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Severe Visual Impairment and Blindness among Children in Mbarali district, Southern Tanzania: Prevalence and types.

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Abstract

Background
The prevalence of severe visual-impairment (SVI) and blindness (BL) in children is related to under-five mortality rates which have reduced in Tanzania. The prevalence and types of SVI-and-BL in Mbarali district is not known. We aimed to determine the prevalence and the types of SVI-and-BL among children in Mbarali district, Mbeya, Tanzania.

Methods
A population based cross-sectional survey was conducted from March 2016 to April 2016 among children less than 16 years in all villages of Mbarali district. A total of 113 village health workers one from each village were trained to identify children with poor vision of <6/60 in the better eye. A total of 247 children were identified and brought to an agreed examination center within the ward, for examination by an ophthalmologist and optometrist. Clinical examination involved assessment of visual-acuity, anterior and posterior segments of the eye and ocular-motility. The cause of visual loss and the type of visual-impairment or blindness was determined using the WHO classification system. All information was recorded on the WHO-recording form for severe visual-impairment or blindness. Population data were obtained from the 2010 census. Data were analyzed using SPSS version 20 and were summarized by frequency tables. Chi -square test was used to test for statistical significance of an association between variables.

Results
Key Informants identified 247 children of whom 66 were found to be SVI or BL. The overall prevalence of SVI-and-BL was 0.05% (95%CI 0.04–0.06%). The prevalence of SVI/BL among <5 years was 0.04% (95%CI 0.02–0.06%) and for children aged 5-15 years was 0.05% (95%CI 0.04–0.07%). Seventy per-cent of SVI-or-BL children were aged 5-15 years. The prevalence of SVI-and-BL among boys was 0.04% (95%CI 0.03–0.06%) while that of females was 0.05% (95%CI 0.03–0.07%). The causes of SVI- and-BL were lens related (27%), refractive error (15%) and corneal related conditions (13%). Severe visual-impairment or blindness was treatable (65%), preventable (9%) and unavoidable (25.7%).

Conclusion
The prevalence of severe visual impairment and blindness in Mbarali district is lower than previous estimates by the WHO, mostly treatable, commoner among girls aged >5 years. It is likely that preventable SVI and blindness have been reduced by successful child survival programs. In order to eliminate avoidable SVI-and-BL, Tertiary eye-services for children need be established at Mbeya Zonal Referral hospital to combat treatable SVI-and-BL.

Key words: Childhood, Blindness, Prevalence, Avoidable, Treatable, Preventable.

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Background

The magnitude of blindness varies between different regions of the world being between 0.3/1000 in high economy countries to 1.5/1000 in very low income countries. In 1999 estimates on blindness showed that there were 1.4 million blind children in the world, with 300,000 of them being in Africa [1]. Blindness in children has impact on the psychological, economic and social development of children and their families. The prevalence of blindness is closely associated with under-five mortality rates, therefore under-five mortality rates are used as proxy indicators for blindness in children [2].Studies worldwide have shown that many children become blind before their fifth birthday [3], indicating the need for strategies to control the problem at this period in the life of the child. The World Health Organization (WHO) targeted to reduce the prevalence of blindness in children from 0.75/1,000 to 0.4/1,000 by year 2020 using various strategies including elimination of corneal scarring from vitamin A deficiency and ophthalmia neonatorum (ON); provision of appropriate surgery for children with cataract with immediate optical correction; examination of all babies at risk of retinopathy of prematurity (ROP) and screen children and provide glasses for significant refractive error through school health programs [4]. In addition, enhanced implementation of child health survival programs under the Integrated Management of Childhood illnesses (IMCI) not only reduces child mortality but also controls blindness.

There has been a progressive reduction of the under-five mortality rate for Tanzania from 130/1000 in 2000 to about 49/1000 in 2015 [5] with a probable corresponding reduction in the prevalence of SVI and BL among children.

Previous reports on blindness in children in Tanzania had shown that majority of blindness was due to preventable causes especially corneal scarring due to measles infection and lack of vitamin A [6]. Another report in 2009 showed a low prevalence of 0.017/1000 in Kilimanjaro region [7]. Kilimanjaro region is not typical of many regions that lack tertiary eye services for children in Tanzania. To our knowledge, whole

population based community surveys to estimate the prevalence of SVI and BL in children have not been conducted in Tanzania.

