The Prevalence and Pattern of Refractive error in Ogun State, Nigeria

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Abstract

Objective
To determine the prevalence and pattern of refractive errors in Ogun State, Nigeria. The prevalence of blindness was also determined.

Method
A cross sectional descriptive survey. Participants aged 15 years and above were randomly selected from 1125 attendees of different community medical outreaches conducted in 5 Local government areas of Ogun State between August 2012 and March 2013. Participants underwent ocular examination and refraction (automated objective and subjective assessments)

Results
The sample consisted of 780 participants. Their mean age was 49.14 (±18.37), and 52.8% were females. About two-thirds [67.7%] had presenting visual acuity [VA] of at least 6/18, while 14.3% were legally blind [VA worse than 3/60]. Astigmatism was the most prevalent refractive error [40%] but on conversion to spherical equivalents, hyperopia [28.5%] became the most prevalent error. Apart from refractive errors, cataract and glaucoma were found to be the other major causes of visual impairment amongst the respondents.

Conclusion
The prevalence of refractive errors and blindness in the study population was higher than previously documented with hyperopia being the most prevalent spherical equivalent refractive error. An urgent integration of primary eye care into the existing primary health care system for prevention of blindness is advocated

Key Words: Refractive errors, Refraction, Visual impairment, Blindness

Introduction
Refractive errors [RE] are errors in the focusing of light by the eye which leads to reduction in vision. The main RE are myopia, hyperopia, astigmatism and presbyopia. Myopia, also called nearsightedness is said to occur when parallel rays of light from a distance comes to a focus in front of the sentinel layer of the retina when the eye is at rest, thus forming a blurred image.

This occurs either because the antero-posterior diameter of the eyeball is too long and/or the refractive power of the eye is too strong. Hyperopia occurs when rays of light are brought to a focus behind the sentinel layer of the retina when the eye is at rest.

This occurs either because the antero-posterior diameter of the eyeball is too short and/or its refractive power is too weak. Astigmatism occurs when a point focus of light cannot be formed upon the retina. It causes two focal points to form at different locations in the eye causing both near and far objects to be blurred.

It may be regular (when the two principal meridian are at right angles to each other) or irregular (when the meridian curvatures do not follow any geometric figure). Presbyopia occurs due to the loss of accommodation that occurs with aging.

Uncorrected refractive errors, which affect persons of all ages, gender, race and ethnic groups, are the main causes of visual impairment. They may result in lost education and employment opportunities, lower productivity and impaired quality of life. In 1990, the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) came up with a joint global initiative known as “Vision 2020” (Right to sight).

Its mission is to eliminate the main causes of avoidable blindness by the year 2020 by facilitating the planning, development and implementation of suitable national eye care programs based on the three core strategies of disease control, human resource development and infrastructure and technology, incorporating the principles of primary health care.

Avoidable blindness is defined as blindness which can be either treated or prevented by known, cost-effective means. Target areas for Vision 2020...
include cataract, refractive errors, trachoma, childhood blindness, low vision, onchocerciasis, glaucoma, diabetic retinopathy and age related macular degeneration. Up to 80% of the world's blindness are avoidable.

As a cause of blindness and low vision, refractive error has not received much attention, because most definition of blindness has been based on best corrected visual acuity. However, with the increasing use of presenting visual acuity in the definition of blindness, the global visual impairment burden has been increased by about 38% with refractive errors becoming the second largest cause of treatable blindness after cataract.

Visual impairment [VI] is categorized into mild or no visual impairment (≥6/18), moderate VI (<6/18-6/60), severe VI (<6/60-3/60) and blindness (<3/60). In 2010, it was estimated that 123 million people had significant visual impairment (<6/18 in the better eye) due to uncorrected refractive errors affecting distance vision, including at least eight million people with blindness (<3/60 in the better eye).

In addition, 517 million people were without adequate correction for functional refractive errors in the 2005 global estimate. The global economic cost in lost productivity due to avoidable distance vision impairment alone was estimated to be $269 billion each year in 2009.

The prevalence of refractive errors has been shown to vary with ethnicity and race. Studies in Europe, America and Australia showed a prevalence of 42.8%, 39.8% and 25% respectively, with myopia accounting for 50% of these. Among adult Chinese population in Singapore, the overall prevalence of myopia, hyperopia and astigmatism were 38.7%, 28.4% and 37.8% respectively with high myopia (>5.00D) being 9.15%.

Studies in India and Bangladesh showed prevalence of 29% and 22% respectively. In Tema, Ghana the prevalence of visual impairment was seen to decrease from 17.1% to 6.7% after refraction and spectacle correction, suggesting that refractive error was the major correctable cause of visual impairment.

