

Causes of childhood blindness: Results from Sebeta School for the Blind, Oromia Region, Ethiopia

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ABSTRACT

Background: Childhood blindness is a widespread problem in developing countries such as Ethiopia, so it's crucial to identify region-specific causes to combat visual impairment.

Objective: To determine the causes of blindness in school children attending the Sebeta School for the Blind in the Oromia region.

Design: Cross-sectional descriptive study.

Subjects: All children attending the school during the study period were included, and those willing to participate were the study subjects.

Methods: The study involved all school children who volunteered, with some excluded: those who declined to participate, were 18 years or older, absent, or uncommunicative. The researchers collected data through a questionnaire based on the WHO/PBL format for children with blindness and low vision, modified as appropriate, and eye exams administered by the principal investigator and an ophthalmic nurse. Key informants (e.g., teachers) were also interviewed. They also used secondary data from students' files to supplement and verify primary data. The data quality was ensured, and it was analyzed using SPSS version 23. Descriptive analysis was used to determine variable means, frequencies, and proportions.

Results: One hundred and fifty five students aged 7-17 years were examined. Childhood blindness affected 148 of them (95.5%). The most common anatomical cause of blindness was the whole globe (37.8%). The cause of blindness was unknown in over two-thirds of cases, with abnormalities since birth and cataracts responsible for 14.9% and 13.5%, respectively. Childhood factors accounted for most of the known causes of SVI/BL (15.5%), with trauma (7.4%) being the most common. Forty-two percent of the causes were avoidable, 14.2% preventable, and 27.7% treatable.

Conclusion: Trauma, a preventable cause, is recognized as a cause of avoidable blindness in these children. Cataract and glaucoma, treatable causes of childhood blindness, have become major causes in blind school children in Central Ethiopia, displacing corneal blindness.

Recommendations: Policymakers should consider these findings when designing health service frameworks. Primary health workers should receive training to refer children early for treatable childhood blindness causes. Increasing the number of specialist paediatric ophthalmic services is crucial for cataract and glaucoma treatment. Preventing trauma involves strict adult supervision and creating a safe domestic environment for children.

Key words: Blind school, Childhood blindness, Ethiopia

INTRODUCTION

Childhood blindness or severe visual impairment is caused by diseases and conditions in childhood or early adolescence, which, if left untreated, can lead to permanent blindness later in life. The causes of childhood blindness vary depending on socio-economic development and access to primary health and eye care services¹.

Preventable causes are responsible for a high percentage of childhood blindness in low-income countries, and community-based interventions are needed to address this. While treatable diseases like cataracts can restore vision in children across all regions, specialized

expertise and equipment are necessary as children's eyes differ from adults¹.

In 2010, the estimated number of blind children worldwide was 1.26 million, a decrease from the previous estimate of 1.4 million in 1999. However, in sub-Saharan Africa, there was a 31% increase in blind children to 419,000².

The causes of childhood blindness are evolving. In many developing countries, integrated management of childhood illness programs has reduced corneal scarring due to measles and vitamin A deficiency. Therefore, the proportion of blindness caused by cataracts is growing. Retinopathy of prematurity is becoming a significant

cause in middle-income countries, and the prevalence of refractive errors, particularly myopia, is rising in school-age children¹.

Approximately 1.4 million children worldwide are blind, accounting for 3.9% of general blindness globally. Seventy five percent of these children live in the poorest regions of Africa and Asia, primarily due to social and economic disparities and inadequate access to primary health care and eye care services¹. This is also true for Ethiopia, where primary health care and eye care services are poor.

A global update on childhood blindness and its causes highlights that in countries like Ethiopia, 7-31% of childhood blindness and visual impairment can be avoided, 10-58% can be treated, and 3-28% can be prevented⁴.

Blind children face lifelong visual impairment, resulting in emotional, social, and economic costs for them, their families, and society⁵. In countries like Ethiopia, where there is little awareness of childhood blindness, it becomes more challenging for affected children to integrate into society.

