



Prevalence of refractive error among students in Asmara college of health sciences, Asmara-Eritrea: A cross-sectional study

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ABSTRACT

Introduction

Refractive error (RE) is a condition in which parallel rays from infinite distance do not focus on retina. RE is classified as hyperopia, myopia and astigmatism. The objective of this study is to assess the prevalence and predictors of RE among Asmara College of Health Sciences students.

Methods

The study design was descriptive cross sectional. Stratified random sampling was used to select 256 respondents from Asmara College of Health Sciences (ACHS). A structured questionnaire, subjective and objective refraction procedures were used to collect the data. Myopia was defined ≤ -0.50 Diopters (D), hyperopia $\geq +0.50$ D and astigmatism ≥ 0.50 DC (absolute value) in any axis in refractive power. Bivariate and multivariate logistic regressions were used to find out the predictors of RE using SPSS (Version 22).

Results

The total number of students who had refractive error were 63 in the age range 19-49 making the prevalence rate to be 25.2% (95% CI: 27.5, 32.7). The prevalence of myopia, astigmatism, and hyperopia was 9.6 (95% CI: 5.9, 13.3), 14.8 (95% CI: 10.4, 19.2), and 5.2 (95% CI: 2.4, 8.0) respectively. Out of the 37 participants who had astigmatism, 2.7% were found to have simple hyperopic astigmatism, 13.5% compound hyperopic astigmatism, 13.5% simple myopic astigmatism, 16.2% mixed astigmatism, and 54.1% compound myopic astigmatism. Out of 13 hyperopic participants, 38.5% were found to have simple hyperopia, and 61.5% latent hyperopia. At multivariate level, Tigigna ethnic group was 10.27 (AOR=10.27, 95% CI: 1.77, 59.64) times more myopic as compared to the other ethnic groups and with unit increase in age the odds of astigmatism increased by 1.06 (AOR=1.06, 95% CI: 1.00, 1.13).

Conclusion

Generally, the prevalence of RE in the college is at a level whereby attention need to be taken. Furthermore, screening is highly recommended in the college as well as community.

Keywords:Prevalence, Refractive error, Myopia, Hyperopia, Astigmatism.

INTRODUCTION

Refractive error (RE) is a condition in which parallel rays from infinite distance do not focus on the retina. It is categorized into three major types: myopia, hyperopia and astigmatism. Myopia is a refractive error when distant objects are focused before retina, hyperopia is a refractive error when distant objects are focused behind retina, whereas astigmatism is a refractive error that exists when the rays from distant point sources are not focused by the eye's optical system to a single point. Definition of refractive errors can vary based on the objectives of the study [1-4].

The Global Initiative Vision 2020 emphasized and identified refractive error as a major public health problem that causes visual impairment worldwide [5]. RE has also a considerable effect on mental ability and academic achievement especially in school children [5]. However, refractive error can be corrected by a pair of spectacles, contact lenses or refractive surgery [6]. The World Health Organization (WHO) estimated that 153 million people are affected by visual impairment from treatable refractive error [7]. RE is also the second leading cause of treatable blindness [8]. According to Ministry of Health (MOH) of Eritrea, about 5000 cases of refractive error were reported annually in Eritrea [9].

The prevalence of refractive error was found to vary from place to place in the world. Prevalence that exceeds 2% is a precursor of screening in any area [10], hence its assessment is imperative. Prevalence of myopia was 36.2% in America [11], 26.1% in Sumatra-Indonesia [12], 37.6% in Punjab University-India [13], 39.5% in medical college Kerala-India [14], 95.5% in China in which 19.5 were highly myopic [15]. Besides, 49.29% of high myopia and 12.19% of low myopia was observed in Ethiopia [16]. Prevalence of hyperopia was 1% in America [11], and 9.2% in Sumatra-Indonesia [12]. Astigmatism was as common as 23% in America [11] and 15.1% Sumatra-Indonesia [12]. A rapid assessment of refractive error conducted in

ZobaMaekel, Eritrea in 2012 found that 6.4% had refractive error [9].

