hypermetropic type of refractive error as compared to the myopic variety has been reported as early as the 1940's. In present study too, the severity of amblyopia as measured by IOAD (inter-ocular acuity difference) (r=0.81, p significant at 0.01) was strongly associated with spherical hyperopic anisometropia. On comparing the presence of low grade amblyopia (mild to moderate) to high grade (severe) with anisometropia of <2D Vs ≥2D, there was significant association of the presence of high grade amblyopia with ≥2D of anisometropia as compared to <2D. (p=0.005, OR=2.2, (95%CI, 1.6 to 3.1). As expected, a more significant association of the presence of severe amblyopia with ≥3D was found (p=0.00, OR=55, (95%CI, 9 to 333).

Thus, current study reveals that anisohyperopia of ≥2D has a strong association with severe amblyopia. Jampolsky et al also reported similar findings.

In conclusion, present study indicates that anisometropia in the absence of strabismus is a known etiology of amblyopia with patients presenting at a later age i.e. beyond the critical period (6-8 years) because uncorrected refractive errors in the absence of strabismus go undetected due to the lack of awareness. Hyperopic anisometropia was found to be more prevalent in current study population with increasing magnitude of anisometropia (≥3 D) having a strong association with higher grades of amblyopia. However the age at presentation had no correlation with the final visual acuity of the amblyopic eye.

REFERENCES
CLINICAL PROFILE OF AMBLYOPIA IN CHILDREN IN A TERTIARY CARE CENTRE, UTTARAKHAND

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Himalayan Institute of Medical Sciences, HIHT University, Jolly Grant, Dehradun

ABSTRACT
AIM- The aim was to study the clinical profile of amblyopia in children in a tertiary care centre.

METHODS
Relevant medical history was taken and detailed clinical examination of all amblyopic children, aged 1-14 years, presenting to the Pediatric eye OPD of Himalayan Hospital, was done.

RESULTS
The average age of presentation of children with amblyopia was 8.56±3.80 years. Anisometropic amblyopia was the most common sub-type of amblyopia (33.33%) followed by strabismic amblyopia (27.78%). Children from rural community were 70.37% and from urban community were 29.62%. Children from plains were 81.48% and from hills were 18.52%. Children with anisometropic amblyopia presented later than children with strabismic amblyopia. Anisometropic amblyopia children, although presented late, had better visual acuity whereas children with sensory deprivation amblyopia had poor visual acuity in comparison to other types of amblyopia.

CONCLUSION
Amblyopia is one of the commonest cause of preventable and reversible childhood visual impairment, provided compliant treatment is started early. Anisometropic amblyopia was the most common subtype found in this region. Children with anisometropic amblyopia, though presented late, had better visual acuity. Effective school screening done in all regions and in all strata of the society can help in early diagnosis and treatment of these children.

Keywords: amblyopia, strabismic, anisometric

INTRODUCTION
Amblyopia has been defined as a unilateral or bilateral decrease of visual acuity caused by deprivation of pattern vision or abnormal binocular interaction even though no cause can be detected by physical examination of the eye\cite{1}. The overall prevalence of amblyopia varies between 1.6 to 3.6% in different regions of the world\cite{2}. The causes of amblyopia include strabismus, anisometropia, high-refractive errors and opacities of the ocular media or a combination of two or more etiologies in the same patient. Inspite of different causes, the basic mechanisms in all cases are either abnormal binocular interaction between eyes or from deprivation in one or both eyes\cite{3}. Amblyopia is one of the commonest cause of childhood visual impairment, the prevalence of which is usually underestimated, often because of lack of awareness. Treatment of amblyopia becomes ineffective around the age of 8 years when the sensitive period of cortical visual maturation is considered complete\cite{4,5}. Lack of adequate understanding or knowledge about this preventable condition is often the reason why very few patients are referred to eye hospitals or specialist practices for the amelioration of the same especially in a developing country like India\cite{6}. It is a treatable condition if compliant treatment started early. To the best of our knowledge, studies regarding clinical profile of amblyopia have not been done in the state of Uttarakhand. So the proposed study has been carried out to find out the prevalence of amblyopia in this region. It will help to plan future strategies to screen and implement appropriate therapeutic measures for treating amblyopia on a mass scale subsequently.

