Prevalence and causes of childhood blindness in Mesqan District, Gurage Zone, Ethiopia: A study utilizing health extension workers

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ABSTRACT

Objective: To determine the prevalence and causes of childhood blindness in Mesqan District in Gurage zone, Ethiopia

Methods: This community-based cross-sectional survey, conducted in July 2024, included 25 recruited kebeles, with 65,528 children. Health Extension Workers (HEWs) performed house-to-house screenings and reported cases of childhood blindness. After screening, ophthalmic examinations were conducted by the principal investigator to confirm the visual impairment. Data on the demographic characteristics, anatomical sites, and aetiology of the identified cases were collected and analyzed.

Results: Among the 25 kebeles surveyed HEWs reported 36 cases of childhood blindness, of which 35 children were examined. Nine (25.7%) cases were confirmed to have Binocular Blindness / Severe Visual Impairment (BL/SVI). The estimated prevalence of childhood BL/SVI was 0.014% (0.14 per 1000; 95% CI 0.0048%–0.0232%). The lens (44.4%) was the most common anatomical site of blindness, followed by cornea and whole globe (22.2% each). The aetiology of blindness also varies. Of the cases, 44.4% had unknown origins, while postnatal factors accounted for 44.4%.

Conclusion: The study findings indicate a low prevalence of childhood BL/SVI in the Mesqan district. However, lens abnormalities remain the most common cause of childhood blindness.

Key words: Childhood blindness, Health Extension Workers (HEWs), Community-based screening, Survey, Rural Ethiopia

INTRODUCTION

The World Health Organization (WHO) estimated 285 million visually impaired people worldwide: 39 million blind and 246 million with low vision. Childhood blindness accounts for 4% of this burden[1], with about 1.4 million affected children, mostly in low-income countries with limited eye care access[2,3]. Major causes include retinal diseases, whole-eye lesions (like microphthalmos), cataracts, and corneal scarring[3].

Ethiopia, a low-income country, faces a high burden of childhood blindness. According to a 2006 national survey conducted in Ethiopia on the prevalence and causes of blindness and low vision, the national prevalence of blindness is 1.6%, and the prevalence of childhood blindness is 0.1%, contributing 6% to the total burden of blindness in Ethiopia[4]. A 2009 Sekoru district survey estimated local childhood blindness/SVI at 0.062% among under-16s, mainly from lens/cornea issues such as cataract and VAD-related scarring[5].

Childhood blindness is a significant global health issue that has a profound impact on affected children, their families, and the society as a whole[6]. A large proportion of low vision and blindness cases in the country are attributed to causes that could have been avoided, either through prevention or treatment[4,7].

This study is unique in that it utilizes Health Extension Workers (HEWs) as key informants in rural Ethiopia, where community-level data on childhood blindness are scarce. By employing HEWs, who are embedded in the community health system, this study aims to provide a more comprehensive estimate of childhood blindness and its causes in the Mesqan District. We hypothesized that the use of HEWs could provide an efficient and reliable method to estimate the prevalence and causes of childhood blindness in rural Ethiopian settings.

MATERIALS AND METHODS

Study period and design

"A community based cross-sectional survey study conducted in the Mesqan District, Gurage Zone, Ethiopia, in July 2024. All children aged < 16 years who had lived in the study administrative unit for more than six months were included in the study."

Sample size

A survey was conducted in 25 out of 26 rural kebeles in the Mesqan district which constitutes a total of 65,528 children <16 years of age. One kebele was excluded due to inaccessibility during the data collection period, as heavy rains and flooding made the roads impassable. The remaining 25 kebeles were selected to ensure geographic and demographic representativeness, covering approximately 96% of the district rural child population. The sample size was determined by including all children under 16 years in the selected kebeles (total 65,528), providing adequate power to estimate low-prevalence conditions such as blindness.

