Prevalence of impaired vision and associated factors among primary school children in primary schools of Addis Ababa, central Ethiopia

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Abstract

Background Visual impairment refers to reduction of vision resulting in a lower than normal visual acuity. Globally, approximately 1.3 billion adults and children live with some form of vision impairment. Visual impairment is usually asymptomatic, overlooked and affects school performance and other functions. School programs are recommended for early detection and timely interventions. In resource limited countries like Ethiopia, undetected visual impairment, lack of adequate and up-to-date information on the problem remain as huge gaps. Thus, we assessed the prevalence of visual impairment (VI), and the associated factors among children attending government primary schools of Lideta sub-city, Addis Ababa, Ethiopia.

Methods This study was a school based cross-sectional study conducted from April to May 2019, using a two staged-cluster sampling method in Lideta sub-city, Addis Ababa, Ethiopia. From the total of 18 government primary schools in Lideta sub-city, 6 were selected using probability proportionate to size (PPS) method. The study population was primary school children aged 7 to 17 in the selected 6 primary schools. A total of 816 primary school children were included in the study. The selected children have undergone screening for the presence of visual impairment and other eye problems. Children’s parents/guardians were interviewed using structured pre-tested questionnaires. Epi-data3.1 and SPSS version 20 were used for data entry and analysis, respectively. Binary logistic regression was performed to check association between dependent and independent variables. Significance was set at p-value <0.05.

Results A total of 773 children were examined for visual impairment. Out of the 773 children, 370 (47.9%) were males and 403(52.1) were females with age range 7 to 17 years and the mean age being 11.69 (SD 2.64). The prevalence of impaired vision among school based children was 4.4%. The causes of visual impairment included: Myopia (43%), Astigmatism with or without Amblyopia (31%), Hyperopia with or without Amblyopia (20%) and others. The students not being aware of eye problem (AOR=2.2, 95%CI: 1.08-4.35) was only significantly associated factor with visual impairment.

Conclusion Visual impairment is a public health concern, the causes are treatable. Regular school screening programs and affordable treatment should be available.

Introduction

It was estimated that globally there were 1.4 million blind children and about 2.8 million with low vision. Each year an estimated 500,000 children are becoming blind [1], of which about 300, 000 live in Africa [2]. The leading causes of vision impairment and low vision are: uncorrected refractive errors, cataract, age-related macular degeneration, glaucoma, diabetic retinopathy, corneal opacity and trachoma [3–5]. Approximately 80% of vision impairment globally is considered avoidable i.e. it is either preventable or treatable [6, 7]. For example, in low-income countries congenital cataract is a leading cause, whereas in high income countries it is more likely to be retinopathy of prematurity [8].
The poorest regions of Africa and Asia are where three quarters of the world’s blind children live. The prevalence of visual impairment, low vision and blindness in children in a country is related to the nutritional, health, and socioeconomic status of that country [9]. Ethiopia is believed to have one of the world’s highest rates of blindness (1.6%) and low vision (3.7%) in the general population, of which more than 80% is either treatable or preventable [10]. Vision or eye sight refers to our ability or power to see. Vision can be measured both in children and adults using a variety of testing tools and this measured vision is called visual acuity (VA). The presence of excellent visual acuity indicates the visual pathway is functioning well [11].

Globally, it is estimated that approximately 1.3 billion children and adults live with some form of vision impairment and this figure is projected to increase unless appropriate measures are taken. With regards to distance vision, 188.5 million people have mild vision impairment, i.e. VA < 6/12 but better or equal to 6/18 in the better eye, 217 million have moderate to severe vision impairment or low vision, i.e. VA worse than 6/18 and better than or equal to 3/60 in the better eye, 36 million people are blind i.e. VA worse than 3/60 [12].

The World Health Organization's (WHO's) International Classification of Diseases (ICD)–10 categories of visual loss define Visual Impairment (VI) as “a corrected VA of <6/12 to 6/18 in the better eye”, Low Vision (LV) as “a corrected visual acuity in the better eye of < 6/18 (< 20/63) down to and including 3/60 (20/400)” [13].