Significance of the study: Childhood blindness is a major public health issue, and it is crucial to identify region-specific causes to aid nations in preventing and treating childhood blindness and visual impairment¹. The findings of this study can aid in understanding region-specific causes and guide appropriate resource allocation for the prevention and treatment of childhood blindness.

“Vision 2020,” the global initiative against avoidable visual impairment led by the WHO and the International Agency for Prevention of Blindness, prioritizes children. Country-specific programs are developed and implemented based on specific priorities for prevention, treatment, and rehabilitation, given the varying causes of visual loss. This study is of immense importance in identifying such causes of visual loss in children, serving as a reference for such programs¹.

In 2001, a study on the causes of childhood blindness was conducted at the Sebeta School for the Blind⁵. Since the study was conducted, there have been changes in the community’s knowledge, attitude, and practice and improvements in health facilities and services. These factors impact childhood blindness. The present study was, therefore, aimed to identify the causes of childhood blindness at the same school, including determining anatomical sources of visual impairment, uncovering underlying causes for severe visual loss, and identifying preventable or treatable factors contributing to blindness in children. The results will help identify changes and guide further public health interventions for children with treatable eye conditions.

MATERIALS AND METHODS

Study setting: The study was conducted at Sebeta School for the Blind, a boarding school that houses around 256 blind or visually impaired children aged 7-23 years. Some students have other physical or learning disabilities. Most are from Ethiopia’s Oromia region and live on the school premises up to the age of 14 years or grade 6, after which they move to town lodgings. The curriculum is taught in Braille in the local language (Afaan Oromo).

Study design, study period and population: A blind school-based cross-sectional descriptive study was conducted from October 2019 to January 2020. All students attending Sebeta School for the Blind during the study period were taken as the source population. The study subjects were those willing to participate.

Inclusion/exclusion criteria: All children attending the school and present during the study period were included. Excluded from the study were students who refused participation, were aged 18 years or older, were absent from school three times, or couldn’t provide the necessary history due to communication barriers.

Sampling: Children aged 7-17 years among the 256 students were invited to participate. Those who agreed were included as study subjects.

Data collection procedure and instruments: Data was collected through a structured questionnaire, including personal details, history of eye surgery, and accompanying disabilities. An eye examination was also performed to identify the anatomical site and possible cause of visual impairment, and key informants (e.g., teachers) were also interviewed.

The questionnaire was based on the WHO/PBL format for children with blindness and low vision, modified as appropriate. The WHO Program for the Prevention of Blindness developed the Eye Examination Record for Children with Blindness and Low Vision (ERCB) to record causes of visual loss among children in blind schools, hospitals, and population-based surveys.

Visual acuity levels were measured using a Snellen “illiterate” E optotype. If a child could not see the 3/60 optotype, their perception of light was checked. Distance visual acuity was measured for each eye and both eyes separately. A pinhole was used to assess visual acuity improvement. Students whose visual acuity improved with a pinhole were referred for further refraction. Anterior segment examination was done using a portable slit lamp. Posterior segment evaluation was performed

using a direct ophthalmoscope after pupil dilation with one drop of 1% tropicamide eye drop, with a 30-minute wait for it to work.

Data were collected by the principal investigator, and an ophthalmic nurse familiarized with the questionnaire and objectives of the study. Secondary data from the students' files complemented the information and/or validated the primary data collected directly. Students who needed further workup and intervention were referred to Saint Paul's Hospital Millennium Medical College (SPHMMC).

Data quality assurance: Structured data collection forms were used to gather all relevant study data. Data were collected by an ophthalmic nurse, with regular supervision by the principal investigator. The principal investigator checked all data for completeness and resolved any identified issues.

Data processing and analysis: Data were entered into SPSS version 23. Descriptive analysis was used to determine means, frequencies, and proportions. Cross-tabulations were also performed, and tables were used to present the findings as appropriate.

