PREVALENCE OF HYPEROPIA AMONG SCHOOL CHILDREN IN THE KUMASI METROPOLIS, GHANA

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ABSTRACT
This descriptive cross-sectional study was to determine the prevalence of hyperopia in public basic schools in the Kumasi metropolis. A study population of 1,756 was randomly selected from 11 public schools. Data were collected through questionnaire and vision screening involving visual acuity assessment, non cycloplegic refraction and ocular health assessment. Out of the 1,756 pupils that were examined of which 788(44.9%) were boys and 968(55.1%) girls, 586 (33.4%) were diagnosed as being hyperopic. Of those with hyperopia, 45.9% and 54.1% were boys and girls respectively. A total of 379 (64.7%) pupils diagnosed as hyperopic had a magnitude of ≤ +1.00DS while 171 (29.2%) had error of magnitude > +1.00DS and ≤ +1.50DS. Thirty-six (6.1%) had errors > +1.50DS. In conclusion the prevalence of hyperopia in public basic schools is very high (33.4%). Primary eye health education is warranted to make parents, teachers and pupils aware of the symptoms of the condition so that in cases of decompensation the management of the condition starts early to avert the complications of the error.

INTRODUCTION
Hyperopia, also termed hypermetropia or farsightedness, is a common refractive error in children and adults. Its effects vary greatly, depending on the magnitude of hyperopia, the age of the individual, the status of the accommodative and convergence system and the demands placed on the visual system (Moore et al., 2008).

Globally, in 2002 more than 161 million people were visually impaired (Resnikoff et al., 2004), of which 124 million had low vision, 37 million were blind, and 14 million were under 15 years of age. However, these estimates do not include refractive error as a cause of visual impairment, which implies that the actual global magnitude of visual impairment is greater. It is estimated that 2.3 billion people worldwide have some degree of refractive error. The vast majority of these could have their sight restored by spectacles, but only 1.8 billion of these have access to eye examinations and affordable correction. This leaves approximately 500 million people, mostly in developing countries who are mainly children, with uncorrected refractive error causing blindness and impaired vision. Many are not aware that there is a cure for their compromised vision, have no one to provide treatment or cannot afford the appliances they need (Holden et al., 2000).
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Refractive error has only relatively recently been recognized as a significant cause of blindness and impaired vision through the work of Dandona et al. (1998) and Taylor et al. (1997). It is estimated that nearly 25% of school-age children have vision problems (Roberts, 1975; Bloom, 1986; PBA, 1996). It is further estimated by researchers that 75-90% of learning in a classroom occurs through the visual system (AOA, 1991; Flax, 2006).

It is therefore imperative that pupils in both elementary and secondary schools and their teachers have the requisite level of vision for effective teaching and learning.

Hyperopic symptoms may not be easily and quickly recognized: more often than not, these subtle signs are seen when they have caused lots of needless troubles too late to rectify as in the case of strabismus. Signs and symptoms of hyperopia include red or tearing eyes, squinting and facial contortions while reading, ocular fatigue or asthenopia, frequent blinking, constant or intermittent blurred vision, near focusing problems, decreased binocularity and eye-hand co-ordination and difficulty with or aversion to reading (Bruce et al., 1999).

The aim of this study is to describe the prevalence and symptoms of hyperopia among Ghanaian school children and to make recommendations for addressing them.

MATERIALS AND METHODS

Study population

The study was conducted in the Kumasi Metropolis, the capital town of Ashanti region, one of the ten regions of Ghana. The screening for hyperopia was conducted among children in public basic schools in the metropolis.

Sampling

All public schools in the Kumasi Metropolis were eligible for the study. Eleven public schools were selected by simple random sampling technique. All students aged 5 to 17 years in the selected schools were invited to participate in the study. A total of 1,756 students were sampled. The study was a descriptive cross-sectional survey.

Data Collection Technique

The strategy involved primary data collected through questionnaire and vision screening. Ocular history and complaints were taken after the personal data were recorded. The interview was based on a standard questionnaire that was translated where necessary into Asante Twi, the local language.