WHO recently suggested that “presenting visual acuity” (i.e., visual acuity tested with distance spectacles, if usually worn), as well as uncorrected visual acuity, be used in all population-based surveys. Most individuals who have a presenting visual acuity in the better eye of < 6/12 down to and including 3/60 may require spectacles, cataract surgery, or other treatment to restore sight and assessment for low-vision interventions [14].

The adverse impacts of childhood visual impairment and blindness are enormous and remain for life. It has been estimated that 75–90% of all learning in the classroom comes to the students either wholly or partially via the visual pathway [15]. Therefore, in children, visual impairment can affect school performance and other functions, such as ability to safely participate in sports [16–20]. Poor performance at school may affect the child's self-confidence and their future careers and limit their future employment opportunities. It has considerable social, psychological, and economic implications for the patients and their care- givers [21].

Most of the children with visual impairment especially due to uncorrected refractive error are asymptomatic and usually overlooked [22]. School vision screening programs are important for the early detection and timely interventions. In countries with high attendance of children in schools, integration of vision screening within screening for other health issues is recommended [22]. In the developed world school regular school screening programs are well practiced. In Ethiopia there are only two NGOs named Vision Care Services (VCS) and Girar bet Le Dikuman which conduct school screening programs in primary schools of Addis Abeba and Ziway respectively. St. Paul Hospital is also in the preparation phase
for school screening in Gulele sub-city. Undetected visual impairment and low vision in children; lack of adequate and recent data remain as huge gaps in the eye care system in Ethiopia. Knowledge of the prevalence of visual impairment and associated factors can help to design and implement intervention strategies relevant to Ethiopia. Therefore, this study aimed at determining the magnitude and associated factors of Visual Impairment in school children in Ethiopia.

**Methods**

**Study area and period**

We conducted school based cross sectional study on school based children in Lideta Sub-city, Addis Ababa, Ethiopia from April to May 2019. Addis Ababa is the capital city of Ethiopia with an area of 540 square kilometers and 3.38 million inhabitants. The structure of power organization of the city includes the city government, 10 sub-cities, namely Arada, Addis Ketema, Kirkos, Lideta, Gulele, Kolfe-Keranyo, Nifas silk Lafto, Bole and Akaki Kaliti [15]. Number of children enrolled in primary schools in Addis Ababa for the 2018/2019 academic year was 45,861. In Lideta sub-city, there are 18 governments owned and 11 private owned schools. There are a total of 16,172 school children enrolled in the regular primary schools for 2019 academic year. Out of these 10,640 school children are enrolled in government primary schools and the remaining 5,532 were enrolled in private, public and church schools [20].

**Operational definitions**

In this study, school child was considered a student whose age is between 7 - 18 years and who was attending school from grades 1 up to 8 in government schools. Similarly, presenting visual acuity was considered the visual acuity of the child without correction with glasses and impaired vision was considered if the visual acuity of a child <6/12 in the better eye. Vision impairment (VI) refers to reduction of vision resulting in a lower than normal VA i.e. VA < 6/12 but better or equal to 6/18 in the better eye as measured using Snellen’s chart. Low Vision (LV) refers to a more severe form of visual reduction i.e. VA worse than 6/18 and better than or equal to 3/60 as measured using the Snellen’s chart.

**Study variables and measurements**

The major outcome variable of interest was prevalence of visual impairment (VI). Independent variables included; age of child, sex of child, family history of spectacle use, guardian occupation, parental marital status, parental education, family income, duration of TV watching, distance of TV watching, duration of mobile phone exposure, outdoor playing, service availability and visit to eye care facility.

Visual Acuity is considered normal and is called 6/6 vision, the United States Customary System (USCS) equivalent of which is 20/20 vision. Vision of 6/12 and corresponds to a lower VA than 6/6. Accordingly VA expressed with a larger denominator represents lower vision [23]. The most popular VA testing chart is *Snellen's* VA chart. It is used in routine VA testing in eye care units. The other VA testing tool named as *Log-MAR* chart is mainly used for research purposes [3, 2]. Visual acuity can be expressed
in four notations namely, the foot notation, metric notation, decimal notation and Log MAR notations [24]. Only the metric notation which expresses normal vision as 6/6 was used in this study.