Identification of factors that predict refractive error is important for prevention and targeted intervention. Age was found to be a significant predictor of refractive error in Tanzania [17] and Ghana [18]. Studies in China [15], Nepal [19], and India-Ahmedabad city [20] have shown that boys had more myopic refractive error than girls, while a study in Jordan [21] had shown the reverse, and a study done among Caucasian population [22] had shown no significant difference. Socioeconomic status and religion were not predictors of hyperopia and astigmatism in Hyderabad, India [23]. In contrast, a research done in Kwame Nkrumah University (Ghana) showed that as one climbs the economic ladder, one is less likely to suffer myopia [24]. Another predictor of myopia was increased hours of study in Ghana [18], and Amman-Jordan [21]

Myopia, hyperopia, and astigmatism are common in school going students especially in college students, as they are more engaged in reading textbooks, exercises, using computers and writing activities for longer hours [25]. Hence, the purpose of this study is to assess the prevalence and identify the predictors of refractive error among Asmara College of health Sciences (ACHS) students in Eritrea. This research will provide baseline data on the prevalence of refractive error which will help to initiate interventions by the concerned authorities to the community for a better future.

METHODS

Study design

A descriptive cross-sectional quantitative study was used to assess the prevalence of refractive error among students in Asmara College of Health Sciences from October to November, 2018.

Study Setting

The study was conducted in Asmara College of Health Sciences, clinical optometry lab, in optometry department, which provides utmost health profession

training in Asmara. Asmara is the capital city of Eritrea, a country located in the Horn of Africa.

Study Population

The study population was ACHS students (N=1,234) enrolled in the academic year 2018/2019. According to the data from registrar office, there were 262 freshmen students, 355 second year students, 317 third year students, 204 fourth year students, 64 fifth year students and 32 masters' students.

Sample Size

Sample size determination was performed using a one sample proportion estimation with finite population correction; where expected proportion of students with refractive error was taken as 4.8% (from previous study done in Asmara) [9], maximum tolerable error of 0.024 (half of the expected proportion since it is less than 10%) [26] and 95% confidence interval ($Z=1.96$). Hence, by considering the values, the initial sample size was 243 students. With an anticipated 5% non-response rate, the final sample size was 256 students.

Sampling Method

Stratified random sampling was used to select the study participants. Study years of the students were taken as strata. Hence, there were in total 6 strata, namely, first year to fifth year as well as the masters' level students.

Sample Allocation

The overall sample size of students calculated was allocated proportionally by strata and gender. The allocation of the 256 sample students by study year and from each gender indicated in (Table 1).

Variables

The dependent variable in this study was mainly occurrence of refractive error. The independent variables include demographic variables: age, gender, marital status, and educational level, field of study, ethnicity, religion, spare hours' usage, study hours and computer usage hours.

Data Collection Tool, Method, and Instrumentation

Demographic data on refractive error of the selected students was collected using self-administered questionnaire. Then visual acuity (VA) was assessed using literate Log Minimum Angle of

Resolution (MAR) chart for all the participants. The cut off for defining significant refractive error was VA less than 6/6 (0.0 Log MAR). For those whose vision was less than 6/6, a dry objective refraction using Keeler retinoscope was performed followed by subjective refraction [1]. Participants with spectacles were tested for uncorrected and corrected VA. The power of spectacles was measured using the manual standard lensometer. For those wearing spectacles and VA worse than 6/6 with correction, objective then subjective refraction was done. Participants with presenting visual acuity of 6/6 were tested by the plus lens test with +1 Diopter Spherical (D) to assess latent hyperopia [18]. Myopia was defined as a spherical equivalent of ≥ -0.50 Diopters (D) (mathematically); which was further categorized as low (≥ -0.50 D and < -3.00 D), moderate (≥ -3.00 D and < -6.00 D) and high (≥ -6.00 D). Hyperopia was defined as a spherical equivalent of $\geq +0.50$ D; which was further categorized as low to moderate ($\geq +0.50$ D and $< +3.00$ D) and high ($\geq +3.00$ D) hyperopia. Emmetropia with astigmatism was defined as absolute cylindrical error of ≥ 0.50 diopter cylinder (DC) but had emmetropia when spherical equivalent was considered (MRSE; > -0.5 D to $< +0.5$ D) [2].

