

## Prevalence, Determinants and Distribution of Refractive Errors in a Nigerian Community

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Refractive errors have been identified as major cause of blindness yet there is little known about the prevalence, distribution and determinants in Nigeria. We present the results of a cross sectional analytical study using 3451 adults living in Owerri, Nigeria. Results show a high prevalence of refractive errors (79.5% and 76.6% in the study and control respectively). Hyperopia was the dominant refractive error; while Myopia (23.4% and 19.6%) and Astigmatism (20.9% and 22.5%) was noted among subjects in study and control groups respectively. A higher prevalence exists among rural dwellers and the contributory factors were environmental factors, poor nutrition and use of irrational and uncontrolled use of chloroquines as first line drugs for malaria. To achieve the targets of the Global Initiative for Elimination of avoidable blindness, we recommend Health education on diet, drug use and safe environmental practices especially for people living in rural areas in developing countries.

**Key words:** Refractive errors, Eye, Blindness, Nigeria, Imo State.

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The human eye is an important special sensory organ whose primary function, vision is achieved by refraction of light rays by the cornea and the crystalline lens and focusing them on the retina. The retina receives the pictures formed by the light rays and send image to the brain via the optic nerve for perception<sup>1,2</sup>.

An individual's ocular refractive status is a physiology parameter hence affected by age, nutrition, diseases, and changes in the internal / external environment of the individual.

Refractive errors of which there are three types- astigmatism, hyperopia and myopia are not diseases but are eye disorder that can impair vision if not corrected<sup>3</sup>.

Worldwide estimates of the number of people with refractive errors range from 800 million to 2.3 billion. Numerous studies have been undertaken on small samples from disparate populations and extrapolations from these data have provided clues about refractive error distribution in many developed countries<sup>4,5</sup>. There is little known about the prevalence of refractive errors in the adult population of Nigeria<sup>6</sup>

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The detection and correction of refractive errors is a cost effective intervention and is one of the priorities under the disease control component of the Global Initiative for Elimination of Avoidable blindness.<sup>7</sup> Uncorrected refractive error is a significant cause of blindness and a leading cause of visual impairment in developed countries.<sup>7</sup> It is clear that without appropriate optical correction, millions of children lose educational opportunity and many adults are excluded from productive working lives with severe economic and social consequences<sup>7</sup>.

The present study was aimed at determining the prevalence and determinants of refractive errors in Owerri, Imo State in order to create a data baseline for the state.

### MATERIAL

Subjects (2606) were recruited between September 2007 and November 2009 from persons who attended the Federal Medical Centre Owerri. The controls (845) were selected from persons living in a near by rural community in Owerri-West Local government Area, after a Multistage random sampling. Only those above 18 years were selected for the study.

Structured interview administered questionnaires were used to determine demographic characteristics, dietary habits, alcohol consumption, tobacco use and past ocular history

was administered to subjects and then detailed history of ophthalmic and systemic problems was obtained.

Those with conditions interfering with accurate ocular refractions such as corneal opacity, visually impairing opaque media, diabetes mellitus and hypertension and those are pseudophakic or aphakic were excluded from analysis.

### METHODS

All the subjects underwent a complete ophthalmic examination which included measurement of distant, near and pin hole visual acuity in subjects with visual acuity less than 6/6 (with Snellen's chart and near reading charts); tonometry; fundoscopy; and perimetry to investigate other possible causes of impairment or reduction in vision. Results analysis was done using EPI Info version 3.5, 2008 statistical Data Package.

### RESULTS

#### Demographic characteristics of subjects

Majority of the subjects were aged 40-49. There were more females than males in both in both study and control groups. There was no significant difference between the control and the study groups as shown in table 1.

**Table 1.** Subjects by age and gender

| Age    | Male            |      |                  |      | Female          |      |                  |      | P Value |
|--------|-----------------|------|------------------|------|-----------------|------|------------------|------|---------|
|        | Study<br>N=1079 |      | Control<br>N=357 |      | Study<br>N=1527 |      | Control<br>N=488 |      |         |
|        | No              | %    | No               | %    | NO              | %    | NO               | %    |         |
| 20 -29 | 194             | 18.0 | 32               | 9.0  | 340             | 22.3 | 89               | 18.2 | 0.5     |
| 30-39  | 183             | 17.0 | 50               | 14.0 | 260             | 17.0 | 122              | 25.0 | 1.00    |
| 40-49  | 279             | 25.8 | 170              | 47.6 | 441             | 28.9 | 189              | 38.7 | 0.12    |
| 50-59  | 244             | 22.6 | 65               | 18.2 | 296             | 19.4 | 47               | 9.6  | 0.49    |
| 60-69  | 179             | 16.6 | 40               | 11.2 | 190             | 12.4 | 41               | 8.4  | 0.32    |