MATERIALS&METHODS
This study was conducted in the Department of Ophthalmology, Himalayan Institute of Medical...
Sciences (HIMS), Swami Ram Nagar, Dehradun, over a period of 12 months. It was an observational descriptive study where all consecutive co-operative children diagnosed as having amblyopia, aged 1-14 years (n=54), who presented to the Pediatric Ophthalmology OPD, HIMS, Dehradun, were included in the study after obtaining written and informed consent from parents/guardians.

EXAMINATION PROCEDURE
The assessment included a detailed history regarding the socio-demographic profile, age of onset as noticed by the parent or guardians, age of presentation to the hospital, history of any associated factor and any previous modality of treatment taken. Uncorrected visual acuity (UCVA) and best-corrected visual acuity (BCVA) was documented with the help of Snellen's visual acuity chart in children ≥ 4 years of age. In children <4 years of age who could not read Snellen/Lea chart, CSM method [C(central) S(steady) M(maintained)] was used for assessment of visual status. Assessment of ocular alignment, ocular motility, associated deviation, latent nystagmus (if any) and slitlamp examination for the assessment of any anterior or posterior segment pathology was performed. Cycloplegic retinoscopy was done. Cycloplegia was attained using 2% homatropine and 1% Tropicamide or 1% atropine. Patients were examined after 30 minutes after use of homatropine and after 3 days of using atropine. Fundus examination was done using direct/indirect ophthalmoscope.

DEFINITION AND CLASSIFICATION
Amblyopia was defined as:

1. Difference in the best-corrected visual acuity (BCVA) between the two eyes of two or more Snellen lines/equivalent measure on the Lea symbol chart in the absence of any organic lesion that could result in a decrease in vision. Children < 4 years of age who could not read Lea/ Snellen were diagnosed to have amblyopia by CSM method.

2. BCVA of <6/12 bilaterally on the Snellen's chart/ equivalent measure on the Lea symbol chart in the absence of any organic lesion that could result in a decrease in vision. Children <4 years of age who could not read Lea/ Snellen were diagnosed to have amblyopia by CSM method.

The criteria used for the diagnosis are listed below:

1. Strabismic amblyopia: This was defined as amblyopia in the presence of a heterotropia at distance or near fixation in the absence of any anisometropia meeting the criteria for a combined mechanism amblyopia. Patients with strabismus along with refractive errors of >1 D spherical equivalent in one or both eyes or eyes with regular astigmatism ≥ 1.5 D of astigmatism in any meridian were also included in this category.

2. Anisometropic amblyopia: This included patients who had amblyopia in the presence of anisometropia that was 1 D or greater in spherical equivalent, or a 1.5 D or greater difference in astigmatism between both the eyes, in the absence of any measurable heterotropia at distance or near.

3. Combined amblyopia: This included patients with either a heterotropia at distance or near along with anisometropia of 1 D or more in spherical equivalent or a 1.5 D or more difference in astigmatism in any meridian between both the eyes.

4. Sensory deprivation amblyopia: This group included patients with a known documented cause of sensory deprivation with no primary heterotropias or refractive errors that could be causally related to the amblyopia.

5. Meridional amblyopia: Patients with refractive errors more than 1 D spherical equivalent in both eyes resulting in subnormal vision in one or both eyes and no associated strabismus or any other ocular pathology were classified under this category. Patients with significant anisometropia (as defined above) along with high refractive errors in both eyes were excluded from this category and were grouped under the anisometropic amblyopia group. Patients with heterotropias for distance or near with bilateral refractive errors more than 1 D spherical equivalent were included under strabismic amblyopia.

6. Meridional amblyopia: Patients with regular astigmatism 1.5 D of astigmatism in any meridian or those with irregular astigmatism in both eyes, resulting in a decrease in vision in one or both eyes and no associated strabismus were classified as having meridional amblyopia. Patients with significant anisometropia (as defined above) along with a difference of 1.5 D or greater astigmatism between the two eyes were excluded from this category and grouped under the anisometropic
amblyopia group. Patients with heterotropias for distance and near with regular astigmatism more than 1.5 D in any meridian or irregular astigmatism were included under strabismic amblyopia.

Classification of the socio-economic status was done according to the modified B.G.Prasad classification in children belonging to rural and Kuppuswamy’s scale in children belonging to urban community.

RESULTS
A total of 54 children were enrolled for the study out of which 5 children had bilateral amblyopia. Hence 59 amblyopic eyes of 54 children were studied. In the present study the average age of presentation of children with amblyopia was 8.56±3.80 years. Maximum children presented between the age group of 10-14 years (48.15%, Table 1).

