusanya et al., 2019). The majority of these children were between the ages of 11 and 15 years. A possible explanation the authors asserted is the increasing visual and academic demands of the secondary school system (Olusanya et al., 2019). Similarly, Opubiri et al. (2013) reported among children who attended a tertiary hospital in the South-South region of Nigeria, a prevalence of refractive errors of 22.5%, with myopia accounting for two-thirds of the refractive error cases (61.4%) and commoner in females compared to males.

Visual impairment among children with refractive errors presenting to a hospital in Osogbo (South-Western Nigeria) was captured by Isawunmi et al. (2016), where 20% had mild to moderate visual impairment while 0.4% presented with severe visual impairment. They submitted simple

myopic astigmatism as the refractive error, which occurred the most at 41.1%. Ekpenyong, Naidoo, Ndep, Akpan, and Ekanem (2020), in a large study of school children aged 6 – 17 in Cross River State, Nigeria, found refractive errors to be the most common cause (70.7%) of visual impairment among study participants. The main predictors of visual impairment in this study were age (older children, aged 12 – 17 years), high socio-economic status and female gender. In keeping with these findings, Isawunmi (2017) put forward that refractive errors ranked as the most frequent (22.9%) cause of visual impairment. Furthermore, 1.4% of children in a school study conducted in Osun State of Nigeria had moderate to severe visual impairment, as reported by Ajaiyeoba, Isawumi, Adeoye and Oluleye (2006).

SPECTACLE UPTAKE AND BARRIERS

It is noteworthy that 80% of visual impairment is avoidable through cost-effective strategies like spectacle wear for the deficit calculated, which is present in refractive errors (Pascolini and Mariotti, 2012). Other interventions for refractive errors include using optical contact lenses and keratorefractive surgeries, which are not as affordable and accessible as spectacles (WHO, 2019). Spectacles are comparatively cost-effective when considering the human capital training and level of technology required in contrast to contact lenses and surgical interventions (which are contraindicated in children due to the unstable nature of their refractive errors) in addressing uncorrected refractive errors. More so, to reduce the probability of failing a class in children by 44%, spectacles were found to be one of the most effective interventions reported by the Lancet Commission (Burton et al. 2021).

Spectacle uptake varies across populations with an array of determinants. In a large study of adolescents aged 12 – 18 in the United States of America, the spectacle uptake rate was 32.2% (95% CI: 29.5% - 35.0%) (Alex, James, Maya and Mante, 2007). The predictors of spectacle wear in this study were older age (15 – 18 years) and children of Caucasian descent (Alex et al., 2007). In China, among secondary school children aged 11 – 17, Congdon, Zheng, Sharma, Choi and Song (2008) reported a spectacle uptake rate of 26.4%; however, 17.9% of this group were not wearing their spectacles at the time of the examination. Older age (14 – 17 years), female gender and worse uncorrected visual acuity were all predictors for spectacle wear (Congdon et al., 2008). In a study in Swaziland conducted among parents of children who required spectacles, the

spectacle uptake rate was 50.3%, in contrast, to 24.8% of parents who disapproved of spectacles in their children or were unsure about it (Sukati, Moodley and Mashige, 2018). Having a first-degree relative who wore spectacles influenced the early presentation of the children at the eye clinics among these parents; however, not associated with spectacle use in the children (Sukati et al., 2018). In Nigeria, among secondary school students in Uyo (South-Southern Nigeria) aged 9 – 21, 5.2% had refractive errors, out of which only 9.8% were using spectacles (Megbelayin, 2013). The most highlighted reasons for not using spectacles among these students included no knowledge of refractive status (56.4%) and inability to afford spectacles (18.2%), as put forward by Megbelayin (2013).

Resnikoff et al. (2008:63); presented the barriers to optical service uptake worldwide to include: "lack of awareness and recognition of the problem at personal and family level, as well as at community and public health level; non-availability of and/or inability to afford refractive services for testing; insufficient provision of affordable corrective lenses; and cultural disincentives to compliance." Even when the spectacle cost was covered among school children in India, who got their spectacles free of charge, spectacle compliance was hampered by other barriers (Pavithra, Hamsa and Madhukumar, 2014). These barriers comprised; forgetfulness to use the spectacles (31.4%), lost spectacles (14.3%), damaged spectacles (11.4%), and parents' refusal (11.4%) (Pavithra et al., 2014). Predictors of compliance with spectacles among these school children aged 7 to 15; were younger children (7 to 9 years), children from urban schools and those whose fathers had a higher level of education (Pavithra et al., 2014).

FACTORS AFFECTING UTILIZATION OF PAEDIATRIC EYE CARE SERVICES IN AFRICAN COUNTRIES

Alrasheed (2021) reported in a systematic review of factors affecting the utilization of paediatric eye care services in African countries; that; unavailability, accessibility challenges, and cost constraints were barriers to eye care services uptake among children in Africa. He further highlighted from the systematic review that, despite the availability, accessibility and affordability of eye care facilities serving children in Africa, other barriers existed. These comprised; little or no knowledge among caregivers, poor understanding of the complications of eye diseases in the paediatric age group and unawareness of which health professional to consult with. Cost constraints are a major barrier to children accessing eye care in Africa (Alrasheed, 2021).

Affordability was a recurrent barrier to children utilizing eye care services across Africa, including; South Africa, Nigeria, Tanzania, Swaziland and Sudan, to mention a few countries (Alrasheed, 2021). Sukati et al. (2018) reported barriers to spectacle use and ocular surgery in children in Swaziland to include; unaffordability, fear of the outcome, damage to the eyes, and cultural and social inhibitions.

