

Prevalence and Pattern of Uncorrected Refractive Errors among School Aged Children in a Semi-Urban Community of Northern Nigeria

Samuel Chibueze Osuji^{1*}, Eunice Ifeyinwa Agwa² and Francis Onyekwere³

¹Department of Healthcare Mission and Research, Samsuji Global Rescue (Sagre) Foundation Inc, Owerri, Nigeria Department of Public Health, School of Health Technology, Federal University of Technology, Owerri, Imo State, and Department of Optometry, Faculty of Health Sciences, King David University of Medical Sciences, Uburu, Ebonyi State, Nigeria

²Department of Dispensing Opticianry, Federal Polytechnic Nekede, Owerri, Imo State, Nigeria

³Department of Optometry, Faculty of Health Sciences, Madonna University Nigeria, Elele, Rivers State, Nigeria

***Corresponding Author:** Samuel Chibueze Osuji, Department of Healthcare Mission and Research, Samsuji Global Rescue (Sagre) Foundation Inc, Owerri, Nigeria Department of Public Health, School of Health Technology, Federal University of Technology, Owerri, Imo State, and Department of Optometry, Faculty of Health Sciences, King David University of Medical Sciences, Uburu, Ebonyi State, Nigeria.

Received: November 29, 2021

Published: November 18, 2022

© All rights are reserved by **Samuel Chibueze Osuji, et al.**

Abstract

Objective: This study aimed to determine the prevalence of uncorrected refractive errors among school aged children in a Semi-urban community of Rantya, Jos, Northern Nigeria.

Methods: A cross-sectional study was employed where a total of 350 children of ages 11 to 19 years, were conveniently sampled. Visual acuity was assessed monocularly using Snellen's chart at 6 metres testing distance. Uncorrected refractive error was defined as an unaided distance visual acuity of 6/9 or less which improved with pinhole. With ethical considerations observed, Ophthalmoscopy was done to rule out pathologies, while Retinoscopy and subjective refraction were also performed to establish refractive anomalies. Data obtained was analyzed using Statistical Package for Social Science (SPSS Ver:16), and tested using descriptive statistic. P-Value of 0.05 or < was taken to be significant.

Results: Out of the 350 participants examined, comprising of 156 (44.6%) males and 194 (55.4%) females, 78 persons presented with uncorrected refractive errors, putting the overall prevalence of uncorrected refractive errors to 22.3%. Among these persons with uncorrected refractive errors, females 50(64.1%) were more than males 28 (35.9%), and this was not statistically significant ($p = 0.123$). The age range of 14 - 16 ($n = 37, 47.4%$) had the highest proportion of uncorrected refractive errors but it was not also statistically significant ($p > 0.05$). The pattern of uncorrected refractive errors showed that Myopia was the most prevalent uncorrected refractive error with 35 (44.9%) persons, while compound Astigmatism with 5(6.4%) persons was the least. About 272 (77.7%) of the study population were Emmetropic with visual acuity of 6/9 and above while 78 (22.3%) of participants had uncorrected refractive errors with visual acuity of 6/12 or less which improved to 0.9% when presented with pin hole.

Conclusion: Since most children with uncorrected refractive error are asymptomatic, screening helps in early diagnosis and timely intervention through vision screening is advocated.

Keywords: Prevalence; Refractive Errors; Children; Northern Nigeria

Introduction

An estimated 596 million people had distance vision impairment worldwide, of whom 43 million were blind in 2020. This is contained in the recent 2021 report of the International Centre for Eye Health (ICEH) [1], as published on the Lancet Global Health Commission on Global Eye Health: vision beyond 2020. Uncorrected refractive error remains the second most common cause of global visual impairment next to cataract, thereby creating a high significant impact on learning and academic success [2]. Global estimates reveal that 12 million children aged 5 to 18 years of age are visually impaired because of uncorrected refractive errors, and these conditions that could be easily diagnosed and corrected with glasses, contact lenses and refractive surgeries [3]. Uncorrected refractive error has remained a significant cause of blindness, the major cause of blindness and the major cause of impaired vision [4].

