



Research Article

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## Prevalence and Distribution of Refractive Errors Among Undergraduates of a Private Tertiary Institution in Nigeria

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### Abstract

Refractive errors constitute one of the predominant causes of visual disorders globally, particularly in young adults. This study aims to assess the prevalence and distribution of refractive errors among undergraduates of Madonna University, Elele, Rivers State. A descriptive, cross-sectional study was carried out with 250 undergraduate students chosen at random from different faculties. The participants were divided into four groups based on their visual acuity, objective and subjective refraction: myopia, hyperopia, astigmatism, and emmetropia. To assess awareness and the use of corrective measures, a standardized questionnaire was also given out. Of the 250 students examined, 47 (18.8%) were emmetropic and 203 (81.2%) exhibited forms of refractive errors. The most prevalent refractive error was myopia (38.4%) followed by hyperopia (26.0%), and astigmatism (16.8%). The greatest number of refractive errors (85 cases, 42.0%) were seen in the 21–23 age range. The prevalence was marginally higher in females (56.2%) than in males (43.8%). Of the students with refractive errors, 132 (65.0%) were either unaware of or did not use any form of correction, whereas 71 (35.0%) reported using corrective lenses. The study indicates a significant prevalence of refractive errors among university students, with myopia as the most prevalent. The distribution of refractive errors varied by age and gender. The university community needs frequent eye tests and awareness campaigns because, despite the high prevalence, awareness and usage of corrective procedures were comparatively low.

**Keywords:** Refractive errors, Myopia, Hyperopia, Astigmatism, Emmetropia, Visual acuity.

### INTRODUCTION

When parallel beams of light fail to concentrate on the retina, refractive errors occur. A refractive error is something in the natural shape of the eyes that causes vision to blur. Refractive errors are among the most prevalent vision disorders that people encounter<sup>[1]</sup>. The eyes function as a relay team, passing light that enters the eye down a pathway to the brain. Light goes through the cornea (the clear part at the front of the eye). The cornea focuses that light through the lens, resulting in a signal that reaches the retina. The retina turns light into electrical signals, which the optic nerve transmits to the brain. The brain then uses these messages to generate the images seen. Depending on the type of refractive error, the shape of the eyeball, cornea, or lens restricts the eyes from properly focusing on objects.

This distorts vision. There are different types of refractive errors. Some make it difficult to focus on near items, while others cause distant objects to appear hazy. Most people acquire refractive errors as they grow and develop. Many refractive errors first emerge in children, although they can develop at any age, even if they had previously had clear vision<sup>[2]</sup>. People who have refractive errors frequently exhibit a variety of visual and ocular symptoms that can have a major impact on their everyday activities and general quality of life. Because light entering the eye does not focus perfectly on the retina, the most common complaint is blurred or foggy vision. This blurred vision may be experienced at a distance, near, or both, depending on whether the error is myopic, hyperopic, or astigmatic in nature<sup>[3]</sup>.

In addition to blurred vision, difficulties with tasks that require visual concentration, such as reading, using digital devices, or attending lectures, are frequently reported. Visual fatigue, also known as eyestrain, can result from prolonged attempts to focus when there is an uncorrected refractive error. A lot of people also get headaches from prolonged accommodative strain and squinting, especially frontal or periorbital headaches<sup>[4]</sup>.

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Myopia (nearsightedness), hyperopia (long-sightedness), astigmatism, and presbyopia are common types of refractive errors [5]. Myopia, hyperopia, and astigmatism are among the vision problems that many college students encounter as a result of refractive errors. If these errors are not identified and corrected, they may result in eye strain, poor academic performance, and a lower quality of life. Despite this, regular eye exams are frequently excluded from the healthcare package for students attending Nigerian Universities. The prevalence of these vision problems among Madonna University students between the ages of 18 and 25 is not well documented. Effective programs for eye care are hard to plan without this knowledge.

## MATERIALS AND METHODS

### Ethical consideration

This study was approved by Madonna University Research Ethics Committee.

### Research Design

This study is a descriptive, cross-sectional study carried out in Madonna University, Elele Campus, Rivers State to access the prevalence and distribution of refractive errors among undergraduates.