KNOWLEDGE OF PARENTS ABOUT EYE HEALTH

The knowledge, attitude and practices of the caregivers were highlighted by Alrasheed (2021) as barriers to the uptake of paediatric eye care services. Parents disapproved of spectacles use in these children, and they cited reasons such as spectacles may be harmful to the eyes among primary school pupils in Ilorin, Nigeria [Ayanniyi, Olatunji, Mahmoud and Ayanniyi (2010, as cited by Alrasheed, 2021)]; spectacles are not suited for children, but, for the aged among patients in South-West Nigeria [Isawumi, Ulaikere, Adejumo, Adebayo and Kekunnaya (2014, as cited by Alrasheed, 2021)]; and spectacles can lead to poorer vision among high school students in Sudan [Alrasheed, Naidoo and Clark (2018, as cited by Alrasheed, 2021)]. The eye health-seeking habits of parents in Swaziland for their children were highlighted by Sukati et al. (2018). The majority of these parents had taken their children for an eye check, of which 44.9% had spectacles prescribed. However, the parents' knowledge about spectacle wear in children was poor, revealed by 44.5% of these parents indicating that poor vision was not the precursor for wearing spectacles at an early age (Sukati et al., 2018). Alrasheed (2021) emphasized that there was generally poor knowledge about the advantage of spectacle use for uncorrected refractive errors in children across Africa, many times due to cultural myths, hence the need for eye health education and promotion.

CHAPTER THREE: METHODOLOGY

The following chapter describes in detail how this cross-sectional descriptive retrospective study (Setia, 2016) was conducted following ethical clearance and approval from the hospital's management.

STUDY SETTING

This study was carried out at the Eye Clinic, Department of Ophthalmology, of a PPP tertiary hospital in Abuja, the capital of the Federal Capital Territory (FCT), Nigeria, which commenced ophthalmic services in 2015.

The FCT is the country capital of the Federal Republic of Nigeria, located in the North Central region of the country right at the centre of Nigeria. Abuja is a highly urbanized city with an estimated population of 3.56 million people (NPC [Nigeria] & ICF International, 2014) majority of whom are from the Gbagi tribe. However, people of other ethnic groups reside in the state.

The residents of Abuja have access to eye health care at the Garki Hospital Abuja, the Federal Capital Territory Administration Hospitals, the National Hospital Abuja, the University of Abuja Teaching Hospital, which are all government hospitals and a couple of private and mission eye clinics.

The hospital where the study took place is located in Garki Area 8, a central location of Abuja, which has over 20 clinical departments with a 104-bed strength to serve the in-patients (Wada, 2019).

The Eye Clinic is one of the weekly consultative out-patient clinics; clinics run six days a week between Mondays and Saturdays with an average attendance of 20 new patients per day seen by two consultants, while an average of 30 patients is seen daily on a follow-up basis.

STUDY DESIGN

This was a cross-sectional descriptive retrospective study carried out between January and March; 2022. It was conducted to gain insight into optical services offered to children by this PPP tertiary hospital over five years after the commencement of these services; a cross-sectional descriptive retrospective study was best suited (Setia, 2016). It involved extracting medical information about

socio-demography, family ocular history, visual acuity for visual impairment, refractive errors, spectacle uptake and reasons for spectacle refusal among paediatric patients who attended the eye clinic; between January 2015 and December 2019. This is five years after the commencement of ophthalmological services at the eye clinic.

POPULATION AND SAMPLING

Study Population

The study was conducted on paediatric patients aged 3 - 17 who are post-verbal children who understand matching tests for visual acuity assessment (Elkington, Frank and Greaney, 1999) who attended the eye clinic.

The Inclusion Criteria included the following:

1. Children between the ages of 3 and 17 years seen at the eye clinic
2. Children who were seen at the facility between January 2015 and December 2019 (five years since the commencement of ophthalmic services)
3. Children presenting with difficulty in vision at any distance (any vision-related symptom).
4. Children who were seen for the first time at the clinic
5. Children presenting with visual acuity better than 3/60 in each eye (not blind in either eye)

Exclusion criteria included the following:

1. Children who presented at the facility following acute trauma (this is an ocular emergency, and refraction is not indicated)
2. Children who presented for surgery (refraction is not a pre-operative indication)
3. Children who presented with inflammatory or infective conditions (acute clinical presentations for which refraction is not indicated)

Sample Size and Sampling Strategy

The Leslie-Kish formula (Kish, 1965 in Israel, 1992) below for a single proportion was used to calculate the minimum sample size:

$$n = \frac{Z_{\alpha}^2 pq}{d^2}$$

Where n = the desired minimum sample size

Z_α = the standard normal deviation and was set at **1.96** and corresponded to the 95% confidence level.

p = the proportion in the target population estimated to have the particular characteristic.

For this study, p was obtained from (Olusanya et al., 2019) as 34.6% = **0.346**

q = 1-p (1 – 0.346 = **0.654**)

d = the level of precision desired (was set at 5% = **0.05** for this study)

n = 347.72

Therefore, the minimum sample size for this study was **348** participants, as calculated.

The systematic random sampling method was used to select a representative sample from the sample population.

A sampling frame (list) of all the paediatric patients seen within the five-year period who meet the inclusion and exclusion criteria was made, thus, giving the total number of paediatric patients eligible to participate in this study. The total number divided by 348 gave the sampling interval. However, for the sample to be representative of the population, a proportional allocation per year out of the total number to eventually arrive at 348 participants was done.

Example: Year 1 = $\frac{\text{Number seen in year 1}}{\text{Total number seen in the five years}} \times 384$

This continued for each subsequent year till a total of 348 participants across the five years was obtained.

DATA COLLECTION

Data Collection Procedure

All potential participants who met the inclusion criteria using the sampling technique were recruited from electronic medical records (the only form of medical records for all patients attending the eye clinic). Variables such as the age, sex, marital status of parents and prematurity status were entered first to define their demography. Then, the family ocular history was followed by the ocular examination of each eye. The visual acuity was measured using the Potec PLC8000 3m automated visual acuity chart. The anterior and posterior segment examination findings were imputed as well.