**Sample size determination and sampling technique**

Total sample size of 816 was determined by applying a formula for single population proportion with 95% confidence interval, prevalence of visual impairment at 9.5% from previous study (25), 3% ($\alpha = 0.03$ margin of error), design effect of 2 and by considering 10% non-response rate. In this study two-stage cluster sampling method was used. Lideta sub-city was the primary sampling unit (PSU). Primary schools in Lideta sub-city were selected using proportional allocation to size (PPS) method which became secondary sampling units (SSU). From 29 primary schools in Lideta sub-City, all the 18 government primary schools in Lideta sub-city were considered as clusters. The total number of children attending at government primary schools was 10,640. Among these, 6 (30%) primary schools were selected using Probability Sampling to Size (PPS) method and were included in the study.

The first school was selected according to a random start (RS) = 28 which was generated using Excel command. Accordingly the first school to be included in the study is “Meskerem 1”. The consecutive clusters (schools) were identified using the formula to calculate the random number that fall in the cumulative sum corresponding to a school. Accordingly, “Omedla”, “Karamara”, “Alem Maya”, “G. Hayelom Araya” and “Tesfa Kokeb” schools were selected and included in the study. The process of identification of the schools included in the study using PPS is indicated in the Annexes.

The total number of children in 6 selected schools was 5,148. The calculated sample size which is 816 was allocated to each school proportional to the number of school children in each specific school. Further, it was planned to select study units SRS method by creating one sampling frame for each school and generate random numbers using Excel. This was not possible as the preparation of sampling frame for each school on Excel was found to be time consuming and data collection had to take place before students were dismissed to study for final exams. Instead of SRS, systematic random sampling method was found to be time saving and was used to select the study units by making use of the class attendance list as a sampling frame. Accordingly, the sample allocated to each school was further proportionally allocated to each class in that specific school. Sampling interval (SI) was calculated for each class in the school and study units were selected until the allocated sample size was fulfilled. School children enrolled in selected schools who are under the age of 18 years and the parents/guardians of whom have given their consent to participate were included into the study.

**Data collection tool, procedure and quality control**

Visual acuity testing was conducted by trained nurses who are staff members in an eye department of Minilik II Hospital. Since it was not possible to get LogMar projectors and rooms in schools with standard lighting conditions, VA testing was conducted using standard 3 meter Snellen's VA charts outside classrooms under the ambient lighting conditions. By convention, the right eye was tested first while the left eye was occluded. To avoid learning effect the left eye was tested using a chart with different
optotypes which have similar size and sequence. Eyes were tested separately and together and the findings were recorded on the recording form. The findings of VA testing were verified by optometrist and therefore VA testing was done two times for children with no visual impairment (VI) and three times for children with VI. Any child with a VA < 6/12 was referred to the optometrist who repeated VA testing to confirm findings of trained nurses. For children who were confirmed to have VA <6/12, the optometrist did both objective and subjective refraction (doing measurements to identify visual problem that can be corrected with glasses). Children whose vision did not improve with glasses were referred to an ophthalmologist who did further eye examination to establish the cause of VI. The parents/guardians of all school children who received eye exams were interviewed by trained nurses using a structured questionnaire. Standard Snellen 3 meter VA charts were used in the possible appropriate environment. Measurements were done by trained nurses and were repeated by an optometrist. Measurements were checked for the possible existence of variation. If variations existed, the source of variation were identified and corrected. The principal investigator supervised the VA measurement process. Structured questionnaires were prepared in English and were translated to Amharic and then translated back to English to check and confirm its consistency. Staff nurses who are currently working in an eye department were selected and were given training on study objective, sources of bias, ethical issues and interview techniques. The questionnaire was pre-tested in one primary school in Lideta sub-city which was not included in the study. By taking 10% of the total sample, a total of 81 children were selected by systematic random sampling for VA testing and examination. Subsequently, the parents/guardians of the examined children were interviewed. Based on the findings of the pre-testing, all the necessary adjustments in the process of data collection and revision of the questionnaires were made. These revised questionnaires were administered to parents/guardians of children who have undergone VA testing and eye examination in the selected children in the 6 primary schools. The trained staff nurses administered the questionnaire by using face-to-face interview technique and the process of questionnaire administration was supervised by the principal investigator. Each questionnaire was also checked for completeness, missed values and inconsistency of responses were manually cleaned up. Explorative analysis was done to explore the data for missed values, outliers and inconsistent values. Identified errors were corrected accordingly