### Area of study

Madonna University, Nigeria, holds the honor of being the nation's first Catholic university. A significant turning point in Nigerian higher education was reached in 1999 when the Very Rev. Fr. Prof. E.M.P. Edeh, CSSp, OFR, founded the institution. It was promptly approved by the National Universities Commission (NUC). Since then, the institution has developed into a symbol of intellectual achievement, embodying a rich academic legacy with its all-encompassing and holistic approach to education. The university is strategically spread across three distinct campuses: The Elele campus in Rivers State, the Okija campus in Anambra State, and the Akpugo campus in Enugu State. While Okija is well known for emphasizing the arts, education, law, management, and social sciences, the Elele campus is unique in that it focuses on health sciences. Each campus is built to concentrate on a different subject of study altogether. In addition to its sophisticated departments and faculties, Madonna University Teaching Hospital, Elele

campus, is critical to the convergence of clinical training and academic theory. Akpugo campus, on the other hand, is home to specialized engineering programs and other advanced disciplines. Madonna University has established a strong student body, securing its place among the top private universities in Nigeria. 5,174 female students and 4,589 male students make up the roughly 9,763 undergraduate students enrolled. This massive enrollment shows that parents and students have faith in the university's academic standing and that it can offer a dynamic and diverse learning environment on all of its campuses.

### Population of Study

The target population for this study were undergraduate students of Madonna University aged 18–25 years.

### Inclusion and Exclusion Criteria Inclusion Criteria:

- Age between 18 and 25 years.
- Enrollment as a full-time student at Madonna University.
- No known ocular diseases unrelated to refractive error.
- Willingness to participate and provide informed consent

### Exclusion Criteria:

- Presence of systemic or ocular conditions (e.g., cataract, glaucoma) that could affect vision unrelated to refractive error.
- Use of ocular medications that may alter refractive status.
- History of ocular surgery or trauma that could affect visual outcomes.

- Refusal or inability to provide informed consent or complete the study procedure

## Sampling Size and Sampling Technique

### Sampling Size

The study's sample size comprised 250 students enrolled at Madonna University, Nigeria, aged 18 to 25 years. Although, 384 students were initially recruited as the study sample size, the final number of participants was reduced to 250 after applying the exclusion criteria to ensure that only eligible respondents were included in the analysis. This sample size was chosen in order to guarantee sufficient representation of the target population and to offer trustworthy prevalence information on refractive errors in the designated age range. Based on the objectives of the study, the size was judged statistically sufficient for significant analysis and was influenced by time, logistical feasibility, and resource constraints.

### Sampling Technique

To enhance the representativeness of the sample, a stratified random sampling technique was employed. To guarantee equal representation from various academic disciplines and a balanced male-to-female ratio, the population was first divided into faculty and gender groups. A simple random sampling method was then used to choose participants at random within each stratum in order to prevent selection bias and guarantee that every eligible student had an equal chance of becoming a part of the study. By using this method, sampling error was lessened and the data gathered accurately represented the distribution and prevalence of refractive errors throughout the wide range of students. Additionally, ethical standards were upheld by only including students who satisfied the inclusion criteria and gave their voluntary assent to participate.

## Instruments for Data Collection

### Instruments used in this study include the following

- Snellen chart
- Near visual acuity chart
- Occlude
- Trial frame and loosed lenses
- Keeler streak retinoscope
- Keeler ophthalmoscope
- Questionnaire

## Validity and Reliability of Instruments

Standard Optometric instruments were used for the study.

## Procedure for Data Collection

For every participant, a comprehensive case history was first obtained to collect demographic information (age, gender, academic level) as well as relevant ocular and systemic health history. This included questions on any history of eye disease, previous use of spectacles or contact lenses, family history of refractive errors, and habits that could influence visual function (e.g., screen time, outdoor activities).

To guarantee comprehension and cooperation, each participant received a thorough explanation of the testing's objectives and methods prior to the start of the examination. Once the appropriate consent was obtained, they also completed a questionnaire.

## Visual Acuity Assessment

Distance visual acuity was measured at 6 meters using an illuminated Snellen's distant vision chart in a well-lit environment. Near visual acuity was measured at 40 cm using a Snellen's near vision chart under similar bright lighting conditions. Both eyes were tested separately (monocular

testing) and then together (binocular testing) without correction and, where applicable, with any habitual correction.

