



## PREVALENCE OF REFRACTIVE ERROR AMONG MEDICAL STUDENTS: IMPLICATIONS FOR IRREGULAR EYE SCREENING SERVICES IN NIGERIA

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### ABSTRACT

Refractive error is caused by an error in the refractive power of the eye due to alteration in the ocular length. Uncorrected Refractive error is the second leading cause of visual impairment worldwide. Uncorrected refractive errors are common visual impairment among medical students. The study was designed to determine the prevalence of Refractive error among medical students. A cross-sectional study conducted from October, 2021 – March, 2021 among Medical students. 157 students were selected by simple sampling technique, aged between 17 to 25 years. Demographic data of each student was obtained by a combination of self-administered interviewer questionnaire and clinical eye examination. The history of the past and previous eye checkup and use of glasses were also determined. Snellen chart, pinhole, pen-torch, ophthalmoscope, retinoscope were used to determine refractive error among the students. The study showed that 14.0% of the students had visual impairment, and the prevalence of refractive error was found to be 10.8% with a preponderance of myopia at 70.6%, hyperopia at 17.6%, then astigmatism at 11.8%. Out of the students with myopia, 88.2% had low degree myopia. The study shows that 18.2% of the students were not using corrective lenses. Refractive error is a significant cause of visual impairment and regular eye screening is necessary for early detection and correction of refractive errors among medical students.

**Keywords:** Visual impairment, Refractive errors, Medical students, myopia, astigmatism, hypermetropia

### INTRODUCTION

Refractive error (RE) is a condition in which the optical system of the non accommodating eyes is unable to focus parallel rays of light on the retina (Thibos, 2018). It is caused by an error in the refractive power of the eye due to alteration in the ocular length (Ratan, 2019).

Uncorrective refractive error affects persons of all ages and is the second leading cause of visual impairment worldwide Ratan, N.M., (2019). Undetected and uncorrected refractive errors constitute a significant visual impairment among medical students

(Alruwaili *et al.*, 2018). WHO (2012) estimated that about 2.3 billion people worldwide including children have refractive errors. The distribution of refractive errors varies with age, race, gender, nature of work, educational status, urbanization, genetic and ethnic factors, outdoor activities and lifestyle changes (Irving *et al.*, 2019). Medical students; a highly vulnerable group, and therefore, uncorrected refractive error can impact negatively on the learning process and educational capacity of these students (Yingyong, 2010). Blindness due to refractive error causes dramatic effect in personality

development, limitations in vision-related tasks. The consequences are a decreased in quality of life and imposes an enormous economic burden to the individual and the society.

Due to their intensive nature of study, medical students may be at high risk for the development of myopia due to prolonged close work. This view is supported by many previous findings (Mirshahi *et al.*, 2014; Alruwaili *et al.*, 2018; Megbelayin *et al.*, 2019 ). In European cohort, Mirshahi *et al.*, (2014) showed that individuals with higher level of education are more likely to be myopic. Again, Alruwaili *et al.*, (2018) reported in a previous study in Al-jouf University among medical students that 83.1% of students had refractive errors. 74.1% were myopic, while the remaining students were either astigmatic or astigmatic and myopic. Another study in Nigeria by Megbelayin *et al.*, (2019) showed that 66% of students representing 79.5% had refractive error; 63.6%, 16.7% and 19.7% were myope, hyperope or simple astigmatic respectively. This was further demonstrated by other studies which indicated that among the refractive errors, prevalence of myopia is increasing worldwide (Dey *et al.*, 2014; Ramya, *et al.*, 2018). The global increase in the prevalence of myopia according to Pan *et al.*, (2012) is attributed to its earlier onset and high myopic refraction. Since most myopic changes is likely to be due to a disparity between the axial length of the eyeball and its refractive power. From the forgoing, myopia is a major health problem in the world and Holden *et al.*, (2016) estimated that the global prevalence of myopia will increase to 50% by 2050 from its current prevalence rate of 2.7% in 2010.

Although, refractive errors are the major causes of visual impairment, its correction with appropriate spectacles is the most cost-

effective interventions in eye health care services. Therefore, early visual screening programmes and preventive interventions are the most effective measures in addressing the menace of refractive errors.

The study was conducted to determine the prevalence refractive errors among medical students in a University in North-East Nigeria.

## MATERIALS AND METHODS

### Study Design and Sampling Techniques

This was a cross-sectional study investigating the prevalence of refractive error among medical students in a University in North-East Nigeria. The students were aged between 17–25 years and the study was conducted from October 2021 to January 2022.

