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Research Article

Pattern of Refractive Errors in Children Attending an Oil Refining Company Clinic in Port Harcourt, Nigeria - A Privileged Population

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Abstract

Background/Aim: Refractive errors are abnormal visual conditions that are usually managed by spectacle correction, use of contact lenses or laser surgery. They are relatively common and should be corrected as soon as possible in children to enable them have adequate vision to live a normal active life without visually-induced limitations. With increasing westernization, the misconceptions illiterate and semi-literate parents had about use of glasses at an early age have been largely overcome and more young children are nowadays being brought to the hospital for visual problems and where refractive errors are implicated, having their parents actually purchase the spectacles and encourage their use. The aim of this study is to find out the types of refractive error that occur in children aged 1 - 18 years obtaining spectacle correction from the Nigerian National Petroleum Corporation (N.N.P.C.) Medical Services in Akpajo, Port Harcourt. This is for comparison with data obtained in other locations within the state, geographical region and worldwide for effective planning for future school health and prevention of blindness programmes in the state.

Methodology: This is a retrospective study in which data on refraction was obtained from the records of all children (aged 1 - 18 years) who were refracted during a period of one year (1st May, 2018 to 30th April, 2019) at the NNPC medical services facility. The children entitled to treatment in this facility are those of currently serving staff of the corporation. Relevant data such as age, sex and past ocular/family history were obtained from the electronic medical records. Other data included visual acuity, results of basic eye examinations; external ocular examination, funduscopy, slit lamp examination as well as the result of refraction. All the information was entered into a proforma specifically designed for this study and analysis was done using SPSS Version 20.

Results: One hundred and fifty one children were seen, sixty six males and eighty five females with an age range of 1 - 18 years. (mean age was 12.53 std = 3.18. The commonest refractive error encountered was hyperopic astigmatism, followed closely by myopic astigmatism. Hyperopia was uncommon and anisometropia was rare. Refractive error is commonest in the adolescent age group (13 - 18 years) and there is no significant relationship between type of refractive error and sex distribution of patients diagnosed with refractive error.

Keywords: *Types of Refractive Error; Children; Oil Company Staff Clinic; Port Harcourt; Nigeria*

Introduction

Refractive error is a condition where there is an abnormality in the focusing of light by the optical system of the eye [1] with the point focus falling either in front of or behind the retina or having more than one point focus with the eye at rest. The result of any of these is blurring of vision which is usually associated with asthenopic symptoms.

While refractive errors are common among populations all over the world, in many developing countries they have not been regarded as a significant problem that could benefit from public health measures due to the assumption that they are a benign, not life threatening minor nuisance. However more consideration should be given to refractive errors by patients and healthcare workers because of its sheer magnitude and impact on our millennium developmental goals. For students, the inability to read standard-sized print, to see what is written on the blackboard/overhead projector, computer, or to discriminate color can have a significant impact on their educational development [2]. Parents and educators should have information regarding every student's visual abilities, as well as how to maximize the use of remaining vision, with strategies to modify the environment or learning tools in order to minimize the disabling effect of any visual impairment on performance. Loss of independence and the ability to enjoy leisure activities are predominant concerns of the older adult with a visual impairment, but in children it's the inability to cope with school work, which usually opens up career opportunities, and the visually induced limitations and seclusion from otherwise interesting activities that our youth may be naturally endowed for that requires urgent attention. Recent data suggest that a large number of people are blind in different parts of the world due to high refractive error because they are not using appropriate refractive correction [3-6]. The aim of this study is to determine the pattern of refractive errors in children aged 1 - 18 years in a peripheral clinic in Port Harcourt, Nigeria. This is a privileged group as treatment including spectacle correction is free for the children of serving staff of the company up to the age of twenty years.