Table 1: Age wise distribution of Amblyopia

<table>
<thead>
<tr>
<th>Type of Amblyopia</th>
<th>&lt;4 years</th>
<th>4-9 years</th>
<th>10-14 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strabismic</td>
<td>1(6.67%)</td>
<td>13(86.66%)</td>
<td>1(6.67%)</td>
<td>15(100%)</td>
</tr>
<tr>
<td>Anisometropic</td>
<td>0(0%)</td>
<td>3(16.67%)</td>
<td>15(83.33%)</td>
<td>18(100%)</td>
</tr>
<tr>
<td>Combined</td>
<td>2(14.28%)</td>
<td>6(42.86%)</td>
<td>6(42.86%)</td>
<td>14(100%)</td>
</tr>
<tr>
<td>Sensory Deprivation</td>
<td>1(16.67%)</td>
<td>2(33.33%)</td>
<td>3(50%)</td>
<td>6(100%)</td>
</tr>
<tr>
<td>Meridional</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>1(100%)</td>
<td>1(100%)</td>
</tr>
<tr>
<td>Total</td>
<td>4(7.41%)</td>
<td>24(44.44%)</td>
<td>26(48.15%)</td>
<td>54(100%)</td>
</tr>
</tbody>
</table>

Males were 61.11% and females were 38.89% with a Male: Female ratio of 1.5:1. Anisometropic amblyopia was the most common sub-type of amblyopia (33.33%) followed by strabismic amblyopia (27.78%) and combined amblyopia (25.93%) (Fig.1).

Average age of presentation of strabismic amblyopia group was 5.64±2.84, anisometropic amblyopia group was 10.11±3.38 years, combined amblyopia was 8.87±3.80 years and sensory deprivation amblyopia was 9.25±3.15 years. Children from the rural community were 70.37% and from the urban community were 29.62%. Children from plains were 81.48% and children from hills were 18.52%.

Treatment for amblyopia was not taken previously in any form by 51.85% of the children. The rest 48.14% had taken treatment either in the form of glasses or patching. In the study 12.96% of the children had history of NLD obstruction as an associated factor with amblyopia. Most of the children belonged to the upper middle (II) socioeconomic status (37.04%) followed by lower middle (III) socioeconomic status (24.07%).

In anisometropic amblyopia 66.67% had visual acuity between 6/18-6/36. In sensory deprivation amblyopia, most of the amblyopic eyes had visual acuity <3/60.
Unilateral amblyopia was present in 90.75% and bilateral amblyopia in 9.25% children. Strabismus was present in 61.11% children. Among these, esotropia was seen in 57.58% and exotropia was seen in 42.42% children (Table 3). Hypermetropia was present in 82.46% and myopia was present in 17.54% children (Table 4).

### Table 2: Visual Acuity in Amblyopic Eye

<table>
<thead>
<tr>
<th>Type of Amblyopia</th>
<th>6/18-6/36</th>
<th>6/60-3/60</th>
<th>&lt;3/60</th>
<th>CSUM*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strabismus</td>
<td>6(40%)</td>
<td>2(13.33%)</td>
<td>6(40%)</td>
<td>1(6.67%)</td>
<td>15(100%)</td>
</tr>
<tr>
<td>Anisometropic</td>
<td>12(66.67%)</td>
<td>5(27.78%)</td>
<td>1(5.55%)</td>
<td>0(0%)</td>
<td>18(100%)</td>
</tr>
<tr>
<td>Combined</td>
<td>5(35.71%)</td>
<td>5(35.71%)</td>
<td>3(21.43%)</td>
<td>1(7.15%)</td>
<td>14(100%)</td>
</tr>
<tr>
<td>Sensory Deprivation</td>
<td>1(10%)</td>
<td>3(30%)</td>
<td>5(50%)</td>
<td>1(10%)</td>
<td>10(100%)**</td>
</tr>
<tr>
<td>Meridional</td>
<td>2(100%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>2(100%)***</td>
</tr>
<tr>
<td>Total</td>
<td>26(44.06%)</td>
<td>15(25.42%)</td>
<td>15(25.42%)</td>
<td>3(5.10%)</td>
<td>59(100%)</td>
</tr>
</tbody>
</table>

*In Children who could not read charts CSM method was used ** 10 eyes of 6 children with sensory deprivation amblyopia, Includes 8 eyes of 4 children with bilateral sensory deprivation amblyopia *** 2 eyes of 1 child with meridional amblyopia