Operational definitions

- *Child:* A human being below the age of 18 years¹⁴.
- *Visual Impairment (VI):* Visual acuity worse than 6/18 up to 6/60 in the better eye¹⁵.
- *Severe visual impairment:* Visual acuity worse than 6/60 up to 3/60 in the better eye¹⁵.
- *Blindness:* Visual acuity of <3/60 in the eye with better vision¹⁵.
- *Childhood blindness:* An eye condition that results in blindness or severe visual impairment¹.
- *Avoidable blindness:* Results from conditions that could have been prevented or controlled if the available knowledge and interventions had been timely applied¹.
- *Uncommunicative:* Not disposed to talk or impart information¹⁶.

Ethical considerations: The SPHMMC review board approved the research proposal, and permission was obtained from the Sebeta School director. Informed written consent was also obtained from each participant's parent or guardian. If not available, the teachers signed the consent form, which was attached to each questionnaire. Patient confidentiality was maintained using initials instead of full names on the questionnaires. Children with treatable eye conditions were identified and referred to SPHMMC for further assessment and treatment.

RESULTS

Demographic background: One hundred and fifty-five students (63.2% male, 36.8% female) aged 7-17 years (mean age: 13.0) were examined. Most (62%) were aged 7-14 years, and 37.5% were over 14 years. Two students (1.2%) had additional impairments (mental retardation and hearing loss). Seventeen students (11.%) had a family history of similar conditions. Visual loss began between ages 1-14 years for most students (54.8%), followed by birth (36.1%) and the first year of life (7.7%). The onset age was unknown for 1.3% of students.

Out of 155 students, 148 (95.5%) had childhood blindness per WHO category: Seven (4.5%) had visual impairment, and 15 (9.7%) had severe visual impairment. Three students (1.9%) showed improvement with a pinhole for the right eye and one (0.6%) for the left eye (Table 1).

Regarding functional vision, 61(39.4%) had no residual vision, 35(22.6%) had useful residual vision, 31(20%) could see to walk, 9(5.8%) could recognize faces, and 19(12.3%) could see print. Twelve (7.7%) had previous surgery: 7(58.3%) cataract surgery, 2(16.7%) eye removal, and 3(25%) unknown. Sixteen (10.3%) had previous trauma, 135(87.1%) had no history of trauma, and 4(2.6%) were unsure.

Regarding anatomical causes of SVI/BL in 148 students, the globe was the most common site (37.8%), with phthisis being the most common lesion (21.6%). Optic nerve pathologies accounted for 21.0%, corneal

Table 1: Presenting visual status of students attending Sebeta School for the Blind by sex and age, August 2019

WHO category of visual loss	Sex		Age (years)		Total (N%)
	M	F	7-14	15-17	
Visual impairment (6/18-6/60)	6	1	4	3	7 (4.5)
Severe visual impairment (6/60-3/60)	10	5	11	4	15 (9.7)
Blindness (<3/60)	47	29	42	34	76 (49)
Blindness (NLP)	35	22	39	18	57 (36.8)
Total					155(100)

pathology, mainly corneal scar, for 16.2%, and cataract for 14.2%. The retina and uvea were the least common sites, accounting for 5.4% and 3.4%, respectively (Table 2).

Aetiological causes of SVI/BL: For more than two-thirds

of the students, the aetiology was unknown. Abnormalities since birth and cataract accounted for 14.9% and 13.5% of the unknown aetiology group, respectively. Childhood factors were responsible for most of the known causes of

Table 2: Anatomical site of abnormality in 148 students with SVI/BL in Sebeta School for the Blind, August 2019, based on WHO/PBL classification

Anatomical site	Total (N%)
Globe	56 (37.8)
Phthitic	32 (21.6)
Anophthalmos	3 (2.0)
Microphthalmos	1 (0.7)
Buphthalmos	17 (11.5)
Removed	1 (0.7)
Disorganized	2 (1.4)
Cornea	24 (16.2)
Scar	20 (13.5)
Staphyloma	4 (2.7)
Lens	21 (14.2)
Cataract	21 (14.2)
Uvea	5 (3.4)
Aniridia	1 (0.7)
Coloboma	2 (1.4)
Uveitis	2 (1.4)
Retina	8 (5.4)
Dystrophy	5 (3.4)
Retinoblastoma	1 (0.7)
Toxoplasma scar	1 (0.7)
Coloboma	1 (0.7)
Optic nerve	31 (21)
Atrophy	26 (17.6)
Hypoplasia	4 (2.7)
Coloboma	1 (0.7)
Globe appears normal	3 (2.0)
Cortical blindness	3 (2.0)
Grand Total	148 (100)