Materials and Methods

This was a retrospective study conducted from refraction records obtained from the Eye clinic of the N.N.P.C. Medical Services, Akpajo, a Port Harcourt suburb. Clinical records of children aged 1 to 18 years who were corrected for refractive errors between May 2018 and April 2019 were retrieved. Information on age, sex, type of refractive error, degree of error (spherical equivalent), previous spectacle use and compliance with follow up visit were obtained from the electronic medical records (EMR). Visual acuity had been measured using appropriate methods based on chronological and developmental age. Preverbal children were assessed with the use of behavioral methods, children aged 3 to 5 years were assessed with Lea's matching test while children older than 5 years were assessed with Snellen's visual acuity chart. Each child underwent a comprehensive ophthalmic evaluation including; pen torch examination of the anterior segment, assessment of ocular alignment, media clarity, and pupillary response, as well as detailed examination of the anterior segment with a slit lamp biomicroscope (SL 115 Classic slitlamp:Carl Zeiss meditec AG, Jena,Germany) and funduscopy to examine the posterior segment. All children below the age of 5 years had cycloplegic refraction after instillation of 1% Atropine or Tropicamide or Cyclopentolate eye drops. In addition, children aged 5years and above who had strabismus, and/or refractive errors greater than 3 diopters also underwent cycloplegic refraction. The rest of the children aged 5 years and above had non-cycloplegic refraction. Objective refraction was obtained by retinoscopy (using a streak retinoscope) and also using an autorefractor (ARKM-100; Takagi Seiko Japan). Subjective refraction was subsequently performed for verbal children and appropriate spectacle prescription given as required. Subjective refraction was performed immediately (during the same visit) for children who had non-cycloplegic retinoscopy or 1 week after cycloplegic retinoscopy and cylindrical lenses were only prescribed when the patient did not accept the spherical equivalent. The retinoscopy and refraction were performed by a senior optometrist. A follow up appointment of three months was scheduled for each patient to assess spectacle adaptation, compliance with spectacle use and corrected visual acuity.

For the purpose of this study, myopia was defined as a spherical error equal to or >-0.5 diopters (D), hyperopia as a spherical error equal to or >+0.50D, and astigmatism as a cylindrical error equal to or >0.5D.

Anisometropia was defined as a difference of 2.00D or more between both eyes after paralysis of the ciliary muscle with a cycloplegic agent. Amblyopia was defined as a difference in visual acuity of two Snellen lines or more between the 2 eyes and cycloplegic refraction as refraction done after paralysis of the ciliary muscle with a cycloplegic agent.

Results

The study sample was 151 comprising of 85 females (53.6%) and 66 males (43.7%) giving a male: female ratio of 1:1.27. The mean age is 12.53, Std = 3.18 with a range of 1 - 18 years (See Figure 1). 51% of the patients were in the adolescent age group (13-18 years) –Figure 2. The highest refractive error was RE - 11.00DS/-0.75 X 47 and LE-10DS/-1.75 X 116 while the 17 year old male patient with anisometropia had a type described as antimetropia with his prescription as follows RE -1.50/-1.00 X 180 and LE +1.50/-2.00 X 172. There was no significant relationship between type of refractive error and sex distribution of patients diagnosed with refractive error (Pearson Chi square =6.847 at sig > 0.3).

Diagnosis	Frequency	Percent
Anisometropia	1	0.7
Astigmatism	17	11.3
Hyperopia	6	4
Myopia	22	14.6
Hyperopic Astigmatism	55	36.5
Myopic Astigmatism	50	33.1
Total	151	100

Table 1: *Types of refractive error.*

The table above shows that 1 (0.7%) of the patients had anisometropia, 17 (11.3%) had astigmatism, 6 (4.0%) had hyperopia, 22 (14.6%) had myopia, 55 (36.5%) had hyperopic astigmatism, while 50 (33.1%) had myopic astigmatism. Figure 1 below shows the distribution of types of refractive error among the patients.