The refraction results were extracted guided by the following case definition:

Case definition:

- DS – Diopter sphere; DC – Diopter cylinder
- Myopia was defined as a spherical value of at least -0.50DS in either eye (WHO, 2000).
- Mild myopia -0.50DS to -3.00DS, Moderate > -3.00DS to -6.00DS, Severe > -6.00DS (WHO, 2004).
- Hypermetropia was defined as a spherical value of at least +2.00DS in either eye (WHO, 2000).
- Mild hypermetropia +2.00DS to +4.00DS, Moderate > +4.00DS to +6.00DS, Severe > +6.00DS (WHO, 2004).
- Astigmatism was defined as a cylinder of at least -0.75DC in either eye (WHO, 2000).
- Mild astigmatism -0.75DC to -3.00DC, Moderate > -3.00DC to -6.00DC, Severe > -6.00DC (WHO, 2004).
- Respondents with bilateral refractive errors were classified according to the more severe eye (WHO, 2000).
- Simple astigmatism was defined as the condition in which one of the two principal meridians of an eye was either myopic or hypermetropic (WHO, 2000).
- Compound astigmatism was defined as a condition where two meridians of an eye were either myopic or hypermetropic (WHO, 2000).
- Mixed astigmatism was defined as the condition in which one meridian was myopic; while the other meridian was hypermetropic (WHO, 2000).

It is important to note that all children 17 years and below had cycloplegic refraction on their first visit, in line with the protocol for managing children with suspected refractive errors at the eye clinic. Cycloplegic refraction involves relaxing the ciliary muscle, which paralyzes accommodation (because; children have a high amplitude of accommodation), thus, ensuring that their refractive power is captured totally (WHO, 2000). The relaxation (cycloplegia) was achieved by instilling an eye drop called cyclopentolate 1% into the conjunctival sac, used for all paediatric patients. Following cycloplegia, where we would have instilled cyclopentolate 1% every 10 mins for 30 minutes with the patient's eyes closed, we proceeded with streak retinoscopy using the

Welch Allyn Retinoscope to get objective results. These patients return after 48 hours for the subjective part of the test, where lenses are tried in the trial frame based on the objective result initially gotten; this then leads to the final subjective refractive result based on the patient's best corrected visual acuity. Whether spectacles were prescribed and accepted by the caregivers was noted. The reasons for refusal were extracted too. Data extraction was done until the entire period of five years was covered.

Data Extraction Sheet

The data collection questionnaire was a data extraction sheet (**Appendix I**) from which the information was extracted. This data extraction sheet contained all the variables of interest related to this study. The data collected included age; sex; parent's marital status; family ocular history of spectacles; presenting visual acuity in each eye; grade of visual impairment per eye; type, grade and axes of refractive errors; and spectacle uptake assessment. The data extraction sheet was pre-tested among ten paediatric medical records from 2020 (a year outside the study period) and found appropriate and efficient for data collection.

The critical outcome variable was "refractive error" because it was the focus and central theme (the dependent variable) of this study. To describe this variable, the refraction results, as detailed in the case definition above, were used as a guide. Refractive errors were grouped into myopia, hypermetropia or astigmatism for type and mild, moderate and severe for the grade based on the refraction result in quantifiable terms. Refractive errors belong to categorical, ordinal data involving more than two groups that can be ordered. Visual impairment as a variable was described by the presenting visual acuity and grouped into mild, moderate and severe visual impairment (Pascolini and Mariotti, 2012). Visual impairment belongs to categorical, ordinal data involving more than two groups that can be ordered.

The exposure variables included age, sex, parents' marital status, prematurity status, history of spectacle use in parents and visual impairment.

DATA ANALYSIS

The data collected was entered, cleaned and analyzed using IBM Statistical Programme for Social Sciences (SPSS) software, version 20. Frequencies and means were generated to observe the

distribution patterns of variables in the study. The Chi-square test and Fisher's Exact test were used to test for associations between ordinal variables where applicable. Bivariate analysis was conducted using cross-tabulations for the dependent variable (refractive error) against each independent variable. The independent variables included age, sex, parent's marital status, prematurity status, a history of spectacle use by a patient, history of spectacle use in parents, visual impairment and spectacle uptake. A p-value of less than 0.05 was considered significant.

VALIDITY AND RELIABILITY

Internal validity was improved by using electronic medical records (the only form of medical records used) instead of extracting medical information from paper medical records, which could be missing or not written down uniformly. The electronic medical records have specified areas for a complete biodata, ophthalmic history, ophthalmic examination, diagnosis, refraction results and treatment. Adherence to the strict inclusion, exclusion criteria, case definition and the sampling procedure was observed to ensure validity. The standard operating procedure for doing cycloplegic refraction with cyclopentolate 1% on all children 18 years old and below (Ozdemir, Tunay, Petricli, Acar and Erol, 2015) is the gold standard; throughout the period for suspected refractive errors within the eye clinic. In addition, we ensured that all participants of this study had cycloplegic refraction done to determine the presence of refractive errors.

To improve the reliability of this study, the refractions were carried out by two optometrists throughout the period. They had been trained and retrained to accurately get the end point of neutralization (an objective point where there is no more reflex movement within the pupil on streak retinoscopy) during each encounter with the Welch Allyn Retinoscope. All subjective refractions were done using the Potec PLC8000 3m automated visual acuity chart for visual acuity assessments. Cycloplegic retinoscopy was emphasized by Ozdemir and colleagues (2015) as superior to automated refraction (not involved in this study). All data extraction was done solely by the principal investigator, guided strictly by the case definition.

ETHICS CONSIDERATIONS

Ethical clearance was obtained from the Biomedical Science Research Ethics Committee of the University of the Western Cape (**Appendix II**) and the Federal Capital Territory Health Research

Ethics Committee (**Appendix III**). The management of the hospital in Abuja provided approval to conduct the study (**Appendix IV**).

Ethical principles elucidated by the World Medical Association (2013), which applied to this study, included:

1. Autonomy and respect – All the data was collected solely by the principal investigator. Patient medical records were not shared with a third party, and their identities were concealed by assigning numbers instead of using their names. Confidentiality was ensured throughout the research process, and the information was used to determine the set variables only.
2. Non-maleficence – There was a commitment to ensuring that all medical records reviewed during the study period were done with no negative effect on any patients. No alterations were made as well to the already documented medical records.