Data collection procedure

Forty-six Health Extension Workers (HEWs) who had been working in their respective kebeles and knew the community well, participated in the data collection. The HEWs read, write and spoke the local language well. They were involved in community health activities, such as immunization, vitamin A supplementation and raising awareness of reproductive health. The selected HEWs had a 1-day training course on common eye diseases, such as refractive error, strabismus, retinoblastoma, cataract, and trachoma. The training course also covered how to identify children with blindness, the common causes of childhood blindness, the use of visual aids, and the filling of child reporting forms based on the WHO eye examination record for blind children. After the completion of the training course, a demonstration of how to acquire the visual acuity of children was shown, and HEWs were instructed to demonstrate the methods they learned to make sure they understood what had been delivered.

Each HEW was given a printed 3-meter distance tumbling-E chart and an HOTV chart to record the VA of the children with daylight illumination. HEWs were then instructed to use various means within their communities to identify children with blindness, including house-to-house visits, church announcements, and social gatherings.

Children suspected of being blind or visually impaired (BL/SVI) were referred to the examination site for further evaluation by an ophthalmologist. Children who were <5 years of age but suspected of having eye problems by the HEWs or the parents/caregivers of the child were brought to the examination site.

The activities of the HEWs were monitored through reminder text messages, phone calls, and by an assigned supervisor, who also took the training to ensure that the survey was conducted for every child.

A complete ophthalmic examination was performed at an ophthalmic center. The VA of the children referred by HEWs was carefully tested using age-appropriate methods. Snellen visual charts were used for children over 5 years of age who could recognize the chart optotypes in a well-lit room, while the HOTV chart was used for children aged 3-5 years and a CSM examination method was used for children below the age of 2 years. The eyes of the children were examined using torch light and slit lamp biomicroscope. If further examination of the retina was required and there were no anterior segment pathology precluding posterior segment examination (for example, dense cataract, dense corneal opacity or a phthisic globe), the pupil was dilated after informed verbal consent was obtained from the guardian. Parents or legal guardians of the children were interviewed and all relevant case histories, family histories, and histories of the mothers' pregnancies were collected.

Variables and operational definitions

- Child was defined as 0 - 15 years (15 completed years)
- *Presented visual acuity*: Visual acuity taken as the visual acuity of the child at presentation without any correction.
- *Severe Visual Impairment (SVI):* Presenting visual acuity of <6/60-3/60
- Blindness was defined as;
  - Presenting VA of less than 3/60 for those who were able to read the VA chart
  - Presenting VA finger counting in <3 meter for those vision taken with finger counting method
  - Not able to fix or follow in children aged <2 years and mentally handicapped uncooperative children
- *In SVI and blindness:* Vision was considered in better eye

Data processing and analysis

A thorough data-cleaning process was undertaken to identify and rectify any errors, inconsistencies, or missing values. The collected information was coded and entered into SPSS version 27 software. Descriptive analysis was conducted to provide a comprehensive summary of the collected data. In addition to descriptive statistics, 95% confidence intervals were calculated for prevalence estimates using binomial exact methods.

Ethical considerations

(i) Ethical clearance was obtained from Addis Ababa University, Department of Ophthalmology Research Office and the Institutional Review Board prior to conducting the study (reference number: 02/2024). Each child's name and other identification-revealing information are not used to ensure confidentiality.

(ii) Written consent from the parents or legal guardians of the children was obtained for each child during the ophthalmic examination after explaining the purpose of the study.

(iii) All treatable cases were treated at the eye care unit, and cases where the service was not available at the unit were referred to the Menelik II tertiary eye care center. The contact information of the Principal Investigator (PI) of the study was provided to the parents or guardians of all referred cases. This was done to help facilitate the referral process and ensure that patients were able to successfully access the tertiary care they required at the Menelik II Referral Hospital.