SVI/BL (15.5%). Among childhood factors, trauma was the most common cause (7.4%), followed by hereditary eye disease as the second most common cause. Heredity was autosomal dominant in 4(2.7%) students, unspecified in 6(4.1%), while toxoplasmosis causing macular

scar was found in 1(0.7%) student. Additionally, two students had childhood neoplasm, one with brain tumour with compressive optic neuropathy and the other with retinoblastoma.

Table 3: Aetiologic category of visual loss in 148 students with SVI/BL in Sebeta School for the Blind, August 2019, based on WHO/PBL classification

Aetiology	Total (N%)
Hereditary	10 (6.8)
Autosomal dominant	4 (2.7)
Unspecified	6 (4.1)
Intrauterine factor	1 (0.7)
Toxoplasmosis	1 (0.7)
Childhood factors	23 (15.5)
Vitamin A deficiency	4 (2.7)
Measles	6 (4.1)
Neoplasm	2 (1.4)
Trauma	11 (7.4)
Unknown aetiology	114 (77.0)
Cataract	20 (13.5)
Glaucoma/Buphthalmos	17 (11.5)
Abnormality since birth	22 (14.9)
Other	55 (37.2)
Grand Total	148 (100)

Avoidable causes of SVI/BL: Forty-two percent of the students had avoidable causes of childhood blindness. Fourteen percent were preventable, and 28% were

treatable. Trauma (7.4%) was the most common preventable cause of SVI/BL, while cataract (13.5%) was the most common treatable cause (Table 4).

Table 4: Avoidable causes of visual loss in 148 students with SVI/BL in Sebeta School for the Blind, August 2019, based on WHO/PBL classification

Aetiology	Total (N%)
Preventable	21 (14.2)
Trauma	11 (7.4)
Measles	6 (4.1)
Vitamin A deficiency	4 (2.7)
Treatable	41 (27.7)
Glaucoma	17 (11.5)
Uveitis	2 (1.4)
Cataract	20 (13.5)
Neoplasm	2 (1.4)
Total avoidable	62 (41.9)

Eight students had the potential for improved visual acuity with intervention. Two had pseudophakia, one improved with pinhole, and the other had dense posterior capsular opacity. Four had dense cataracts and light perception acuity, and two had refractive errors. The students were referred to SPHMMC for further attention. The school director was also informed for follow-up.

DISCUSSION

Ninety-five-point five percent of the examined blind students at the Sebeta School for the Blind had SVI/BL, comparable to 93% reported in 2015 and 94.5% in 2001 in Amhara regional state, Northwest Ethiopia² and children in schools for the blind in Ethiopia (Bako, Shashemene, and Sebeta)⁵, respectively.

Sixty percent of the students in the school were included in the study, indicating that many elementary school students were over 18 years old. This delay could be due to a lack of Braille educational support materials and late school start-ups for blind children. Also, their parents or guardians may abandon children with SVI/BL.

This study found that the lesion of the whole globe was the most common cause of SVI/BL. Similar results were reported in the People's Republic of China, where the whole globe was also the most typical anatomical site of visual loss (25.5%)¹². A 2015 research report from Northwest Ethiopia found that corneal pathologies were the most frequent causes of SVI/BL, which contrasts with the results of this study². Measles immunization coverage differed between Oromia (38.8%) and Amhara (33.3%)¹⁷, regions according to the 2005 Ethiopian Demographic and Health Survey (DHS) which may have contributed to the difference in the causes of SVI/BL in these regions. Similar findings were reported in a study conducted in Eritrea, where corneal pathologies accounted for the highest proportion of SVI/BL (16.9%)⁷. Corneal pathologies were also the most common causes of SVI/BL in East and southeastern African countries, such as Malawi, Kenya, and Uganda, with a prevalence of 35.2%⁹.