   Justice – All medical records were accorded the same attention to detail, mindful of extracting the necessary information from them.
3. Justice – All medical records were accorded the same attention to detail, mindful of extracting the necessary information from them.

Data Management: The research data was stored on google drive, as well as, on an external hard drive. The data extraction sheets are in the custody of the principal investigator and kept within a fireproof cabinet. Disposal of the data will be at least five years from the date of final publication by shredding physical data and permanently deleting digital data.

CHAPTER FOUR: RESULTS

The data collected was entered, cleaned and analyzed using IBM Statistical Programme for Social Sciences (SPSS) software, version 20. This chapter presents the results generated following the analysis.

SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

A total of 348 paediatric medical records were reviewed in this study. The mean age was 11.28±3.47 years. There were 142 (40.8%) males and 206 (59.2%) females with a male: female ratio of 1:1.5. The 8 – 12 years old age group had the highest number of participants at 165 (47.4%) paediatric patients, on the other hand, 52 (14.9%) paediatric patients constituted the 3 – 7 years old age group. Figure 1 shows the age and sex distribution of the studied population.

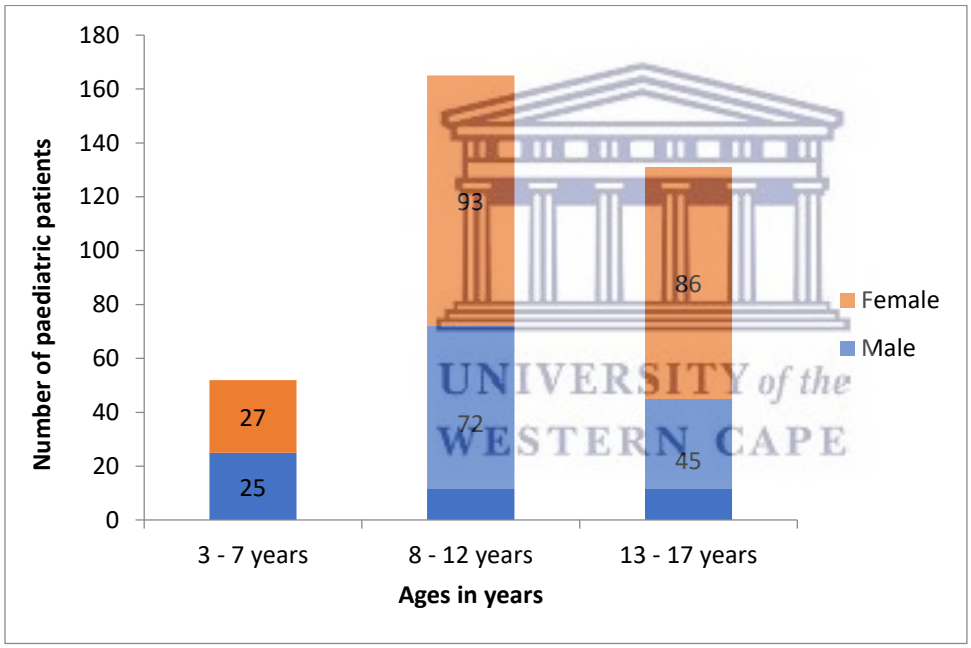

Figure 1: *Age and Sex Distribution of the Study Population.*

Marital Status of the Parents

The majority of the parents (91.1%) were predominantly married, while a few of the paediatric participants, 2.3% (n = 8), were orphaned, as shown in Table 1.

Table 1: Marital Status of Parents

Marital Status of Parent	Frequency (N)	Percentage (%)
Married	317	91.1
Single parent (Separated/Divorced)	23	6.6
Orphaned	8	2.3
Total	**348**	**100**

FAMILY OCULAR HISTORY

Prematurity Status of the Patients

Of the paediatric participants, 319 (91.7%) were born at term, in contrast, to 8.3% (n = 29) who were born preterm, depicted in Table 2.

Table 2: Prematurity Status of the Patients

Prematurity Status of the Patients	Frequency (N)	Percentage (%)
Term	319	91.7
Preterm	29	8.3
Total	**348**	**100**

History of Spectacle Use in Patients and Parents

About a third (30.5%) of the paediatric patients had used spectacles prior to presentation at the eye clinic, while; 16.4% of their parents had a history of spectacle use, as depicted in table 3.

Table 3: History of Spectacle Use in Patients and Parents

Variables	Frequency (N)	Percentage (%)
Previous Spectacle Use in Patients		
Yes	106	30.5
No	242	69.5
Spectacle Use in Parent(s)		
Yes	57	16.4
No	291	83.6
Total	**348**	**100.0**

OCULAR EXAMINATION

Presenting Visual Acuity (Grade of Visual Impairment)

Of all the paediatric patients with presenting visual acuities, 213 (61.2%) were normal, while; 87 (25%), 27 (7.8%), and 21 (6.0%) had mild, moderate and severe visual impairment, respectively, in the worse eye, see table 4.4. Visual impairment, as determined by presenting visual acuity, was found in 135 paediatric patients with a prevalence of 38.8%.

Table 4: Grade of Visual Impairment (n = 348)

Visual Acuity	Frequency (N)	Percentage (%)
Normal vision (> or = 6/12)	213	61.2
Mild visual impairment (<6/12 - 6/18)	87	25.0
Moderate visual impairment (<6/18 - 6/60)	27	7.8
Severe visual impairment (<6/60 - 3/60)	21	6.0

Refraction Results

The prevalence of refractive errors among the study population was 38.8%, as found in 135 paediatric patients. The refraction results revealed that the majority, 63.7% (n = 86) of the paediatric patients, had mild refractive errors, with 38 (28.1%) and 11 (8.1%) having moderate and severe refractive errors, respectively. The most common type of refractive error was compound myopic astigmatism at 12.6% (n = 44); compound hypermetropic astigmatism followed closely with 7.8% (n = 27) of the paediatric patients. While; mixed astigmatism accounted for 3.7% (n = 13) of paediatric patients, simple hypermetropic astigmatism was the least common 1.1% (n = 4) among this study population. Table 4.5 shows the prevalence, grade and type of refractive errors.