### Objective and Subjective Refraction

Individuals with subnormal unaided visual acuity were subjected to additional refractive testing. A Keeler streak retinoscope was used to perform objective refraction in a low-light environment so that the reflex could be clearly seen. The response in each eye meridian was neutralized using a trial frame and loose trial lenses. Subjective refraction was used to refine the prescription after the objective findings were obtained. A number of lenses were placed in front of the participant's eye during this procedure, and they were asked to rate the clarity of each one until the best corrected visual acuity (BCVA) was attained. The Jackson cross cylinder procedure was used to further refine astigmatism, where present.

### Ocular Examination

Every study participant had both eyes checked to make sure that any vision loss was caused by a refractive defect and not another ocular condition. Ophthalmoscopic examinations were conducted when necessary to rule out internal ocular abnormalities. This systematic procedure guaranteed that each participant's refractive errors were measured accurately and reliably.

### Procedure for Data Analysis

Descriptive statistics from the statistical package for social science (SPSS Version 29) were used to evaluate the data. Tables and several pie and bar charts were used to display the data that was gathered.

## RESULTS

The results section presents the findings of the study on the Prevalence and Distribution of Refractive Errors among Undergraduates of Madonna University, Elele, Rivers State. The total number of participants was 250 students aged 18 to 25 years comprising 140 females (56%) and 110 males (44%) across various faculties of Madonna University.

**Table 1:** Age Distribution of Respondents (N = 250)

Category	Frequency (N)	Percentage (%)
18-20	72	28.8
21-23	110	44.0
24-25	68	27.2
Total	250	100

A total of 250 students aged between 18 and 25 years participated in the study. The majority of respondents (44.0%) were within the 21–23 age group, followed by 28.8% in the 18–20 age group, and 27.2% in the 24–25 age group. This distribution reflects a fairly balanced representation of early and mid-young adulthood within the university population.

**Table 2:** Gender Distribution of Respondents (N = 250)

Category	Frequency (N)	Percentage (%)
Male	110	44.0
Female	140	56.0
Total	250	100

Gender-wise, female participants accounted for a slightly higher proportion (56.0%) compared to males (44.0%), indicating a modest gender imbalance in the sample, possibly reflective of actual university enrollment trends.

**Table 3:** Department Distribution of Respondents (N = 250)

Category	Frequency (N)	Percentage (%)
Optometry	90	36.0
Nursing Science	65	26.0
Pharmacy	30	12.0
Medical Laboratory Science	40	16.0
Public Health	25	10.0
Total	250	100

With respect to department distribution, students from the Department of Optometry represented the largest group (36.0%), likely due to their greater interest or accessibility for participation in a vision-related study. This was followed by students from the Department of Nursing Science (26.0%), Medical Laboratory Science (16.0%), Pharmacy (12.0%), and a smaller proportion (10.0%) from Public Health. This variety helped ensure a more representative sample across academic disciplines.

**Table 4:** Distribution of refractive errors by age group

Age Group	Myopia	Hyperopia	Astigmatism	Total Refractive Errors
18-20	33	21	14	68
21-23	40	28	17	85
24-25	23	16	11	50
Total	96	65	42	203

**Table 5:** Gender distribution of refractive errors

Refractive Error	Male	Female	Total
Myopia	42	54	96
Hyperopia	29	36	65
Astigmatism	18	24	42
Emmetropia	21	26	47
Total	110	140	250

From the above information given, no significant difference in prevalence was found between males and females. The level of significance ( $p > 0.05$ )

Out of the 203 students with refractive errors, only 71 (35.0%) reported using corrective lenses or having undergone corrective procedures

## DISCUSSION

The study investigated the Prevalence and Distribution of Refractive Errors among Undergraduates of Madonna University, Elele, Rivers State. This section provides a detailed comparison of the findings with relevant studies, draws inferences, and explores possible reasons for differences or similarities in results. The study involved 250 students aged 18 to 25 years comprising 140 females (56%) and 110 males (44%) across various departments of Madonna University. This study reveals a high prevalence of refractive errors (81.2%) among university students aged 18 to 25 years, with myopia being the most common (38.4%), followed by hyperopia (26.0%), and astigmatism (16.8%). The findings of this study are somewhat consistent with previous research on the frequency and distribution of refractive errors in young adults, particularly college students. Global trends that identified myopia as a serious public health concern, particularly among students and populations involved in chronic near labor [6], which are consistent with the observed prevalence of myopia (38.4%). Additionally, compared to hospital-based, which found astigmatism to be more common [7], our findings indicate hyperopia (26.0%) was more common than astigmatism (16.8%). The discrepancy, however, might be explained by the fact that the study recruited a younger, more active reading group rather than a hospital cohort with more clinical symptoms, where results could be influenced by older patients and concomitant diseases. Also, Abah *et al.*