Pre-test Study

Pre-test study was conducted among 10 Law School students, College of Arts and Social Science, by distributing the questionnaire for self-administration and then checking their visual acuity at ACHS optometry lab. This was done to assure the correctness of the procedures, ascertain acquisition of desired information, and prevent the creation of any confusion and misunderstandings during the main study.

Data Analysis

Questionnaires were double entered in Census Survey Processing System (CSPro Version 6.3) to eliminate keyboarding error. The data was then exported to Statistical Package for Social Science (SPSS, Version 22.0) for further analysis. The nominal variables were summarized by using counts and percentages while variable at scale level were summarized using mean/ standard deviation (SD) or median/ interquartile range (IQR), as appropriate. Prevalence of refractive errors and 95% confidence interval (CI) were computed. Bivariate logistic regression was used to find out the possible demographic associates of refractive error and crude

odds ratio (95% CI) was reported. Variables that were significant at bivariate level were further retained at multivariable level, as a result of which, adjusted odds ratio (95% CI) was computed. P-values less than 0.05 were considered as significant throughout the analysis.

Ethical Approval and Consent to Participate

Ethical clearance was obtained from the ethics committee of ACHS and Ministry of Health. Purpose of the study was explained and confidentiality was assured to study participants. They were given code for anonymity and identity protection. Their participation was voluntary and assured by signing the consent form.

RESULTS

The number of study participants proposed primarily was 256. Out of these, 6 participants were not willing to participate, constituting 2.34% as non-response rate.

Demographic Characteristics

Table 2 shows demographic characteristics of the study participants. The age range of the participants was 19-49 years old with the median age 20 years (IQR=3) in which 135 (54%) were males. Out of the 250 students participated, 225 (90.0%) were single and the remaining 25 (10%) were married. The majority (n=197, 78.8%) of the participants came from urban and 53 (21.2%) were from rural. Distribution by religion showed 216 (86.4%) were Christians, 30 (12%), Muslims and 4 (1.6%) others. The majority (n=87, 34.8%) of the students were third year students followed by second year (n=82, 32.8%), fourth year (n=40, 16%), freshmen (n=23, 9.2%), fifth year (n=15, 6%) and masters' (n=3, 1.2%). The predominant ethnic group (n=215, 86%) was found to be Tigrigna followed by Tigre (n=17, 6.8%), Afar and Bilen (n=6, 4.8%) each, Saho (n=4, 1.2%), Kunama and Hidarb (n=1, 0.6%) each.

Prevalence of Refractive Error

Prevalence by Major Types

The overall prevalence of refractive error among the participants was 25.2% (95% CI: 27.5, 32.7). Of

the students who had at least one refractive error, 13 (5.2%) were hyperopic, 37 (14.8%) astigmatic and 24 (9.6%) myopic (Table3).

Prevalence by Types of Astigmatism or Hyperopia

Out of the 37 participants who had astigmatism, 2.7% were found to have simple hyperopic astigmatism, 13.5% compound hyperopic astigmatism, 13.5% simple myopic astigmatism, 16.2% mixed astigmatism, and 54.1% compound myopic astigmatism (Figure 1). On the other hand, of 13 hyperopic participants, 38.5% were found to have simple hyperopia, and 61.5% latent hyperopia (Figure 2).

Prevalence of Refractive Error by Demographic Characteristics

The prevalence of at least one refractive error (myopia, astigmatism, or hyperopia) and for each of the three refractive errors was computed across categories of the demographic characteristics (Table 4).