Table 5: Prevalence, Grade and Type of Refractive Errors (n = 348)

Refractive Errors	Frequency (N)	Percentage (%)
Present	135	38.8
Absent	213	61.2

Grade of Refractive Errors

Absent	213	61.2
Mild	86	24.7
Moderate	38	10.9
Severe	11	3.2

Types of Refractive Errors

Absent	213	61.2
Compound Myopic Astigmatism	44	12.6
Compound Hypermetropic Astigmatism	27	7.8
Simple Myopia	22	6.3
Simple Myopic Astigmatism	15	4.3
Mixed Astigmatism	13	3.7
Simple Hypermetropia	10	2.9
Simple Hypermetropic Astigmatism	4	1.1

SPECTACLE UPTAKE RATE AND BARRIERS TO UPTAKE

Among the 135 paediatric patients with refractive errors, the spectacle uptake rate was 79.3% accounting for 107 of them, in contrast to; 28 (20.7%) paediatric patients whose caregivers rejected spectacles, as illustrated in figure 2.

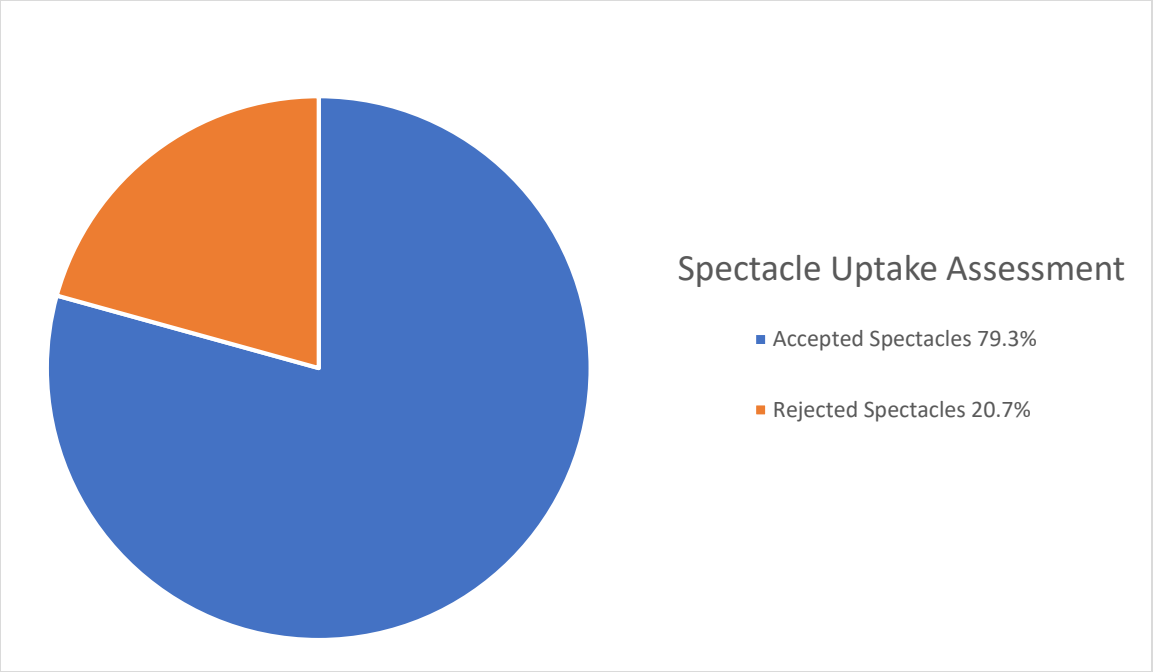

Figure 2: *Spectacle Uptake Rate among Participants with Refractive Errors (N = 135)*

Of the caregivers who declined spectacle use, 16 (57.1%) cited financial constraints as a major barrier to the use of spectacles in their children at the time. Other barriers included; cultural inhibitions in 8 (28.6%) of the caregivers and religious inhibitions in 4 (14.3%), as depicted in figure 3.

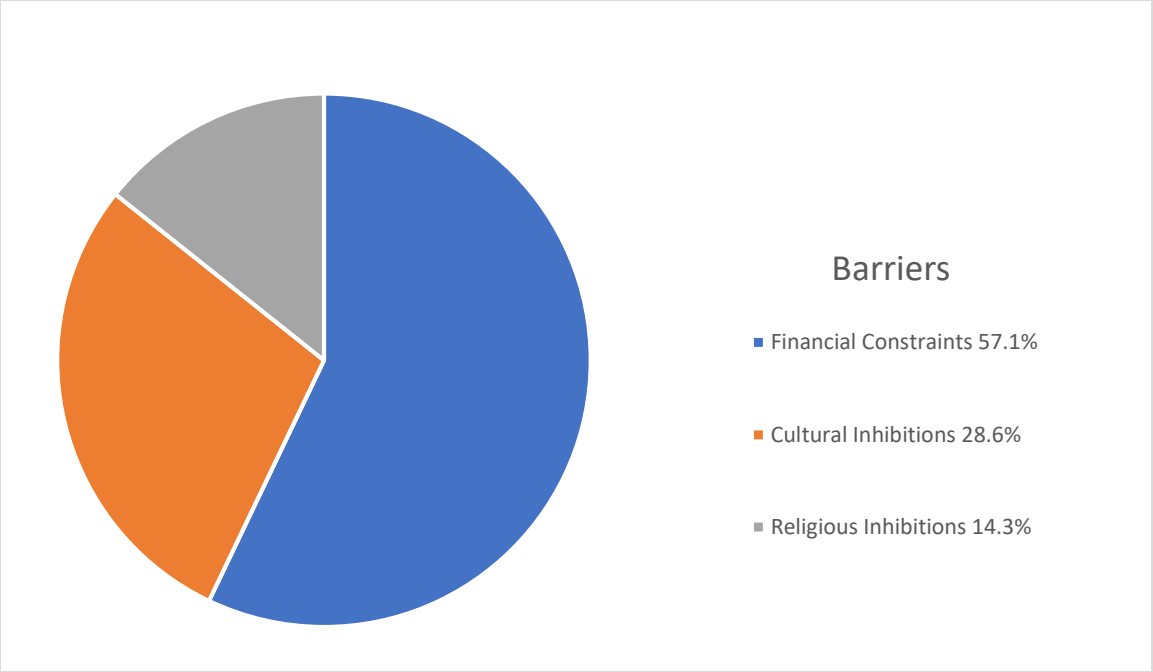

Figure 3*: *Barriers to Spectacle Uptake (N = 28)

