# Determination of Refractive Error in Schoolchildren 

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## KEYWORDS

CB,
VI,
RE,
OM assessment, SC, urban population, screen exposure time


#### Abstract

: Studies have also concluded that about $80 \%$ of cases of blindness can be prevented by identifying the underlying cause. Additional studies have concluded that CB is a significant international issue. The studies also concluded that $30 \%$ of Indians E-VL before the age of 20. As a result, they concluded that early OM assessment in YC is essential. In light of this, we set out to assess RE usage among SC in our study. In our study, we found a statistically significant connection between urban population and screen exposure time ( $>2.5$ hours per day), likely due to the easy availability of computers, laptops, mobile phones, and video games. ( P value: 0.0126). Our study found a statistically significant link between 8th-10th graders and screen exposure time ( $>2.5$ hours per day), likely due to higher computer, laptop, mobile phone, and video game use. (p-value $<0.0001$ ). In our study, we found that $53.8 \%$ were spending more than 30 minutes per day reading, while $46.2 \%$ were spending less than 30 minutes per day.Hence, it is imperative to promptly address the issue of VI caused by RE. Early-age screening, then appropriate recognition and management strategies, can help with this.


## INTRODUCTION

Researchers have concluded from past studies that refractive errors (RE) were considered a significant contributor to visual impairment (VI) on a global scale and represent the second leading cause of avoidable blindness. ${ }^{1}$ Studies also concluded that the cause of blindness accounts for around $80 \%$ of the cases and is preventable as well. ${ }^{2}$ Further studies have concluded that childhood blindness (CB) is a significant global concern. ${ }^{2}$ Another significant etymology of blindness, according to many researchers in CB, was accompanied by cataracts. Two studies have also touched on the fact that, every min, a child loses their vision. ${ }^{3}$ Hence, researchers also concluded that the issue of $C B$ was highly significant simply because a child had to experience a greater number of blind years compared to an adult who became blind at an elderly age. ${ }^{3}$ Various
studies have proved that uncorrected RE (specifically, myopia, hyperopia, and astigmatism) account for $43 \%$ of VI cases worldwide, cataracts contribute to $33 \%$ of cases, and glaucoma up to $2 \% .^{3}$ Studies also concluded that $30 \%$ of Indians lose their vision before 20 approaches. Hence, they concluded that earlier assessment of ocular morbidity (OM) in young children (YC) is mandatory. ${ }^{4}$ As per our literature search, there is no such study on OM in the field practice region of KIS, Karad. Henceforth, the goal of our study was to evaluate the RE among schoolchildren (SC).

## AIM

To evlautae the RE among SC.

## INCLUSION CRITERIA

1. 6-16 years of age.
2. Both male \& female

## EXCLUSION CRITERIA

1. Mentally retarded children.
2. Any type of congenital disorder
3. Absentees on day of examination
4. Belo 6 years of age or above 16 years of age.

## MATERIALS \& METHOD

We have conducted a cross-sectional study in KIMS, Karad. The data collection was 12 months in total, and the analysis and compliance period was around 6 months, starting in October 2017 and ending in May 2019, which was around 18 months in total. Total number of SC were 750 in number.

## METHOD OF COLLECTION OF DATA

We conducted a standard questionnaire study to gather relevant information from students. Principals of all the schools were approached before screening, and their permission was granted and data was fixed for screening. A total of two visits were given to each school. Data was collected from patients after informed consent.We conducted an investigation which include V acuity (A) by snellen 's chart test (SCT) with \& without pinhole test, near vision by SNV chart, anterior segment examination with torch light \& slit lamp biomicroscopy to rule out anterior segment pathology(ASP), VA by manual refractometry, direct \& indirect opthalmoscopy to rule out posterior segment pathology(PSP). Furthermore, vision was tested for each eye separately. The cut off level of VA to denaote failure was fixed at less than 6/6 in either eye. C failing this test were listed.

