

# Prevalence of Refractive Error among Children of Koshi Rural Municipality of Sunsari District: Door-to-Door Screening

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## Abstract

**Background:** Uncorrected refractive error is the commonest cause of preventable visual impairment and disability among children. This study aimed to find out the prevalence of refractive error among children in the Koshi Rural Municipality of Sunsari district.

**Methods:** This cross-sectional study conducted from 1 November to 31 December 2020 involved children between the ages of 4 - 18 years from Koshi Rural Municipality. The variables recorded included gender, age, religion, school type, visual acuity, and types of refractive error. Ethical approval was taken from the rural municipality and institutional review committee of Biratnagar Eye Hospital.

**Results:** A total of 7830 children were screened in the door-to-door campaign. The majority (n = 5508, 72%) were Hindu and 2232 (28%) were Muslims. Only 6575 (84%) children were enrolled in school. Among them 3130 (40%) were going to government schools, 2105 (26.9%) were going to private schools and 1340 (17.1%) children were going to a Madrasa (Muslim school) for education. The prevalence of refractive errors among children of Koshi Rural Municipality was 131 (1.7%) (95% CI: 1.4 - 2.0). Hypermetropia was seen in 69 (53%) children, followed by Myopia 60 (46%).

**Conclusion:** The prevalence of uncorrected refractive error among children of Koshi Rural Municipality was low. However, the prevalence of refractive error was high among Muslim children.

**Keywords:** Children; Prevalence; Refractive error

## Declarations

**Ethics approval and consent to participate:** Ethical approval for this research was taken from Institutional Review Committee, Biratnagar Eye Hospital (BEH-IRC/58/A). Informed consent was obtained from the patients' legal guardians.

**Consent for publication:** Not applicable

**Availability of data and materials:** The full data set supporting this research is available upon request by the readers.

**Competing interest:** None

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**Authors' contributions:** SY: concept, design, data collection, drafting of manuscript. RRK: critical review of manuscript. SKT: critical review of manuscript. SY:

literature search, manuscript preparation and editing. RPS: literature search, manuscript preparation and manuscript editing. All authors have read and approved the final manuscript.

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**R**efractive error is a type of vision problem that happens when the shape of the eye prevent light from focusing correctly on the retina [1]. Globally, at least 2.2 billion people have a near or distant vision impairment and about 1.1 billion people live with vision problems, of which 90% of them are from low- and middle-income countries [2]. Vision loss is projected to affect 1.7 billion people by 2050 [3]. Refractive error is one of the most common causes of visual impairment around the world and the second leading cause of treatable blindness [4]. The vast majority could have their sight restored by spectacles, but only 1.8 billion people have access to eye examinations and affordable correction [5].

About 13 million children aged 5 - 15 years worldwide are visually impaired from uncorrected refractive error [6]. In children, the prevalence of refractive error varies from as low as 1% in Tanzania to as high as 18.6% in Kathmandu [7 - 9]. The prevalence of refractive error is high in private schools (4.7%) in comparison to public schools (2.5%) in Nepal [10]. As there is less publication on community-based screening programs of children in Nepal, this research will provide valuable information about refractive status of all children in the community.

The Nepal REACH (Refractive Error among Children) project of Biratnagar Eye Hospital aims to identify and treat refractive errors in children (4 - 18 years) of Sunsari District and Biratnagar Metropolitan City of Eastern Nepal [11]. Koshi Rural Municipality is a rural municipality out of six rural municipalities located in Sunsari District of Province No. 1 of Nepal. According to the Ministry of Federal Affairs and Local Development, Koshi has an area of 75.98 square kilometers (29.34 sq mi) and the total population of the municipality is 43,626 as of the Census of Nepal 2011. Koshi Rural Municipality was inhabited by mostly the people of the Muslim caste and followed by Hindus. Hence, we aimed to assess the prevalence of refractive error and its association with different variables such as age, sex, religion in children living in the Koshi Rural Municipality of Sunsari district by a door-to-door screening of children.