BIVARIATE ANALYSIS

Association between Grade of Refractive Errors and Exposure Variables

Performing bivariate analysis between the grade of refractive errors and the exposure variables showed that previous spectacle use in the patient (p-value <0.001), spectacle use in the parents (p-value 0.004) and visual impairment (p-value <0.001) were statistically significantly associated with the grade of refractive error. See Table 6. Of the 135 children with refractive errors, about a quarter, 32.6% (n = 44), had used spectacles previously, and about half, 47.8% (n = 21) of these 44 participants, had a moderate refractive error.

Table 6: Bivariate Analysis of Association between Grade of Refractive Errors and Variables

Variable	Grade of refractive error			P - value
	Mild N (%)	Moderate N (%)	Severe N (%)	
Age Group				
3 - 7 years	12 (14.0)	4 (10.5)	3 (27.3)	0.638
8 - 12 years	42 (48.8)	22 (57.9)	5 (45.5)	
13 - 17 years	32 (37.2)	12 (31.6)	3 (27.3)	
Gender				
Male	39 (45.3)	16 (42.1)	1 (9.1)	0.071
Female	47 (54.7)	22 (57.9)	10 (90.9)	
Prematurity Status of patient				
Term	80 (93.0)	32 (84.2)	11 (100.0)	0.214
Preterm	6 (7.0)	6 (15.8)	0 (0.0)	
Marital Status of the parent				
Married	78 (90.7)	35 (92.1)	11 (100.0)	1.000
Single parent (Separated/Divorced)	6 (7.0)	3 (7.9)	0 (0.0)	
Orphaned	2 (2.3)	0 (0.0)	0 (0.0)	
Previous spectacle use among children				
Yes	16 (18.6)	21 (55.3)	7 (63.6)	**<0.001**
No	70 (81.4)	17 (44.7)	4 (36.4)	
Spectacle use in parent(s)				
Yes	11 (12.8)	13 (34.2)	5 (45.5)	**0.004**
No	75 (87.2)	25 (65.8)	6 (54.5)	
Visual Impairment				
Mild visual impairment (<6/9 - 6/18)	77 (89.5)	9 (23.7)	1 (9.1)	**<0.001**
Moderate visual impairment (<6/18 - 6/60)	9 (10.5)	18 (47.4)	0 (0.0)	
Severe visual impairment (<6/60 - 3/60)	0 (0.0)	11 (28.9)	10 (90.9)	

Multivariate logistic regression analysis was performed to determine the extent of association between the exposure variables and refractive errors, this revealed statistical significance for previous use of spectacles in patients and visual impairment. Notably, visual impairment had an absolute statistically significant association with refractive errors (p-value < 0.001). Table 7 highlights that a prior history of spectacle use was associated with 4.54 times greater odds (OR, 4.54; 95% CI, 1.44-14.30) of moderate refractive error and 5.64 times greater odds (OR, 5.64; 95% CI, 0.78-40.73) of severe refractive error.

Table 7: Multivariate Logistic Regression Model of Variables Associated with Refractive Errors

Variable	Odds ratio (OR)	95% Confidence Interval (CI)	P-value
Mild			
(Reference)			
Moderate			
Previous spectacle use in patient	4.538	1.441 – 14.295	**0.010**
Spectacle use in parent(s)	0.870	0.217 – 3.483	0.844
Visual impairment	<0.001	<0.001 - <0.001	**<0.001**
Severe			
Previous spectacle use in patient	5.640	0.781 – 40.730	0.086
Spectacle use in parent(s)	0.856	0.099 – 7.399	0.888
Visual impairment	<0.001	<0.001 - <0.001	**<0.001**

CHAPTER FIVE: DISCUSSION

There is a worldwide prevalence of visual impairment from uncorrected refractive errors in children of 0.97% (Resnikoff et al., 2008). A greater proportion of this burden of visually impaired and blind children do live in low-income countries, with Western sub-Saharan Africa having the highest prevalence of (1.11%, 0.95-1.26) (Burton et al., 2021). In Nigeria, the prevalence of blindness in children aged 10 – 15 was 0.6% (Kyari et al., 2009), with limited national data about the burden of refractive errors and visual impairment among children. However, data exists from school-based and hospital-based studies wherefrom the prevalence of refractive errors ranges from 22.5% - 34.6% (Opubiri et al., 2013; Adio et al., 2011; and Olusanya et al., 2019).

The prevalence of refractive errors found in this study was 38.8%, in keeping with 34.6% reported by Olusanya et al. (2019) among children who presented to the University College Hospital, Ibadan, in South-Western Nigeria, and 28.95% found by Adio et al. (2011) among paediatric patients attending a tertiary hospital in the South-South region of Nigeria. However, higher than 22.5% previously reported by Opubiri et al. (2013) among children who attended a tertiary hospital in the South-South region of Nigeria. A possible explanation for this difference may be the difference in the methodology used by Opubiri et al. (2013), who sought only to include children with refractive errors as study participants (114 of them) compared to this study. This study revealed a female preponderance and myopia as the most typical refractive error among this study population, similarly reported by these studies (Adio et al., 2011; Opubiri et al., 2013; Isawumi et al., 2016; and Olusanya et al., 2019). The age distribution; was aligned with findings from previously mentioned studies (Adio et al. 2011; Opubiri et al. 2013; Isawumi et al. 2016; and Olusanya et al. 2019). In agreement with Olusanya et al. (2019), who asserted that the increasing visual and academic demands of the secondary school system lead to a higher prevalence among 11 – 15 year-olds, this study, in addition, noted that the upper primary and early secondary school pupils (aged 8 – 12) were most affected (51%). Working in larger class spaces could likely be a contributory factor in making refractive errors more symptomatic.

