



Childhood blindness and visual impairment in an underserved population in South West Nigeria: A clinic-based study

Michaeline A. Isawumi

Ophthalmology Unit, Department of Surgery, College of Health Sciences, Osun State University, Osogbo, Nigeria

Correspondence: michaeline.isawumi@uniosun.edu.ng

<https://dx.doi.org/10.4314/ecajs.v22i3.1>

Abstract

Background: Knowledge of the causes of poor vision among children will contribute to interventions and policies to prevent childhood blindness and visual impairment.

Methods: This was a 3-year descriptive study of consecutive cases presenting to the secondary eye clinic at State Specialist Hospital in Osogbo, Nigeria. Sociodemographic characteristics were documented, and full clinical eye examinations were done. Descriptive analyses were carried out.

Results: Among 214 children examined, 59.3% were male and the mean age was 9.3 ± 3.5 years. The predominant age group was 0 to 5 years (40.2%). Common causes of blindness and visual impairment were: refractive error (22.9%), corneal disease (21.5%), and cataract (19.6%). Refractive error was significantly more common among participants between 11 and 16 years of age ($P < 0.001$). All cases of retinoblastoma occurred among participants 0 to 5 years old ($P < 0.001$). Blindness most commonly resulted from corneal opacities (31.1%), severe visual impairment most commonly resulted from cataracts (35.4%), and moderate visual impairment was most often the result of refractive error (47.8%). According to the World Health Organization classification of visual impairment, 74 participants (34.6%) were blind, 48 (22.4%) had severe visual impairment, and 92 (42.9%) had moderate visual impairment.

Conclusions: The causes of blindness and visual impairment are mainly avoidable. Provision of adequate manpower, necessary equipment in the hospitals for subsidised refractive and cataract surgical services, and uptake of these services are required towards prevention.

Keywords: childhood blindness, visual impairment, eye healthcare facilities, advocacy, Nigeria

Introduction

The Convention on the Rights of the Child (CRC) defines a child as a “human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier”.¹ Childhood blindness is defined, according to the World Health Organization (WHO), as a presenting visual acuity (VA) less than 3/60 in the better eye or a visual field loss (VFL) of less than 10 degrees from point of central fixation in the better eye of an individual under the age of 15 years.^{2,3}

The psychological, social, and economic impacts of blindness extend far beyond individual patients to their families, communities, and society as a whole.⁴ Of about 1.4 million blind children in the world, 75% live in developing countries of Asia and Africa.⁵ A child becomes blind every minute, and childhood blindness causes about 75 million blind person years (number blind \times length of life).⁵ Most blind children are either born blind or become blind before they reach 5 years of age. About 40% of childhood blindness is preventable or treatable.⁵ The commonest cause of blindness and visual impairment worldwide is cataract, both in adults and children. Other causes include glaucoma, refractive error, and corneal scarring, especially in Asia and



Africa.⁶ Recent studies have shown various changes in the trends of causes of childhood blindness in different parts of world.⁷

There are few hospital-based studies on causes of blindness and visual impairment in children in Nigeria. This study set out to investigate the common causes of blindness and visual impairment presenting to an eye care facility in Osogbo, Nigeria.

Methods

Study setting

This study was carried out at the eye clinic of State Specialist Hospital (SSH), in Osogbo, the capital city of Osun State. SSH is 1 of 2 teaching hospitals in the state, which is located in the South West geopolitical zone of Nigeria. Ophthalmologists and other trained eye care workers all work at the 2 teaching hospitals in the 2 big cities of Osun—Ile Ife and Osogbo. During the study period, there were only 2 ophthalmic nurses and 1 visiting volunteer ophthalmologist at SSH. Eye care in the rural areas of the region is otherwise the responsibility of understaffed primary health care centres, with minimal eye care expertise or resources.

Study design

This was a prospective, observational, clinic-based study of children seen in the clinic over a 3-year period, from January 2014-December 2016.

Sampling

The study population included children presenting to the eye clinic at SSH, Osogbo. All children (0-16 years of age) attending the eye clinic within the study period were eligible, while those older than 16 years and those who did not attend the clinic were excluded. VA was assessed according to age and classified using the WHO grades of visual impairment and blindness. For infants able to fixate on and follow light or reach out to objects, VA was classified as “believed sighted”; inability to respond as such was noted as “believed not-sighted” among infants. The charts used included the HOTV, E, and literate Snellen visual acuity charts. Uncooperative children were noted as uncooperative for VA but believed sighted. Any child with a visual acuity of less than 6/9 was referred for screening for refractive error. Information was obtained from the parents, caregivers, or patients, as necessary and appropriate. Information obtained included demographic data, such as age, sex, and father’s occupation. A pen light was used to examine the anterior segments, noting any deviation of the eyes, nystagmus, drooping lids, conjunctival injections, corneal opacity, abnormal pupils, or obvious cataracts. Any squint present was examined for extent of deviation by using free prisms to carry out the prism alternate cover test. Direct ophthalmoscopy was done to note the presence or absence of a red reflex and also used to examine the fundus for children who cooperated, while examination under anaesthesia was carried out for those who would not cooperate. Dilated fundoscopy using a combination of cyclopentolate and tropicamide eye drops for pupillary dilatation were carried out using a Heine binocular indirect ophthalmoscope (Heine Optotechnik, Herrsching, Germany). Cycloplegic refraction was also carried out where necessary, using a Heine streak retinoscope (Heine Optotechnik) to determine the type of refractive error. Any child whose visual acuity was less than 6/18 after correction was finally enrolled into the study. Other complaints were noted, assessed, and treated or according to the diagnoses made. Causes of blindness and visual impairment were particularly noted.