Visual acuity measurements were performed on each eye of each pupil using the standard Snellen charts. Retinoscopy and subjective non-cycloplegic refraction were performed. Along with the assessment of refractive errors, the participants underwent evaluation of ocular motility and binocular vision. Procedures that were used were versions (both monocular and binocular) alternate cover test, near points of accommodation and convergence and amplitude of accommodation and convergence using the RAF Binocular Gauge.

Using the direct ophthalmoscope (Welch Allyn) and pen torch, ocular health assessment was done on all the pupils to rule out any ocular disease. Informed consent from teachers, parents and verbal assent from each pupil was obtained.

Data Analysis

All refractive error readings were recorded in spherical equivalent (SE). Hyperopia was defined as a spherical equivalent greater than +0.50DS. Anisometropia was defined as a difference of at least 1D in the spherical or cylindrical refraction between both eyes. Data analysis was performed using statistical package for social scientists (SPSS) version 16. Descriptive statistics and chi-squared test was used to analyze data. A significance level of 0.05 was used.

RESULTS AND DISCUSSION

Out of a total of 1,756 school children (participation rate 89.5%) screened 44.9% (788) were boys while 55.1% (968) were girls. Pupils screened were aged between 5 and 17 years (Mean age: 12.3 years). The age and sex distribution of the respondents is shown in table 1.
Prevalence and Magnitude of hyperopia by sex

In Table 2, the distribution of hyperopia by age and sex is presented. The prevalence of hyperopia by sex is also shown in Table 3. Out of the children screened a total of 586 (33.4%) were hyperopic with 45.9% (269) being boys and 54.1% (317) girls. The results indicate that the prevalence of hyperopia in children between the ages of 5 and 17 years in the study was 33.4%. This is higher than the prevalence of 22.6% reported in Southern India by Kalikivayi (1997) though in his study cycloplegic refraction was performed on all hyperopes aged over 4 years old.

The prevalence of the condition was 34.1% in boys and 32.7% in girls. There is a significant difference in observed prevalence of hyperopia between the sexes in this study across all age groups (p<0.05).

A study by Ip et al. (2008), also found that girls were more likely to be hyperopic than boys. Likewise, Pokharel et al. (2000) noted a significantly higher prevalence of hyperopia in girls.

Magnitude of hyperopia with respect to age

The degree or magnitude of hyperopia measured in this study was generally low. No participant had hyperopia above +2.00DS. A total of 379 (64.7%) pupils diagnosed had hyperopia of +1.00DS while 207 (35.3%) had degree of hyperopia between +1.25DS and +2.00DS. This was as expected as it has been established that the magnitude of hyperopia is greatest at

![Table 1: Age and sex distribution of the respondents](image1)

![Table 2: Prevalence of hyperopia by age and sex in the pupils](image2)

![Table 3: Magnitude of hyperopia by sex](image3)
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birth, and steadily decreases with age (Goh et al., 2005; He et al., 2004; Maul et al., 2000; Murthy et al., 2002). Table 4 shows the degree of hyperopia with respect to age.

The study revealed a decrease in magnitude of hyperopia with increase in age. The highest magnitudes were in the 5-8 years age group where 33(18.2%) of the members of that group had magnitudes between +1.75DS and +2.00DS (p < 0.05) and 9-12 years, with the lowest in the teen ages. This supports the findings of the study by Mohindra et al. (1981).

Differences in Magnitudes of hyperopia

In a few cases, differences existed in the magnitudes of hyperopia in a child’s eyes (anisometropia). A total of 82.9% of the hyperopes were isometropic while 17.1% were anisometropic. This is very important due to the increased risk of amblyopia associated with anisometropic hyperopia(Kivlin, 1981; Tanlamai, 1979; Schapero, 1971). The distribution of hyperopes based on differences in magnitude in both eyes is shown in Table 5.

