

Refractive errors among patients attending the ophthalmology department of a medical college in North-East India

Tanie Natung¹, Trishna Taye¹, Laura Amanda Lyngdoh¹, Begonia Dkhar¹,
Ranendra Hajong²

¹Departments of Ophthalmology, ²General Surgery, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Shillong, Meghalaya, India

ABSTRACT

Purpose: To determine the magnitude and pattern of refractive errors among patients attending the ophthalmology department of a new medical college in North-East India. **Materials and Methods:** A prospective study of the new patients (age ≥ 5 years), who were phakic and whose unaided visual acuities were worse than 20/20 but improved with pinhole, was done. Complete ophthalmic examination and refraction with appropriate cycloplegia for age were done for the 4582 eligible patients. Spherical equivalents (SE) of refractive errors of the right eyes were used for analysis. **Results:** Of the 4582 eligible patients, 2546 patients had refractive errors (55.56%). The proportion of emmetropia (SE -0.50 to $+0.50$ diopter sphere [DS]), myopia (SE < -0.50 DS), high myopia (SE > -5.0 DS), and hypermetropia ($> +0.50$ DS for adults and $> +2.0$ DS for children) were 53.1%, 27.4%, 2.6%, and 16.9%, respectively. The proportion of hyperopia increased till 59 years and then decreased with age ($P = 0.000$). The proportion of myopia and high myopia decreased significantly with age after 39 years ($P = 0.000$ and $P = 0.004$, respectively). Of the 1510 patients with astigmatism, 17% had with-the-rule (WTR), 23.4% had against-the-rule (ATR), and 19% had oblique astigmatisms. The proportion of WTR and ATR astigmatisms significantly decreased ($P = 0.000$) and increased ($P = 0.000$) with age, respectively. **Conclusions:** This study has provided the magnitude and pattern of refractive errors in the study population. It will serve as the initial step for conducting community-based studies on the prevalence of refractive errors in this part of the country since such data are lacking from this region. Moreover, this study will help the primary care physicians to have an overview of the magnitude and pattern of refractive errors presenting to a health-care center as refractive error is an established and significant public health problem worldwide.

Keywords: Astigmatism, hypermetropia, myopia, refractive errors, spherical equivalent

Introduction

Refractive error is the most common cause of visual impairment and the second most common cause of blindness in the world. The global estimate of the total number of people of all ages with visual impairment is 253 million, of which 36 million are blind.^[1,2] The major causes of visual impairment are uncorrected refractive errors (43%) followed by cataract (33%). About

217 million people have low vision (severe to moderate visual impairment) in the world.^[1,2]

Refractive error has been recognized as a public health problem in many countries including India as well as by the WHO in its global initiative VISION 2020 – the right to sight.^[2] It may lead to a loss of education and employment opportunities, lower productivity, and impaired quality of life.^[2-4]

The loss of sight causes enormous human suffering to the affected individuals and their families as well as economic losses

Address for correspondence: Dr. Tanie Natung,
North Eastern Indira Gandhi Regional Institute of Health
and Medical Sciences, Mawdiangdiang, Shillong - 793 018,
Meghalaya, India.
E-mail: natungtanie@gmail.com

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How to cite this article: Natung T, Taye T, Lyngdoh LA, Dkhar B, Hajong R. Refractive errors among patients attending the ophthalmology department of a medical college in North-East India. J Family Med Prim Care 2017;6:543-8.

Access this article online

Quick Response Code:



Website:
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DOI:
10.4103/2249-4863.222023

globally.^[5] The global cost of correcting vision impairment from uncorrected refractive error has been estimated to be 2800 million US dollars.^[6] Similarly, the potential productivity loss resulting from the global burden of uncorrected refractive error has been estimated to be 121.4 billion international dollars.^[7]

Up to date information on the prevalence and causes of visual impairment is essential to set policies and priorities and to evaluate global eye health.^[1] It is important for the primary care physicians to know the magnitude and type of refractive errors among the patients attending a health-care center since refractive error is an established and significant public health problem.

There are some population-based studies on refractive errors from India, but to the best of our knowledge, there is no hospital- or population-based study on refractive errors reported from North-East India.

Therefore, we conducted a prospective, cross-sectional study of patients attending the outpatient department (OPD) of ophthalmology of a medical college in North-East India to find out the magnitude and pattern of refractive errors in different age groups.