Visual impairment, as reported by Isawunmi et al. (2016), among children with refractive errors attending an eye clinic in Osogbo, Southwest Nigeria, accounted for 20% with mild to moderate

visual impairment, while 0.4% presented with severe visual impairment. In addition, 1.4% of children in a school study had moderate to severe visual impairment, as found by Ajaiyeoba et al. (2006). This was in contrast to the findings of this study where, among this study population, a quarter of the participants had mild visual impairment, with 7.8% and 6% having moderate and severe visual impairment, respectively. This difference may be accounted for by the mainly urban population in this study, which may be engaged much more in near tasks as compared to children domiciled in semi-urban and rural areas engaged in outdoor activities.

Spectacle uptake rates among community-wide studies globally have been low, more so among students in Nigeria (Alex et al., 2007; Congdon et al., 2008; Ajaiyeoba et al., 2006). Alex et al. (2007) reported a spectacle uptake rate of 32.2%, while Ajaiyeoba et al. (2006) found a spectacle uptake rate of 3% among school children in South-Western Nigeria. Both study findings differ from those of the current study, which reported a spectacle uptake rate of 79.3%, which could be explained by the fact that this study was hospital-based. The participants in this study presented to the hospital with various visual complaints and were more likely to proceed with the recommended intervention (spectacles), in contrast, to participants of these other studies (Alex et al., 2007; Congdon et al., 2008; Ajaiyeoba et al., 2006) who were involved in community-based studies.

Children with a previous history of spectacle use from this study were 4 to 5 times more likely to have moderate to severe refractive errors, indicating that majority of the participants in this study with significant refractive errors were aware of their visual impairment and had sought intervention before this study. The majority had mild refractive errors, similar to findings by Megbelayin (2013), who reported more than half of the students with mild refractive errors. It is said that many participants were unaware that a problem existed in the eyes because their refractive errors were mild, and they had not used spectacles prior (Megbelayin, 2013).

Globally, barriers to spectacle uptake include; cultural inhibitions, unaffordability of corrective lenses, absent or insufficient refractive services and poor recognition of the need (Resnikoff et al. 2008). Considering that the participants in this study came to the hospital to seek eye care, the most common barrier was financial constraints for the spectacles at 57.1%, followed by cultural inhibitions at 28.6%. These barriers are similar to findings by Resnikoff et al. (2008) in a

worldwide study, Alrasheed (2021) in a systematic review of paediatric patients in Africa, and Megbelayin (2013) in a study among school children in South-Southern Nigeria. Cost being a recurrent barrier to spectacle uptake was not the main inhibitor to spectacle uptake in a multi-country study in Europe where Lafuma, Laurendeau, Lamerain and Berdeaux (2010, as cited by Megbelayin, 2013) highlighted the accompanying possible cultural inhibitions linked to poor spectacle uptake, in contrast, to refractive surgeries and contact lenses used as alternatives. A possible explanation for cost not ranking as a barrier may have been the fact that participants were from high-income countries [Lafuma, Laurendeau, Lamerain and Berdeaux (2010, as cited by Megbelayin, 2013)]. In the current study, disapproval from the caregivers also included; cultural (28.6%) and religious (14.3%) reasons outside financial constraints. This trend was observed in India, where Pavithra et al. (2014) reported parents' refusal to spectacle uptake in 11.4% of their school children; and in Swaziland, 24.8% of parents disapproved of the use of spectacles in their children or were unsure (Sukati et al., 2018). These barriers were possible reasons for some students objecting to spectacle uptake postulated by Megbelayin (2013) in his study conducted in South-South Nigeria. As valid as the need to correct refractive errors in these children existed, these financial, cultural and religious inhibitions stood in the way of their eye care.

LIMITATIONS OF THE STUDY

The retrospective nature of this study was a limitation, as information was sought from medical records. However, the electronic medical record system reduced the incidence of missing patient records and information.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

CONCLUSION

In this study, among paediatric patients attending a tertiary eye clinic, the prevalence of refractive errors was similar to that obtained in another hospital-based study in Nigeria. A quarter of this study's participants had mild visual impairment, while visual impairment generally accounted for 38.8% of the study population.

This study had a higher spectacle uptake rate compared to community-based studies. Barriers to spectacle uptake included financial constraints, cultural and religious factors.

From this study, participants with a history of spectacle use were more likely to have moderate and severe refractive errors inferring that the majority of the participants in this study population who had significant refractive errors were aware of their visual impairment and had sought help before this study.

Therefore, to minimise barriers to spectacle uptake among children, caregiver education and empowerment, through eye health education and promotion are required to curb cultural and religious barriers against spectacle uptake.

RECOMMENDATIONS

The following recommendations are suggested from this study and include:

1. To address the barriers related to spectacle uptake:
    a. Expansion of the National Health Insurance Act (NHIA) to include full spectacle coverage for all children at the very least, leaving no one behind. Currently, the NHIA contributes a proportion on a co-pay basis for spectacles.
    b. Organization of health education and promotion series on the importance of early use of spectacles in children if need be, with full community participation (involving the caregivers, monarchs and religious leaders) for sustainable impact.
2. Strengthening the school eye health system by training teachers to identify students with refractive errors for early referral to the nearest affiliated health care facility.

3. A national survey to determine the actual magnitude of the burden of refractive errors among children in Nigeria is highly recommended.

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APPENDICES

APPENDIX I: DATA EXTRACTION SHEET

Questionnaire on the prevalence of refractive errors, visual impairment and spectacle uptake among paediatric patients in Abuja, Nigeria.