## RESULT

| Gender | Frequency | Percentage |
| :---: | :---: | :---: |
| Males | 387 | 51.6 |
| Females | 363 | 48.4 |
| Total | 750 | 100 |

Table 1: Gender wise distribution
In our study, we found that, out of 750 patients, 387 were males (up to $51.6 \%$ ), whereas 363 were females (up to $48.4 \%$ ).

| Age Group(in years) | Frequency | Percentage |
| :---: | :---: | :---: |
| $06-09$ | 140 | 18.7 |
| $10-12$ | 209 | 27.9 |
| $13-16$ | 401 | 53.4 |
| Total | 750 | 100 |

Table 2: Age -wise distribution

In our study we have found that, both on urban and rural areas, majority of the patients were 401 ( $53.4 \%$ ) from 13-16 years of age, followed by 209 with 10-12 years of
age finally 140 patients with 6-9 years of age. Hence, the mean age was $12.25 \pm 3.01$.

| Standard | Frequency | Percentage |
| :---: | :---: | :---: |
| $2^{\text {nd }}-4^{\text {th }}$ | 190 | 25.4 |



| $5^{\text {th }}-7^{\text {th }}$ | 235 | 31.3 |
| :---: | :---: | :---: |
| $8^{\text {th }}-10^{\text {th }}$ | 325 | 43.3 |
| Total | 750 | 100 |

Table 3: SD of students

In our study, we found that, out of 750 patients, the majority were from the 8th-10th standard with 325 patients, whereas the minimum were from the 2nd-4th standard with 190 patients.

| Region | Frequency | Percentage |
| :---: | :---: | :---: |
| Rural | 423 | 56.4 |
| Urban | 327 | 43.6 |
| Total | 750 | 100 |

Table 4: Region-wise division
In our study, we found that, out of 750 patients, 423 were from rural areas, up to $56.4 \%$, whereas 327 patients were $43.6 \%$.

| Vision obtained by Investigator | Frequency | Percentage |
| :---: | :---: | :---: |
| $6 / 6$ | 666 | 88.8 |
| $6 / 9$ | 46 | 6.2 |
| $6 / 12$ | 18 | 2.4 |
| $6 / 18$ | 10 | 1.3 |
| $6 / 24$ | 7 | 0.9 |
| $\leq 6 / 36$ | 3 | 0.4 |
| TOTAL | 750 | 100 |

Table 5: Uncorrected VA

In our study, we found that, out of 750 patients, 666 patients, or $88.8 \%$, showed $6 / 6$ vision, whereas 3 up to $0.4 \%$ showed $\leq 6 / 36$ vision.

| Number of total students <br> examined | Number of cases obtainedby <br> Investigator |  | Number of cases <br> confirmed by <br> Refractionist |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Frequency | Percentage | Frequency | Percentage |
| 750 | 84 | $\mathbf{1 1 . 2}$ | 63 | $\mathbf{8 . 4}$ |

Table 6: Prevalence of RE

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In our study, we found that of the 84 cases detected with defective vision by the investigator, 63 were accepted as true cases of RE by the refractionist. Out of 21 suspected cases, 7 patients didn't follow up in OPD for cycloplegia
and PMT, and the rest, 14 patients, were mostly in the 2nd-4th grade, where it was difficult to get relevant information about their V .

| Cases | Frequency | Association Percentage(out of <br> $\mathbf{7 5 0})$ |
| :---: | :---: | :---: |
| Old cases | 13 | 1.7 |
| Newly detected cases | $\mathbf{5 0}$ | 6.7 |

Table 7: Old \& new RE

In our study, we found that, out of 750 patients, 50 were new cases of $R E$ and 13 were already wearing spectacles.

| Gender | Refractive Error |  | Total |
| :---: | :---: | :---: | :---: |
|  | Present | Absent |  |
| Male | $27(7.0 \%)$ | $360(93.0 \%)$ | $387(100 \%)$ |
| Female | $36(10.0 \%)$ | $327(90.0 \%)$ | $363(100 \%)$ |
| Total | $63(8.4 \%)$ | $687(91.6 \%)$ | $750(100 \%)$ |

Table 8: Gender-wise division with or without RE

In our study, we found that there was a higher prevalence seen in females (up to $10 \%$ ) than males (up to $7 \%$ ), but the relation was not statistically significant ( $\mathrm{p}=0.15$ ).

| Age Group (in years) | Refractive Error |  | Total |
| :---: | :---: | :---: | :---: |
|  | Present | Absent |  |
| $\mathbf{6 - 9} \mathbf{~ y r s}$ | $9(6.4 \%)$ | $131(93.6 \%)$ | $140(100 \%)$ |
| $\mathbf{1 0 - 1 2} \mathbf{~ y r s}$ | $24(11.4 \%)$ | $185(88.6 \%)$ | $209(100 \%)$ |
| $\mathbf{1 3 - 1 6} \mathbf{y r s}$ | $30(7.4 \%)$ | $371(92.6 \%)$ | $401(100 \%)$ |
| Total | $63(8.4 \%)$ | $687(91.6 \%)$ | $750(100 \%)$ |