Mbarali district is one of the 8 districts of Mbeya region. The district is administratively divided into two divisions, 17 wards, 113 villages and 169,818 households and a total population of 300,517 of whom 138,713 (68,983 males and 69,730 females) are children aged 0-15 years. Children below 5 years were 50,107 (8). Vitamin A and measles immunization coverage in the past 5 years has been around 72% and >95% respectively [8,9]. Health care is provided at one district hospital, 6 health centres and 39 dispensaries. Each village has two Village Health Workers (VHW) that have been selected by the communities and are responsible for health related community services. Routine eye care services are provided occasionally on outreach basis from the Regional Hospital, which is staffed by an Assistant Medical Officer in Ophthalmology. Mbeya Zonal Referral hospital currently provides tertiary eye services to children occasionally using a visiting paediatric ophthalmology team from the National Hospital, Muhimbili Dar-es-Salaam, about 950 kilometres away.

The aim of the study was to estimate the prevalence and classify the type of severe visual impairment and blindness among children in Mbarali district, using Village Health Workers as Key Informants to identify children for planning purposes.

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Methods

Study design

A population based cross-sectional survey was conducted from March 2016? -April 2016

Study setting

The study was conducted in the whole of Mbarali district in Mbeya region, Tanzania. Data were collected from households and schools. The target population was all children <16 years residing in the district

Study population

A total of 113 VHWs (Key informants) were used for identification of children. All 138,713 children aged <16 years residing in the district were eligible for detection by Key Informants.

***Inclusion criteria*:** Children with a presenting visual acuity of <6/60 in the better eye, who have been residing in the district for a minimum of 6 months and whose parents agreed to participate in the study were enrolled for the study.

***Exclusion criteria**:* Children with a presenting visual acuity of >6/60 in the better eye.

Data collection

One VHW was selected by the village to attend training on how to identify children with eye problems. A total of 113 VHWs were trained at 12 training stations in batches of 7-13 at one health facility in their respective ward. They were trained by trained Mbarali district hospital nurses for 6 hours on how to take visual acuity using the 6/60 optotype E chart at 6 meters, recognize, list and refer for examination children with poor vision, white pupillary reflex, unusually small/big eyes and any other eye abnormality. Village health workers identified children from their villages using house to house visits, screening vision at schools and by spreading information in churches and other

community gatherings. All children who could not read the 6/60 optotype on the E chart were listed. Pre-verbal children who could not be tested using the E chart but whose parents suspected them to have poor vision were also listed. Listed children were referred and brought for examination at a nearby pre-determined examination centre within the ward (where training of VHWs was done). All eligible children were examined by an ophthalmologist and an optometrist.

Clinical examination included assessment of visual acuity, anterior and posterior segment and ocular motility. Findings were recorded on the WHO Prevention of Blindness Programme eye examination record form for children with blindness and low vision [10] and the cause of visual loss determined using the WHO classification system [10]

Severe visual Impairment was defined as presenting visual acuity of <6/60-3/60, while blindness was defined as presenting visual acuity of <3/60 in the better eye. Preventable blindness was defined as that due to causes (eg, vitamin A deficiency, measles) that can potentially be prevented through simple health promotion, prevention and education at community and household levels by non-specialist. Treatable causes were conditions where surgical, medical or optical interventions could have preserved or restored sight (example, cataract and glaucoma surgery). All children requiring further treatment were listed and referred to Mbeya Zonal Referral Hospital. The rest of the children were counseled accordingly.

Data analysis

Data were analyzed using Statistical Package for Social Sciences version 20 software. Categorical data are presented as percentages while means were used for continuous data. The prevalence of blindness was estimated using the number of identified SVI/blind children in the study population as the numerator and the denominator was the total population of children 0-15 years according to 2010 census data [11]. Differences between proportions were ascertained using Chi squared test. A two-sided p-value of less than 0.05 was considered statistically significant and 95% confidence

intervals for prevalence were calculated assuming a normal approximation to the binomial distribution.