Data management and analysis

Data were entered using Epi-data and analyzed using SPSS version 20 statistical software. Frequency tables, graphs and descriptive summaries were used to describe the data. Based on the objective of the study, the association between stated dependent and independent variables were analyzed using bivariate logistic regression and Chi-Square tests after checking fulfillment of assumptions. Variables with P values $\leq 0.25$ at bivariate regression analysis level were recruited for multivariate logistic regression. Finally, the strength of association between outcome and predictor variables was assessed at P Value $\leq 0.05$ using adjusted odds ratio (AORs) with corresponding 95% CIs.

Results
**Characteristics of School children**

Out of the total 816 sampled, 773 primary school children attending grades 1–8 were examined and included in the analysis making the response rate 94.7%. Out of the 773 children, 370 (47.9%) were males and 403(52.1) were females. The Children's age ranged from 7 to 17 with the mean age being 11.69 (SD = 2.64). About two third 508(65.7%) of children were in the category of age between 12 and 17 years. More than half 452(58%) of were between grade 5 up to 8 school [Table 1].

Table 1 General Characteristics of school children of Primary school Children in Lideta Sub-city. 2019

| Variables       | Frequency | Percentage |
|-----------------|-----------|------------|
| **Age**         |           |            |
| 7-11            | 265       | 34.3       |
| 12-17           | 508       | 65.7       |
| **Sex**         |           |            |
| Male            | 375       | 48.5       |
| Female          | 398       | 51.5       |
| **Current grade** |          |            |
| 1-4             | 351       | 41.5       |
| 5-8             | 452       | 58.5       |

Socio-demographic and Economic Characteristics of Parents/guardians

Among the interviewed 773 parents/guardians, most of them 410(53%) were mothers, 184 (23.8%) were fathers, 64 (8.3%) were siblings and 115 (14.9%) were guardians. Their age ranged from 18–80 years giving a mean parent/guardian age of 39.73. About a quarter 198(25.6%) of them fall in age category less than 35 years old and nearly three fourth 542(70.1%) were females.

Most of them 532 (68%) were married, 90 (10.3%) were single, 80 (10.3%) were divorced and 81(10.5%) were widowed. Concerning their marital religion, 490 (63.4%) were Orthodox Christians. 206 (26.6%) were Muslims, 74 (9.6%) were Protestants. 2 (0.3%) were Catholics.

Regarding the educational status of parents/guardians, 153 (19.8%) were illiterate, 133 (17.2%) were literate, 212 (27.4%) had primary education, 174 (22.5%) had secondary education and 101 (13.1%) had higher education. Their family size ranged from 2–10 with a mean family size of 5. When further categorized into “smaller” and “larger” 516 (66.8%) fell in the “smaller” category with which has less than 5 family members and 257 (33.2%) fell into the “larger” category with family size 5–10. The family
average monthly income ranged from ETB 100 to 7,000 with a mean of 1619.17 when further categorized into different levels, 634 (82.0%) earn income less than ETB 1,650 per month, 132 (17.1%) earn ETB 1651–5250 per month and 7 (0.9%) earn between 5251 up to 7000.

Table 2 Socio-demographic Characteristics of Parents/Guardians of school children in Lideta sub-city. 2019
| Variables          | Frequency | Percentage |
|--------------------|-----------|------------|
| **Age**            |           |            |
| <35                | 198       | 25.6       |
| 35-46              | 196       | 25.4       |
| 46-60              | 220       | 28.5       |
| >61                | 159       | 20.6       |
| **Sex**            |           |            |
| Male               | 231       | 29.9       |
| Female             | 542       | 70.1       |
| **Marital status** |           |            |
| Single             | 80        | 10.3       |
| Married            | 542       | 68.8       |
| Divorced           | 80        | 10.3       |
| Widowed            | 81        | 10.5       |
| **Educational status** |     |            |
| Illiterate         | 153       | 19.8       |
| Literate           | 133       | 17.2       |
| Primary            | 212       | 27.4       |
| Secondary          | 174       | 22.5       |
| College and above  | 101       | 13.1       |
| **Family size**    |           |            |
| <5                 | 516       | 66.8       |
| 5-10               | 257       | 33.2       |
| **Monthly income** |           |            |
| <1650              | 634       | 82.0       |
| 1651-5250          | 132       | 17.1       |
| **Relationship with child** | |            |
| Father             | 184       | 23.8       |
| Mother             | 410       | 53.0       |
| Sibling            | 64        | 8.3        |
Visual Impairment among School Children