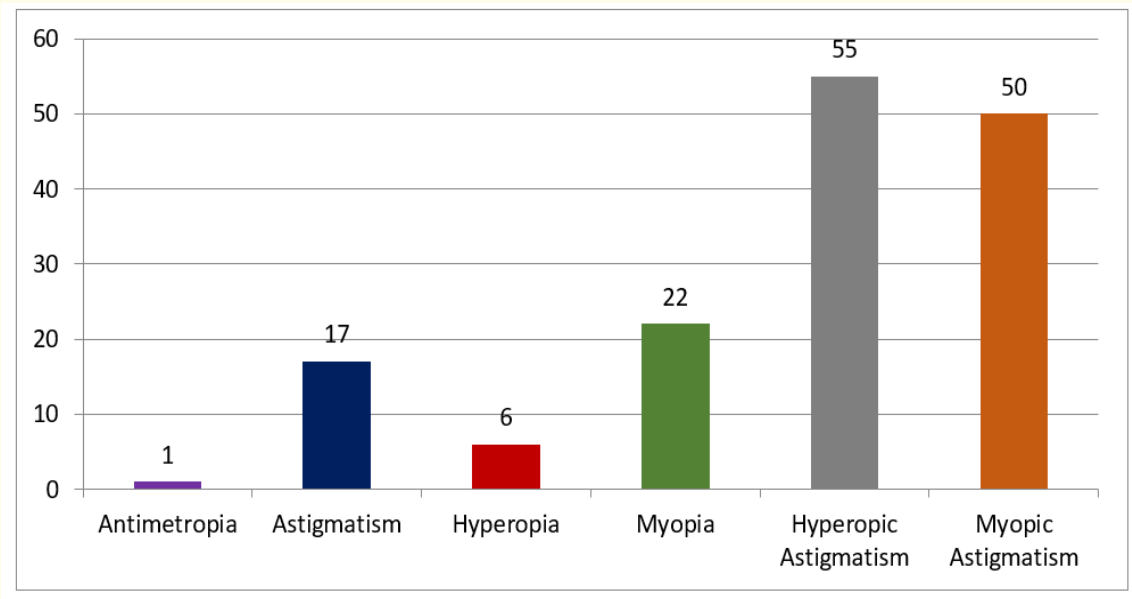

Figure 1: *Types of Refractive Error.*

The commonest type of refractive error encountered was hyperopic astigmatism (n = 55, 36.5%) followed by myopic astigmatism (n = 50, 33.1%), then myopia (n = 22, 14.6%), Astigmatism, hyperopia and anisometropia made up 11.1%, 4% and 0.7% respectively (Figure 1).

Age	Frequency	Percent
1 - 6 Years	6	4.0
7 - 12 Years	68	45.0
13 - 18 Years	77	51.0
Total	151	100
Mean = 12.53, Std = 3.18		

Table 2: *Age distribution of patients diagnosed with refractive errors.*

The table above shows the age distribution of patients diagnosed with refractive error. From the table 6 (4.0%) were aged 1 - 6 years, 68 (45.0%) were aged 7 - 12 years while 77 (51.0%) were aged 13 - 18 years. The mean age is 12.53 and standard deviation is 3.18.