A refractive error is an optical defect of the eye that prevents light from being brought to a sharp focus on the retina. It is a problem with focusing light accurately onto the retina due to the shape of the eye [5]. Ametropia a condition of refractive error is defined as a state of refraction in which parallel rays of light coming from infinity with accommodation relaxed come to a focus either in front or behind the retina, in one or both meridians [6]. The different types of ametropia include myopia, hypermetropia and astigmatism. Refractive error could be considered as an avoidable condition among various conditions leading to visual disabilities in children. Most of the children with uncorrected refractive error are asymptomatic and hence screening helps in early detection and timely interventions. Hence the vision 2020 initiative to eliminate avoidable blindness gave high priority to correction of refractive error and placed it within the category of childhood blindness. If refractive error is left uncorrected among school aged children, amblyopia may occur and it may be too late to treat and this may affect the child's performance at school [5].

A large proportion of people worldwide have refractive errors, irrespective of age, sex and ethnic groups. According to the world health organization [3], 258 million people are visually impaired worldwide, 39 million are blind, 246 are low vision patients while 90% of the world's visually impaired live in developing countries and globally uncorrected refractive errors are the main causes of visual impairment. An estimated 153 million people worldwide

have visual impairment from uncorrected refractive error in 2004 and 8 million of them were blind, the magnitude of this uncorrected visual impairment has been overlooked because epidemiological studies have tended to focus on the 'best corrected' sight rather than presenting visual acuity [7]. In their report on the global estimate of visual impairment resulting from uncorrected refractive error, Dandona and Dandona [8] estimated that globally there were 5 million persons (range of 4-6 million) who were blind (distance vision worse than 3/60 in the better eye) due to uncorrected refractive error. Afterwards, Maharaj *et al* [9] estimated that 300 million people are visually impaired globally and uncorrected refractive errors with the associated visual impairment result in global economy losing \$269 billion in productivity annually.

For several reasons, secondary school students are at a greater risk of having visual impairment, because they are occupied with other activities they find more interesting, however, many of the causes are correctable and preventable if treated early. Dandona and Dandona [10] indicated that blindness due to uncorrected or inadequately corrected refractive errors start at a younger age as such it hinders education, personality development and career opportunities in addition to causing an economic burden on society. Therefore, they can read better at near where most reading is done. Oveneri-Ogbomo and Assien [11] indicated that uncorrected refractive error remains a public health problem which has a considerable impact on learning and academic achievements especially in under-served and under-resourced communities. Detecting ocular disorders among secondary school students including refractive errors are important as such disorders are part of the leading causes of serious health problems and decay in childhood education, especially in Nigeria and Sub-Saharan Africa. This study therefore, aims to determine the prevalence of uncorrected refractive errors among school aged children in a semi-urban community of Jos, Northern Nigeria and to determine the distribution of these anomalies in relation to age and gender.

Materials and Methods

The design followed a population-based cross-sectional study where 350 school aged children from the ages of 11 to 19 years were sampled using convenience sampling technique due to their availability within the screening period, which was conducted in a 5 - day screening program in Rantya, a semi-urban community of Jos, Northern Nigeria. Ethical approval was sought and obtained

from the Director of Primary Healthcare, Jos North Local Government Council and the Children’s Parents/Guardians. Verbal consent was also obtained from the Community head, and from the participants after clear explanation of the study and its purpose had been made to them. Confidentiality of subjects was ensured. Materials used included Standard Snellen’s Visual Acuity Chart for distance testing, Retinoscope for Objective Refraction, Trial lens case accessories for Subjective refraction, Penlight for external ocular assessment, and Ophthalmoscope to rule out pathologies. Brief case histories of participants were taken and contained demographic variables, medical histories and presenting conditions. Visual acuities were assessed monocularly using Snellen’s chart at a distance of 6 meters under appropriate illumination both before and after refraction. Uncorrected refractive error was defined as an unaided distance visual acuity of 6/9 or less which improved with pinhole. Data obtained were recorded and analyzed using Statistical Package for Social Science (SPSS Ver.16), and tested using descriptive statistic. A p-value of < 0.05 was taken to be significant.