Table 9: Age-wise division with or without RE

In our study, we found that, out of total C confirmed with RE (63), $7.4 \%$ belong to the age group of $13-16$ years, $11.4 \%$ belong to the age group of $10-12$ years, and $6.4 \%$ belong to the age group of $6-9$ years.

| Standard | Refractive Error |  | Total |
| :---: | :---: | :---: | :---: |
|  | Present | Absent |  |
| $\mathbf{2}^{\text {nd }} \mathbf{- 4}^{\text {th }}$ | $14(7.4 \%)$ | $176(92.6 \%)$ | $190(100 \%)$ |


| $\mathbf{5}^{\text {th }} \mathbf{- 7}^{\text {th }}$ | $18(7.7 \%)$ | $217(92.3 \%)$ | $235(100 \%)$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{8}^{\text {th }} \mathbf{- 1 0}^{\text {th }}$ | $31(9.5 \%)$ | $294(90.5 \%)$ | $325(100 \%)$ |
| Total | $63(8.4 \%)$ | $687(91.6 \%)$ | $750(100 \%)$ |

Table 10: SD of students with or without RE

In our study we have found that, higher prevalence of RE were detected in children of class 8th -10th standard but the difference was not statistically significant . $(\mathrm{p}=0.61)$.

| Region | Refractive Error |  | Total |
| :---: | :---: | :---: | :---: |
|  | Present | Absent |  |
| Rural | $25(5.9 \%)$ | $398(94.1 \%)$ | $423(100 \%)$ |
| Urban | $38(11.6 \%)$ | $289(88.4 \%)$ | $327(100 \%)$ |
| Total | $63(8.4 \%)$ | $687(91.6 \%)$ | $750(100 \%)$ |

Table 11: Region-wise division with or without RE
In our study, we found that a higher prevalence was detected in urban areas, up to $11.6 \%$. $(\mathrm{P}=0.0052$ )

| Family History | Child with <br> Refractive Error | Child without <br> Refractive Error | Total |
| :---: | :---: | :---: | :---: |
| Present | $27(32.6 \%)$ | $56(67.4 \%)$ | $83(100 \%)$ |
| Absent | $36(5.4 \%)$ | $631(94.6 \%)$ | $667(100 \%)$ |
| Total | $63(8.4 \%)$ | $687(91.6 \%)$ | $750(100 \%)$ |

Table 12: Inter-relation of family H/O with RE
In our study, we found a statistically significant coalition of family H/O with $R E(p=<0.001)$.

| Complaints | Frequency among cases of <br> refractive error | Percentage |
| :---: | :---: | :---: |
| Inability to watch blackboard | 26 | 41.2 |
| Able to watch blackboard | 37 | 58.8 |
| Total | 63 | 100 |

Table 13: Division of students cpmplaining of poor distant vision among cases

In our study, we found that 26 participants (out of 63) complained of their inability to watch the blackboard clearly, while the rest, 37, had other complaints. This
shows that the rest of the C were not familiarized with their issue. Hence, school-based screening is extremely crucial for the early overall management of RE.


| Complaints | Frequency | Percentage |
| :---: | :---: | :---: |
| Blurred Vision | 26 | 41.27 |
| Headache | 20 | 31.75 |
| Eye Strain | 13 | 20.63 |
| Half shutting of the eye <br> enhancing vision Total | 4 | 6.35 |

Table 14: C/O with RE

In our study, we found that blurred vision (BV) was the most frequent $\mathrm{C} / \mathrm{O}$, followed by headaches, eyestrain, and halfshutting of the eyes, which enhanced vision.

| Power in Diopters | Right Eye | Left Eye |
| :---: | :---: | :---: |
| $\boldsymbol{- 0 . 5 ~ \& ~ - 0 . 7 5 ~}$ | $26(54.16 \%)$ | $30(62.5 \%)$ |
| $\boldsymbol{- 1} \boldsymbol{\&}$ above | $12(25.0 \%)$ | $8(16.66 \%)$ |
| $\boldsymbol{+ 0 . 5 ~ \& ~ + 0 . 7 5}$ | $7(14.59 \%)$ | $4(8.34 \%)$ |
| $\boldsymbol{+ 1} \&$ above | $3(6.25 \%)$ | $6(12.5 \%)$ |
| Total | $48(100 \%)$ | $48(100 \%)$ |