$X^2 = 2.42, df=1, p\text{-value}=0.12, or=0.9, 95\% C.I=0.70-1.06$ [UNIVARIATE]

$X^2=1.36, df=4, p\text{-value}=0.850$ [ BIVARIATE]

**Refractive status of patients**

Majority of the subjects (79.5% and 76.6% of the study and control groups respectively) had ametropia. Only 20.5 % and 23.2% of the study and control respectively were emmetropic. The differences between the study and control groups were not statistically significant. The commonest

refractive error was hyperopia(35.2% and 34.7% of the study and control groups respectively) followed by myopia(23.4% and 19.6% of the study and control groups respectively). The least was astigmatism (20.9% and 22.5% of the study and control groups respectively). These findings are shown in table 2

**Table 2.** Refractive Status of Patients

| Refractive Status | Study group N=2606 |      | Control group n=845 |      | P value |
|-------------------|--------------------|------|---------------------|------|---------|
|                   | No                 | %    | No                  | %    |         |
| Hyperopia         | 917                | 35.2 | 293                 | 34.7 | 1.00    |
| Myopia            | 610                | 23.4 | 166                 | 19.6 | 0.60    |
| Astigmatism       | 545                | 20.9 | 190                 | 22.5 | 0.73    |
| Emmetropia        | 534                | 20.5 | 196                 | 23.2 | 0.73    |

$X^2=0.27, df= 1, p\text{-value}=0.60, OR=1.19, 95\% C.I=0.58-2.48$ [UNIVARIATE]  
 $X^2 = 0.7, df=3, p=0.873$ [BIVARIATE]

**Table 3.** Prevalence of ametropia in different Age groups and Gender

| Age   | Male        |      |               |      | Female       |      |               |      | P Value |
|-------|-------------|------|---------------|------|--------------|------|---------------|------|---------|
|       | Study N=827 |      | Control N=266 |      | Study N=1245 |      | Control N=383 |      |         |
|       | No          | %    | No            | %    | NO           | %    | NO            | %    |         |
| 20-29 | 148         | 18.0 | 24            | 9.0  | 285          | 22.9 | 72            | 18.8 | 0.38    |
| 30-39 | 141         | 17.0 | 38            | 14.3 | 209          | 16.8 | 93            | 24.3 | 1.00    |
| 40-49 | 217         | 26.2 | 127           | 47.7 | 370          | 29.7 | 153           | 39.9 | 0.53    |
| 50-59 | 188         | 22.7 | 50            | 18.8 | 231          | 18.6 | 34            | 8.9  | 0.49    |
| 60-69 | 133         | 16.1 | 27            | 10.2 | 150          | 12.0 | 31            | 8.1  | 0.41    |

$X^2 =0.77, df=1, p\text{-value} =0.38, 95\% \text{ confidence interval} =0.35-1.55$ [univariate]  
 $X^2 = 1.55, df = 4, p\text{-value} =0.818$ [Bivariate]

**Table 4.** Ametropia and location of residence of subjects

| Age    | Male        |      |               |      | Female       |      |               |      | P Value |
|--------|-------------|------|---------------|------|--------------|------|---------------|------|---------|
|        | Study N=804 |      | Control N=251 |      | Study N=1268 |      | Control N=398 |      |         |
|        | No          | %    | No            | %    | NO           | %    | NO            | %    |         |
| Male   | 445         | 55.3 | 134           | 53.5 | 530          | 41.8 | 158           | 39.8 | 0.06    |
| Female | 359         | 44.7 | 117           | 46.5 | 738          | 58.2 | 240           | 60.2 | 3.38    |

$X^2 =3.38, df=1, p\text{-value}=0.06, OR= 1.7, 95\% C.I =0.93-3.07$ [univariate]  
 $X^2 =3.96, df=1, p\text{-value}=0.046$ [Bivariate]

**Table 5.** Ammetropia and risk factors affecting vision

| Refractive Status                  | Study group N=2072 |      | Control group n=649 |      | P value |
|------------------------------------|--------------------|------|---------------------|------|---------|
|                                    | No                 | %    | No                  | %    |         |
| Alcohol consumption                | 696                | 33.6 | 178                 | 27.4 | 0.280   |
| Tobacco use                        | 412                | 19.9 | 98                  | 15.1 | 0.350   |
| Quinines as most used anti-malaria | 1405               | 67.6 | 319                 | 49.2 | 0.010   |
| History of ocular Trauma           | 421                | 20.3 | 193                 | 29.7 | 1.00    |
| Poor dietary Habits                | 1288               | 62.2 | 205                 | 31.6 | 0.001   |

$X^2= 20.4$  ,df=1, p-value= 0.001, OR=3.8,95% C.I.=2.02-7.27[Univariate]

### **Ammetropia And Risk Factors Affecting Vision**

About sixty seven percent and forty nine percent of ametropics in the study and control groups respectively used chloroquine as their regular anti-malarial while 62.2 % in the study group and 31% in the control group were in the habit of consuming food items of low nutritional values as shown in table 5.