Associates of Refractive Error

The magnitude and direction of association of the demographic variables with occurrence of overall refractive error and each type of refractive error were assessed using bivariate logistic regression. From the ten potential associates, only age was found to be significant predictor of overall refractive error. The results revealed that for unit increase in age, the odds of refractive error significantly increased by 1.06 (95% CI: 1.01, 1.12) (Table 5). Moreover, year of study and ethnicity were found to be determinants of myopia, while, age and hours of study were found to be significant predictors of astigmatism at bivariate level. At multivariate level, only ethnicity was a significant predictor of myopia in which Tigrigna ethnic group were 10.27 (AOR=10.27, 95% CI: 1.77, 59.64) times more myopic as compared to the other ethnic groups. Moreover, multivariate logistic regression on the predictors of astigmatism revealed that only age as significant, in which with unit increase in age the odds of astigmatism increased by 1.06 (AOR=1.06, 95% CI: 1.00, 1.13).

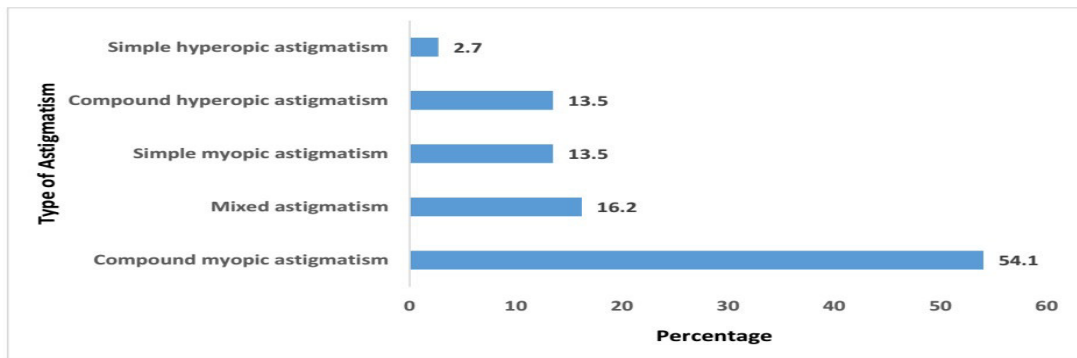


Figure 1. Percentage distribution of participants by type of astigmatism (n=37)

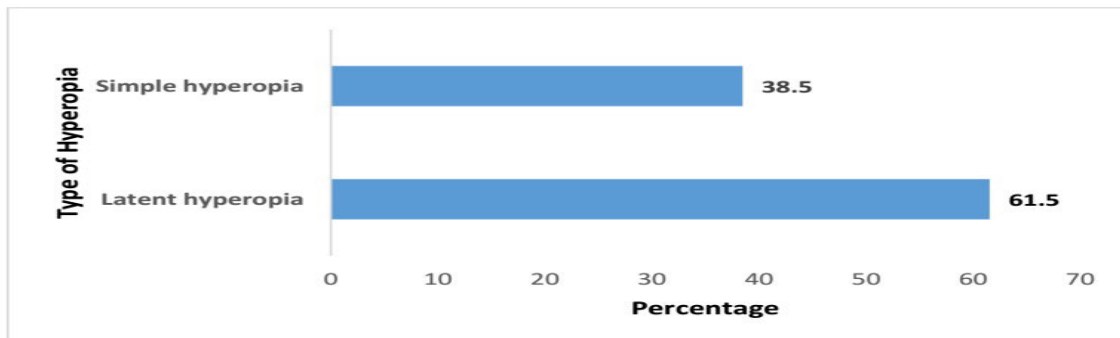


Figure 2. Percentage distribution of participants by type of hyperopia (n=13)

Table 1. Sample allocation of the study participants by gender and year of study (n=256)

Study Year		Students Enrolled	Samples Taken
Year I	Male	162	33
	Female	100	24
Year II	Male	193	38
	Female	162	40
Year III	Male	180	39
	Female	137	26
Year IV	Male	110	24
	Female	94	20
Year V	Male	36	5
	Female	28	4
Masters	Male	24	2
	Female	8	1
Total	Male	705	141
	Female	529	115
Grand Total		1234	256

Table 2. Demographic characteristics of the study participants (n=250)

