

# Prevalence of Refractive Errors, Color Vision Defects and Other Ocular Disorders in School-going Children: Primary Screening by School Teachers

Anmol Gupta\*, Ram Lal\*\*, S.R. Mazta\*, Deepak Sharma\*

\*Department of Community Medicine & \*\*Ophthalmology; Indira Gandhi Medical College, Shimla, Himachal Pradesh, India

**Abstract:** The purpose of the study was to estimate the prevalence of ocular morbidity and to assess the effectiveness of the trained teachers in a vision screening program for children of age 5-15 years attending school in Shimla hills. Trained school teachers measured visual acuity in children using ETDRS chart. Children with visual acuity worse than 6/9 in any eye were referred to an ophthalmic assistant. Ophthalmic assistants prescribed spectacles to children needing refractive correction and referred children needing further examination to ophthalmologist at IGMC, Shimla. Thirty teachers from fifteen schools enrolled 2,000 children in the study and screened 2 enrolled children. Sensitivity was 81.5% and specificity 92.56%. Prevalence of refractive error was 4.2% and the color vision blindness 0.3%. Myopia and Hypermetropia were the most common eye problems identified by the ophthalmic assistant. Primary vision screening by teachers can effectively reduced the workload of ophthalmic assistants. **Key words:** Refractive error; vision screening.

## INTRODUCTION

Refractive error is an optical defect, intrinsic to the eye which prevents light from being brought to a single point focus on the retina, thus reducing vision. Refractive error remains one of the primary causes of visual impairment in children worldwide<sup>1</sup>. Childhood blindness and visual impairment are as important and perhaps more devastating and disabling than adult onset blindness, because of the long span of life and their permanent effects on the developing eyes. Refractive errors and more particularly myopia, place a substantial burden on the individual and society. School-age children constitute a particularly vulnerable group where uncorrected refractive errors may have a dramatic impact on learning capability and educational potential<sup>2</sup>. Prevalence of visual impairment in children varies from as low as 2.72% in South Africa to as high as 15.8% in Chile<sup>3,4</sup>. Less than 1% prevalence of refractive errors was reported in primary school children in rural Tanzania,<sup>6</sup> 1% in Katmandu<sup>7</sup>, 14.8% in Malaysia<sup>8</sup>, 36.7%. The wide including the targeted study population (population-based or school-based), methods of the degrees of myopia, hypermetropia and astigmatism.

To address the issue of blindness in children, the World Health Organisation (WHO) recently launched a global initiative, VISION 2020-The Right to Sight, to eliminate avoidable blindness among children. Myopia is the most common refractive error in children. High myopia is associated with potentially blinding conditions such as retinal tear, retinal detachment, macular degeneration, cataract and glaucoma. The economic costs of correction for myopia with spectacles, contact lens or LASIK in optometry and ophthalmology centres amount to billions of dollars<sup>11</sup>. Strategies to address the eye health of children in India have focused on school eye health programs. School eye screening programs have been part of the activities of the district blindness control society (DBCS) activities since 1996<sup>12</sup>. Screening of children in schools is most commonly done by trained school teachers although some programs utilize ophthalmic assistants and ophthalmologists for primary screening. Screening school children is arguably the second largest program of the national programs for control of blindness in India after cataract surgery and is currently a priority of the Sarva Shiksha Abhiyan the education initiative of the government. However, studies pertaining to school screening programs in India is scarce, especially when compared to evidence for initiatives addressing age-related cataracts. In this study, we report the effectiveness of using teachers for screening for eye disorders among children attending classes 1<sup>ST</sup> TO 10<sup>th</sup> at schools.

## MATERIALS AND METHODS

Aim of the study was to estimate the prevalence of ocular morbidity and to assess the effectiveness of teachers in a vision screening program for children of age 5-15 years attending school in Shimla district for North India: We carried out a cross-sectional study on 2000 students in Shimla district

from Feb to July 2010. Multistage cluster sampling was used to identify the sample population of School going students in the age range 5-15 years. A sample size of 2000 was calculated assuming prevalence of refractive errors in school children as 30% (confidence level 95%, relative precision 10% and a design effect of 2). The list of schools in Shimla district and the number of students in each grade provided by the Directorate of Education. Details regarding the project were communicated to the principal/head of these schools through a letter. School Principal was requested to nominate at least two teachers for training under the program. Science teachers were preferred for the training but this was not an inclusion criterion for training. School teachers were trained in two training sessions jointly by the faculty from Department of Community Medicine and Ophthalmology IGMC, Shimla, India. Each trained teacher was provided with a kit that included visual acuity cards, ETDRS-chart (Early treatment of Diabetic Retinopathy E chart), a measuring tape for 6 meter distance, a register to record details of the child and eye health education material. After completion of the training, the teacher assessed the visual acuity of each child in the school using an ETDRS chart at 6 meters distance. Criteria for classification of visual impairment were visual acuity less than 6/9. The vision of the right eye was tested first followed by the left and the results immediately noted on a standard form. Trained ophthalmic assistants subsequently screened the children identified as "need further referral" by the school teacher at a date not later than a month from the initial screening by the teacher. The ophthalmic assistants examined children at the school itself. The examination included assessment of visual acuity and refraction. The ophthalmic assistant prescribed spectacles for children identified with refractive errors. Children identified with eye problems that needed examination by an ophthalmologist were referred with eye problems that needed examination by an ophthalmologist were referred to IGMC, Shimla. Reports received from each school were entered into a computer in as MS-OFFICE Excel worksheet. Data was analyzed using Epi info software for windows. Data on false negative was derived from the examination by ophthalmic assistants of children identified as normal by the teacher. Data on false positives was derived from the examination by ophthalmic assistants of children identified as having an eye problem by the teacher.