Symptoms of Hyperopia reported

The main symptoms reported by the respondents were tearing, itchiness, photophobia and headaches. These symptoms were also identified by Moore et al. (2008). We concede however, that the symptoms reported could also be due to other ocular conditions like allergy and dry eyes.

The symptoms reported by the hyperopic pupils are presented by gender in Table 6.

CONCLUSION

Prevalence of hyperopia was 34.3% with higher occurrence in girls and pupils aged 9 to12 years being more at risk of the condition in our study. Pupils diagnosed as hyperopic were all low hyperopes.

LIMITATIONS TO THE STUDY

To our knowledge, this is about the first study into the prevalence of Hyperopia in Ghana, it was therefore exploratory. As such, we envisage that some limitations were inherent. First, the study relied on reports of the respondents, and some of the results may not be factual.

### Table 4: Degree of hyperopia with respect to age

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>≤ +1.00</th>
<th>+1.25 to +1.50</th>
<th>+1.75 to +2.00</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-8</td>
<td>41</td>
<td>107</td>
<td>33</td>
<td>181 (30.9)</td>
</tr>
<tr>
<td>9-12</td>
<td>180</td>
<td>39</td>
<td>3</td>
<td>222 (37.9)</td>
</tr>
<tr>
<td>13-17</td>
<td>158</td>
<td>25</td>
<td>0</td>
<td>183 (31.2)</td>
</tr>
<tr>
<td>Total</td>
<td>379</td>
<td>171</td>
<td>36</td>
<td>586 (100.0)</td>
</tr>
</tbody>
</table>

### Table 5: Distribution of hyperopes based on differences in magnitude in both eyes

<table>
<thead>
<tr>
<th>Age group</th>
<th>Isometropia (%)</th>
<th>Anisometropia (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-8</td>
<td>151 (83.4)</td>
<td>30 (16.6)</td>
<td>181 (100.0)</td>
</tr>
<tr>
<td>9-12</td>
<td>190 (85.6)</td>
<td>32 (14.4)</td>
<td>222 (100.0)</td>
</tr>
<tr>
<td>13-17</td>
<td>145 (79.2)</td>
<td>38 (20.8)</td>
<td>183 (100.0)</td>
</tr>
<tr>
<td>Total</td>
<td>486 (82.9)</td>
<td>100 (17.1)</td>
<td>586 (100.0)</td>
</tr>
</tbody>
</table>
Table 6: The distribution of the symptoms of hyperopia by gender

<table>
<thead>
<tr>
<th>Major disturbing symptom*</th>
<th>Frequency</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys (%)</td>
<td>Girls (%)</td>
</tr>
<tr>
<td>Tearing</td>
<td>57 (9.9)</td>
<td>73 (12.5)</td>
</tr>
<tr>
<td>Itchiness</td>
<td>64 (10.9)</td>
<td>64 (10.9)</td>
</tr>
<tr>
<td>Photophobia</td>
<td>44 (7.5)</td>
<td>56 (9.6)</td>
</tr>
<tr>
<td>Headaches/asthenopia</td>
<td>29 (5.0)</td>
<td>43 (7.3)</td>
</tr>
<tr>
<td>Redness</td>
<td>29 (5.0)</td>
<td>26 (4.4)</td>
</tr>
<tr>
<td>Grittiness</td>
<td>19 (3.2)</td>
<td>25 (4.3)</td>
</tr>
<tr>
<td>Skipping lines while reading</td>
<td>13 (2.2)</td>
<td>19 (3.2)</td>
</tr>
<tr>
<td>Blurring</td>
<td>13 (2.2)</td>
<td>13 (2.2)</td>
</tr>
</tbody>
</table>

(*N=586 for each major presenting symptom for hyperopes)

Also, cycloplegia was not done. As a result, accommodation relaxation may not have been total with fogging, hence some hyperopes could have been undiagnosed. It is again conceded that, for the respondents with poor accommodative facility, the two minutes allowed may not have been sufficient to fully relax their accommodation.

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REFERENCES


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