### Data Collection and Screening Procedure

Data of each student was collected by a combination self-administered interviewer questionnaire and clinical eye examination. The self-administered interviewer questionnaire was used to obtain information on sociodemographic variables of each participant. The past and present ocular complaints and family ocular history were also determined. Students who consented and satisfied the inclusion criteria were included in the study. The study was approved by the Ethical Committee of the institution.

### Visual Acuity Measurement

Visual acuity measurement was determined separately for each eye with the Snellen chart at 6 m in bright daylight. The study subjects were considered to have normal vision if their visual acuities were 6/6 or better and refractive error is present if their visual acuity was less than 6/9 which improves with pinhole test. Refractive error of 0.50DS or more was diagnosed as myopia, +1.50DS or more as hyperopia and 0.75DC or more as astigmatism. Ocular examination of the eye was performed using a pen torch and an

ophthalmoscope. Refraction was determined using the streak retinoscope, where the patient is unable to read the smallest letters (N6 letter); convex lenses (presbyopic add) are added until these smallest letters are read. The dioptric value of the presbyopic required to optimize the near vision is recorded. Subjects who required further examination and management were referred appropriately for further examination and treatment. Students with the history of ocular surgery, glaucoma and active intraocular disease were excluded from the study. All examinations were conducted by trained ophthalmologists and optometrists.

### Data Analysis

The Statistical Package for Social Scientists (SPSS) version 22.0 (SPSS, Inc., Chicago, IL, USA) was used to analyze the data. Continuous variables were expressed as mean  $\pm$  standard Error of means ( $M \pm SE$ ). Percentage was used to determine the percentages of students that have normal vision, Refractive error and Non refractive visual impairment.

## RESULTS

The students were aged between 17 – 25 years; the mean age was  $21.0 \pm 1.25$  years. 57.3% (90) of the students were males while 42.7% (67) were females. Table 1 showed the age and sex distribution of the participants in the study. Out of the 157 students, 17 had (10.8%) errors of refraction while 5 students (3.2%) had vision impairment not caused by refractive error.

Table 2: shows the type and age distribution of refractive error; myopia (12), hyperopia (3) and astigmatism (2s) among the students.

Table 3: Shows gender distribution of students according to the type of refractive error. The commonest refractive error was myopia 12 (70.6%), then followed by

hyperopia 3 (17.6%) and while astigmatism was 2 (11.8%). The study showed that the majority of the myopic students were having low degree myopia (88.2%) while the balance had moderate degree myopia (11.8%). No case of high degree myopia was detected in the study.

Table 4: shows the distribution of previously (64.7%) and currently diagnosed (35.3%) students with refractive errors.

Table 5: Shows the number and percentage of students with normal vision (86.0%), Refractive error (10.8%) and Non refractive visual impairment (3.2%). 64.7% (11) of the students with refractive error were previously diagnosed. Out of the students previously diagnosed with refractive error, only 18.2% (2) students' used prescribed glasses. 6 students (35.3%) were newly diagnosed with refractive error in the present study.

**Table 1:** Age and gender distribution of the students

Gender	Age in years			Total
	17 – 19	20 - 22	23 – 25	
Male	46	32	12	90
Female	38	21	8	67
Total	84	53	20	157

**Table 2:** Prevalence of refractive error by age among the students

Gender	Age in years			Total
	17-19	20-22	23-25	
Myopia	3	4	5	12
Hyperopia	0	1	2	3
Astigmatism	0	1	1	2
Total	3	6	8	17

**Table 3:** Gender distribution of students based on the type of refractive error

Types of Refractive error	Males	Females	Total
Myopia	7	5	12
Hyperopia	2	1	3
Astigmatism	1	1	2
Total	10	7	17

**Table 4:** The distribution of previously and currently diagnosed students with refractive errors

Variables	Number	Percentage (%)
Previously diagnosed refractive error	11	64.7%
Currently diagnosed refractive error	6	35.3%
Total	17	100%

**Table 5:** Number and percentage of students with normal vision, Refractive error and Non refractive visual impairment

Variables	Number	Percentage
Normal vision	135	86.0%
Refractive error	17	10.8 %
Non refractive error	5	3.2%
Total	157	100.0%