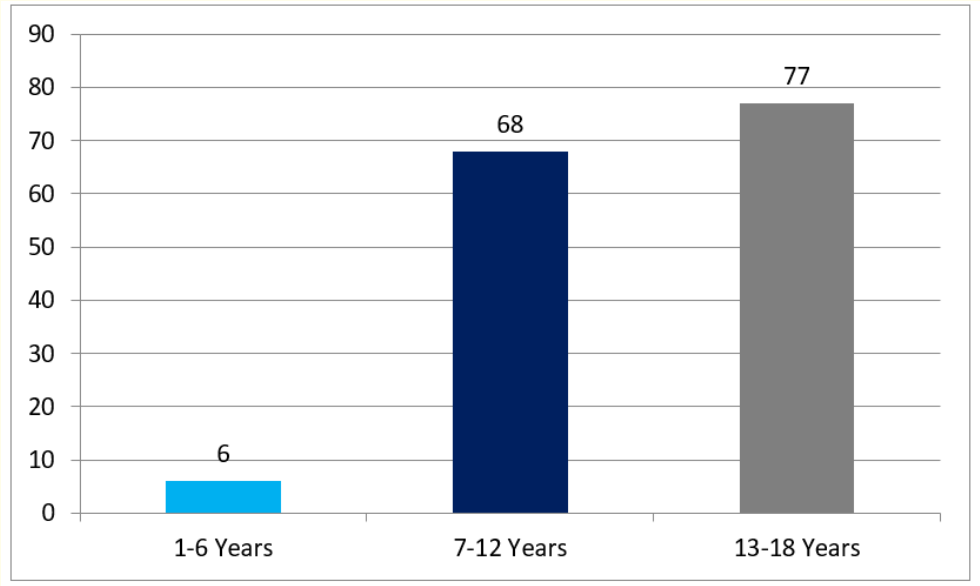

Figure 2: *Age distribution of patients.*

Sex	Frequency	Percent
Male	66	43.7
Female	85	56.3
Total	151	100

Table 3: *Sex distribution of patients diagnosed with refractive error.*

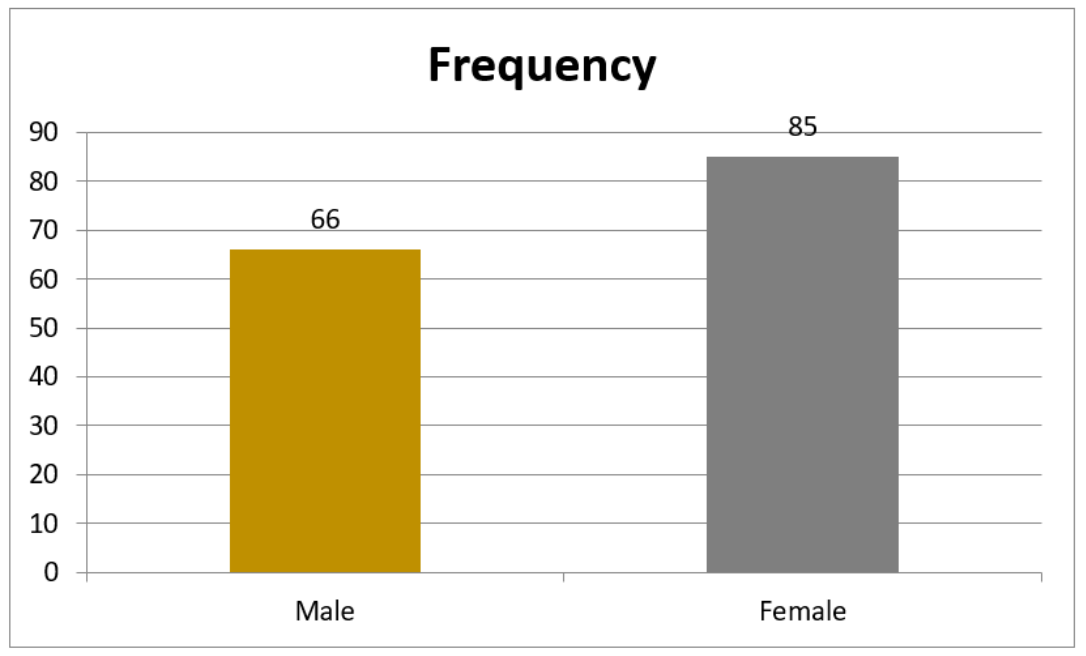

Figure 3: *Sex distribution of patients.*

Age	1 - 6 Years	7 - 12 Years	13 - 18 Years	Total
Anisometropia	0	0	1	1
Astigmatism	1	8	8	17
Hyperopia	0	2	4	6
Myopia	0	14	8	22
Hyperopic Astigmatism	2	25	28	55
Myopic Astigmatism	3	19	28	50
Total	6	68	77	151

Table 4: *Age distribution of patients diagnosed with refractive errors.*

The table above shows that the patient diagnosed with Anisometropia was between the age of 13 - 18 years. Also, out of the 17 patients diagnosed with Astigmatism 1 patient was between 1 - 6 years, 8 were between 7 - 12 years while 8 were between 13 - 18 years. Similarly, out of 6 patients diagnosed with Hyperopia 2 were between 7 - 12 years while 4 were between 13 - 18 years. Also, out of the 55 patients diagnosed with Hyperopic Astigmatism 2 patients were between 1 - 6 years, 25 were between 7 - 12 years while 28 were between 13 - 18 years. And lastly, out of 50 patients diagnosed with Myopic Astigmatism, 3 patients were between 1 - 6 years, 19 of the patients were between 7 - 12 years while 28 of the patients were between 13 - 18 years. The chart below further shows the refractive errors distribution by age.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.847[a]	10	.740
Likelihood Ratio	8.050	10	.624
N of Valid Cases	139		