Results

Prevalence (%) of uncorrected refractive errors

The prevalence is shown in table 1 below.

Visual Status	Frequency	Prevalence (%)
Uncorrected Refractive Errors	78	22.3
Emmetropia	272	77.7
Total	350	100

Table 1: Shows the prevalence of uncorrected refractive errors in semi-urban community of Rantya, Jos.

Pattern (%) of uncorrected refractive error

The pattern is shown in table 2 below

Uncorrected refractive error	Frequency	Prevalence (%)
Myopia	35	44.9
Hyperopia	11	14.1
Simple astigmatism	18	23.1
Compound astigmatism	5	6.4
Anisometropia	9	11.5
Total	78	100%

Table 2: Showing the pattern of uncorrected refractive errors in semi-urban community of Rantya, Jos.

Prevalence (%) of uncorrected refractive error in relation to gender.

The gender distribution is shown in table 3 below.

Gender	Frequency	Prevalence (%)
Males	28	35.9
Females	50	64.1
Total	78	100

Table 3: Showing the gender distribution of uncorrected refractive error in semi-urban Community of Rantya, Jos.

Prevalence (%) of uncorrected refractive errors in respect to age

The age distribution of uncorrected refractive error in Rantya is shown in table 4 below.

Age	Frequency	Prevalence (%)
11-13	20	25.7
14-16	37	47.4
17-19	21	26.9
Total	78	100

Table 4: Showing the age distribution of uncorrected refractive error in semi-urban community of Rantya, Jos.

Discussion

Visual impairment due to uncorrected refractive error is a significant cause of morbidity in children worldwide. The visual experience of a child plays a significant role in his or her physiological, physical and intellectual development [12]. Uncorrected refractive error is a significant cause of abnormal visual experience and if left untreated, leads to amblyopia [13]. In a cross sectional study to determine the prevalence and pattern of refractive errors among school aged children, a total of 350 school children from a Semi-urban community of Rantya, Jos in Northern Nigeria, who were within the ages of 11 to 19 years were examined of refractive anomalies. Out of the 350 participants that were examined, seventy-eight (78) presented with uncorrected refractive errors, putting the overall prevalence of uncorrected refractive errors to 22.3%.

This result is in tandem with that obtained in Southern China by He *et al* [14] which gave a refractive error prevalence rate of 22.3%,

and in close range of that obtained by Goh *et al* [15] among Malays which gave a refractive error prevalence of 17.1%. The result falls far below that obtained among medical students in Calabar, Nigeria by Megbalayin *et al* [2] with a prevalence rate of 79.5%, and that obtained among school children in Agona Swedru, Ghana by Oveneri-Ogbomo and Assien [11] with a refractive prevalence rate of 85.9%. However, it also rates much higher than those obtained in other studies like that of Kawuma and Mayeku [16] conducted among children of lower primary schools in Kampala District of Uganda, with a prevalence of 11.6%, Assefa *et al* [17] in Gondar town of Northwest Ethiopia which gave 9.4% among school children, Mahraji *et al* [9] in KwaZulu-Natal 7%, Amruta *et al* [18] with refractive errors prevalence of 5.46% in urban setting and 2.63% in rural setting of Maharashtra, India, Opubiri and Pedro-Egbe [19] in Yenegoa council, Bayelsa, Nigeria 2.2%, Lindquist *et al* [20] in Fiji, India, with the refractive error prevalence of 2.0%, and that of Murthy *et al* [21], where the prevalence of uncorrected, baseline (presenting), and best corrected visual acuity of 20/40 or worse in the better eye was 6.4%, 4.9%, and 0.81%, respectively.