Table 15: Allotment of cases of myopia \& hypermetropia (HM)

In our study, we found that most of the $\mathrm{c}(54.16 \%$ and $62.5 \%)$ presented with power of -0.5 or -0.75 D in the right and left eye, whereas very few c ( $14.59 \%$ and $8.34 \%$ ) presented with power of +0.5 and +0.75 D in the right and left eye.

| Type of <br> Refractive Error | Number of <br> students | Percentage <br> among cases(63) | Percentage among <br> Total study <br> participants(750) |
| :---: | :---: | :---: | :---: |
| Myopia | 38 | 60.3 | 5.1 |
| Hypermetropia | 10 | 15.9 | 1.3 |
| Astigmatism | 15 | 23.8 | 2.0 |
| Total | 63 | 100 | 8.4 |

Table 16: Proportion of types of RE

In our study, we found that the most frequent RE found was myopia(M) ( $60.3 \%$ ), followed by astigmatism(A) ( $23.8 \%$ ) and HM (15.9\%).

| Area | N | Screen Exposure Time per day |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  | 30 <br> Min./Day | 1 <br> hr./Day | 1.5 <br> hrs./Day | 2 <br> hrs./Day | hrs./Day |


| Rural | 423 | 52 | 206 | 89 | 57 | 19 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Urban | 327 | 40 | 157 | 48 | 49 | $\mathbf{3 3}$ |
| Total | 750 | 92 | 363 | 137 | 106 | 52 |

Table 17: Region-wise allocation of screen exposure time per day

In our study, we found that,there was a statistically significant association between urban population and screen exposure time ( $>2.5$ hours per day) in the present
study, probably due to easy access to computers, laptops, mobile phones, and video games. $(\mathrm{p}$ value $=0.0126)$

| STANDARD | $\mathbf{N}$ | Screen Exposure Time per day |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathbf{3 0}$ <br> Min./Day | $\mathbf{1}$ <br> hrs./Day | $\mathbf{1 . 5}$ <br> hrs./Day | $\mathbf{2}$ <br> hrs./Day | >=2.5 <br> hrs./Day |
| 2nd -4th | 190 | 32 | 68 | 51 | 33 | 6 |
| 5th-7th | 235 | 47 | 150 | 11 | 8 | 19 |
| 8th-10th | 325 | 13 | 145 | 75 | 65 | 27 |
| Total | 750 | 92 | 363 | 137 | 106 | 52 |

Table 18: SD allocation of screen exposure time per day

In our study, we found that, there was a statistically significant relationship between 8th-10th grade standard students and screen exposure time ( $>2.5$ hours per day)
in the present study, probably due to more exposure to computers, laptops, mobile phones, and video games. (p value $=<0.0001$ ).

| Constant reading time | Frequency (N=750) | Percentage |
| :---: | :---: | :---: |
| <30mins/day | 347 | 46.2 |
| >30mins/day | 403 | 53.8 |
| Total | 750 | 100 |

Table 19: Division of constant reading time
In our study, we found that, $53.8 \%$ were found to spending more than 30 minutes per day, and $46.2 \%$ were found to be spending less than 30 minutes per day for constant reading.

| Distance of watching TV | Frequency | Percentage |
| :---: | :---: | :---: |
| $<\mathbf{1 0}$ feet | 486 | 69 |
| $>10$ feet | 219 | 31 |
| Total | 705 | 100 |

Table 20: Assessment of TV watching distance
In our study, we found that, there was no statistically significant association between distance from TV and the prevalence of RE ( $\mathrm{p}=0.61$ ).