It was also found that corneal scar/phthisis accounted for 35.1% of SVI/BL cases, with measles and vitamin A deficiency contributing to only 6.8%. Measles immunization coverage has improved in Ethiopia over the years, which may explain the low number of affected children. However, measles and vitamin A deficiency may have contributed to corneal scar/phthisis cases where the causes were unclear. The prevalence of Bitot's spots in Ethiopia was 1.7% among children aged 6-71 months, and 47% of children aged 6-35 months received vitamin A supplements, according to the DHS 2019⁸. The results may appear low, but the problem remains significant.

Reviewed literature has conflicting classifications for phthisis bulbi, with the majority considering it caused by childhood factors in developing countries. The current study found that corneal scarring and phthisis accounted for 35.1% of cases, which is lower than a study from 19 years ago in Ethiopian schools for the blind, where it accounted for 62.4%⁵. Similar findings were reported in other countries, including Chile (35.9%) and South India (38.4%)¹⁰.

In the study, 21 (14.2%) students with SVI/BL had cataracts, and 7 (33.3%) had cataract surgery on at least one eye. Compared to the four East African countries, where 18% of children attending schools for the blind had cataracts as the primary cause of visual impairment, and 83% had undergone cataract surgery on at least one eye¹⁹. The number of children in this study who had undergone cataract surgery was much lower.

Of the subjects in this study, 41.9% had avoidable causes of SVI/BL, with treatable causes accounting for the majority (27.7%). In contrast, a 2015 study in

Northwest Ethiopia reported over 80% of the causes were avoidable, with potentially preventable causes accounting for 65%². The proximity of the school to Addis Ababa, where healthcare is easily accessible, and prior visits by governmental and non-governmental organizations to the Sebeta school may explain the lower percentage (41.9%) of avoidable causes of SVI/BL found in this study. This result is similar to findings in Eritrea, where avoidable causes of childhood blindness were reported at 47.9%⁷. In contrast, the percentage of avoidable causes of SVI/BL found in this study (41.9%) was higher than the results of a study conducted in China, which reported 37.5% of avoidable causes (15% potentially preventable and 22.5% potentially treatable)¹¹.

The WHO/PBL eye examination form for children with blindness and low vision was used. Many of the research results consulted used the same document for comparison, ensuring a reliable and consistent benchmark for comparison.

In this study, most students with SVI/BL (77.0%), most of whom had phthisis bulbi, had an unknown cause. This may be due to the prolonged presence of the ocular problem and delayed consultation with health professionals.

Some students involved in this research might not know the probable cause and the age of onset of their blindness, and some were also not cooperative during physical examination.

Children from remote and underserved parts of the country may not attend a special school. Therefore, there may be under-representation of these children.

CONCLUSION

- (i) Trauma, a preventable cause of blindness, has become a recognized cause of avoidable blindness in blind school children.
- (ii) Cataract and glaucoma, both treatable causes of childhood blindness, have become major causes of blindness in blind school children in Central Ethiopia. This is a notable shift from the commonly reported corneal blindness.
- (iii) Regarding the anatomic site, lesion of the whole globe was the most common cause of SVI/BL.

Eight students in this study had visual acuity that could be improved with further workup and intervention, indicating a lack of screening before entering school.

RECOMMENDATIONS

A low percentage of students in this study had undergone cataract surgery. Many factors could be considered as causes, but the limited number of centers in Ethiopia that provide such services and the low health-seeking behavior of the community may be the major ones. We recommend training primary health workers to refer children diagnosed with treatable causes of childhood

blindness early and increasing the number of specialist paediatric ophthalmic services to address paediatric cataracts and glaucoma. Community awareness creation could also contribute a lot.

Ensuring strict adult supervision of children and creating a safe domestic environment can help prevent trauma. Furthermore, community education on the importance of seeking immediate professional medical attention after an injury is crucial. We recommend providing low-vision aids for the children. An ophthalmic exam should be mandatory for registering students in special needs schools.

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