## DISCUSSION

In this study, the prevalence of refractive error was found to be 10.8%. This shows that uncorrected refractive error was the commonest cause of visual impairment (77.3%) among the medical students. In line with our findings, Megbelayin *et al.*, (2019) also reported that 79.5% of the medical students from University of Calabar, Nigeria had refractive error. The result of this study, however, shows lower prevalence of refractive error compared to other published studies in Africa (Kabinda and Mousumi, 2016; Alruwaili *et al.*, 2018; Lily and Daniel, 2019). Demographic characteristics of the studied population, such as age, gender, race, ethnicity, genetic and environmental factors might have accounted for the variation in the prevalence of refractive error around the World. Also, variation in prevalence between rural and urban settings could be attributed to differences in socioeconomic status, educational level, an increase demand of close work, and lifestyle changes. Most of the students were from rural areas which may

explain why the prevalence of refractive error was lower than most previous studies in Africa.

The study showed that the commonest refractive error among the college students was myopia (70.6%), followed by hyperopia (17.6%) and then astigmatism (11.8%) which is consistent with many previous studies (COMET *et al.*, 2013 ; Alruwaili *et al.*, 2018 ; Jin *et al.*, 2018) which increases with advancing age.

Interestingly, however, the result of this study is slightly lower than other published studies (Kyari *et al.*, 2009; Kabinda *et al.*, 2016; Lily and Daniel, 2019). The high prevalence of myopia in these students could be attributed to the increased intensity of near work caused by an elongation in axial length of the eyeball which is not accompanied by proportional increase in the refractive power of the eye.

However, contrary to the result of this study, other studies have reported different trends. Kabinda *et al.*, (2016) reported that myopia was the major refractive error (81.9%), followed by astigmatism (14.9%) and then hyperopia (3.2%). Furthermore, Hashemi *et al.*, (2018) in a systemic review of refractive errors around the world showed that astigmatism was the most common refractive error in children and adults followed by hyperopia and then myopia.

Aller *et al.*, (2014) suggested certain strategies to minimize the progression of myopia which include prescription of corrective spectacles, increase outdoor activities, and the use of pharmacological agents. The best method of correcting refractive errors is the prescription of appropriate corrective spectacles.

The prevalence of hyperopia of 17.6% was remarkably high in the study, but was consistent with the result of a study previously conducted in Calabar, Nigeria

(Megbelayin *et al.*, 2019). In comparison with other published studies in Africa (Lily and Daniel; Kabinda and Mousumi, 2016) the prevalence of hyperopia in this study was significantly higher which may be attributed to geographical and ethnic variation. In the current study, the prevalence of astigmatism (11.8%) was similar to the study of Kabinda and Mousumi, (2016) but was significantly lower than another published work in Nigeria by Megbelayin *et al.*, (2019). The commonest pattern of astigmatism observed in the college students was the simple type.

Results from many studies show that females are disproportionately affected, being 70% more likely to have refractive error compared to their male counterparts. Earlier exposure to pubertal hormones-induced growth; particularly of the length of the eye ball may explain the gender related differences in prevalence of refractive error (Sanfilippo *et al.*, 2008). This is contrary to the findings of the current study since the prevalence of refractive error in both sexes was almost equally distributed among the college students. Lyu *et al.*, (2015) reported that after menarche, females are associated with decreased risk of moderate and high myopia.

The result showed high rate of undiagnosed and uncorrected refractive error (28%) among the college students which is consistent with the findings of previous studies that uncorrected refractive errors contribute significantly to the burden of visual impairment (Rahman *et al.*, 2015; Alruwaili *et al.*, 2018). In this study, uncorrected refractive error among the students was significantly high which may be attributed to lack of awareness about the defects.

Simple provision of corrective spectacles could have reduced visual impairment due refractive errors by 2.9% (10.6 – 7.7%) in the study group. In agreement, The Nigeria National Blindness and visual impairment

Study (Ezelum *et al.*, 2011) observed that correction of refractive error significantly reduced the burden of blindness. The most reliable and cost effective strategy to minimizing this readily treatable and preventable cause of visual impairment and blindness in developing nations, like Nigeria is the provision of an appropriate pair of spectacles.

## CONCLUSION

The present study has established that the prevalence of uncorrected refractive error among the students was 10.8% with preponderance of myopia (70.6%) followed by hyperopia (17.6%) and then astigmatism (11.8%). The high prevalence of refractive error among the medical students reflects the prolong nature of close work of medical studies. We suggest that periodic eye screening programmes could lead to early detection of ocular problems due to refractive errors and timely use of appropriate pair of spectacles could assist in the fight against this avoidable blindness that impact negatively on the future career prospect of these students.

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