

Prevalence and types of refractive error among students presenting to a federal university school clinic in North-Central Nigeria

Fatima H Umar¹, Ruth J Alfin²

Abstract

Background: Uncorrected refractive error (URE) is a major public health problem with extensive negative social and economic impact on patients. It can limit educational and employment opportunities of affected individuals. We sought to determine the prevalence and types of refractive error (RE) among students presenting to a federal university school clinic in North-central Nigeria.

Methods: A school based retrospective study where the records of all students seen at the eye unit of the university clinic between March, 2019 and March 2020 was done. Details of student's refractions were retrieved from their records and categorized based on distant and near RE types. For each student, the eye with the better vision was used for the analysis. Myopia was defined as an error of greater or equal to -0.50DS; hypermetropia as an error of greater than or equal to +0.50DS; while astigmatism was defined as an error of greater than or equal to 0.50DC. Data was analyzed using Statistical Package for Social Student version 21.

Results: A total of three hundred and twenty-two students

were seen in the eye unit of the university clinic during the study period, of which 95 (29.5%) underwent refraction. RE was found in 81 of them giving a RE prevalence of 25.2%. There were more females 49 (58.0%) than males with RE with a M: F of 1:1.4. With an age range of 17-58 years, the most frequent age group was 17-26 years (51.8%). Myopia was the predominant RE 31(38.3%) and hypermetropia was the least RE found in 4 (4.9%) eyes.

Conclusion: Uncorrected refractive error is common among university students presenting to the eye unit of the university clinic with myopia being the most common type. There is therefore, a need to establish regular and effective screening programmes that will promote early detection and correction in order to forestall its negative impact on students' academic performance.

Keywords: Refractive error, Prevalence, students

Highland Med Res J 2022;23(2):51-54

Introduction

Uncorrected refractive error (URE) is the leading cause of visual impairment and the second leading cause of blindness worldwide.^{1,2} It is a major public health problem with extensive negative social and economic impact on patients and their families. It can limit educational and employment opportunities of affected individual and their communities. It has been reported that, URE results in an annual loss of \$269 billion worldwide.³ Factors such as poverty and lack of access to treatment limits its correction.⁴ To the best of the authors' knowledge no study has been done on refractive error (RE) in this university community. This study reports on the prevalence and types of RE among students who invariably need good vision to enhance their academic potentials.

Methods

A hospital based retrospective study of the medical records of all students who presented to the eye unit of the University Health services in Jos between March

2019 and March 2020 on account of eye problem was done. The university clinic is located in Jos, the capital of Plateau state in North-central Nigeria and it provides health care for students, academic and nonacademic staff of the university and their relations as well as the public.

Clinic records of all patients seen within the said period was got and those of the students were identified, retrieved and reviewed. All students who had subjective refraction were included and the result of subjective refraction was used for the analysis, except in cases where the refraction did not improve their vision or details of the refraction findings were not recorded in the case note. Information obtained from patient's case notes included age, sex, refraction results as well as the diagnosis. Students with incomplete refraction results were excluded from the study. The eye with the better presenting visual acuity was used in classifying the student's RE type. Refractive error was defined based on this study as presenting visual acuity of 6/9 or worse and or near vision of worse than N5. Myopia was defined as an error of greater than or equal to -0.50 diopters sphere; hypermetropia was an error of greater or equal to +0.50 diopters sphere, while astigmatism was defined as an error of greater than or equal to ± 0.50 diopters cylinder. All students who needed a reading addition were considered as having presbyopia, particularly if there was difficulty in reading fine print despite full correction for distant RE. The study was approved by the Research Ethics committee of the University of Jos.

¹Department of Ophthalmology, Faculty of Medical Sciences, University of Jos, Nigeria. ²Department of Surgery, College of Medicine and Allied Health Sciences, Bingham University. Jos Campus Nigeria.

All correspondences to:
Fatima H Umar
Email: umarfatima939@gmail.com

Results

A total of 24,000 students were seen in the General Out-Patient Department (GOPD) of the University Health Services during the study period, of which 322(1.3%) students were either referred from the GOPD or presented directly to the eye clinic. Their ages ranged from 17-58 years with mean age of 25.8 (± 7.5) years with age category of 17-26 years constituting the most common age group as seen in table 1. Of the students seen at the Eye unit, 95 (29.5%) students had reduced vision (less than or equal to 6/9 and or near vision of less than N5) in one or both eyes and had refraction. Of these, 81 students (25.2%) were found to have RE. Table 2 shows the age sex distribution of students with refractive error. Forty-nine (60.5%) were females with a male to female ratio of 1: 1.4.