Variables	Frequency	Percent
Age (Median=20.0, IQR=3)		
Less or equal 20	147	58.8
21 to 25	66	26.4
Greater or equal 26	37	14.8
Gender		
Male	135	54.0
Female	115	46.0
Marital status		
Married	25	10.0
Single	225	90.0
Residence		
Urban	197	78.8
Rural	53	21.2
Religion		
Christian	216	86.4
Muslim	30	12.0
Other	4	1.6
Year of study		
Freshmen	23	9.2
Second Year	82	32.8
Third Year	87	34.8
Fourth Year	40	16.0
Fifth Year	15	6.0
Masters	3	1.2
Ethnicity		
Tigrigna	215	86.0
Tigre	17	6.8
Others‡	18	7.2

Others‡ include Afar, Bilen, Kunama, Saho, Hidarb. IQR: Interquartile Range

Table 3. Prevalence (95% CI) of refractive error by major type (n=63)

Refractive Error	Frequency	Prevalence	95% CI
Myopia	24	9.6	5.9-13.3
Astigmatism	37	14.8	10.4-19.2
Hyperopia	13	5.2	2.4-8.0
Overall Refractive Error	63*	25.2	19.8-30.6

**Sum of frequencies for myopia, astigmatism, and hyperopia exceeds the total (63)*

because some students have one or more type of refractive errors.

Table 4. Prevalence of refractive error by demographic characteristics (n=63)

Variables	Emmetropian (%)	Refractive ^c Error n (%)	Hyperopia ^c n (%)	Myopia ^c n (%)	Astigmatism ^c n (%)
Age					
Less or equal 20	115 (78.2)	32 (21.8)	9 (6.1)	11(7.5)	17(11.6)
21 to 25	47 (71.2)	19 (28.8)	2 (3.0)	9(13.6)	12(18.2)
Greater or equal 26	25 (67.6)	12 (32.4)	2 (5.4)	4(10.8)	8(21.6)
Gender					

Male	101 (74.8)	34 (25.2)	6(4.4)	12(8.9)	23(17.0)
Female	86 (74.8)	29 (25.2)	7(6.1)	12(10.4)	14(12.2)
Marital status					
Married	14 (56.0)	11 (44)	1(4.0)	5(20.0)	7(28.0)
Single	173 (76.9)	52 (23.2)	12(5.3)	19(8.4)	30(13.3)
Residence					
Urban	149 (75.6)	48 (24.4)	10(5.1)	19(9.6)	29(14.7)
Rural	38 (71.7)	15 (28.3)	3(5.7)	5(9.4)	8(15.1)
Religion					
Christian	160 (74.1)	56 (25.9)	10(4.6)	21(9.7)	34(15.7)
Muslim	23 (76.7)	7 (23.3)	3(10.0)	3(10.0)	3(10.0)
Other	4 (100)	0 (0)	0(0.0)	0(0.0)	0(0.0)
Year of study					
Freshmen	19 (82.6)	4 (17.4)	2(8.7)	2(8.7)	0(0.0)
Second Year	61 (74.4)	21 (25.6)	6(7.3)	4(4.9)	13(15.9)
Third Year	68 (78.2)	19 (21.8)	3(3.4)	9(10.3)	13(14.9)
Fourth Year	27 (67.5)	13 (32.5)	2(5.0)	4(10.0)	8(20.0)
Fifth Year	11 (73.3)	4 (26.7)	0(0.0)	4(26.7)	2(13.3)
Masters	1 (33.3)	2 (66.7)	0(0.0)	1(33.3)	1(33.3)
Ethnicity					
Tigrigna	163 (75.8)	52 (24.2)	0(0.0)	3(50.0)	1(16.7)
Tigre	13 (76.5)	4 (23.5)	1(16.7)	1(16.7)	0(0.0)
Others‡	4 (66.7)	2 (33.3)	12(5.0)	20(8.4)	36(15.1)

Note: The total number of individuals who have refractive error^a might be less or equal to the sum of those having myopia, hyperopia, and astigmatism, because one individual might have more than one type of refractive error

Table 5. Factors associated with refractive error using bivariate logistic regression