Table 5: *Summary of Chi-square on the relationship between refractive errors and sex distribution.*

The table above shows that there is no significant relationship between type and age distribution of patients diagnosed with refractive errors, since the Pearson Chi-Square = 6.847 at Sig. >0.05.

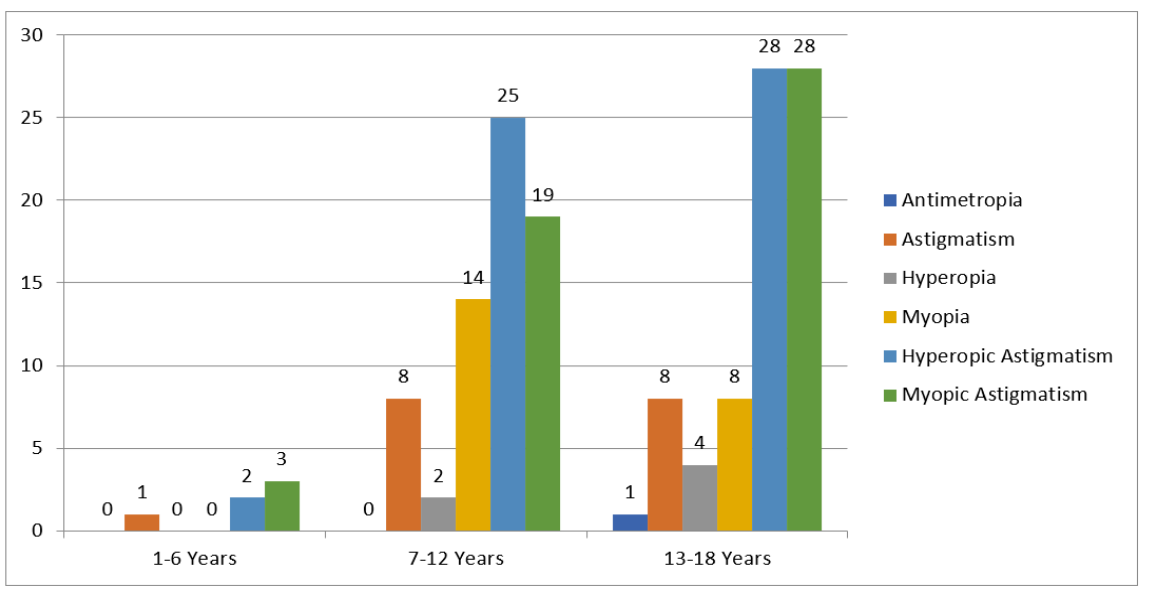

Figure 4: *Refractive errors by age.*

	Sex		
Refractive Error	**Male**	**Female**	**Total**
Anisometropia	1	0	1
Astigmatism	6	11	17
Hyperopia	1	5	6
Myopia	9	13	22
Hyperopic Astigmatism	28	27	55
Myopic Astigmatism	22	28	50
Total	66	85	151

Table 6: *Sex distribution of patients diagnosed with refractive error.*

The table above shows that both males and females are about equally affected by hyperopic astigmatism (n = 28;27) compared to myopic astigmatism (m:f = 22:28) and myopia (m:f = 9:13) which are commoner in females.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.280[a]	5	.510
Likelihood Ratio	4.864	5	.433
N of Valid Cases	151		

Table 7: *Summary of Chi-square on the relationship between refractive errors and sex distribution. The table above shows that there is no significant relationship between type of refractive error and sex distribution of patients diagnosed with refractive error, since the Pearson Chi-Square = 4.280 at Sig. >0.05.*