In Nigeria, various population studies have documented prevalence rates of refractive errors to be 10.7%, 12.4% and 15.4%, respectively. In 2007 the Nigerian National blindness and visual impairment survey discovered that uncorrected refractive error was responsible for 77.9% of mild visual impairment, 57.1% of moderate visual impairment, 11.3% of severe visual impairment, and 1.4% of blindness in the country, with myopia being more prevalent.

There is an urgent need to improve refractive error and spectacle coverage in Nigeria by prompt incorporation of primary eye care into the existing primary health care system. This study aimed to determine the prevalence and pattern of refractive error and blindness in Ogun State, Nigeria.

**Methods**

A cross sectional study of respondents aged 15 years and above who were randomly selected from amongst patients who attended the various general medical community outreach programs carried out in 5 [Ikenne, Odogbolu, Sagamu, Ijebu Ode, Obafemi Owode] Local Government Areas [LGA] out of the 20 LGA in Ogun State, South Western Nigeria between August 2012 and March 2013.

The 5 LGAs were selected by systematic random sampling using the State's list of Expanded Programme on Immunisation. Individuals with dense media opacity obscuring the visual axis or strabismus which could prevent refraction with an automated keratorefractor were excluded from the sample. The study was carried out according to the Declaration of Helsinki. Informed consent was obtained from all respondents and all procedures were non-invasive.

Respondents underwent a full ocular examination including visual acuity check unaided and with correction [pinhole and subjective refraction for VA<6/9], anterior and posterior segment examination with flash light and ophthalmoscope respectively, as well as objective and subjective refraction. Objective refraction was done using a PAK 2000 Automated keratorefractor that was regularly calibrated.

An average of 5 readings was taken for each eye. The readings were recorded as emmetropia (> - 0.5 D, < + 0.5D), myopia (< − 0.5D), hyperopia (> + 0.5D), and astigmatism [using minus cylinder format was defined as worse than - 0.5D cylinder]. The spherical equivalents (half cylinder plus sphere) were calculated for those with astigmatism to allow for comparison with other studies.

The socio-demographic data of the participants was also documented. The data analysis was performed using SPSS version 16 and significance level was set at p<0.05.

**Results**

A total of 780 participants who met the inclusion criteria were examined out of the 1125 patients who attended the medical outreach. The mean age of the respondents was 49.14±18.37 years with age range of 15 to 100 yrs. Females constituted 52.8% of the sample and the respondents were predominantly [87.2%] of the Yoruba tribe, farmers, artisans and civil servants (Table 1).
The results obtained from each eye were statistically similar, hence results for the right eye only is reported as also done in previous studies. Most [67.7%] of the respondents had a presenting visual acuity [VA] of at least 6/18 which improved to 76.2% [594] after correction [FIG I].

Using the presenting/unaided VA, 133 [17.1%] respondents had moderate visual impairment [VI] while 112 [14.3%] were blind but this improved after correction to 83 [10.6%] and 95 [12.2%] respectively.

Forty percent [312] of the respondents had astigmatism but when converted to spherical equivalents, 54.9% [428] had either myopia or hyperopia while 33% [258] had no refractive error [emmetropia] as shown in Table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N=780</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age [years]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>50</td>
<td>6.4</td>
</tr>
<tr>
<td>21-30</td>
<td>102</td>
<td>13.1</td>
</tr>
<tr>
<td>31-40</td>
<td>107</td>
<td>13.7</td>
</tr>
<tr>
<td>41-50</td>
<td>171</td>
<td>21.9</td>
</tr>
<tr>
<td>51-60</td>
<td>132</td>
<td>16.9</td>
</tr>
<tr>
<td>&gt;60</td>
<td>218</td>
<td>27.9</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>368</td>
<td>47.2</td>
</tr>
<tr>
<td>Female</td>
<td>412</td>
<td>52.8</td>
</tr>
<tr>
<td>Tribe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yoruba</td>
<td>677</td>
<td>87.2</td>
</tr>
<tr>
<td>Igbo</td>
<td>51</td>
<td>6.5</td>
</tr>
<tr>
<td>Benue</td>
<td>11</td>
<td>1.4</td>
</tr>
<tr>
<td>Others</td>
<td>38</td>
<td>4.9</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professionals</td>
<td>76</td>
<td>9.9</td>
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<tr>
<td>Civil Servant</td>
<td>98</td>
<td>12.5</td>
</tr>
<tr>
<td>Trader</td>
<td>274</td>
<td>35.7</td>
</tr>
<tr>
<td>Farmer</td>
<td>43</td>
<td>5.6</td>
</tr>
<tr>
<td>Artisan</td>
<td>166</td>
<td>13.8</td>
</tr>
<tr>
<td>Others</td>
<td>172</td>
<td>22.4</td>
</tr>
</tbody>
</table>
Figure 1: Visual Acuity of participants before and after Refraction