## METHODS

**T**he descriptive cross-sectional study was conducted from 1 November to 31 December 2020. Ethical approval for this research was taken from Institutional Review Committee, Biratnagar

Eye Hospital and informed consent was obtained from the legal guardians of the participating children. Door-to-door screening of children with all COVID-19 related precautions was done in all eight wards of Koshi Rural Municipality. For data collection, census was done. All children between the age of 4 to 18 years found during door-to-door screening were included and children absent at home during the screening were excluded.

The variables collected were religion, age, gender, class, school type, and school-going or non-school-going. Besides this, clinical examination of the eyes was conducted. Visual acuity test was done by showing standard ESO PVS (Pocket Vision Screener) card having an optotypic equivalent to 0.2 LogMar units at a 3-meter distance. Children who were able to read the PVS card with each eye from a 3-meter distance were considered to have normal visual acuity. A torchlight examination was done to rule out any abnormalities in the anterior eye. Children who fail to read PVS cards have any ocular complaints or any abnormalities were sent to a well-equipped mobile vision van where an optometrist performed further examinations like retinoscopy (to check for refractive error), slit lamp examination with portable handheld slit-lamp, fundus evaluation with a direct ophthalmoscope, and other binocular vision assessments. Children with refractive error were prescribed and dispensed spectacles from the vision van immediately, while ones that needed ophthalmologist consultation were referred to Biratnagar Eye Hospital for free consultation and treatment by the hospital.

Data was collected by using a pre-defined proforma, for quality control trained optometrist and ophthalmic assistant were involved in the examination and diagnosis. Regular monitoring and supervision was done by the supervisor. The data were compiled, cleaned, and processed. Descriptive analyses were done by using SPSS where mean and standard deviation was calculated for continuous data, and for categorical data chi square test were applied for the association of different variables with refractive error.

## RESULTS

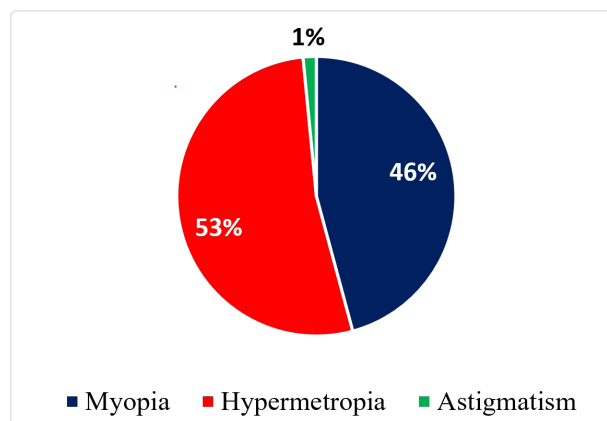
**A** total of 7830 children were screened in the door-to-door screening. The prevalence of refractive error among children of Koshi Rural Municipality was 1.7% (95% CI: 1.4 to 2.0) with the prevalence of 1.8% (95% CI: 1.4 to 2.3) among males and 1.4% (95% CI: 1.1 to 1.9) among females. A total of 4025 (51.4%) children were

male, the majority, 5598 (72%), were Hindu followed by 2232 (28%) Muslims. The majority (n = 2460, 31.4%) children were within the age group (7 - 9) years. A total of 6575 (84%) of children were enrolled in school. Among them, 3130 (40%) went to government schools, 2105 (26.9%) went to private schools and 1340 (17.1%) children went to Madrassa (Muslim school). The majority of the children, (n = 5569, 71.1%) went to primary level school followed by (n = 762, 9.7%) secondary level schools.

Gender and age categorization was not associated with refractive errors. The Pearson's chi-square test showed that children belonging to the Muslim community had a high prevalence of refractive error with odds ratio of 0.33 (95% CI: 0.23 to 0.46) (**Table 1**). The most common refractive error among the children was hypermetropia 69 (53%), followed by myopia 60 (46%) (**Fig 1**).