Furthermore, regarding the patterns of uncorrected refractive errors determined in the study, out of the seventy-eight participants with uncorrected refractive errors, thirty-five (35, 44.9%) had Myopia, eleven (11, 14.1%) had Hyperopia, eighteen (18, 23.1%) had Simple Astigmatism, five (5, 6.4%) had Compound Astigmatism, and nine (9, 11.5%) had Anisometropia. Out of the entire study population, Myopia was determined to be the most prevalent uncorrected refractive error in the study with a prevalence of 10%. This is high compared to the results obtained in other studies like that of Oveneri-Ogbomo and Assien [11] with myopia prevalence of 1.7% among school children in Agona Swedru Ghana, He *et al* [14] in Southern China with 5.3% prevalence in 5year olds, and Amruta *et al* [18] in rural and urban Maharashtra India showing myopia prevalence of 1.45% and 3.16% respectively. The prevalence of myopia, hyperopia and astigmatism in this study were found to be 10.0%, 3.1% and 6.5% respectively, making myopia the most prevalent uncorrected refractive error. And this is in agreement with the work of Amruta *et al* [18], where they observed that the prevalence of myopia, hypermetropia and astigmatism in urban children was 3.16%, 1.06% and 0.16% respectively. In rural children, the prevalence of myopia, hypermetropia and astigmatism was 1.45%, 0.39% and 0.21% respectively. The prevalence of uncorrected refractive error especially myopia was higher in urban

children. The difference in the prevalence of uncorrected refractive errors in various studies may be due to racial, environmental and ethnic factors, as well as differences in sample sizes and methodologies. However, the difference in prevalence of uncorrected refractive errors as compared to this study may be due to difference in ethnicity, racial, socio-economic factors, environmental factors and access to adequate eye care [22].

In relation to age, our study showed that uncorrected refractive errors are common among children that are within the ages of 14 - 16 years (n = 37, 47.4%), as compared to children of other age groups, although this was not significant. This is at variance to the studies by Opubiri and Pedro-Egbe [19], Yenegoa, Nigeria, where uncorrected refractive errors were more in children within the age groups of 8 - 10 years, and that of Kawuma and Mayeku [16] in Kampala district of Uganda, where significant refractive errors were found to occur among primary school children aged 6 to 9 years at a prevalence of approximately 12%. More so, Lindquist *et al* [20] also determined that there was a comparatively low prevalence of uncorrected refractive errors of 0.9% noted among school aged children within 12 - 20 years in Fiji. The difficulty to ascertain the actual age of the children used in this study and the variation in age groups used in both studies could account for the differences in results.

As regards gender, our study revealed that a higher population with uncorrected refractive errors were noted to be more common in females 50 (64.1%) than in males 28 (35.9%), and these constituted 14.3% females and 8.0% males of the entire study population, although this was not significant. This is also in tandem with the studies by Megbalayin *et al* [2] conducted among medical students in Calabar, Nigeria, where uncorrected refractive errors were found to be more common in females (82%) than their male counterparts (78%). Several studies have shown more females to have uncorrected refractive errors than men. In this study, 80.3% of eyes had normal vision while those with visual acuity of 6/9 or better were 90.6%. A similar study on eye health status in school children aged 5-15 years in South-Eastern Nigeria, observed that 96.5% of students had visual acuity of 6/9 or better [23]. Furthermore, uncorrected visual acuity of 6/12 or less (reduced vision) was revealed among children at the prevalence of 9.4%, and which improved to 0.9% following pinhole examination. This is similar to that obtained in South Africa by Naidoo *et al* [24] where visual acu-

ity of 6/12 or less was found to be at the prevalence of 1.4%, and decreasing to 0.32% upon pinhole examination.

Conclusion

Our study showed that the prevalence of uncorrected refractive errors among school-aged children in a semi-urban community of Jos, northern Nigeria was 22.3%, with myopia as the most prevalent uncorrected refractive error. Vision screening among school aged children to help in early diagnosis and timely interventions, is therefore, advocated, since most children with uncorrected refractive error are asymptomatic.

Conflict of Interest

None.