RESULTS

Twenty-five kebeles were surveyed encompassing 65,528 children; among these, in eight kebeles no case of childhood blindness was reported by the HEWs, and in one kebele one child was reported to have blindness but was not available for examination for three separate days. Of the total 65,528 children screened, HEWs reported 36 cases of childhood blindness and 35 of them were thoroughly examined by the principal investigator. Nine of the thirty-five (25.7%) cases were confirmed to have blindness/severe visual impairment, and the rest had mild visual impairment or mild allergic/infectious conjunctivitis. Five (55.6%) of them were boys and 4 (44.4%) of them were girls and the age range was between 10 months and 14 years with a mean age of 9.2 years (boys) and 8.45 years (girls) (Table 1). Excluding the area where children with suspected, but not confirmed, blindness lives, it makes the total estimated number of children 63,404. Using our methodology, the estimated district prevalence of childhood blindness/SVI was 0.0142% (95% CI: [0.00491%, 0.0235%]). Of the 35 examined, 55% were under 5 years, but only 22% (2/9) of confirmed BL/SVI cases were in this group.

Table 1: Age, sex, VA cross tabulation of binocular BL/SVI Mesqan district, Ethiopia, 2024

Age	Sex (M/F)	Visual Acuity				
		Does not fix or follow	6/60-3/60	3/60--LP	NLP	
10 months	F	X				
2 years	M	X				
10 years	F			X		
10 years	M		X			
10 years	M			X		
10 years	M			X		
11 years	F			X		
12 years	F				X	
14 years	M			X		
Total		2		6	1	9

Lens was the most common anatomical site of BL/SVI (44.4%) followed by cornea and whole globe with the same magnitude (22.2% each) (Table 2).

Table 2: Anatomical sites of childhood blindness and severe visual impairment (BL/SVI), Mesqan district, Ethiopia, 2024

Anatomical site	Number of cases of bl/svi	(%)
Cornea	2	22.2
Lens	4	44.4
Whole globe	2	22.2
Amblyopia	1	11.1
Total	9	100

Two cases of cataract and one case of phthisis bulbi were attributed to trauma, one was attributed to intrauterine factors (congenital cataract secondary to congenital rubella syndrome) (Table 3).

Table 3: Etiology of childhood BL/SVI Mesqan district, Ethiopia, 2024

Etiology	Number of cases	(%)
Intrauterine	1	11.1
Postnatal/Infancy/ childhood factors	4	44.4
Unknown	4	44.4
Total	9	100.0

Among the corneal opacity cases, one was attributed to a postherpetic infection. Four of these cases, 44.4% cases had an unknown etiology. (Table 4). The case with amblyopia was due to post-surgical aphakia for childhood cataract, which was treated at a tertiary eye hospital during early infancy, but the parents failed to adhere to the postoperative follow-up due to financial reasons.

Table 4: Etiology* Anatomical site crosstabulation

		Etiology			
Anatomical site		Intrauterine	Postnatal/childhood	Unknown	Total
	Cornea	0	1	1	2
	Lens	1	2	1	4
	Whole globe	0	1	1	2
	Amblyopia	0	0	1	1
	Total	1	4	4	9

DISCUSSION

Health Extension Workers (HEWs) have been used as a tool to identify different non-ocular childhood illnesses with a positive predictive value ranging from 61% to 89% for different childhood illnesses in Ethiopia[8]. In this study, we used HEWs, who are government employees, that provide house-to-house outreach services in rural Ethiopia. To the best of our knowledge, this community survey utilizing HEWs as Key Informants (KIs) to determine the magnitude of childhood blindness and severe visual impairment is the first of its kind in Ethiopia.

Out of the thirty-five children identified by the HEWs, only nine were confirmed to have BL/SVI, making the positive predictive value of HEWs 25.7%. This value differs from study to study, ranging from 13.2%[9] to 32%[5,10]. The reason for the low PPV was that the majority of the referred children for examination were below the age of 5 years, where VA was not required to be taken by the HEWs, and all cases with any ocular illness or condition was sent for examination. Potential under detection in children under 5 years may stem from HEWs' reliance on parental reports without mandatory VA testing. Even though the PPV for the detection of childhood blindness was low, all referred children had mild ocular infection or mild visual impairment.