Materials and Methods

A hospital-based, prospective, cross-sectional study was conducted in the department of ophthalmology of a new medical college in North-East India. The study was conducted in accordance with the ethical standards of 1964 Declaration of Helsinki.

Only the new patients who attended the Ophthalmology OPD between 1st June, 2011 to 31st May, 2012 were included in the study. All the patients of age 5 years or more who were phakic and whose unaided visual acuities were worse than 20/20 in one or both eyes but improved with pinhole were selected.

A proper pro forma was made containing all the relevant information of the patients. Assessment of visual acuity using a standard illuminated Snellen's visual acuity chart or E chart with and without pinhole was done for all the patients. Automated refraction with auto-ref/keratometer (Unicos URK-700, Korea) and objective refraction using streak retinoscope (Beta 200; Heine Optotechnik GMBH and Co., KG, Herrsching, Germany) were done by an optometrist. Cycloplegic refraction using two drops of cyclopentolate 1% was done for children up to 18 years of age. Subjective refraction was performed for all the patients. The anterior and posterior segments of these patients were examined in detail. Patients with pseudophakia, aphakia, and organic lesions in the cornea, lens and posterior segment impairing the vision, and one eye were excluded from the study.

Following definitions were used in the study

Spherical equivalents (SE) of refractive errors were taken as half the cylinder plus the spherical component. Emmetropia was

defined as SE between - 0.50 and + 0.50 diopter sphere (DS), myopia as SE <-0.50 DS, and hyperopia as SE >+0.50 DS for adults and SE >+2.0 for children (up to 15 years). High myopia was taken as SE <-5.0 DS.

Astigmatism was defined in minus cylinder format: cylindrical error <-0.5 diopter cylinder was considered for the study. With-the-rule (WTR) astigmatism was defined as axis between 15° of either side of horizontal meridian, against-the-rule (ATR) astigmatism as axis between 15° of either side of vertical meridian, and oblique astigmatism (OA) as axis between 15 and 75° or 105 and 165°.

Statistical analysis was performed using the SPSS software package (SPSS for Windows, version 16.0; SPSS, Inc., Chicago, IL, USA) and Epi Info (TM) software package, version 3.5.1 (Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA). All the *P* < 0.05 were taken as statistically significant. For the analysis purpose, the age groups were divided into four groups, namely, 5–19, 20–39, 40–59, and ≥60 years. Comparison of means between groups was calculated using independent *t*-test and trends with age was analyzed using Chi-square for trend. The Pearson coefficient of correlation was used to compare the right and left eye refractive errors.

Results

Of the 10,693 patients who attended the Ophthalmology OPD during the study period, 4582 patients were eligible for the study. Of these eligible patients, a total of 2546 patients (55.56%) had refractive errors (in SE). Data of only the right eyes were used for the analysis since there was a good correlation between the right and left eye refractive errors (Pearson correlation, 0.883). The age of patients ranged from 5 to 88 years with the mean being 39.83 ± 18.86 years. Age and gender distribution of patients is given in Table 1. The distribution of different types of refractive errors (in SE) is given in Table 2.

One thousand five hundred and fourteen (59.5%) patients were females, and 1032 (40.5%) were males. The mean age of the

Table 1: Age and gender distribution of patients

Age (years)	Male	Female	Total
5-19	161 (37.18)	272 (62.81)	433 (17.00)
20-39	296 (37.04)	503 (62.95)	799 (31.38)
40-59	369 (44.08)	468 (55.91)	837 (32.87)
60 and above	206 (43.18)	271 (56.81)	477 (18.73)
Total	1032 (40.53)	1514 (59.46)	2546

Data are the number of patients (percentage of total group)

Table 2: Distribution of different types of refractive errors (spherical equivalents) in different age groups

Age groups	Emmetropia	Myopia	High myopia	Hyperopia	Total
5-19	210	178	9	33	430
20-39	427	303	18	33	781
40-59	486	125	5	211	827
60-90	229	91	3	153	476
Total	1352	697	35	430	2514

males and females were 41.31 ± 19.04 and 38.82 ± 18.66 years, respectively (statistically significant at $P = 0.001$).