Ethical issues

Ethical approval was obtained from the Research and Ethics Committees of Muhimbili University of Health and Allied Sciences. Written informed consent was obtained from parents of all children before commencement of clinical examination. Permission to conduct the study was granted by the Mbarali District Executive Officer.

Results

A total of 247 children were brought for examination by VHWs. Hundred eighty one children had a visual acuity of > 6/60 in the better eye. Among them, 91 children had SVI/BL in one eye while another 82 children presented with various other eye conditions. This group of 181 children were managed accordingly but were not included in the analysis.

A total of 66 children were identified as having SV or BL. The overall prevalence of SVI and BL in children aged 0-15 years was 0.05% (95%CI: 0.04-0.06%), equal to 5 blind children per 10,000. Forty eight children had SVI (0.03%, 95%CI 0.02 – 0.04%) while 18 (0.01%, 95% CI 0.007-0.02%) were blind.

The distribution of children with SVI/BL by age and sex is shown in Table 1. Forty six (70%) of SVI or BL children were aged 5-15 years.

Table 1: Distribution of children with severe visual impairment and blindness by age and sex

Gender	Age		Total
	<5 years	5-15 years	No (%)
	No (%)	No (%)	
Male	7 (23)	24 (77)	31 (47)
Female	13 (37)	22 (63)	35 (53)
Total	20 (30)	46 (70)	66 (100)

The prevalence of SVI and BL among <5 years was 20/50,107 (0.04%; 95%CI 0.02-0.06%) and that of children aged 5-15 years 46/88,606; 0.05% (95%CI 0.04-0.07%).The prevalence of SVI and BL among boys was 31/68983 (0.04%, 95%CI 0.03-0.06%) while that of females was 35/69730 (0.05% 95%CI 0.03 -0.07%). There were no significant differences in prevalence of SVI or BL between sex (p=0.40) and age group (p=0.42).

Table 2: Anatomical causes of severe visual impairment and blindness

Cause	No (%)	95% CI
Lens related	18 (27.3)	**17.4-39.8**
Uncorrected refractive error	10 (15.2)	**7.9-26.6**
Corneal related	9 (13.6)	**6.8-24.8**
Squint and amblyopia	7 (10.6)	**4.7-21.2**
Cortical blindness	6 (9.1)	**3.8-19.4**
Optic atrophy	5 (7.6)	**2.8-17.5**
Congenital glaucoma	4 (6.1)	**2.0-15.6**
Retina	4 (6.1)	**2.0-15.6**
Whole globe	2 (3.0)	**0.5-11.5**
Uvea	1 (1.5)	**0.1-9.3**
Total	66 (100)	

The causes of SVI or BL are shown in Table 2. Lens related conditions (27%) and refractive errors (15%) were the leading causes of SVI or BL in the study population, followed by corneal related conditions (13%), squint and amblyopia (10.6%) and cortical blindness (9%).

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Table 3: Classification of type of severe visual impairment and blindness

Type of SVI or BL		No (%)	95% CI
Avoidable			
1. Preventable	Conjunctivitis	5 (7.6)	**2.8 -17.5**
	Measles related	1 (1.5)	**0.1 - 9.3**
	Subtotal	*6 (9.1)*	**3.8 -19.4**
2. Treatable	Cataract	18 (27.3)	**17.4 - 39.8**
	Refractive Error	10 (15.2)	**7.9 - 26.6**
	Congenital glaucoma	4 (6.1)	**2.0 - 15.6**
	Amblyopia	7 (10.6)	**4.7 - 21.2**
	Keratoconus	3 (4.5)	**1.2 - 13.6**
	Uveitis	1 (1.5)	**0.1 - 9.3**
	Subtotal	*43 (65.1)*	***52.4 - 76.2***
Unavoidable			
	Cortical blindness	6 (9.1)	**3.8 - 19.4**
	Retina/optical nerve disease	9 (13.6)	**6.8 - 24.8**
	Congenital nystagmus	2 (3.0)	**0.5 - 11.5**
	Subtotal	17 (25.8)	**16.1 - 38.2**
Total		**66 (100)**	

Most (73%) of SVI and BL was avoidable (preventable and treatable). Among this group, treatable causes were the leading causes of SVI or BL (65%). Only a quarter of children were SVB or BL due to unavoidable causes (Table 3).

