Prevalence of refractive errors among the school-going children in East Sikkim

Karma Loday Bhutia, Sonam Choden Bhutia¹, Nisha Gupta², Diki O Shenga

Purpose: Vision plays an important role in child’s development for learning and communication. Uncorrected refractive error (URE) has become a major challenge to health care policymakers especially in school-going children. We aim to report the prevalence of refractive error among the school students of the east district of Sikkim, India. Methods: A cross-sectional study was carried out among 15,954 school children under school health program of national program for control of blindness. The screening was conducted in 40 schools of east district which included primary, higher secondary, monastic and private schools. Results: The prevalence of refractive error was 6.7% among which myopia was the most common error present in 335 (31.1%) children, followed by astigmatism in 317 (29.4%) and the remaining 29 (2.6%) with hyperopia. The age group between 14-17 years had high prevalence of refractive error (9.2%). Females had slightly higher refractive error (6.93%) than males (5.9%). Most backward classes were found to be highest suffering from refractive error (26.65%) and the least seen was found in schedule tribe (11.6%). Conclusion: The study provides a useful and baseline data about the refractive error amongst the school children of east Sikkim. A larger study needs to be conducted in all the schools of the state to get a clearer picture of RE and other eye related diseases to detect vision problem as early as possible.

Key words: Hyperopia, myopia, prevalence, refractive error, Sikkim India

Vision plays an important role in a child’s development for learning and communication.¹ Uncorrected refractive error has become a major challenge to the health care policymakers.² An estimated 19 million children are hardly been in practice in India. While many screening programs in schools are being carried out, there is a lack of accurate data in the prevalence of visual impairment.³

Active screening and timely intervention at the right time will not only help in vision restoration but will also influence a child’s growth and development.⁴ In 1960, the Government of India constituted a school health committee which recommended medical examination of the children at the time of entry into school but this has hardly been in practice in India.⁵ Our study will be the first to report the prevalence of refractive errors among school-going children in Sikkim.

Methods

Study design

A cross-sectional study was conducted among the school children of East Sikkim from March 2016 to March 2018. The study was done under the School Health Program of the National Program for Control of Blindness (NPCB) for identification and treatment of refractive errors. The screening was carried out in 40 schools which included primary, higher secondary, monastic, and private schools.

Study population

A total of 15,954 children were screened for refractive errors. Permission was taken from the principals of the selected schools. Informed and written consent was obtained from the teachers prior to enrolling the students for the study. Medical examination was conducted under the guidance of ophthalmologists. The teachers were sensitized about the magnitude of childhood blindness, their role in the early detection of vision problems, and other eye diseases. They were trained to screen the vision in each eye separately using the Snellen chart in their respective schools and to record questionnaires. An eye health education program was conducted for the students and teachers to make them aware of eye health. The children detected to have any ocular anomaly by the trained teachers were referred first to an optometrist, who did subjective

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKLRepMedknow_reprints@wolterskluwer.com

Cite this article as: Bhutia KL, Bhutia SC, Gupta N, Shenga DO. Prevalence of refractive errors among the school-going children in East Sikkim. Indian J Ophthalmol 2021;69:2018-20.
correction by placing the appropriate lenses in the trial frame. The visual acuity tested with the Snellen chart placed at 6 m for any children with refractive errors and for children below 10 years cycloplegic refraction was done using Homatropine 2% eyedrops after 2 h of instilling the drops. Lastly, those who still did not improve were referred to the base hospital for further complete ophthalmic examination by the ophthalmologist.

Refractive errors was diagnosed when the presenting visual acuity was less than 20/40 and improved to ≥20/40 with correction. Myopia was defined as measured objective refraction of > −0.75 D spherical equivalent in one or both eyes. Hyperopia was considered when the measured objective refraction of > +2.00 D spherical equivalent in one or both eyes was present. Astigmatism was considered when the measured objective refraction of > 0.75 D cylinder was there in one or both eyes. These refractive errors were categorized according to the Refractive Error Study in Children (RESC) Survey group.6

The data were entered into the Excel sheet and analyzed using the Statistical Package for the Social Sciences version 16.0 (SPSS Inc, Chicago, IL, USA). The data were expressed as proportions (n, %).

Results

A total of 15,954 school children were screened from 40 different schools of East Sikkim. Refractive error was highly prevalent in the age group of 14–17 years with 9.2% (n = 419) among 4,582 students followed by 8.2% (n = 430) in the age group 10–13 years in a total of 5,741 children. However, the age group between 6 and 9 years had comparatively less prevalent refractive errors with 3.7% (n = 228) among 6,131 students [Table 1]. We also observed that increasing age was associated with an increased risk. From a total of 15,954 students studying in different schools of East Sikkim, the prevalence of refractive errors was 6.7% (n = 1077) among which myopia was the most common with 31.1% (n = 335), followed by 29.4% of astigmatism (n = 713), and the remaining 26.6% (n = 29) with hyperopia [Table 2].

