

## Ocular Morbidity among Students in Relation to Classroom Illumination Levels

SHAILESH WAGLE, RAMACHANDRA KAMATH, \*RAJNARAYAN TIWARI AND #SHREEMATHI MAYYA

From Department of Public Health and #Statistics, Manipal University, Manipal, Karnataka; and \*Occupational Medical Division, National Institute of Occupational Health, Meghani Nagar, Ahmedabad, Gujarat; India.

### Correspondence to:

Dr Rajnarayan R Tiwari, Scientist E,  
National Institute of Occupational  
Health, Meghani Nagar, Ahmedabad  
380 016, Gujarat, India.  
shreemathi.mayya@manipal.edu  
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**Objective:** This cross-sectional study was done to find the prevalence of eye strain and other ocular morbidities among students in Udupi, Karnataka.

**Methods:** The study protocol included interview, visual acuity examination using Snellen chart, and measuring classroom illumination through lux meter.

**Results:** 26% students had visual morbidity and the most prevalent symptoms of eyestrain were headache (38.6%), watering of eyes (25.7%), pain around eyes (15.6%) and blurred vision (11.9%). 55.5% classrooms and 88.4% blackboards did not have proper illumination.

**Conclusions:** Low classroom illumination levels may be a possible factor for development of visual morbidity.

**Keywords:** Asthenopia, Eyestrain, School children, Factors.

The quality of the environment provided by the school greatly affects a student's health. Illumination is one such factor, reported by research studies to have significant effect not only on the performance of the students, but also on their physical and mental health [1]. Having their origin in childhood, many ocular morbidities go unnoticed and are responsible for affecting the performance of a child in school and also to cause severe disability in future [2]. Low levels of illumination have also been proven to be a factor in development of asthenopia or eye strain [3]. Thus the present study was carried out to assess the prevalence of eye strain and other ocular morbidities among students of government primary schools in Udupi taluk in Karnataka, and to assess possible associations between eyestrain and level of classroom illumination.

### METHODS

The present cluster-based cross-sectional study was conducted in government primary schools in Udupi taluk. After ethical clearance from the Institutional Ethics Committee, students from Class 6 and 7 of nine randomly selected schools were included in the study. Students with congenital eye problems, with history of trauma or surgical procedure of the eyes were excluded. Students who had not been studying in the same school from Class 3, *i.e.*, at least 3 years in the same school environment were also excluded to ensure equal duration of exposure to illumination in classrooms. Written informed consent

from head teachers of all schools and verbal assent was taken from each student before examination.

Students were interviewed using a semi-structured questionnaire that included details regarding personal characteristics and visual symptoms. Standard procedures using a standard Snellen "E" chart was used to conduct vision testing [4]. A score of less than 6/9 with either or both was taken as case of visual morbidity. A separate "school detail form" was used to gather details about the school, and classroom and blackboard illumination were assessed separately using standard calibrated digital lux meter (LX-1010B).

### RESULTS

Of the 596 students enrolled in the study, 319 (53.5%) were boys. When asked regarding housing conditions, 92.1%, 78.4% and 84.6% reported availability of electricity, tube lights and television in their homes, respectively. Using Snellen E chart, 155 (26 %) were found with visual morbidity (**Table I**).

The measurement of illumination levels showed that among the 69 classrooms and blackboard evaluated, 61 (88.4%) blackboards and 38 (55.1%) classrooms failed to meet the standard level of 300 lux [5]. Classroom illumination was found to have significant association with visual morbidity [OR=1.5 (1.0-2.2);  $P=0.0047$ ] while blackboard illumination levels were not associated with visual morbidity (**Table II**).

**TABLE I** DISTRIBUTION OF VISUAL ACUITY AND SYMPTOMS AMONG STUDENTS (N=596)

<i>Visual Morbidity Status</i>	<i>Frequency (%)</i>
Reduced visual acuity	155 (26.0)
Visual Symptoms	Frequency (%)
Unclear view in Class	68 (11.4)
Double image	8 (1.3)
Blurred vision	71 (11.9)
Watering of eyes	153 (25.7)
Pain around eyes	93 (15.6)
Redness of eyes	20 (3.4)
Vision checked by a doctor	18 (3.0)
Non Visual Symptoms	
Headache	230 (38.6)
Tired feeling	3 (0.5)
Unsatisfied with sleep	33 (5.5)

## DISCUSSION

This cross-sectional study in government primary schools in a district in Southern India showed visual morbidity in 26% students. A significant number of classrooms (55.1%) and blackboards (88.4%) in these schools had sub-optimal illumination.

The prevalence of visual morbidity is similar to findings of other National [2,6,7] and International [8,9] studies. An earlier study in the same region also reported that 65% of classrooms in primary schools in were not adequately illuminated or ventilated [10]. A study from in Pakistan [11] also found that classroom illumination was a statistically significant factor for causing visual morbidities.

The study has the limitation of finding the prevalence of only refractive error as the study design did not allow for the detailed evaluation of each subject. However, all efforts were made that the study subjects share the same environment so as to minimize the effect of other factors.

Thus based on the study findings it is recommended

that the students should be periodically examined for visual health with the help of trained professionals at school level. At the school level, regular infrastructural audit should be conducted to assess the environmental parameters which may affect students' health adversely. Emphasis should be given on utilization and maintenance of appropriate artificial illumination sources such as tube lights and bulbs.

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*Ethical Clearance:* The Manipal University Ethics Committee has cleared this study.

*Consent of the guardian:* As the study was carried out during school timings it was not feasible to take consent of parents. However the consent of the class teachers who are guardian of the students during school hours was taken. In addition the verbal assent of the participating student was also taken.

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**TABLE II** ASSOCIATION BETWEEN VISUAL MORBIDITY AND BLACKBOARD AND CLASSROOM ILLUMINATION LEVELS

<i>Illumination level</i>		<i>Visual morbidity</i>		<i>P value</i>	<i>Unadjusted OR (95%CI)</i>
		<i>Present (%)</i>	<i>Absent (%)</i>		
Classroom illumination level	Improper (<300 lux)	102 (29)	250 (71)	0.047	1.5 (1.0–2.2)
	Proper (>300 lux)	53 (21.7)	191 (78.3)		
Blackboard illumination level	Improper (<300 lux)	24 (32.4)	50 (67.6)	0.178	1.43 (0.69-1.97)
	Proper (>300 lux)	131 (25.1)	391 (74.9)		

**WHAT THIS STUDY ADDS?**

- High proportion of classrooms and blackboards in the study area were sub-optimally illuminated.
- Classroom illumination was significantly associated with visual morbidity among the study population.

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