Bibliography

- International Center for Eye Health (ICEH) Report (2021). Global Eye Health: Vision beyond 2020". Lancet Global health Commission (2021).
- Megbelayin EO., et al. "Refractive Errors and Spectacle Use Behavior among Medical Students in a Nigerian Medical School". *British Journal of Medicine and Medical Research* 4 (2014): 2581-2589.
- World Health Organisation. "Visual impairment and blindness". Fact sheet No (2009): 282.
- Dandona R., et al. "Refractive errors in children". *Bulletin of the World Health Organisation* 56.3 (2002): 65-67.
- Denniston, Alastair; Murray, Philip. Oxford Handbook of Ophthalmology (3.edition.) OUP Oxford (2014): 826.
- Khurana AK. "Comprehensive Ophthalmology". 5th Edition. New Delhi: New Age International Limited (2012).
- Smith TS., et al. "Potential lost productivity resulting from global burden of uncorrected refractive error". *Bulletin of the world health organization* 87 (2009): 431-437.
- Dandona R and Dandona L. "Estimation of global visual impairment due to uncorrected refractive error". *Bulletin of the World Health Organization* 86.1 (2008): 63-70.
- Mahraj YI., et al. "The KwaZulu-Natal Child Eye Care Programme: Delivering refractive error services to primary school learners". *The South African Optometrist* 70.2 (2011): 61-68.
- Dandona R and Dandona L. "Refractive error blindness". *Bulletin of the World Health Organisation* 79.3 (2001): 237-243.
- Ovenseri-Ogboma GO and Assien R. "Refractive error in school children in Agona Swedru, Ghana". *The South African Optometrist* 69.2 (2010): 86-92.
- American association of pediatric ophthalmology and strabismus, and the American academy of ophthalmology (2003). Policy statement: eye examination in infants, children and young adults by pediatricians". *Pediatrics* 111 (2003): 902-907.
- Weakly SH., et al. "Prevalence of eye diseases in primary school children in rural area of Tanzania". *British Journal of Ophthalmology* 84 (2000): 1291-1297.
- He M., et al. "Refractive error and visual impairment in urban children in southern china". *Investigative Ophthalmology and Visual Science* 45.3 (2004): 793-799.
- Goh PP., et al. "Refractive error and visual impairment in school age children in Gombak District, Malaysia". *Ophthalmology* 112 (2005): 678-85.
- Kawuma M and Mayeku R. "Prevalence of refractive errors among children in lower primary school in Kampala district". *Africa Health Sciences* 2.2 (2002): 69-72.
- Assefa WT., et al. "Prevalence of Refractive Errors Among School Children in Gondar Town, Northwest Ethiopia". *Middle East and African Journal Ophthalmology* 19.4 (2012): 372-376.
- Amruta SP., et al. "Prevalence of uncorrected refractive error and other eye problems among urban and rural school children". *Middle East African Journal Ophthalmology* 16.2 (2009): 69-74.
- Opubiri I and Pedro-Egbe CN. "Screening of primary school children for refractive error in South-South Nigeria". *Ethiopian Journal of Health Sciences* 22.2 (2012): 129-134.

20. Lindquist AC., *et al.* "Screening for uncorrected refractive error in secondary school-age students in Fiji". *Clinical and Experimental Ophthalmology* 39 (2011): 330-335.
21. Murthy GVS., *et al.* "Refractive Error in Children in an Urban Population in New Delhi". *Investigative Ophthalmology and Vision Science* 43.3 (2002): 623-631.
22. Padhye AS., *et al.* "Prevalence of uncorrected refractive error and other eye problems among urban and rural school children". *Middle East and African Journal of Ophthalmology* 16 (2011): 69-74.
23. Ugochukwu CO. "Survey of eye health status of primary school children in Nkanu west local government area of Enugu State of Nigeria". *Dissertation for the award of a fellowship of the National Postgraduate Medical College in Ophthalmology* (2002): 39-42.
24. Naidoo KS., *et al.* "Refractive error and visual impairment in African children in South Africa". *Investigative Ophthalmology and Visual Science* 44 (2003): 3764-3770.