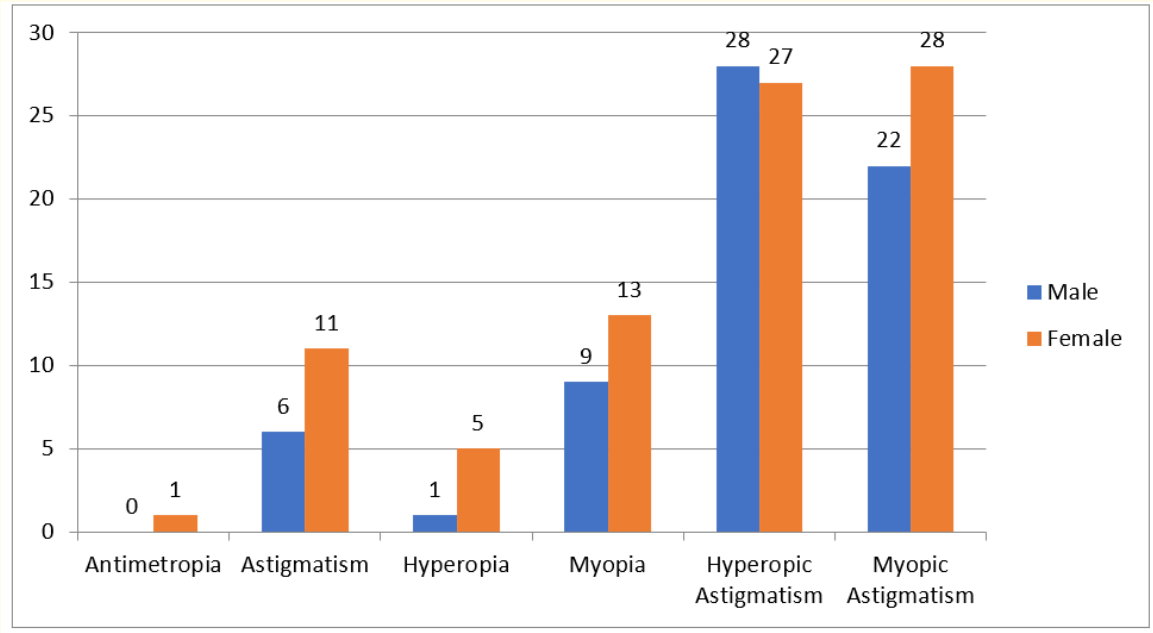

Figure 5: *Refractive errors by sex.*

Discussion and Conclusion

Worldwide, uncorrected refractive error is the main cause of moderate and severe visual impairment and the second leading cause of blindness [7], accounting for an estimated 153 million and 8 million affected people respectively, despite the fact that correction of refractive error with appropriate spectacles is one of the most cost-effective interventions in eye health [5].

Within the one year period under review, one hundred and fifty-one children with refractive errors obtained spectacle correction from this facility. The m: f ratio was 1: 1.27 (43.7%: 56.3%) and the commonest type of refractive error encountered in this study was hyperopic astigmatism(36.5%) followed by myopic astigmatism (33.1%), myopia (14.6%), astigmatism (11.4%) and hyperopia. Onakpoya and Adeoye [8] in their study of childhood eye diseases in South -Western Nigeria, observed that 73.2% of the children with refractive errors were female while Opubiri [9] also working in South-south Nigeria found that 63.5% of the patients were female which agrees with our results here.

Various studies have shown that gender differences at the age of onset of puberty affect development of Refractive errors and with differences between biometric ocular parameters of males and females being reported, which suggests a possible correlation between gender and refractive error. We found refractive error(RE) to be slightly more common in females (56.3%) than males (43.7%) ($p = 0.04$) in the present study, a result similar to those observed in [8] Oshogbo, South-West Nigeria, Birnin Kebbi, Nigeria [10] and Ethiopia [11].