Variables	Any Refractive error OR (95% CI)	Myopia OR (95% CI)	Hyperopia OR (95% CI)	Astigmatism OR (95% CI)
Age (Years)	1.06 (1.01, 1.12)*	1.04 (0.98, 1.12)	1.00 (0.89, 1.18)	1.06 (1.01, 1.13)*
Gender				
Male	1.00 (0.56, 1.77)	0.84 (0.36, 1.94)	0.72 (0.23, 2.20)	1.48 (0.73, 3.03)
Female	Reference	Reference	Reference	Reference
Marital status				
Married	1.61(0.92, 2.11)	2.71 (0.91, 8.04)	0.74 (0.09, 5.94)	2.53 (0.97, 6.56)
Single	Reference	Reference	Reference	Reference
Residence				
Urban	0.82 (0.41, 1.61)	1.03 (0.36, 2.89)	0.89 (0.24, 3.36)	0.97 (0.42, 2.27)
Rural	Reference	Reference	Reference	Reference
Religion				
Christian	1.15 (0.47, 2.83)	0.97 (0.27, 3.47)	0.44 (0.11, 1.69)	1.68 (0.48, 5.86)
Muslim	Reference	Reference	Reference	Reference
Year of study				
Freshmen	0.58 (0.12, 2.79)	0.26 (0.04, 1.66)	†	†
Second Year	0.95 (0.27, 3.30)	0.14 (0.03, 0.65)*		1.23 (0.25, 6.08)
Third Year	0.77 (0.22, 2.69)	0.32 (0.08, 1.21)		1.14 (0.23, 5.66)
Fourth Year	1.32 (0.35, 4.97)	0.31 (0.07, 1.43)		1.63 (0.30, 8.70)
Fifth Year	Reference	Reference	Reference	Reference
Ethnicity				
Tigrigna	3.10 (0.61, 15.80)	10.90 (2.06, 57.59)*	†	1.12 (0.13, 9.89)

Tigre	1.55 (0.28, 8.69)	2.18 (0.24, 19.58)	3.77 (0.41, 34.83)	†
Other‡	Reference	Reference	Reference	Reference
Spare time usage				
Watch movies	0.67 (0.23, 1.98)	0.51 (0.13, 1.97)	0.82 (0.09, 7.08)	0.62 (0.19, 2.07)
Play some sports	0.48 (0.13, 1.74)	0.29 (0.04, 1.95)	0.49 (0.03, 8.25)	0.44 (0.10, 2.00)
Read books	0.75 (0.23, 2.45)	0.64 (0.14, 3.02)	1.70 (0.18, 16.35)	0.55 (0.14, 2.25)
Other	Reference	Reference	Reference	Reference
Study hours				
1 to 3	2.33 (0.57, 9.48)	0.77 (0.27, 2.16)	0.83 (0.25, 2.84)	0.75 (0.31, 1.81)
3 to 6	1.49 (0.40, 5.53)	0.80 (0.25, 2.51)	0.47 (0.09, 2.42)	1.44 (0.61, 3.42)
Greater than 6	1.45 (0.36, 5.79)	2.19 (0.52, 9.27)	†	0.89 (0.18, 4.40)
Less than 1 hour	Reference	Reference	Reference	Reference
Computer usage hours				
1 to 3	0.61(0.30, 1.24)	1.30 (0.5, 4.85)	0.53 (0.15, 1.92)	0.36 (0.15, 0.87)*
3 to 6	0.99 (0.48, 2.06)	2.03 (0.51, 8.19)	0.33 (0.06, 1.91)	0.44 (0.16, 1.22)
Greater than 6	0.92 (0.27, 3.15)	0.81 (0.08, 8.41)	†	0.60 (0.15, 2.51)
Less than 1 hour	Reference	Reference	Reference	Reference

Others‡ include Afar, Bilen, Kunama, Saho, and Hidarb. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. †:

COR (95%CI) cannot be computed because one of the cells in the cross tabulation was zero. OR: Odds Ratio

DISCUSSION

Currently, RE is becoming the most prevailing and increasing eye problem worldwide [27-29]. Epidemiologist assumed that refractive status is best evaluated among the secondary school finishing age students, as myopia is believed to be most likely stabilized at this age [30]. The observed epidemiology of visual disorders due to refractive errors is the most common diseases among students worldwide [13]. Thus, student population requires considerable attention because untreated refractive errors have a substantial effect on learning and academic achievement of students other than being a personal issue [31].