1. Serial number……

A. SOCIO-DEMOGRAPHIC CHARACTERISTICS

2. Date of birth ……..
3. Translated Age……
4. Sex: (1) Male (2) Female ☐
5. Marital Status of Parents ☐

   1. Married 2. Single parent (separated/divorced) 3. Orphaned
6. Prematurity status 1. Born at term 2. Born premature ☐

B. FAMILY OCULAR HISTORY

7. Previous use of spectacles in patient (1) Yes (2) No ☐
8. Spectacle wear in parents (1) Yes (2) No ☐

C. OCULAR EXAMINATION

` 9. Visual Acuity RE: 0. Normal; 1. <6/12 – 6/18; 2. < 6/18 -6/60; 3. < 6/60 – 3/60 ☐

10. Visual Acuity LE: 0. Normal; 1. <6/12 – 6/18; 2. < 6/18 -6/60; 3. < 6/60 – 3/60 ☐
11. Anterior segment RE: 1. Normal; 2. Abnormality detected …….. ☐
12. Anterior segment LE: 1. Normal; 2. Abnormality detected …….. ☐
13. Posterior segment RE: 1. Normal; 2. Abnormality detected …… ☐
14. Posterior segment LE: 1. Normal; 2. Abnormality detected …… ☐

D. REFRACTION RESULTS

15. Grade of Refractive Error

0. No error

Myopia

1. Mild RE ☐ LE ☐
2. Moderate RE ☐ LE ☐
3. Severe RE ☐ LE ☐

Hypermetropia

4. Mild RE ☐ LE ☐
5. Moderate RE ☐ LE ☐
6. Severe RE ☐ LE ☐

Astigmatism

7. Mild RE ☐ LE ☐
8. Moderate RE ☐ LE ☐
9. Severe RE ☐ LE ☐

16. Type of Refractive Error

0. No error RE LE

1. Myopia (simple) RE LE

2. Hypermetropia (simple) RE LE

3. Simple Myopic Astigmatism RE LE

4. Compound Myopic Astigmatism RE LE

5. Simple Hypermetropic Astigmatism RE LE

6. Compound Hypermetropic Astigmatism RE LE

7. Mixed Astigmatism RE LE

17. Axis of Astigmatism RE: 0. No error; 1. Regular; 2. Irregular ☐

18. Axis of Astigmatism LE: 0. No error; 1. Regular; 2. Irregular ☐

E. Spectacles as management

19. 0. No error; 1. Accepted; 2. Rejected ☐

F. Reason for rejection

20. **……**

APPENDIX II: Approval by the Biomedical Science Research Ethics Committee of the University of the Western Cape

UNIVERSITY *of the* WESTERN CAPE

60 YEARS *of hope, action & knowledge*

29 November 2021

Dr S Bitto
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number:	BM21/10/15
Project Title:	The Prevalence of Refractive Errors, Visual Impairment and Spectacle Uptake among Paediatric Patients in Abuja, Nigeria.
Approval Period:	**19 November 2021 – 19 November 2024**

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project and the requested amendment to the project.

Any further amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report annually by 30 November for the duration of the project.

For permission to conduct research using student and/or staff data or to distribute research surveys/questionnaires please apply via:
https://sites.google.com/uwc.ac.za/permissionresearch/home

The permission letter must then be submitted to BMREC for record keeping purposes.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

NHREC Registration Number: BMREC-130416-050

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

APPENDIX III: Approval by the Federal Capital Territory Health Research Ethics Committee

FEDERAL CAPITAL TERRITORY

Health Research Ethics Committee

Research Unit, Room 10 Block A Annex, HHSS, FCTA Secretariat,
No. 1 Kapital Street 11, Garki, Abuja-Abuja.

Notice of Approval of Research
Approval Number: FHREC/2021/01/128/28-10-21

Full Study Title: **The Prevalence of Refractive Errors, Visual Impairment and Spectacle Uptake among Paediatric Patients in Abuja, Nigeria.**

Principal Investigator:	**Dr. Bitto, Sewuese**
Address of Principal Investigator:	Department of Ophthalmology, Garki Hospital, Area 8, Garki, Abuja.
Date of receipt of valid application:	21/09/2021

The FCT Health Research Ethics Committee (FCT HREC) has approved the research described in the above stated protocol.

This approval is valid from **28/10/2021** to **27/10/2022**.

Note that no activity related to this study may be conducted outside of these dates. Only the FCT HREC approved informed consent forms may be used when written informed consent is required. They must carry FCT HREC assigned protocol approval number and duration of approval of the study. The FCT HREC reserves the right to conduct compliance visit to your research site without prior notification.

The National Code of Health Research Ethics requires the investigator to comply with all guidelines, rules and regulations regarding the conduct of health research, and with the tenets of the code.

Modifications: Subsequent changes are not permitted in this research without prior approval by the FCT HREC.

Problems: All adverse events or unexpected side effects arising from this project must be reported promptly to FCT HREC.

Renewal: This approval is valid until the expiration date. If this project is to proceed beyond the expiration date, an annual report should be submitted to FCT HREC early in order to request for a renewal of this approval.

Closure of Study: At the end of the project, a copy of the final report of the research should be forwarded to FCT HREC for record purposes, and to enable us close the project.

For queries and further information contact FCT HREC office. I wish you best of luck with your research.

Desmond Emereonyeokwe
Secretary, FCT HREC
October 28, 2021.

Federal Capital Territory Abuja
Health Research Ethics
28 OCT 2021
APPROVED
ABUJA
The Heart of Nigeria

APPENDIX IV: Garki Hospital Abuja Research Approval

nisa
GARKI HOSPITAL ABUJA

Professor Emeritus Umaru Shehu, *CFR FAS DFMC*
Chairman

Dr. Adamu Onu
MBBS, FWACP, MS
Medical Director

GHA/HR/GEN/0239/21

15th September 2021

Dr. Bitto, Sewuese
Department of Ophthalmology,
Garki Hospital, Abuja

Dear Dr. Bitto,

RE: APPLICATION FOR APPROVAL TO CARRY OUT MEDICAL RESEARCH IN THE EYE CLINIC

Your application dated 13th September 2021 on the above subject matter refers.

Please be informed that the Hospital Management has approved your request.

Thank you.
FOR: GARKI HOSPITAL, ABUJA

15 SEP 21

RUME ABENE BENSON (MRS.)
HEAD, HUMAN RESOURCES

CC: file

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