The mean refractive error was -0.517 ± 1.95 DS. The distribution of spherical errors (in SE) is graphically shown in Figure 1. Emmetropia was found in 1352 patients (53.1%). The proportion of different types of refractive errors (in SE) is shown in Figure 2. The mean age of emmetropes was 40.02 ± 18.39 years. The mean age of males was 42.46 ± 18.45 years and that of females was 38.32 ± 18.12 years (statistically significant $P = 0.000$). The proportion of emmetropia increased till 59 years and then decreased (χ^2 for trend $P = 0.103$). The progression of different types of refractive errors (in SE) with increase in age is shown in Figure 3. The distribution of different types of refractive errors (in SE) in different age groups is shown in Figure 4. There were 561 males (54.36% of all males) and 791 females (52.24% of all females). The distribution of different types of refractive errors (in SE) in different sexes is given in Figure 5.

Myopia was found in 697 (27.4%) patients. The mean age of myopes was 32.85 ± 17.92 years. The mean age of males was 33.27 ± 18.38 years and that of females was 32.57 ± 17.63 ($P = 0.618$) years. The proportion of myopia increased till 39 years and then decreased significantly with increasing age (χ^2 for trend $P = 0.000$) [Figure 3]. There were 274 males (26.55% of all males) and 423 females (27.94% of all females).

High myopia was found in 67 (2.6%) patients. The mean age of high myopes was 32.12 ± 14.26 years. The mean age of males was 33.41 ± 15.31 years and that of females was 31.25 ± 13.62 ($P = 0.557$) years. The proportion of high myopia decreased significantly with age after 39 years (χ^2 for trend $P = 0.0046$) [Figure 3]. There were 27 males (2.61% of all males) and 40 females (2.64% of all females).

Hyperopia was found in 430 (16.9%) patients. The mean age of hyperopes was 51.71 ± 16.26 years. The mean age

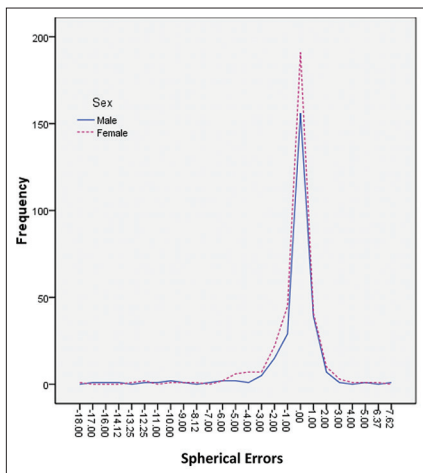


Figure 1: Distribution of spherical errors (in spherical equivalents) in the study population

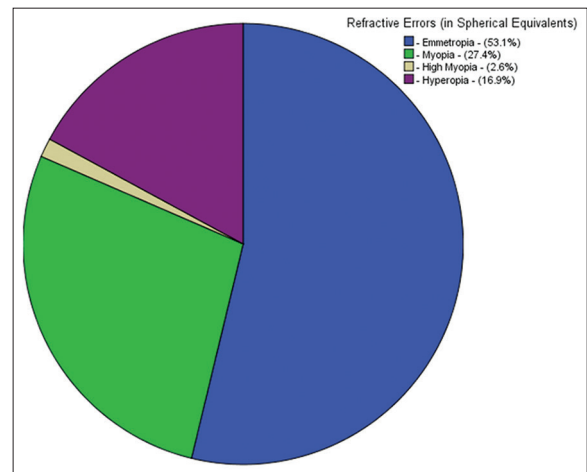


Figure 2: Proportion of different types of refractive errors (in spherical equivalents) in the study population

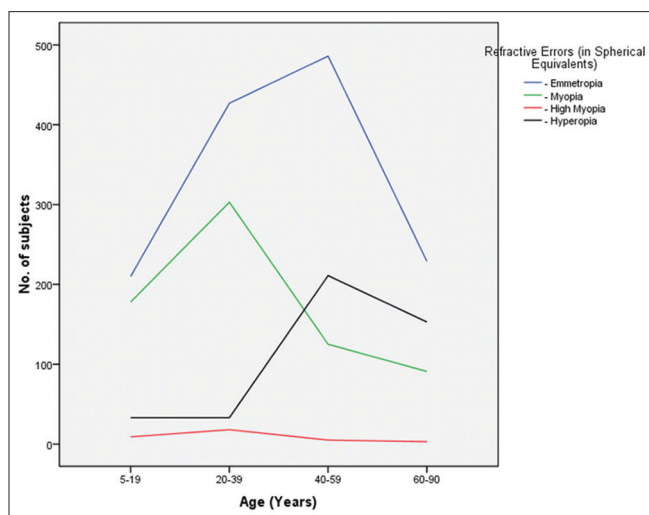


Figure 3: Progression of different types of refractive errors (in spherical equivalents) with increase in age