In addition to the lower PPV of HEWs, the overall prevalence of childhood BL/SVI observed in this study was lower than previously reported in other Ethiopian districts. This may be partly explained by the exclusion of one kebele due to inaccessibility during data collection, potential under-detection of younger children (<5 years), and contextual factors such as improved preventive and eye-care interventions in recent years.

The district total prevalence of childhood BL/SVI was 0.14 per 1,000 children. This estimate is comparable to the 2017 and 2022 study conducted in Nigeria in different district areas (0.12 per 1,000 children)[9,11]. However, the prevalence estimates from the other studies showed more substantial differences. A 2010 study from Ethiopia reported an estimated district prevalence of 0.62 per 1,000 children[5]. Differences in methodology, study area characteristics, and health system engagement could explain these variations. Similarly, a 2011 study from China found a higher prevalence of 0.3 per 1,000 children and a study from Malawi reported a district prevalence of 0.4 per 1000[10,12].

The observed variability in prevalence estimates across these studies may be attributed to geographical and socioeconomic differences between the study settings. This may contribute to variations in underlying risk factors, number of children surveyed and access to eye care services for children.

Lens abnormalities, particularly cataracts, were the most common anatomical cause of BL/SVI in this study population, accounting for 44.4% of the cases. This finding is consistent with previous community-based reports from other parts of Africa[5,9,12]. In addition, one case of amblyopia was attributed to loss of follow-up after cataract surgery. This shows the need for early detection, improved access to surgical intervention, and effective postoperative follow-up care.

On the other hand a 2017 study conducted in Ethiopia among children attending schools for blind found cornea/phthisis secondary to measles and vitamin A deficiency to be the most common anatomical site of visual loss[13]. Considering the different methodologies used, direct comparison is difficult. Generally, using KIs over school screening represent the magnitude of childhood BL/SVL in the community by identifying children younger than the school age[14].

Eighty-nine percent of the cases were due to avoidable causes, with proper care and rehabilitation. Previous studies have also shown that a fairly large percentage of childhood blindness is due to either treatable or preventable causes: 89% in- Ethiopia[5], 60% in-Nigeria[9], 52% in-Iran[15] and 50% in-China[10].

Strengths and limitations

This study focused on rural areas (Mesqan District, Gurage Zone) where data on childhood blindness are limited.

This provides valuable information on the prevalence and causes of childhood BL/SVI in this region. We employed HEWs to collect data, utilizing their door-to-door access and relationship with the community for effective coverage of target groups, focusing on an essential public health problem. The results of this study can contribute to the development of targeted interventions and policies on childhood blindness in the area.

The limitations of this study may include, first, the methodology used for identification (key informant) could be missing some cases. If the key informants were not aware of those cases, they would not have been able to bring them forward. Furthermore, with the stigma associated with blindness, perhaps some parents or guardians do not like to report that their children have any visual impairment. Second, seasonal factors such as July rains may have affected accessibility beyond the excluded kebele. Third, this study did not evaluate the sociodemographic, economic or cultural aspects of childhood blindness, which might have missed significant contributing factors of the issue to create a more targeted intervention.

CONCLUSION

The magnitude of childhood BL/SVI in the Mesqan district of Gurage zone was found to be low. Lens abnormality remains the most common cause of childhood blindness in the area; posttraumatic cataract in particular accounts for the majority of cases. A significant proportion (44.4%) had unknown etiology and the majority of causes of BL/SVI were due to avoidable causes.

This survey showed the importance of enhancing community-based health workers' ability to identify and refer children with eye health concerns, potentially integrating VA training for under 5s.