## RESULTS

Thirty school teachers examined 2000 children, 956 were male and 1044 were females. The mean age of the study participants was 12.54±2.254. School teachers identified 225 children as having defective vision. Of 225 children, refractionist confirmed 84 children as having refractive error (True positive). Refractionist findings were used as gold standard. We calculated validity parameters for the sample population as a whole. (Table 1) Color vision blindness was found in 6 students (0.3%). One student was found to have amblyopia diagnosed by Ophthalmologist at IGMC, Shimla.

**Table 1: Validity Parameters**

	Refraction (refractionist)	
	Present	Absent
Present Refractive error Trained Teacher	84 True Positive	141 False positive
Absent	19 False Negative	1756 True negative

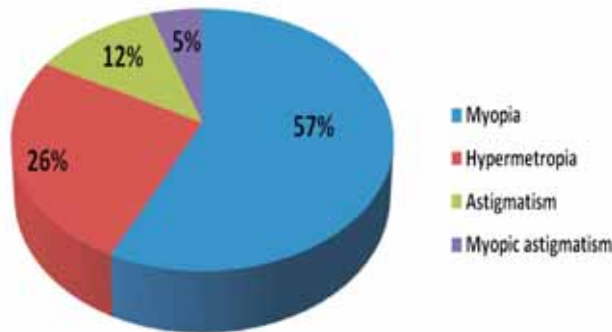
Sensitivity = 81.5%

Specificity = 92.56%

Prevalence of refractive error was 4.2%. Myopia was the most common refractive error followed by other refractive errors. (Table 2) (Figure).

**Table 2: Type of refractive error**

Refractive error (Refractionist)	N=84	Percentage
Myopia	48	57.1%
Hypermetropia	22	26.2%
Astigmatism	10	11.9%
Myopic Astigmatism	4	4.8%

**Figure:** Type of refractive error

## DISCUSSION

Screening school children is arguably the second largest National program for control of blindness in India after cataract surgery. It is one of the top priority programs of the education initiative of the government (the Sarva Shiksha Abhiyan). However, studies pertaining to school screening programs in India is scarce. Especially when compared to evidence for initiatives addressing age-related cataracts. For the available studies results are not comparable because of different methodologies/criteria used in those studies. The current work, conducted in Shimla, reports the prevalence of refractive errors, color vision and effectiveness of school teachers for screening among school students in North India area and highlights the urgent need to implement appropriate eye care programs targeting school children.

A large sample of 2000 children across one district gave the prevalence of refractive error among the school children as 4.2% and the prevalence of color vision blindness of 0.3% in our study. This study also tested the validity of vision screening. On the basis of our results, the programme would be able to strengthen the strategy for detection of refractive error and ophthalmic problems in school children in an effective and by calibrated screening. A

trained teacher was used as screener to detect the true negative by primary screening and at the 2<sup>nd</sup> level a technical persons (refractionist) were used to confirm the screened individuals. Further the expert persons (Ophthalmologist) gave the final opinion of the position in question. Thus, the study was crucial for the eye care programme. The vision screening done by the trained school teacher had a specificity of 92.36%. Thus, vision screening by the trained school teachers could accurately identify students who did not have vision defects with 81.5% sensitivity. In a study in New York State in the United states of America (USA), using a vision screening battery, the Snellen's test was 100% specific but it missed 75.5% of the children found to have vision problems when given a complete visual examination<sup>13</sup>. Although the methodology is different in the 2 studies. Our study had a lower rate of specificity and a relatively high sensitivity due to the initial training by the experts and careful selection of teachers. Refractive errors which often become manifest during school age carry serious prognostic implications. A low prevalence of refractive errors of 2% has been reported from Eastern India by Datta et al...among primary school children of 5-13 years.<sup>14</sup> Internationally prevalence of refractive errors among children of age 5-15 years from Africa and Finland ranges from (2.7-5.8%)<sup>15, 16</sup>. Low prevalence of color vision defects 90.11%) has been reported by Pratap et al. from North India<sup>17</sup>. Overall, our results indicate that utilizing the services of teachers for screening the eyes of school-going children from classes 1<sup>st</sup> to 10<sup>th</sup> not only substantially reduces the workload of eye care service providers but also increase the reach to a large no. Of children in farther areas due to more no. Of days of study by school teacher,. One of the lacunas of school based study is inability to reach out to those children who are not attending schools. But since the enrollment rate in our state is nearly 100% so this can be addressed in our study. Studies that provide evidence on strategies to reduce false positive and false negative rates and the frequency of school screening (annual or at specific time periods) will help improve the effectiveness of the screening program. Further training and periodic supervision of vision screening by school teachers could improve the validity of the vision test.

## ACKNOWLEDGEMENT

We express our gratitude to Dr AS Rathore Deputy Director Ophthalmology, Ministry of Health and Family Welfare, New Delhi for funding the study and director sarva Shiksha Abhiyan, Himachal Pradesh Sh Rajesh Sharma for his support.

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