Regarding gender, out of 7,450 males, 6.5% (487) had refractive errors whereas 6.93% (590) females had refractive errors from a total of 8,594 [Table 3]. Some other ocular cases like squint, vitamin A deficiency, and cataract were also diagnosed by the ophthalmologist but could not be recorded for analysis due to the unavailability of data. We also observed that the children in monastic school had refractive errors.

Sikkim is home for a majority of ethnic communities distributed as schedule caste (Damai, Kami, Lohar, Majhi, and Sarki), most backward classes (Bujel, Gurung, Manger, Rai, Sunar, Jogi), and schedule tribe (Tamang, Limboo, Bhutia, Lepcha).9 We recorded 4,265 students belonging to schedule caste with 287 (6.65%) suffering from refractive errors followed by 3,400 most backward classes (MBC) with refractive errors of 1,876 (55.2%); 125 (11.6%) students were found to be suffering from refractive errors belonging to schedule tribe (ST) communities among 1,851 students and the remaining 6,438 belonged to others with refractive errors of 2,547 (39.5%) [Table 4].

Discussion

Screening programs in schools are primarily aimed at detecting refractive errors but the health services provided are inadequate due to the shortage of resources and insufficient infrastructure.10 Geographically, the East district of Sikkim has three subdivisions, Gangtok (capital), Pakyong, and Rongli, constituting a population of 283,583 (2011 census).11 This is the first prevalence study on refractive errors being conducted in the state.

We observed that the school children within the age group of 14–17 years were found to be the highest (9.2%) with refractive error and are comparable with many studies indicating that with increasing age, the disease increases.12–14

Girls were mostly affected with (6.9%) refractive errors as compared to boys (5.9%) and many have reported similar studies.15,16 According to Gouda SM et al., school dropouts in males (11.1%) were more than the females (8.8%) in Sikkim.

The overall prevalence of refractive errors in the study was 6.7% which is in consort with the study reported by Warad C et al.18 in Karnataka (6.4%). However, a few studies have reported a higher prevalence and this could be due to multiple factors like population size, geographical locations, and race

| Table 1: Age distribution of refractive error in primary school children of East Sikkim |
| Age group (years) | Total no. of students | Refractive error | % |
|-------------------|----------------------|-----------------|---|
| 6-9               | 6,131                | 228             | 3.7 |
| 10-13             | 5,241                | 430             | 8.2 |
| 14-17             | 4,582                | 419             | 9.1 |
| Total             | 15,954               | 1,077           | 6.7 |

| Table 2: Refractive error based on myopia, hyperopia, and astigmatism among the school children |
| No. of students | Myopia (%) | Astigmatism (%) | Hyperopia (%) |
|----------------|------------|-----------------|--------------|
| 1,077          | 335 (31.1%)| 317 (29.4%)     | 29 (2.6%)    |

| Table 3: Gender distribution of refractive errors in the primary school of East Sikkim |
| Gender              | No. of students examined | Refractive error | Refractive error (%) |
|---------------------|--------------------------|------------------|----------------------|
| Male                | 7,450                    | 443              | 5.9                  |
| Female              | 8,554                    | 590              | 6.93                 |
| Total               | 15,954                   | 1,077            | 13.43                |

| Table 4: Caste distribution of refractive error in primary school children of east Sikkim |
| Caste                | Total no. of students examined | Refractive error (%) |
|----------------------|-------------------------------|----------------------|
| Scheduled caste (SC) | 4,265                         | 26.65                |
| Most backward classes (MBC) | 3,400            | 55.2                |
| Scheduled tribe (ST) | 1,851                         | 11.6                |
| Others               | 6,438                         | 39.5                |
| Total                | 15,954                        | 100                 |
leading to various disparities. We also observed that the children studying in monastic schools also had refractive errors who are often ignored.

Myopia was the most common refractive error (31.1%) followed by astigmatism (29.4%), and hyperopia (2.6%) being the least and many studies have reported similar results. Among the ethnic communities, refractive error was most prevalent among the students belonging to most backward classes with refractive error (55.2%) and the least in schedule tribe (11.6%). According to Saw et al. in 2006 and Rai SK et al. in 2015, refractive error varies with ethnicity. Various components like nutrition, lifestyle, and hereditary might be involved in contributing to the rise of refractive errors.