In the current study, the prevalence of RE was 25.2% among the college students. A study conducted among the community of ZobaMaekel, Eritrea showed 6.4% of RE in the age group ranging from 15 to 50 years [9]. Hence, refractive error can be considered as higher among college students as compared to the general community. In line to this study, 29.7% prevalence of RE was observed among drivers of public institutions in Ibadan, Nigeria [8]. Other study in Netherlands showed similar result to the current study in which 22% of uncorrected RE was presented [32]. A study conducted in Ethiopia, revealed 9.4% of RE [16] in which they took cut-off for VA less than 6/18 (0.5 log MAR) yielding lower value than our study in which we took cut-off VA less than 6/6 (0.0 log MAR) resulting in greater

outcome of RE. Prevalence of myopia, hyperopia, and astigmatism in the current study versus worldwide pooled prevalence were 9.6% vs 26.5%, 5.2% vs 30.9%, and 14.8% vs 40.4% respectively [33]. The fact that the study subjects in this study were only college students which are relatively younger with few environmental and occupational exposures that can lead to refractive error, might be the reason for the relatively less prevalence in this study.

In the current study, there was a significant association between age and myopia. The fact that the axial length of the eye increases with age is the main contributing factor to refractive error, especially for being myopic. In Kahama district, Tanzania, participants aged 25 to 39 years were twice more likely to present with refractive error than 15 to 19 years old, while participants aged 40 years and older were 3.2 times more likely to present with visual impairment [17]. Similar results were also observed in Ghana in which older participants suffered more myopia than younger participants [18]. There was no significant association between refractive error and gender in this study. Similar studies were observed in studies conducted in Caucasian population, US [22], and Hong Kong, China [34]. However, prevalence among females was higher than males in Amman, Jordan [21]. Ethnic practices may have ocular repercussions on individuals, whether refractive or pathological and as such ethnicity is a variable to be

accounted for which was significantly observed in this study.

Despite the use of mobile phones, tablets, or personal computers, no significant association between refractive error and screen usage hours was observed in this study. Studies has shown that small, transient myopic shift seems to occur after computer use, but its significance with respect to creating permanent myopic change is unknown [35, 36]. This result disproved the Cohn's use abuse theory. Year of study was found to be statistically insignificant in this study, which might be due to almost equal distribution of the courses throughout the study years, consistent to a study conducted in Saudi [37]. However, a study conducted in Bucaramanga, Colombia showed prevalence of refractive error increased when year of study increased [38].

Studies have justified the concept of sustained accommodation by stating that, pulling of the choroid forward and inward, sclera circumference can be elongated and the new increased axial length of the eye can be presented as myopia [39-43]. In agreement to this, studies done in Ghana and Jordan showed significant association of myopia with increased study hours [18, 21]. On the other hand, this study and others [44-46] found no significant association between RE and near work tasks. However, it is worth to note that accommodative disorders might occur with prolonged study hours, though RE and study hours were not significant as stated by Cohn use-abuse theory.

LIMITATION OF THE STUDY

The use of cross sectional design did not allow establishing the causal relationship among the subjects, that is why, we could not figure out why some of the students had myopic and astigmatism than the others.

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CONCLUSION

RE was found one in every four participants (25.2%) which indicate that the refractive status of the ACHS students is alarming. Age and ethnicity were found to be significant determinant of astigmatism and myopia respectively from the selected potential demographic predictors.

ACKNOWLEDGEMENTS

We owe special thanks to all Asmara College of Health Sciences students who willingly spared their time in provision of valuable information as well as patiently examined during the data collection.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS CONTRIBUTIONS

RG, BT, FA and HA designed the study, performed data collection and analysis and wrote the article. TA, GGB and EHT contributed to the study design, assisted with data analysis and critically reviewed and revised the article. The manuscript has been read and approved for publication by all authors.

AVAILABILITY OF DATA AND MATERIALS

The complete dataset supporting the conclusion of this article is available can be used and analyzed in electronic and paper form with the corresponding author upon a reasonable request.

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