## DISCUSSION

In this door-to-door screening program in Koshi Rural Municipality, the prevalence of refractive error was found to be 1.7% which is below the WHO prevalence of 2 - 10% worldwide. The reason for low prevalence might be due to less near work, less use of gadgets requiring near focus, and more outdoor activities by the children living in these rural areas. A meta-analysis showed that the prevalence of refractive error in children



**Figure 1:** Types of Refractive Error.

is low in comparison to adults in Southeast Asia [12]. A study conducted at Solukhumbu showed a prevalence of 3.5% which was higher than ours [13]. Furthermore, the prevalence was comparatively less than that in Jhapa (8.5%) and Kathmandu (19.8%) [14, 15]. This higher prevalence of refractive error in urban areas may be associated with children spending more time doing near work such as playing with digital gadgets and spending less time in outdoor games and activities.

In this cohort, 53% were hypermetropic followed by Myopia (46%). However, a retrospective study done in Pokhara showed myopia to be the most common refractive error (69%) followed by hypermetropia (9.6%) in children [16]. Our study had a very a smaller number of children with astigmatism whereas in a

**Table 1: Demographic profile and its association with refractive error (n = 7830). Values are presented as number (%) or odds ratio (CI).**

Variables	Refractive Error, n (%)		Odds ratio (CI)	p-value	
	Yes	No			
Gender	Male (n = 4025)	75 (1.9)	3950 (98.1)	1.2 (0.89 to 1.80)	0.17
	Female (n = 3805)	56 (1.5)	3749 (98.5)		
Religion	Hindu (n = 5598)	60 (1.1)	5538 (98.9)	0.33 (0.23 to 0.46)	0.001*
	Muslim (n = 2232)	71 (3.1)	2161 (96.9)		
Age categorize	4 to 6 (n = 965)	13 (1.3)	952 (98.7)		0.95
	7 to 9 (n = 2460)	33 (1.3)	2427 (98.7)		
	10 to 12 (n = 2280)	37 (1.6)	2243 (98.4)		
	13 to 15 (n = 1332)	27 (2.0)	1305 (98)		
School types	16 to 18 (n = 793)	21 (2.6)	772 (97.4)		0.001*
	Government school (n = 3130)	35 (1.1)	3095 (98.9)		
	Private school (n = 2105)	30 (1.4)	2075 (98.6)		
	Madrassa (n = 1340)	43 (3.2)	1297 (96.8)		
	Not enrolled in school (n = 1255)	23 (1.8)	1232 (98.2)		
Total		131 (1.7)	7699 (98.3)		

\*Pearson's chi-square test

study conducted in Lumbini showed astigmatism to be as high as 47% [17]. The refractive error was more prevalent in the age group 16 to 18 years which was similar to the study done at Solukhumbu [13]. Our study area belongs to rural areas where the prevalence of refractive error was low; this was supported by different literature that shows high prevalence among the urban community where the educational load and near work is more among school students compared to rural [18]. Spending more time on outdoor activities protects against the development of myopia possibly due to more daily outdoor light exposure.

One of the striking findings in this study was the prevalence of refractive error was higher in children of Muslim community. The prevalence was similar in private schools (1.4%) and in public schools (1.1%) but as high as 3.2% in children enrolled in Madrassa. The reason may be due to genetic causes, which need to be further evaluated. In this study refractive error was not associated with gender and age categorization ( $p < 0.95$ ) which is similar to the study done at Dhangadhi ( $p < 0.229$ ) but contrary to the study done in Karachi ( $p < 0.04$ ) [10, 19].

Door-to-door screening for refractive error

among children of Koshi Rural Municipality was the new model where both school-going and non-school-going children were assessed by a trained optometrist following standard protocol at the community level. Even marginalized community children were also assessed and received free treatment as per the requirements. This finding has some implications for Koshi Rural Municipality for further planning. Government should facilitate eye screening in children and implement program for community awareness regarding importance of refractive error, visual acuity testing and amblyopia in children. We need to conduct further studies to identify the reasons for high refractive error among Muslim community. The limitation of the study was that some children might have been missed as a single visit was made to each house. Regular compliance checks for spectacle-wearing and yearly follow-ups were beyond the scope of this project.

## CONCLUSION

The prevalence of refractive error in children of Koshi Rural Municipality was low. However, the prevalence of refractive error was high among Muslim children.

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