(2018) discovered that the prevalence of hyperopia among Nigerian secondary school students was lower (18-21%). In their meta-analysis of student visual health, it was indicated that age-related accommodative lag, prolonged screen usage, and less outdoor activity may be the cause of our study's higher rate<sup>[8]</sup>. Even though astigmatism is less widespread here, it remains clinically relevant. Disparities between studies may be due to discrepancies in diagnostic criteria and equipment. Astigmatism may be under-detected and under-reported, particularly during school screenings<sup>[9]</sup>. Another recurrent characteristic in low- and middle-income countries is the limited uptake of corrective measures (only 36.4% of those affected wore glasses or underwent treatment). In line with the worldwide observations made by the World Health Organization and reaffirmed in African contexts, barriers include expense, limited access to eye care experts, low awareness, and social shame<sup>[10-11]</sup>. In a 2024 cross-sectional study among medical students in Raichur, India, Gowda *et al.* reported a lower total prevalence of refractive errors at 37.6%, with myopia accounting for 18.4%, hyperopia for 9.6%, and astigmatism also for 9.6%. Although the figures are substantially lower than those of the present study, the hierarchical distribution of refractive error types is consistent, myopia being most frequent. The difference in total prevalence may be attributed to variations in screening coverage, socioeconomic background, and academic workload<sup>[12]</sup>. In a high-density academic setting in Tianjin, China, it was reported that a strikingly high prevalence of myopia at 92.5%, with emmetropia accounting for only 6% and hyperopia for just 1.3%<sup>[13]</sup>. The overwhelming dominance of myopia in East Asia has been associated with increased near work, prolonged screen exposure, and limited outdoor activity. Compared to our findings, the Chinese prevalence highlights the influence of environmental and lifestyle factors on refractive development.

The Kazerun Eye Study conducted in Iran revealed that 42.7% of people had myopia, 3.8% had hyperopia, and 29.5% had astigmatism<sup>[14]</sup>. Despite the fact that their high astigmatism rate is due to regional differences in corneal biomechanics or even differences in the diagnostic criteria used to identify clinically severe astigmatism, this is in line with the global high myopic trend. The prevalence of total refractive error was much lower at 25.2%, with myopia accounting for 38.3% and hyperopia for 4.9%, according to a 2023 retrospective study by Yakubu *et al.* from a federal university clinic in North-Central Nigeria. The lower rates are likely due to the study's hospital-based design, which only tracks patients who show up for a clinical assessment. This means that asymptomatic or untreated instances that are common in general populations are not included.

Furthermore, a study in southeastern Nigeria found that over 60% of university students with refractive errors had never undergone an eye examination, echoing our findings that only 35.0% of affected individuals were using corrective lenses<sup>[15]</sup>. This trend emphasizes widespread under-diagnosis and poor access to eye care services among young adults in resource-limited settings. Collectively, while the absolute values vary across regions and methodologies, the global consensus affirms myopia as the most prevalent refractive error, especially among university-age populations. Environmental exposure, academic pressure, genetics, and access to screening are major determinants shaping these patterns. Our results underscore the urgent need for proactive screening and vision correction interventions in tertiary institutions across Nigeria. Even though the trends in this study are generally in line with data from other countries and regions, small variances in incidence patterns are probably due to differences in methodology, age demographics, and environmental factors.

## CONCLUSION

According to this study, more than four out of five Madonna University students suffer from refractive errors. In line with global trends that link myopic progression to increase near work, screen exposure, and decreased outdoor activity, myopia emerged as the most common refractive error. The prevalence of hyperopia and astigmatism followed trends seen in comparable university-based populations in Nigeria and around the world. Additionally, the data points to a little female predominance in refractive errors and a larger load among penultimate

and final-year students, which is probably caused by academic visual stress. Given that untreated refractive errors can impair learning effectiveness and lower academic performance, the low percentage of students (35.0%) utilizing corrective devices is alarming. Conclusively, refractive errors, though simple to diagnose and correct, remain underdetected and undercorrected within the university population. Addressing this issue should be considered a health and academic priority.

## Conflict of interest

There is no conflict of interest.

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