### **DISCUSSION**

In this study, the majority of the subjects were aged 40-49 years (27.6% and 42.5% of the study and control groups respectively). The decline in vision at near from presbyopia and hyperopia as the lens becomes rigid may explain why majority of those who presented for visual care were in this age group. After the age of 40 years lens cannot change its shape as it once easily did due to increasing rigidity therefore it becomes more difficult to see clearly at closed range<sup>1,3</sup>. Most domestic and office duties are at near point activities and demand good near vision. Ageing also modifies a pre-existing error making it more symptomatic<sup>6</sup>.

There were more women in this study (58.6% and 57.8% of the study and control groups respectively). Women as a result of pregnancy, child birth and motherhood are more health conscious than men. This agrees with earlier studies<sup>6,8,9</sup>.

The prevalence of ametropia in this study was 79.5% and 78.6% in the study and control groups respectively. Studies done in the United States of America, Western Europe and Australia showed a prevalence of 35.1%,37.7% and 22.2%.<sup>10</sup> respectively. The relatively high prevalence rate of refractive errors in this study appears

paradoxical as demographic studies have shown that Asia and America harbour more aged population than developing countries like Nigeria since increase in age is a physiologic determinant of refractive errors<sup>11</sup>. This observation shows that the environment may be a factor in this high prevalence.

Ametropia was found more in females and rural dwellers. The influence of the environment on ocular physiology has been earlier noted<sup>12-16</sup>. In the rural settings, women may be more exposed to hazard due to pollution of the environment from use of firewood for cooking, bush burning practices, cow's skin and hides, long exposure to ultraviolet rays from sunlight during farming, use of lantern/candle to read and dusty environment especially during harmattan and dry season.

The most dominant refractive error was hyperopia (35% and 34.7% in the study group and control group with no significant difference between the two groups, p=1.00) while myopia was found in 23.4% and 19.6% of the study and control groups respectively. This is similar to the findings in earlier study done in the western Nigeria among public drivers<sup>17</sup>. The studies done in United States of America, Western Europe and Australia however showed a prevalence of 9.9%, 11.6% and 5.8% hyperopia<sup>10</sup>. Factors responsible for ametropia in our environment probably cause a decline in the accommodation of the lens causing more of hyperopia than myopia. A prevalence of 20.9% and 22.5% of astigmatism was found in the study and control groups respectively. Hyperopic and myopic astigmatism was also found in some subjects. This was similar to the prevalence of 27.4% of astigmatism found in the pilot study among patients attending the eye clinic of the University Of Nigeria Teaching Hospital<sup>6</sup>. The

studies done in Sumatra Indonesia and India (APEDS showed a prevalence of 18.5% and 12.9% astigmatism<sup>11</sup>. This may be due to differences in genetic and environmental factors.

Among factors that are very likely to affect refractive ability of the eyes are the use of chloroquine as anti-malarial drugs and poor dietary habits. About sixty seven percent and forty nine percent of ametropics in the study and control groups respectively used chloroquine as their regular anti-malarial. Malaria is endemic in Nigeria and the chloroquine is used as first line drug especially in the rural areas. Abuse of chloroquine affects components of refraction especially in the absence of adequate nutrition<sup>1</sup>. Many of the ametropics (62 % in the study group and 31% in the control group) were in the habit of consuming food items of low nutritional values. The effect of nutritional deficiencies on visual health has been noted<sup>1</sup>. From this study, poor dietary habit may be implicated as a risk factor for ametropia.

It is not evident from our study that ocular trauma, the use of alcohol and tobacco significantly affect the prevalence of ametropia.

### CONCLUSION

This study has provided information on the prevalence of refractive errors among adults in Imo state, Nigeria. The level of prevalence was high compared with the levels in high and medium income resource countries. The marked difference may be due to the identified poor level of nutrition and frequent use of chloroquine derivatives for the treatment of malaria and living in the rural area.

### Recommendation

Regular screening exercise for ametropia is recommended in to identify those with refractive errors for early corrective measures. Health education on diet, drug use and safe environmental practices should be incorporated as one of the priorities under the disease control component of the Global Initiative for Elimination of avoidable blindness

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