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Discussion

Findings from this study show a prevalence of SVI and BL of 0.05% in children ≤15 years of age in Mbarali district which is lower than that of 0.09% estimated by WHO in 1999.It is also lower than that found in a similar study in Malawi [12] in 2009 where the prevalence was 0.09%. The difference is probably related to the improved child survival programs and their impact on reducing blindness in children with time. The infant mortality rate for Tanzania has reduced from 69 per 1000 in 2009 to 49/1000 in 2015. On the other hand, our findings are similar to a recent study in Ethiopia [13] with a prevalence of 0.06%. The prevalence in the current study is higher than a study in, Uganda [14] and a previous study in Kilimanjaro region, Tanzania by Shirima et all [7]. The authors attributed the low prevalence in Uganda (0.02%) and Kilimanjaro (0.017%) to availability of tertiary eye care services in the study area to deal with treatable SVI or BL including identification, referral, and treatment. Such services are lacking in Mbeya region and the whole of the southern part of Tanzania. Moreover, there are no routine eye services in Mbarali district to even identify and refer children with SVI or BL.

Study results showed a slight increase though not significant in prevalence of blindness with age. Epidemiological studies have shown that children become blind before their fifth birthday [3]. Studies in areas where there are no services have shown similar results [15] and is related to the backlog of untreated patients that have grown up as time passes.

In contrast to other population based studies [12, 14] in Sub-Saharan Africa and Asia [15] and studies in blind schools where the prevalence of SVI or BL among boys was higher than among girls, our result show a slightly higher prevalence (0.05%) among girls compared to boys (0.04%). Parent's willingness to seek health care and education for boys than girls was among the proposed reasons for a high prevalence of SVI or BL among boys. It is possible that affected boys have been sent for studies outside the district thereby reducing the prevalence among boys in our study area.

The major causes of SVI/BL in our study are similar to those obtained in similar settings in Malawi [12], Ethiopia [13] and Uganda [14] where lens anomalies were the commonest cause of SVI or BL. In our study, corneal conditions were however less common compared to an earlier hospital based study in Dodoma Tanzania [6], and other population based studies in Africa [12,13] suggesting a reduction of corneal blindness in this study

The proportion of children with avoidable blindness (73%) is lower than that obtained in similar studies in Africa and Asia [12,13,15]. The difference could be due to a lower proportion of preventable causes of SVI or BL especially corneal scarring in our study. A quarter of children were SVB or BL due to unavoidable causes.

In this study, village health workers were used as key informants and correctly identified children with visual problems where 61(24.6%) of identified children were SVI or BL in both eyes. This signifies the importance of this group of people in eye health of the community. Before this study, the group was used in assisting implementation of other health related interventions including Mass drug administration for Neglected Tropical Diseases, immunization and vitamin A supplementation among children. Training on how to recognize children with eye conditions has empowered them with an additional skill to enable them to support the community in eye health related issues. Further follow up on whether they will continue identifying such children whenever implementing the other health community roles is recommended. The VHWs used in this study are regarded as Key informants who were used in similar studies in Bangladesh [15].

Conclusion

The prevalence of SVI or BL in Mbarali district among children is lower than previous estimates. Most of the SVI or BL is avoidable with a higher prevalence of treatable than preventable SVI and BL.

The low prevalence compared to previous estimates is mostly related to reduction in preventable causes of SVI or BL due to successful implementation of vitamin A

supplementation and measles immunization in Tanzania. However, in order to achieve the goal of Vision 2020 The Right to Sight of eliminating avoidable blindness by the year 2020 in Southern Tanzania, efforts should be focused at establishing and improving access to tertiary eye services for children at Mbeya Zonal Referral Hospital. Access to tertiary eye services will enable children with treatable causes of SVI and BL like cataracts cataracts and congenital glaucoma to be operated in time to avoid amblyopia. Equally important is to maintain vitamin A supplementation and measles immunization high coverage to further reduce and eventually eliminate preventable blindness due to corneal related scarring. Apart from their other roles in the health of communities, where available, VHWs may be used as a resource for identifying children with visual impairment and blindness in the community after training.

Financial and non-financial competing interests

The authors have no proprietary interest in any materials mentioned in this article.

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