Table 1: Age distribution of study participants

Age category(years)	Frequency	Percent
17-26	217	67.4
27-36	66	20.5
37-46	32	9.9
>46	7	2.2
Total	322	100

Table 2: Age and Sex distribution of students with refractive error(N= frequency)

Age Category (years)	Sex		Total N(%)
	Male N(%)	Female N(%)	
17-26	13(39.4)	28(58.3)	41(50.6)
27-36	2(6.1)	6(12.5)	8(9.9)
37-46	15(45.5)	11(22.9)	26(32.1)
> 46	3(9.0)	3(6.3)	6(7.4)
Total	33(100.0)	48(100.0)	81(100.0)

Table 3: Distribution of refractive error among students

Type of refractive error	Number of patients (%)
Myopia	31(38.3)
Astigmatism	18(22.2)
Hypermetropia	4(4.9)
Presbyopia	28(34.6)
Total	81(100.0)

Myopia was the commonest RE seen in 31(38.3%) eyes, this was followed by presbyopia 28 (34.6%) with the least being hypermetropia 4 (4.9%) as shown on Table 3. The age group where all the different types of RE was most

Table 4: Distribution of refractive error type by age group of students

Age category (years)	Myopia N (%)	Astigmatism N (%)	Hypermetropia N (%)	Presbyopia N (%)	Total
17-26	22(71.0)	16(88.9)	3(75.0)	0	41(50.6)
27-36	5(16.1)	2(11.1)	1(25.0)	0	8(9.9)
37-46	3(9.7)	0	0	23(82.1)	26(32.0)
>46	1(3.2)	0	0	5(17.9)	6(7.5)
Total	31(38.3)	18(22.2)	4(4.9)	28(34.6)	81(100.0)

prevalent was 17-26 years and this was seen in 41(50.6) eyes (See Table 4).

Disaggregating myopia by age and gender, it was found to be more common in the 17-26 years age group (70.1%) and among females (64.5%) as shown in Tables 4 and 5. Of the 31 myopic eyes, 29 eyes (93.5%) had myopia of < -3DS whereas two eyes (6.5%) had myopia of ≥ -3DS. The range of refractive power seen in this study was as follows: myopia: - 0.50DS to - 7.00DS; hypermetropia: + 0.50DS to + 1.00DS; and astigmatism: 0.50DC to 2.50DC. Of the students with presbyopia, 26(92.9%) had presbyopia alone, while 2(7.1%) had other prevailing distant refractive errors. The minimum age at which a subject was prescribed with a reading addition was 37 years. There were more presbyopic males 15 (53.6%) compared to females. The mean

reading add was +1.50DS. The majority (78.6%) of the reading additions were between + 1.00D to + 1.50D. Twenty-five (80.6%) of students with refractive error had their vision corrected to 6/6.

Table 5: Distribution of Refractive error type by gender

Refractive Type	Sex		Total N (%)
	Female N (%)	Male N (%)	
Myopia	20(64.5)	11(35.5)	31(38.3)
Astigmatism	12(66.7)	6(33.3)	18(22.2)
Hypermetropia	3(75.0)	1(25.0)	4(4.9)
Presbyopia	13(46.4)	15(53.6)	28(34.6)
Total	48(59.3)	33(40.7)	81(100.0)

Discussion

This is the first retrospective study done to evaluate the refractive status of students attending the eye unit of federal university clinic in North-central Nigeria. The study highlights the importance of detecting and correcting RE among the studying population. The high prevalence of refractive error found in this study is comparable to that reported by Oveneri-Ogbomo et al.⁵ Higher prevalence of RE of 54.9% and 67.7% was reported among university students by Jyothirmal et al and Maqbool et al respectively.^{6,7} This higher prevalence of RE seen in the above surveys could be due to racial and genetic factors when compared with the index study. However a lower prevalence of 13.3% was documented by Oveneri and Assien in Ghana and 2.2% by Opubiri and Egbe, 4.0% by Nebiyat et al, 9.5% by Abah et al and the 4.8% by Balarabe et al in other parts of Africa.⁸⁻¹² The variation of the prevalence in these studies could be due to difference in race, study area (rural or urban), study sample, age group of study participants, the study definitions, methodology used for the classification of refractive errors as well as the use of cycloplegic agent. In this study, the study sample was students between the ages of 17- 58years with different methodology and classification criteria compared to another study in which children younger than 20 years were studied and also cycloplegic refraction was used in determining refractive status⁹. Cycloplegic refraction would have provided information on latent hyperopia, especially in younger patients with high amplitude of accommodation and as such detect low refractive error that could be missed with non-cycloplegic refraction. However, the non-cycloplegic refraction has the advantage of preventing the blurry vision from the cycloplegic agent which would interfere with the academic activities of the students for the duration of action of the cycloplegic agent used.