![Bar chart showing visual acuity](chart.png)

Table 2: Types of Refractive errors among the participants

<table>
<thead>
<tr>
<th>Refractive state</th>
<th>N=780 n[%]</th>
<th>MALES n=368 n [%]</th>
<th>FEMALES n=412 n [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emmetropia</td>
<td>258 [33.0]</td>
<td>127 [34.5]</td>
<td>131 [31.6]</td>
</tr>
</tbody>
</table>

Refraction was not done in 10.2% [94] of respondents due to media opacities caused by dense cataract, cornea disease etc [Table 2]. Fifteen [1.9%] respondents had high myopia [defined as myopia of worse than -5.0 dioptres] and 14 [1.8%] had significant hyperopia [defined as hyperopia greater than +3.0 dioptres].

The prevalence of hyperopia was higher in females than males, while females had higher prevalence of myopia and emmetropia (Table 2).

However, there was no statistically significant association between gender and refractive error (p=0.12). Sixty three percent [491] of the respondents had normal anterior segment and 85% [665] had normal posterior ocular segments while 21% [162] had cataract, 10% [75] had glaucoma and 8% [64] had different types of conjunctivitis (Figures 2 and 3).
Figure 2: Anterior Segment Diagnosis of the participants

- Normal: 63%
- Cataract: 21%
- Conjunctivitis: 4%
- Pterygium: 2%
- Cornea Disease: 2%
- Others: 8%

Figure 3: Posterior Segment Diagnosis of the participants

- Normal: 85%
- Glaucoma: 10%
- Macular Disease: 2%
- Other Retinal Diseases: 2%
Discussion

In this study, respondents were mainly of the Yoruba tribe and aged 15 years and above. The prevalence of refractive error was 54.9%, which is high when compared to other population studies carried out in South Western Nigeria by Ajibode, Adegbehingbe, Onakpoya et al which documented 10.7%, 12.4% and 15.4% respectively.

This value is also higher than those reported in India [29%] and Bangladesh [22%]. This prevalence rate was however more comparable to values obtained in Europe [42.8%] and America [39.8%]. The high difference when compared with other local studies may partly be due to the differences in measurement techniques for example the use of visual acuity, pin hole or subjective refraction only in determining the refractive states of the population studied by the different authors as compared to automated refraction which is more objective and reproducible.

Astigmatism was the highest refractive error seen amongst 40% of the respondents but this was lower than the findings by Ezelum et al in the Nigerian National blindness and visual impairment study which also documented astigmatism as the most prevalent refractive error in Nigeria with a value of 58.7%.

Adegbehingbe et al also documented a high prevalence of astigmatism [55.8%] in Ile-Ife, even though this was a hospital based study which may not be representative of the population. The high prevalence of astigmatism seen in these studies can be attributed to the use of automated refraction as also shown by Ezelum et al which is able to detect even mild forms of simple regular astigmatism caused by the effect of the eyelids on the cornea, which may be missed during manual refraction.

A third of the respondents however had no refractive error while 28.5% were hyperopic and 26.4% were myopic with more males being myopic and more females being hyperopic. Studies amongst Chinese have documented higher rates of myopia [38.7%] and high myopia being up to 9.15%. The prevalence of hyperopia was lower than finding by Ezelum et al [50.7%] and also lower than values from the African-Americans in the Barbados Eye Study [46.9%] and by Adelufé-Osietu [42.6%] in Lagos, even though the latter did not do automated refraction.

The prevalence of blindness [VA <3/60] amongst the respondents was 14.3% when using the presenting VA and 12.2% [95] using best corrected VA. This was higher than the 3.4% reported by the Nigerian National blindness study and could be due to the limited number of respondents examined.

This value is however significant and buttresses the urgent need to integrate primary eye care into the existing primary health care system so as to make eye care and prevention of blindness accessible to all in Ogun State. Although over 60% of our respondents had normal ocular findings, cataract and glaucoma where the two commonest finding after refractive error. This is however in keeping with the global causes of visual impairment.

Conclusion

The prevalence of refractive errors and blindness in the study population was higher than previously documented with hyperopia being the most prevalent spherical equivalent refractive error. An urgent integration of primary eye care into the existing primary health care system for prevention of blindness is advocated.

Acknowledgement

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References


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