### Table 3 : Profile of Strabismus in Amblyopia

<table>
<thead>
<tr>
<th>Type of Amblyopia</th>
<th>Strabismus Absent</th>
<th>Strabismus Present</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strabismic</td>
<td>0(0%)</td>
<td>8(53.33%)</td>
<td>7(46.67%)</td>
</tr>
<tr>
<td>Anisometropic</td>
<td>18(100%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Combined</td>
<td>0(0%)</td>
<td>9(64.29%)</td>
<td>5(35.71%)</td>
</tr>
<tr>
<td>Sensory Deprivation</td>
<td>2(33.33%)</td>
<td>2(33.33%)</td>
<td>2(33.33%)</td>
</tr>
<tr>
<td>Meridional</td>
<td>1(100%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Subtotal</td>
<td>21(38.89%)</td>
<td>19(57.58%)</td>
<td>14(42.42%)</td>
</tr>
<tr>
<td>Total</td>
<td>21(38.89%)</td>
<td>33(61.11%)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4: Refractive Status of Amblyopic Eye

<table>
<thead>
<tr>
<th>Type of Amblyopia</th>
<th>Hypermetropia</th>
<th>Myopia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strabismic</td>
<td>14(93.33%)</td>
<td>1(6.67%)</td>
<td>15(100%)</td>
</tr>
<tr>
<td>Anisometropic</td>
<td>16(88.89%)</td>
<td>2(11.11%)</td>
<td>18(100%)</td>
</tr>
<tr>
<td>Combined</td>
<td>11(78.57%)</td>
<td>3(21.43%)</td>
<td>14(100%)</td>
</tr>
<tr>
<td>Sensory Deprivation</td>
<td>6(60%)</td>
<td>4(40%)</td>
<td>10(100%)*</td>
</tr>
<tr>
<td>Total</td>
<td>47(82.46%)</td>
<td>10(17.54%)</td>
<td>57(100%)**</td>
</tr>
</tbody>
</table>

* 10 eyes of 6 patients with sensory deprivation amblyopia, Includes 8 eyes of 4 children with bilateral sensory deprivation amblyopia. ** 57 eyes of 53 children. 2 eyes (1 child) with meridional amblyopia were not included.
DISCUSSION

In the present study the average age of presentation was 8.56±3.80 years. Comparable results were reported by Menon V et al in New Delhi, where the average age of presentation was found to be 7.97±6.18 years. Woldeyes A et al in Ethiopia and Sapkota K et al in Nepal reported almost similar results.

In the present study, anisometropic amblyopia was the most common sub-type of amblyopia (33.33%) followed by strabismic amblyopia (27.78%). Comparable results were reported by FitzGerald DE et al in New York, Groenewoud JH et al in The Rotterdam study and Rosman M et al in Singapore.

In other studies, strabismic amblyopia was the commonest subtype found followed by anisometropic amblyopia. All the studies including the present study reinforce the fact that anisometropic amblyopia and strabismic amblyopia are the two most common types of amblyopia among various types of amblyopia.

In the present study it was found that children with anisometropic amblyopia presented later than children with strabismic amblyopia. Similar pattern was found in other studies.

In the present study, there were more number of children from the rural community (70.37%) than from the urban community (29.62%). Two other studies done separately by Murthy GVS et al in New Delhi in the urban community and by Dandona R et al in Andhra Pradesh in the rural community also showed that the prevalence of amblyopia was higher in the rural community than in the urban community which is comparable with the present study.

Anisometric amblyopia children, although presented late, had better visual acuity whereas children with sensory deprivation amblyopia had poor visual acuity in comparison to other types of amblyopia. Similar pattern was found in the study done by Menon V et al, Woldeyes A et al and Woodruff G et al in UK. In the present study 61.11% of the children had strabismus. Among these children with strabismus, esotropia was seen in 57.58% and exotropia was seen in 42.42%.

Jamali P et al in Iran, Woldeyes A et al in Ethiopia and Sethi S et al in Peshawar also found esotropia to be more common than exotropia in amblyopia.

In the present study 82.46% of amblyopic eyes had hypermetropia and 17.54% had myopia. Woldeyes A et al done in Ethiopia and Pant BP et al in Nepal found similar results.

Finally, even though the present study suffers from selection bias, as the data were hospital based, the findings may be helpful in stimulating to conduct further population and school based studies.

ACKNOWLEDGMENTS

We would like to thank the entire staff of Department of Ophthalmology, HIHT, Jolly Grant, Swami Ram Nagar, for their help and support without which conducting this study would not have been possible.