Myopia was found to be the most common type of uncorrected refractive error (URE) among the study participants. This finding is similar to the results of other studies.^{6, 11} This could be attributable to the high visual demands related to more time students spent doing near work such as reading, using computer, phones and watching television as was observed in a previous study.¹³ However, a longitudinal study that examined parental myopia, near work, school achievement and children's RE have shown genetic to be an important factor associated with myopia¹⁴. In contrast, some studies found hypermetropia to be the predominant RE type.^{15,16,17} This could probably be due to the study population which included the extreme age groups where hypermetropia is commonly seen. The use of non-cycloplegic refraction in our study could have biased our result towards myopia as the non-cycloplegic refraction have been reported to produce more myopia and less

hyperopia.¹⁸ Some other authors found astigmatism to be common among their study population.^{5,19,20,21} The prevalence of presbyopia in this study is lower than that found among adults 35years and above in population based studies.^{22,23} The age of onset of presbyopia found in the present study is higher than that found in other studies.²³⁻²⁵ However, Tony et al and Edwards et al found a higher age of onset of presbyopia.^{26,27} This variation in the age of onset of presbyopia has been shown in several studies to be attributed to geographical variations in latitude and climate, where hotter climates are associated with earlier onset of presbyopia.²⁸⁻³⁰ More than half of the additions prescribed ranged between + 1.00DS to +1.50DS, as most of those that require the presbyopic correction are between the ages of 37-46 years. This is vital as it will help in planning for refractive services in the university clinic as stocking reading lenses in this range can serve the need of most of the presbyopic population.

More than three quarter of the students with RE were found to have their vision improved to 6/6 with correction. Correction of RE is very necessary as uncorrected refractive error is a major public health challenge worldwide due to the negative impact of poor vision on socioeconomic status of the affected individuals as well as their families and also limiting the educational and employment opportunities of economically active persons and healthy individuals and also limiting the academic performance of the affected students.²² Persistent academic failures can discourage the student and therefore result in loss of interest in the study with eventual withdrawal from school. Therefore, the need for eye screening of new students at registration and periodic reassessment of old students cannot be overemphasized. This would promote prompt identification and correction of RE in order to maximize academic potentials of students.

Conclusion

Refractive errors are common among students presenting to the university clinic with myopia being the most prevalent type. There is therefore need to establish a vision screening programme at registration and periodically during the course of their studies. This will promote early detection and correction of RE and forestall its negative impact on academic performance of the students.

References

1. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol.* 2012;96(5): 614-618. doi:10.1136/bjophthalmol-2011-300539.
2. Naidoo KS, Leasher J, Bourne RR, Flaxman SR, Jonas JB, Keeffe J et al. Global vision impairment and blindness due to uncorrected refractive error,