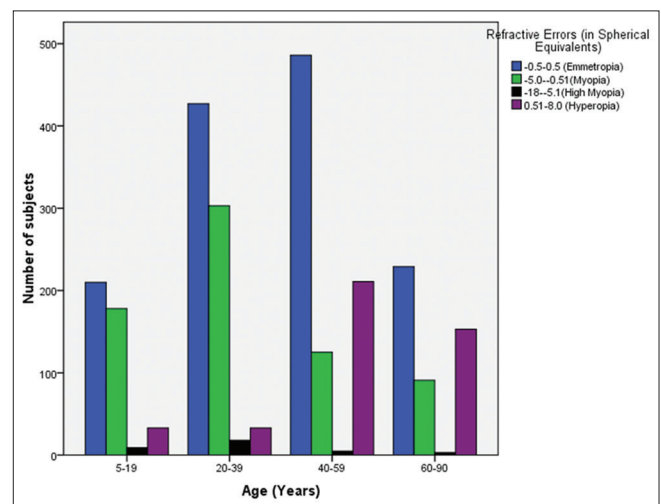


Figure 4: Distribution of different types of refractive errors (in spherical equivalents) in different age groups

of males was 51.74 ± 16.51 years and that of females was 51.69 ± 16.13 years ($P = 0.976$). The proportion of hyperopia increased till 59 years and then decreased (χ^2 for trend $P = 0.000$) [Figure 3]. There were 170 males (16.47% of all males) and 260 females (17.17% of all females).

One thousand five hundred and ten patients (59.30%) had astigmatism. Of these, 432 patients (17%) had WTR astigmatism, 595 patients (23.4%) had ATR astigmatism, and 483 patients (19%) had OA. The proportion of WTR astigmatism decreased significantly with age (χ^2 for trend $P = 0.000$) whereas ATR astigmatism increased significantly with age (χ^2 for trend $P = 0.000$). The proportion of OA showed decreasing trend but was not statistically significant (χ^2 for trend $P = 0.29$). There were 605 males (58.62% of all males) and 905 females (59.77% of all females).

Discussion

There are many population-based studies on the proportion of refractive errors.^[3,8-21] These studies have thrown light on the pattern of refractive errors and various aspects of visual impairment in different parts of the world. There are some hospital-based studies on the proportion of refractive errors available from some other countries.^[22-26]

Refractive error is an established and significant public health problem.^[2] Therefore, it is pertinent for the primary care physicians to know the magnitude and type of refractive errors in the community.

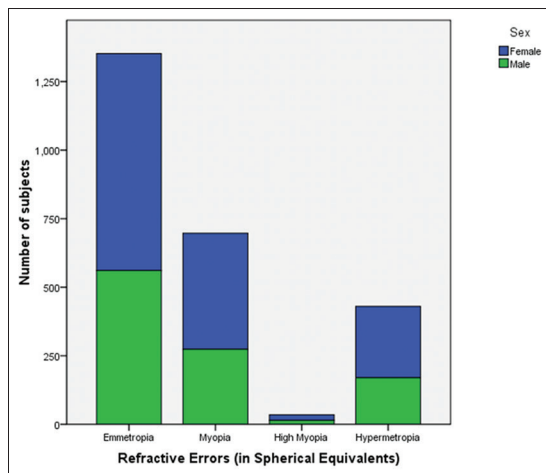


Figure 5: Distribution of different types of refractive errors (in spherical equivalents) in different sexes

Uncorrected refractive error can lead to the development of squint and amblyopia (lazy eye) which are its unwanted complications and are difficult to treat once developed. Therefore, it is important that these are diagnosed and treated early.