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Authors' contributions

Fisiha Ademe Worku conceptualized the study, prepared the proposal, collected the data, conducted the analysis, interpreted the results, and drafted the manuscript for submission. Addisu Worku Teshome and Emmanuel Osie-Mensah supervised the analysis and interpretation of results and reviewed the manuscript.

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REFERENCES

1. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol*. 2012; **96**(5):614–618.
2. Burton MJ, Ramke J, Marques AP, Bourne RRA, Congdon N, Jones I, *et al*. The Lancet Global Health Commission on Global Eye Health: vision beyond 2020. *Lancet Glob Health.* 2021; **9**(4):e489–551.
3. Gilbert C. Blindness in children: declining magnitude over time - The International Agency for the Prevention of Blindness [Internet]. [cited 2023 Oct 22]. Available from: https://www.iapb.org/news/blindness-in-children-declining-magnitude-over-time/
4. Berhane Y, Worku A, Bejiga A, *et al.* Prevalence and causes of blindness and low vision in Ethiopia. *Ethiop J Health Dev*. 2007; **21**(3):204–210. doi: 10.4314/ejhd. v21i3.10050.
5. Demissie BS, Solomon AW. Magnitude and causes of childhood blindness and severe visual impairment in Sekoru District, Southwest Ethiopia: a survey using the key informant method. *Trans R Soc Trop Med Hyg*. 2011; **105**(9):507–511.
6. Pizzarello L, Abiose A, Ffytche T, Duerksen R, Thulasiraj R, Taylor H, *et al*. VISION 2020: The Right to Sight: a global initiative to eliminate avoidable blindness. *Arch Ophthalmol Chic* Ill 1960. 2004; **122**(4):615–620.
7. Teshome T. Prevalence and causes of blindness in Merhabete, North Shoa, Ethiopia. *Ethiop J Health Dev*. 2002; **16**(1):71–76.
8. Getachew T, Mekonnen S, Yitayal M, Persson LÅ, Berhanu D. Health Extension Workers' diagnostic accuracy for common childhood illnesses in four regions of Ethiopia: a cross–sectional study. *Acta Paediatr*. 2019; **108**(11):2100–6.
9. Aghaji AE, Ezegwui IR, Shiweobi JO, Mamah CC, Okoloagu MN, Onwasigwe EN. Using key informant method to determine the prevalence and causes of childhood blindness in South-Eastern Nigeria. *Ophthalmic Epidemio*l. 2017; **24**(6):401–405.
10. Xiao B, Fan J, Deng Y, Ding Y, Muhit M, Kuper H. Using key informant method to assess the prevalence and causes of childhood blindness in Xiu'shui County, Jiangxi Province, Southeast China. *Ophthalmic Epidemiol*. 2011; **18**(1):30–35.

11. Ajige JL, Muhammad N, Hassan-Wali A. Childhood blindness and visual impairment in a local government area in North-Central Nigeria: A key informant survey. *Niger Med J*. 2022; **63**(1):10 - 15.
12. Kalua K, Patel D, Muhit M, Courtright P. Causes of blindness among children identified through village key informants in Malawi. *Can J Ophthalmol*. 2008; **43**(4):425–427.
13. Asferaw M, Woodruff G, Gilbert C. Causes of severe visual impairment and blindness in students in schools for the blind in Northwest Ethiopia. *BMJ Glob Health*. 2017; **2**(2):e000264.
14. Du Toit R, Courtright P, Lewallen S. The use of key informant method for identifying children with blindness and severe visual impairment in developing countries. *Ophthalmic Epidemiol*. 2017; **24**(3):153–167.
15. Razavi H, Kuper H, Rezvan F, Amelie K, Mahboobi-Pur H, Oladi MR, *et al*. Prevalence and causes of severe visual impairment and blindness among children in the Lorestan Province of Iran, using the key informant method. *Ophthalmic Epidemiol*. 2010; **17**(2):95–102.