It has been documented [1] that the human eye grows by 5 mm from birth to 6 years, and by an additional 1 mm after 6 years until the age of 12 years. The prevalence of RE has been reported to increase to 2% by the age of 6 years and to 15% by the age of 15 years in the general population, indicating the possibility of a relationship between increase in age and RE. This study found RE to increase with age and was highest (51.0%) among children in the 13 to 18 years age group. Similar findings were reported by Assefa., *et al*. [11] in Ethiopia, Isawunmi [12] in Oshogbo and by Opubiri., *et al.* [9] in Bayelsa state, Nigeria.

The commonest refractive error encountered in this study was hyperopic astigmatism. This is in contrast to the findings of Opubiri., *et al.* in another hospital-based study in south-south Nigeria in which myopia was the commonest error occurring in 61.4% of the children. Also, only one hundred and fourteen cases (114) were seen by Opubiri over a period spanning four years while in our series, one hundred and fifty-one children received prescription glasses in one year because it was readily available and free. In a vision screening survey to detect refractive errors in 614 students from three secondary schools in Birnin Kebbi, North-east Nigeria [9], the prevalence of uncorrected refractive error was found to be 4.4% as only three students that needed glasses out of thirty were found to be wearing spectacles. Myopia was found to be the most common refractive error in 18 (60%) of the pupils with refractive errors. Among the 27 pupils with uncorrected refractive error, 14 (46.7%) reported the barrier to using glasses as not being aware of the error while 11 (36.7%) reported having not been taken to the Hospital as their major challenge. Ezinne [13] also found myopia to be the commonest refractive error at Onitsha where it accounted for 46.3% of refractive errors discovered during a school screening exercise.

Pediatric ophthalmology is one of the rapidly emerging subspecialties in Nigeria. Reports on the pattern of eye diseases in different parts of the country show refractive error as the commonest condition followed by allergic conjunctivitis [14,15]. An analysis of the types of refractive error shows that in this region astigmatism is very common with it being implicated in a total of 80.9% of our subjects; 55 (36.1%) had hyperopic astigmatism, 50(33.1%) had myopic astigmatism and 17(11.3%) had simple astigmatism. This is in agreement with the findings of Huang., *et al.* [16] who evaluated demographic and ocular risk factors for astigmatism among 3 to 5 year old preschoolers in five geographic areas in the United States of America and quantified the magnitude of association with astigmatism. This study showed that African American, Hispanic and Asian children had a higher risk for astigmatism than other racial/ethnic groups, and that spherical refractive error (either myopia or hyperopia) was associated with an increased risk of astigmatism.

The Durban Declaration on Refractive Errors and Service Delivery, passed in 2007 at the inaugural World Congress on Refractive Error, resolved to prioritize solutions toward refractive service development [17]. The priorities for refractive service development included in the Declaration refer to increasing awareness; influencing policies; addressing the paucity of services/eye care personnel by investing in training, infrastructure, and spectacles; providing appropriate technology; addressing barriers to accessing services; creating collaborative partnerships to meet the objectives of VISION 2020; making available optical appliances and devices to communities; and disseminating evidence-based information on best practices in refractive service development and delivery.

The strategies aimed at solving the problem of uncorrected RE in low- and middle-income countries should, include both refraction and dispensing of spectacles at either the primary or secondary level of eye care, since it is at these levels that most access to services for communities occur [18]. The children of the NNPC staff are privileged to have readily accessible and free eye health care but this should be a fundamental human right of every child in this country. Mandatory pre-school screening for both refractive and non-refractive conditions should be done with health promotion, and prompt referral. Health personnel from each community should be trained to refract patients, counsel them on their refractive conditions, and dispense spectacles. It is also imperative that spectacles that are acceptable and

affordable to poorer individuals and communities be made available. The social entrepreneur model offers the expansion of services as well as contributes to poverty alleviation by using local people that are trained to dispense spectacles within the boundaries of refraction clinics and facilities.

In conclusion, although this study was limited by its inability to determine the prevalence of refractive error in this population, its findings are of public health importance for planning future school health and prevention of blindness programmes in the state. Also there is need for future studies on a larger scale to evaluate the relatively high percentage of astigmatism associated with spherical errors and alone in this region.

Conflicts of Interest

Nil.

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