**Conclusion**

The study provides useful and baseline data about the refractive errors among the school children of East Sikkim. Refractive error was highly prevalent in students belonging to most backward classes, among girls, and in between the age group 14–17 years. Our study also focused on students attending monastic schools which generally remains ignored. A larger study needs to be conducted in all the schools of the state to get a clearer picture of refractive errors and other eye-related diseases to detect vision problems as early as possible.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Gilbert C, Jugnoo SR, Graham EQ. Visual impairment and blindness in children. In: Gordon JJ, Darwin CM, Robert AW, Sheila KW, editors. The Epidemiology of Eye Diseases. 2nd ed. London: Arnold; 2003. p. 260-83.
2. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. Br J Ophthalmol 2012;96:614-8.
3. Resnikoff S, Pascolini D, Mariotti SP, Pokharel GP. Global magnitude of visual impairment caused by uncorrected refractive errors in 2004. Bull World Health Organ 2008;86:63-70.
4. Ipe A, Shibu P, Skariah R. Prevalence of refractive errors and the extent of correction possible with conservative methods, among patients visiting a tertiary care hospital in South Kerala. Age 2016;6:16-45.
5. Reichman NE, Corman H, Noonan K. Impact of child disability on the family. Matern Child Health J 2008;12:679-83.
6. Bourne RR, Dineen BP, Huq DM, Ali SM, Johnson GJ. Correction of refractive error in the adult population of Bangladesh: Meeting the unmet need. Invest Ophthalmol Vis Sci 2004;45:410-7.
7. Singh S, Singh H, Joshi VS. Eye diseases among primary school children. Indian J Ophthalmol 1974;22:1-3.
8. Negrel AD, Maul E, Pokharel JP, Zhao J, Ellwein LB. Refractive error study in children: Sampling and measurement methods for a multi county survey. Am J Ophthalmol 2000;129:421-6.
9. Bhasin V. Ethnic relations among the people of Sikkim. J Soc Sci 2002;6:1-20.
10. Weil LM, Van Newkirk MR, McCarty CA, Taylor HR. Age-specific causes of bilateral visual impairment. Arch Ophthalmol 2000;118:264-9.
11. Census of India, Series 12 Part XII-A. District census handbook. Sikkim Administrative Divisions. Director of census operation, Sikkim 2011.
12. Pavithra MB, Maheshwaran R, Rani Sujatha MA. A study on the prevalence of refractive errors among school children of 7-15 years age group in the field practice areas of a medical college in Bangalore. Int J Med Sci Public Health 2013;2:641-5.
13. Sethi S, Kartha GP. Prevalence of refractive errors among school children (12-17 years) of Ahmedabad city. Indian J Community Med 2000;25:181-3.
14. Matta S, Matta P, Gupta V, Dev A. Refractive errors among adolescents attending Ophthalmic OPD. Indian J Community Med 2006;31.
15. Prema N. Prevalence of refractive error in school children. Indian J Technol 2011;4:1160-1.
16. Gouda SM, Shekher TV. Factors leading to school dropouts in India: An analysis of national family health survey-3 data. IOSR J Res Method Educ 2014;4:75-83.
17. Murthy GV, Gupta SK, Ellwein LB, Muñoz SR, Pokharel GP, Sanga L, et al. Refractive error in children in an urban population in New Delhi. Invest Ophthalmol Vis Sci 2002;43:623-31.
18. Warad C, Suranagi PV, Poornima MS, Nagveni. Refractive errors among school children in and around Davangere. J Pub Health Med Res 2014;2:28-31.
19. Shake T, Mitta KS. Pattern of refractive errors in primary school children in Dehradun city of Uttrakhand State. Delhi Journal of Ophthalmology 2016;27:106-10.
20. Rai SK, Thapa HB, Gurung N, Bhari AM, Sharma MK. Pattern of refractive error in primary school children in Rupandehi district, Nepal. J Univers Coll Med Sci 2015;31:31-6.
21. Panda L, Nayak S, Rohit CK, Das T. Tribal Odisha eye disease study (TOES)#7. Prevalence of refractive error in children in tribal Odisha (India) school screening. Indian J Ophthalmol 2020;68:1596-9.
22. Panda L, Nayak S, Warkad VJ, Das T, Khanna R. Tribal Odisha eye disease study (TOES) report #5. Comparison of prevalence and causes of visual impairment among children in native and urban schools of Odisha (India). Indian J Ophthalmol 2019;67:1012-5.
23. Saw SM, Goh PP, Cheng A, Shankar A, Tan DT, Ellwein LB. Ethnicity-specific prevalences of refractive errors vary in Asian children in neighbouring Malaysia and Singapore. Br J Ophthalmol 2006;90:1230-5.