After conducting visual acuity (VA) testing, 34 children were found to have impaired vision (VI) i.e their VA in the better eye <6/12 on the 3-meter Snellen VA chart. The prevalence of visual impairment (VI) in these school children is 4.4% (95%CI: 3.0, 6.1). Out of 34 children with VI, 21 (61.76%) were males and 13 (38.23%) were females. VI was more observed in adolescents i.e. age group 12–17.

The Causes of Visual impairment include Myopia (43%), Astigmatism with or without Amblyopia (31%), Hyperopia with or without Amblyopia (20%) and others like Keratoconus and Pseudophakia.

Figure 4 Causes of VI in School Children in Lideta Sub-city, 2019

Findings of Interview with Parents/Guardians of the School Children

Awareness of Child’s eye problem: After conducting face-to-face interview with parents/guardians of the 773 students, the majority 518 (67%) answered they have not seen any problem with the eyes of their child. 255 (33%) reported some form of eye problem in their child. From the 255 who responded they have observed eye problem in the child about two-third 157 (61.6%) did not take their child to modern eye-care service., 98 (38.4%) said they have taken the child to a modern eye care unit. The main reasons for not taking the child for the observed eye problems were financial problems and expecting self-resolution.

Family History of Eye Problems: From the 773 interviewees the majority 618 (79.9%) have no family history distance vision since their childhood of 155 (20.1) responded family history of problem with distance vision. From the 155 interviewees who gave positive family history of eye problems, the majority 73 (47%) did not know the cause of eye problems in the family member.

Playing Outdoors: Regarding outdoor playing by the child, the majority 657 (85%) of the 773 interviewees responded that their child plays outdoors every day, 110 (14.2%) responded that their child does not play outdoors and 6 (0.8%) did not know if their child played outside or not. The 6 respondents who did not know if their child plays outdoors or not were excluded from further analysis. From the 657 children who played outdoors, 340 (51.8%) were males and 317 (48.2%) were females. From the children who played outdoors 247 (37.6%) are in the age range 7–11 years and 410 (62.4%) were in the age range 12–17 years.

The duration of playing outdoors by the children ranged from 1–8 hours. The mean outdoor playing hours is 2.16 hours the mode is 2 hours. Outdoor playing hours were further categorized into three. More than half of them 459 (59.4%) played from 1–2 hours, 180 (23.3%) played from 3–4 hours and 18 (2.3%) played 5–8 hours.

TV watching by the child: From the total 773 respondents, more than two-third 690 (89.3%) responded that their child watches TV every day, 77 (10%) said their child does not watch TV and 6 (0.8%) do not
know if their child watches TV or not. The 6 responses with “I don’t know” responses were excluded from further analysis. From the 690 children 330 (47.8%) were males and 360 (52.2%) were females. Majority of the children who watch TV 445 (64.5%) fell into adolescent age category i.e. ages 12–17 and 245 (35.5%) fell in the age group 7–11.

TV watching hours of a child ranged from 1–7 hours per day with a mean of 2.14 hours per day and the mean and mode are 2. When further categorized, 480 (69.6%) children watch TV from 1–2 hours, 193 (28%) children watch from 3–4 hours, and 17 (2.4%) children watch TV from 5–7 hours.

Regarding the TV watching distance, the average TV watching distance for a child is 2.05 meters, with a median and mode of 2 meters. TV watching distance ranged from 1–7 meters. TV watching distance was further categorized into three categories. 511 (77%) children watch TV from 1–2 meters, 141 (20.4%) children watch TV from 3–4 meters and 38 (6.7%) children watch TV from 5–7 meters.