Primary care physicians can easily pick up the problem of refractive error if careful history is taken for blurring of vision and other associated symptoms such as headache while studying. Refractive error, especially myopia, is a common problem in the young people, more so in the student community. Similarly, presbyopia is very common among people of 40 years and older. Students may lose interest in studies if the refractive errors are not corrected properly. Similarly, working and older age group people may suffer for want of refractive error correction. This in turn may lead to loss of education, economic losses, and lower quality of life.^[2-4]

Further, primary care physicians and health workers can help in spreading awareness about the need for proper correction of refractive errors and screening of eye ailments in the community including the schools. Even vision screening by trained teachers is also an effective way for early detection of refractive errors.^[20]

The present study provides the hospital-based data on the pattern of refractive errors of patients presenting to the ophthalmology OPD of a medical college in North-East India. Table 3 gives the comparison of pattern of refractive errors found in our study with other hospital-based studies in the world. The pattern of refractive errors in our study is similar to the pattern found by Adeoti and Egbewale.^[22]

Although our study is a hospital-based one, the pattern of refractive errors and the percentage of males and females are comparable to that found in a population-based study from India [Table 4].^[11]

Majority of patients (53.1%) had SE -0.50 – $+0.50$ DS (emmetropia). Similar findings have been reported in some population studies.^[8,22]

Myopia was the predominant refractive error found in this population. The proportion of myopia and high myopia (in SE) were 27.4% and 2.6%, respectively. The proportion of myopia decreased significantly with age. Similar trend of decreasing myopia with increasing age has been reported from certain studies.^[27-29] However, opposite trend has been reported in studies from India and Barbados.^[8,11,30] The difference in proportion of myopia was not statistically significant in between

Table 3: Comparison of pattern of refractive errors in different hospital-based studies

Study	n	Female (%)	Male (%)	Myopia (%)	High myopia (%)	Hyperopia (%)	Astigmatism (%)
Rizyal <i>et al.</i> , 2008	1100	56.33	43.7	68.22*	NR	27.38*	63.31*
Lawan <i>et al.</i> , 2011	5893	55.17	44.8	14*	NR	11*	33*
Adeoti <i>et al.</i> , 2011	3396	54.39	45.6	25.18*	2.8*	16.74*	21.8*
Current study	4582	59.5	40.5	27.4	2.6	16.9	59.3

*Not in spherical equivalents. NR: Not reported

Table 4: Comparison of present study with population-based studies from India

Study	n	Female (%)	Male (%)	Myopia (%)	High myopia (%)	Hyperopia (%)	Astigmatism (%)
CGS, 2004	2508	53.87	46.13	26.99	3.71	18.7	54.78
APEDS, 2004	1722 (>15 years)	55.7	44.3	19.39	NR	9.83	12.94
Current study	4582	59.5	40.5	27.4	2.6	16.9	59.3

CGS: Chennai Glaucoma Study; APEDS: Andhra Pradesh Eye Disease Study; NR: Not reported

the sexes ($P = 0.261$). The proportion of high myopia decreased significantly with age. The difference in proportion of high myopia was not statistically significant in between the sexes ($P = 0.740$).

The proportion of hyperopia in our study was 16.9%. It increased till 59 years and then decreased with increasing age. Similar trend has been found in some population-based studies.^[8,11,30] The difference in proportion of hyperopia was not statistically significant in between the sexes ($P = 0.327$).

The proportion of astigmatism in our study was 59.30%, which is higher than other studies. ATR astigmatism was the most common type followed by oblique and WTR astigmatism. In many population-based studies, ATR astigmatism has been found to be the most common type of astigmatism.^[8,11,29,31,32] However, WTR astigmatism has been reported to be the most common type from some other studies.^[33-36] The proportion of WTR and ATR astigmatism decreased and increased significantly with age, respectively.

The number of female patients with refractive error is more than males across different studies.^[8,22-24,26] In our study also, similar trend is found ($P = 0.000$). The percentage of female patients in our study is more than other studies probably because our institute is situated in a place with matrilineal society.

Conclusion

To conclude, refractive error is a common and significant cause of visual impairment in the study population. The pattern of refractive errors in the study population is similar to a previously published hospital-based study and a population-based study. The findings from this study have given the magnitude and pattern of refractive errors among the patients attending the Ophthalmology Department of this Medical College. Since there is no published study, either hospital or community based from North-East India till date, this study will serve as the initial step for conducting a community-based study on the prevalence of refractive errors in this part of the country. Periodic collection of statistics on the magnitude and pattern of refractive errors will help in designing plans to tackle this common disorder and the complications thereof in the community and the state. Moreover, it is expected that this study will help the primary care physicians to have an overview of the magnitude and pattern of refractive errors presenting to a health-care center. It is required for them have this knowledge since refractive error is an established and significant public health problem worldwide.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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