- 1990–2010. *Optom Vis Sci.* 2016;93(3):227-234. doi:10.1097/OPX.0000000000000769.
3. Fricke TR, Holden BA, Wilson DA, Schlenker G, Naidoo KS, Resnikoff et al. Global cost of correcting vision impairment from uncorrected refractive error. *Bull World Health Organ.* 2012;90(10):728-738. doi:10.2471/BTL.12.104034.
 4. Smith TST, Frick KD, Holden BA, Fricke TR, Naidoo KS. Potential lost productivity resulting from the global burden of uncorrected refractive error. *Bull World Health Organ.* 2009; 87(6): 431-437. doi:10.2471/BLT.08.055673.
 5. Oveneri-Ogbomo GO, Omuemu VO. Prevalence of refractive error among school children in the Cape Coast Municipality, Ghana. *Clinical Optometry.* 2010; 2:59-66. doi:10.2147/OPTO.S10583
 6. Jyothirmai T, Meenakshi V, Padmavathi SV. A study on refractive error among medical students attending ophthalmology department. *IOSR J Dent MedSci.* 2017; 16:57-61.
 7. Maqbool S, Rizwan AR, Manzoor I, Qais A, Furqan A, Rehman A. Prevalence of refractive errors among medical students and identification of associated factors. *Life and science.* 2021;2(4):164-168.
 8. Oveneri-Ogbomo GO, Assien R. Refractive error in school children in Agona Swedru, Ghana. *S Afr Optom.* 2010;69(2):86-92.
 9. Nebiyat K, Alemayehu W, Tigist SW. Refractive errors among school children in Addis Ababa, Ethiopia. *JOECSA.* 2015;19(2):1-6.
 10. Opubiri I., Adio, AO, Megbelayin EO. Refractive error pattern of children in South-South Nigeria: A tertiary hospital study. *Sky J of Med. and Med. Sci.* 2013;1(3):10-14. Available online <http://www.skyjournals.org/SJMMMS>. Accessed May 13, 2021.
 11. Abah E, Chinda D, Samaila E, Anyebe E. Profile of refractive errors and presbyopia in a university community: A clinical study. *Annals of Nig Med.* 2010;4(2):55-58.
 12. Balarabe HA, Adamu I, Abubakar A. Vision screening to detect refractive errors in three selected secondary schools in Birnin Kebbi, North West, Nigeria. *Sahel Med Journal.* 2015;18(2):61–65. doi:10.4103/1118-8561.160799.
 13. Phillip D, Vogel M, Brandt M, Rauscher F G, Hiemisch A, Wahl S, et al. The relationship between myopia and near work, time outdoors and socio-economic status in children and adolescent. *BMC Public Health.* 2022; 22: 2058.
 14. Mutti DO, Mitchell GL, Moeschberger ML, Jones LA, Zadnik K. Parental myopia, near work, school achievement, and children's refractive error. *Invest Ophthalmol and Vis Sci.* 2002;43(12):3633-3640.
 15. Nwosu SN. Blindness and visual impairment in Anambra state, Nigeria. *Trop Geo Med.* 1994;46(6): 346-349.
 16. Nworah PB, Ezepue UF. Prevalence of errors of refraction in a Nigerian eye clinic. *Orient Journal of Med.* 1992; 4:57-60.
 17. Bagaiya T, Pam V. Refractive errors in Kaduna, Nigeria. *Nig J Surg Res.* 2003;5(3):106-109.
 18. Li T, Zhou X, Zhu J, Tang X, Gu X. Effects of cycloplegia on the measurement of refractive error in Chinese Children. *Clin and Exp Optometry.* 2019; 102:160-165.
 19. Kawuma M, Mayeku R. A survey of the prevalence of refractive errors among children in lower primary schools in Kampala District. *Afr Health Sci.* 2002;2 (2):69-72
 20. Ejimadu CS, Onua AA. Pattern of refractive errors and presbyopia seen in a private eye clinic in Port Harcourt, Nigeria. *Journal of Med and Biomed Research.* 2014;13(2): 82-86.
 21. Nakua EK, Otupiri E, Owusu-Dabo E, Dzomeku VM, Out-Danquah K, Anderson M. Prevalence of refractive errors among junior high school students in the Ejisu-Juaben municipality of Ghana. *Journal of Sci and Tech.* 2015;35(1):52-62. doi:10.4314/just.v35i1.5.
 22. Uche N, Ezegwui I, Uche E, Onwasigwe EN, Umeh RE, Onwasigwe CN. Prevalence of presbyopia in a rural African community. *Rural and remote health.* 2014; 14:2731.
 23. Marmamula S, Keeffe JE, Raman U, Rao GN. Population-based cross-sectional study of barriers to utilization of refraction services in South India: Rapid Assessment of Refractive Errors. *British Med Journal Open.* 2011;1(1):e000172.
 24. Koroye-Egbe A, Oveneri-Ogbomo G, Adio AO. Refractive Error Status in Bayelsa State, Nigeria. *Journal of the Nig Optometric Association.* 2010;16 (2):11-15.
 25. Ejimadu CS, Onua AA, Ani E. Onset of Presbyopia in a black population in Niger-Delta, Nigeria. *W J of Ophthal & Vision Res.* 2019;2(4):1-3.
 26. Tony C, Pinhkeo S. A retrospective study on presbyopia onset and progression in a Hispanic population. *Optometry.* 2005; 76(1):37-46.
 27. Edwards MH, Law LF, Lee CM, Leung KM, Lui WO. Clinical norms of Amplitude of accommodation in Chinese. *Ophthalmic and Physiol Opt.* 1993; 13(2):199-204.
 28. Weale RA. Epidemiology of refractive errors and presbyopia. *Surv of Ophthalmol.* 2003;48(5):515-543.
 29. Miranda MN. The geographic factors in the onset of presbyopia. *Trans of the Am Ophthalmol Soc.* 1979; 77:603-621
 30. Rambo VC. Further notes on the varying ages at which different people develop presbyopia. *Am J Ophthalmol.* 1953;36(5):709-10. doi:10.1016/0002-9394(53)90315-8. PMID:13040471