**Video/Mobile/PC games:** Playing video/mobile/PC games was reported by 299 (38.7%) parents/guardians, 448 (58%) responded that their child does not play electronic games and 26 (3.4%) responded “I do not know”. The time spent playing video games in a day ranged from 1 hours – 7 hours with a mean of 1.45 hours, and median and mode of 2 hours. Hours of Video/Mobile/PC games per day are further categorized in the following table.

**Visual Impairment (VI) and Associated Factors**

Binary logistic regression was done to check association between the dependent variable VI and the independent variables. The independent variables were age of the child, sex of the child, parental education, family income, Family history of eye problems, outdoor playing by the child, TV watching by the child, playing video/mobile/PC games by the child. In this analysis the COR (95%CI) of all the independent variables included 1 showing the absence of association between the dependent and the independent variables. The individual COR with 95% CI values are summarized in the following table.

Table 4 Summary of binary logistic regression results of associated factors of VI in primary school children in Lideta sub-city, 2019
| Variables                  | Visual impairment | COR(95%CI)      | AOR(95%CI)      | P-value |
|----------------------------|-------------------|-----------------|-----------------|---------|
|                            | Yes               | No              |                 |         |
| Students Sex               |                   |                 |                 |         |
| Male                       | 21                | 354             | 1.76 (0.87, 3.56) | 1.72 (0.83-3.50) | 0.137   |
| Female                     | 13                | 385             | 1.00            | 1.00    | 1.00    |
| Parental education         |                   |                 |                 |         |
| Illiterate                 | 5                 | 148             | 0.54 ( )        | 0.614 (0.19-1.99) | 0.417   |
| Literate                   | 7                 | 126             | 0.21 ( )        | 0.619 (0.21-1.83) | 0.385   |
| Primary                    | 11                | 201             | 0.02 ( )        | 0.617 (0.20-1.99) | 0.399   |
| Secondary                  | 9                 | 165             | 0.02 ( )        | 1.701 (0.32-8.9) | 0.532   |
| Above 12                   | 2                 | 99              | 1.00            | 1.00    |         |
| Awareness of eye problem   |                   |                 |                 |         |
| Aware                      | 17                | 238             | 2.10 (1.06, 4.20) | 2.17 (1.08-4.35) | 0.029   |
| Not aware                  | 17                | 501             | 1.00            | 1.00    |         |

**Discussion**

Visual Impairment affects children world-wide by reducing the child’s learning potential and limiting physical activities. In this study all the schools lack vision screening program for children which are the current WHO recommendation for primary schools. The prevalence of VI is 4.4% (95% CI) [8, 12]. In 32 (94%) of the children with VI, the causes are Refractive Errors like myopia, hyperopia and astigmatism.

These findings are lower than the findings of the study which was conducted to determine prevalence of refractive errors and VI among schoolchildren in rural central Ethiopia from November 2010 to January 2011 where the prevalence of VI was 9.5%. This difference could be because of the fact that all the school children were included in the other study without sampling. The causes for impaired vision were mainly refractive errors, which is similar finding with our study [25].

The other school-based cross-sectional study which was conducted between 15 June 2015 and 30 November 2015 in primary schools of Arada sub-city Addis Ababa, estimated the prevalence of VI at among school children in the study area was 5.8% [26]. This finding is also within the 95%CI of the prevalence estimate of our study.

Another study which was conducted in Addis Ababa and published in 2016 aimed at assessing the prevalence and identifying factors associated with visual impairment among school-age children in
Ethiopia. In this cross sectional study, the prevalence of VI was 7.24% which is higher than our finding which can be explained by the inclusion of older age group [27].

When compared to the study which was done in Tanzania which estimated prevalence of VI at 9.5%, our finding is lower which could be a regional variation. In a recently published article of the cross sectional study which was conducted on Orang Asli children who are an isolated ethnic group in Malaysia, the prevalence of VI was 40.9% which is ten times higher than the findings of our study. The main cause of VI in this study was refractive error 34.5% with the majority being Hyperopia. In this isolated community the highest prevalence of VI is recorded and the predominant cause of VI is Hyperopia [28]. These variations could suggest a difference in genetic makeup of that specific population.