| Socio-demographic variables | Forms of refractive errors |  |  | P <br> value |
| :---: | :---: | :---: | :---: | :---: |
|  | Myopia | Hyperopia | Astigmatism |  |
| Age |  |  |  |  |
| - 6-9 years | 3(7.9\%) | 5 (50.0\%) | 1 (6.7\%) | 0.0061 |
| - 10-12 years | 15 (39.4\%) | 4 (40.0\%) | 5 (33.3\%) |  |
| - 13-16 years | 20 (52.7\%) | 1 (10.0\%) | 9 (60.0\%) |  |
| Gender |  |  |  |  |
| - Male | 15 (39.4\%) | 5 (50.0\%) | 7 (46.6\%) | 0.79 |
| - Female | 23 (60.6\%) | 5 (50.0\%) | 8 (53.4\%) |  |
| Standard |  |  |  |  |
| - $2^{\text {nd }}-4^{\text {th }}$ standard | 6 (15.8\%) | 5 (50.0\%) | 3 (20.0\%) | 0.15 |
| - 5th $-7^{\text {th }}$ standard | 10 (26.3\%) | 3 (30.0\%) | 5 (33.3\%) |  |
| - $8^{\text {th }}-10^{\text {th }}$ Standard | 22 (57.9\%) | 2(20.0\%) | 7 (46.7\%) |  |
| Region |  |  |  |  |
| - Urban | 25 (65.8\%) | 6 (60.0\%) | 7 (46.7\%) | 0.44 |
| - Rural | 13 (34.2\%) | 4 (40.0\%) | 8 (53.3\%) |  |
| Total | 38 (100\%) | 10(100\%) | 15(100\%) |  |

Table 21: Correlation of Socio-demographic variables with different forms RE

## DISCUSSION

In our study, out of the total study participants (750), $51.6 \%$ were male students and the remaining $48.4 \%$ were female students. Another similar study by Vidusha KSS et al. (2018) showed that $6 \%$ male students and $49.4 \%$ female students. ${ }^{5}$ Further, in our study, out of the total study participants (750), $53.4 \%$ of students belong to the age group of $13-16$ years, $27.9 \%$ belong to the age group of $10-12$ years, and $18.7 \%$ belong to the age group of 6 9 years. The mean age of the study population is found to be 12.25 , with a SD of 3.01 . Similar observations (mean age: 9.5 years) were found in a study by Naik R et al. (2013), considering students of age groups -15 years in Ahmednagar district, Maharashtra. ${ }^{6}$

In our study, out of the total study participants (750 students), $56.4 \%$ were from rural regions, whereas $43.6 \%$ were from urban regions. Similar observations were witnessed in a study undertaken by Pavithra et al. in Srinagar to assess the prevalence of RE in SC with 555 students were from rural regions and 507 students were from urban areas. ${ }^{7}$ In our study, we found that an $8.4 \%$ rate of prevalence of RE was found in total study participants. A similar prevalence rate $(7.0 \%)$ was observed in a study by Pradhan N et al. (2018) conducted in Haryana. ${ }^{8}$

In our study, we have found that a higher prevalence was seen in females ( $10 \%$ ) than males ( $7 \%$ ). Pradhan N et al. had analogous results in their study (year 2018) done in

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rural areas of Haryana: $86 \%$ in girls, whereas boys remained at $6.22 \%$ only. ${ }^{8}$ Another identical study done by Tay MT et al. on young Singaporeans revealed a higher prevalence rate in girls than boys based on prior attainment of puberty. ${ }^{9}$ The most frequent RE found was M ( $60.3 \%$ ), followed by A ( $23.8 \%$ ) and HM ( $15.9 \%$ ) in the present study. This similar impression was observed in the study executed in Ahmedabad by Sonam Sethi et al.: $63.3 \%$ of students had M, followed by A (20.4\%) and HM (11.4\%). ${ }^{10}$

## LIMITATION OF STUDY

1. Our study was a cross-section observation type; therefore,therefore it failed to derive a real temporal association between risk variables and RE.
2. We have not included ODs like vitamin A deficiency, conjuctivitis, etc.
3. The data was mainly collected by the patients, so it may not provide the real picture.
4. Our study was a school-based type, but a major proportion of children in rural areas are dropouts and those who attend school. Hence, assessment of VI because of RE in children in the true sense was possible only with larger-scale population-based studies.

## RECOMMENDATION

1. All children of school-going age and their parents should be familiarized with the signs and symptoms of RE for early detection and intervention.
2. All school screenings should be carried out on a periodic basis, and the teachers should be adequately trained to assess the children with poor performance due to DV and refer them to a doctor promptly.
3. All schools should implement health programs, and where they already exist, they should strengthen their services.
4. Parents should insist their child decrease the duration of watching TV, using computers or laptops, and other near-work activities. Also, children should have as many outdoor activities as possible.
5. Children with positive parental histories should be scrutinized at juvenile
6. Studies (not restricted to S-C) should be initiated to cover school drop-outs.
7. A prospective study on a large scale should be undertaken to prove casual.

## CONCLUSION

We come to the conclusion that VI due to RE should be addressed as early as possible, which is attainable only by screening at an early age and hence early recognition and management.

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