In all the studies discussed above, the leading cause of VI is Refractive errors. These conditions are treatable with spectacles and if left untreated at an early age, will lead to Amblyopia (Lazy eye) where the child’s vision stops from developing. This in turn will cause a visual handicap for life.

When we look at the associated factors of VI, there were a number of factors which showed statistically significant association with VI in published literature. These variables include history of spectacle use by both parents, distance of TV watching, duration of TV watching, duration of computer/mobile game and outdoor playing [27]. Being female, being in the age group of 10–13, being in the age group of 14–18 years, watching television for 2–4 hours/day, watching television at <1 m, watching television at 1–2 m, mobile exposure for 2–4 hours/day, mobile exposure for >4 hours/day, medical visit while experiencing symptoms and no medical visit experience [29] were also identified as factors which showed statistically significant association with VI. These associated factors in published literature were also used as independent variables in this study. The variables included, age of the child, sex of the child. Parents/guardian’s education level, playing outdoors, watching TV every day and playing mobile/TV video games were considered as independent variables. Additional independent variables included in this study were family size, family income and the parents'/guardians awareness of the child’s eye problem. Binary logistic regression was run for the mentioned variables using a relaxed criterion of P-value (<0.25) for variable selection for multiple regression. Accordingly, the selected variables were “Student’s sex”, “Respondent’s educational status” and “Awareness of child’s eye problem”.

In the multiple logistic regression, the only variable which showed statistically significant association was “awareness of child’s eye problem” (AOR = 2.2, 95%CI: 1.08–4.35) indicating a lesser odds of having a child with VI in the parents who are aware of their child’s problem. As this variable is not included any of the study in published literature, comparison was not possible. The absence of association with most of the independent variables identified in published literature may suggest the VI could be of genetic origin than the influence of environmental factors.

**Conclusion**

The findings of this study indicate that VI is a public health concern which needs due attention.
The leading causes of VI are refractive errors. VI due to Refractive errors in Children can easily be corrected with spectacles at an early age. If a child’s refractive errors are not corrected earlier than 9 years of age, a condition known as Amblyopia (Lazy eye) will occur. In Amblyopia the child’s vision is halted from developing and cause permanent VI or even worse conditions like low vision and blindness. Early detection and correction of VI in children is crucial to prevent the occurrence of permanent visual disability. This can be achieved through school eye screening and early referral, and having adequate and affordable supply of spectacles.

Limitations of the study

VA testing was done using 3 meter Snellen acuity chart. The 6 meter Log-MAR chart was available but using this chart was challenged by space problems. The standard retro-illuminated Log-MAR projector could not be available for the study. The results of this survey can be used to calculate sample sizes for other studies but the true prevalence of VI can only be determined by school screening. In order to generalize the findings of this study to the city of Addis Ababa, it is necessary to conduct similar study in the two more randomly selected sub-cities.

Declarations

Ethical approval and consent to participate

The study protocol was approved by the Institutional Review Board of Jimma University, Ethiopia, and Addis Ababa Regional Administration Educational Bureau, Addis Ababa, Ethiopia. Official letter of support was written by Education bureau to Lideta sub-city Administration Education office. Official support letters were written to seven primary schools which were included in pre-testing and the study. Written and signed consent was obtained from parent/legal guardians to participate into the study and their respective children too. All parents/ guardians of the children were given the information on the status of his/her child’s eye health. For those children identified as having impaired vision or other problems, glass prescriptions, referrals to eye units and all the necessary information were provided.

Consent for publication: Not applicable

Availability of data and materials: Available upon request

Competing interests: The authors declare that they have no competing interests

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Authors’ contributions:

AB: conceived the study, formulated the research questions, and designed the study, AB: coordinated the data collection, analyzed the data, and drafted the paper. AB, LS and TS: did the analysis, reviewed the paper for intellectual content. All authors read and approved the final manuscript.
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Abbreviations

Log-MAR: Logarithm of Minimum Angle of Resolution, PBL: Prevention of Blindness, VA: Visual Acuity, VCS: Vision Care Services, VI: Visual Impairment

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Figures

![Pie chart showing causes of VI in school children in Lideta Sub-city, 2019](image)

**Figure 1**

Causes of VI in School Children in Lideta Sub-city, 2019