Data management

Data were recorded on a WHO/Prevention of Blindness (WHO/PBL) form and results entered into and analysed using SPSS version 17. Descriptive analysis was carried out for categorical variables, producing frequencies, means, and standard deviation. Between-group differences were assessed using the chi-square test, with a significance level of 0.05.

Results

A total of 214 children were examined, 59.3% of whom were male. Ages ranged from less than 1 year to 16 years, with a mean of 9.3 ± 3.5 years. The 0- to 5-year age group predominated, with 86 participants (40.2%) (Table 1). The commonest ocular disorders were refractive error (22.9%), corneal disease (21.5%), and cataract (19.6%). Most of the disorders, especially trauma (71.4%), occurred more often among males, but the association was not statistically significant ($P = 0.47$) (Table 2). Corneal opacities (23 of 74 participants [31.1%] classified as blind), globe abnormalities (17 of 74 [23.0%]), and cataracts (14 of 74 [18.9%]) were the common causes of blindness, while refractive error was the least common aetiologic category associated with blindness. Cataracts (affecting 17 of 48 participants [35.4%] with severe visual impairment) and corneal opacities (12 of 48 [25.0%]) were the common causes of severe visual impairment. Among 92 participants classified as having moderate visual impairment, the most common diagnoses were refractive error ($n = 44$ [47.8%]) and cataract ($n = 12$ [13.4%]) (Table 3).

All 5 cases of retinoblastoma caused blindness and all were found among children in the 0- to 5-year age group.

Table 1: Distribution of age group by gender among children 0 to 16 years of age

Age (years)	Male	Female	Total n (%)
0-5	50	36	86 (40.2)
6-10	39	22	61 (28.5)
11-16	38	29	67 (31.3)
Total	127 (59.3)	87 (40.7)	214 (100)

$\chi^2 = 0.76$ $P = 0.68$

**Table 2: Distribution of causes of visual impairment by gender among children 0 to 16 years of age**

Cause of visual impairment	Male n (%)	Female n (%)	Total n (%)
Corneal opacities	24 (52.2)	22 (47.8)	46 (21.5)
Refractive error	26 (53.1)	23 (46.9)	49 (22.9)
Chorioretinal scar	4 (66.7)	2 (33.3)	6 (2.8)
Trauma	15 (71.4)	6 (28.6)	21 (9.8)
Glaucoma	8 (53.3)	7 (46.7)	15 (7.0)
Globe abnormalities	15 (83.3)	3 (16.7)	18 (8.4)
Retinoblastoma	3 (60.0)	2 (40.0)	5 (2.3)
Cataract	25 (59.5)	17 (40.5)	42 (19.6)
Others	7 (58.3)	5 (41.7)	12 (5.6)
Total	127 (59.3)	87 (40.7)	214 (100)

$\chi^2 = 7.598$ $P = 0.47$

Table 3: Distribution of causes blindness and visual impairment among children 0 to 16 years old according to World Health Organization (WHO) categories

Causes	*Blindness	*Severe visual impairment	*Moderate visual impairment	Total
Corneal opacities	23 (31.1)	12 (25.0)	11 (12.0)	46 (21.5)
Refractive error	2 (2.7)	3 (6.3)	44 (47.8)	49 (22.9)
Chorioretinal scar	3 (4.1)	2 (4.2)	1 (1.1)	6 (2.8)
Trauma	6 (8.1)	6 (12.5)	9 (9.8)	21 (9.8)
Glaucoma	2 (2.7)	4 (8.3)	9 (9.8)	15 (7.0)
Globe abnormalities	17 (23.0)	1 (2.1)	0	18 (8.4)
Retinoblastoma	5 (6.8)	0	0	5 (2.3)
Cataract	13 (17.6)	17 (35.4)	12 (13.0)	42 (19.6)
Others	3 (4.1)	3 (6.3)	6 (6.5)	12 (5.6)
Total	74 (34.6)	48 (22.4)	92 (43.0)	214 (100.0)

$\chi^2 = 202.497$, $P < 0.001$

*Blindness – Visual acuity < 3/60 to no light perception

*Severe visual impairment – Visual acuity 3/60 to <6/60

*Moderate visual impairment – Visual acuity 6/24 to 6/60

Table 4: Causes of visual impairment across age groups in children 0 to 16 years of age

Cause of impairment	Age (years)			Total
	0-5	6-10	11-16	
	n (%)	n (%)	n (%)	
Corneal opacities	29 (63.0)	10 (21.8)	7 (15.2)	46 (21.5)
Refractive error	5 (10.2)	15 (30.6)	29 (59.2)	49 (22.9)
Chorioretinal scar	3 (50.0)	1 (16.7)	2 (33.3)	6 (2.8)
Trauma	5 (23.8)	6 (28.6)	10 (47.6)	21 (9.8)
Glaucoma	7 (46.7)	3 (20.0)	5 (33.3)	15 (7.0)
Globe abnormalities	11 (61.1)	5 (27.8)	2 (11.1)	18 (8.4)
Retinoblastoma	5 (100.0)	0	0	5 (2.3)
Cataract	17 (19.8)	15 (24.6)	10 (14.9)	42 (19.6)
Others	4 (33.3)	6 (50.0)	2 (16.7)	12 (5.6)
Total	86 (40.2)	61 (28.5)	67 (31.3)	214 (100)

Discussion

Childhood blindness and visual impairment are major disabilities that compromise normal childhood development and usually confer lifelong negative consequences on children.^{5,8,9}

The mean age of children included in this survey (9.3 ± 3.5 years) was similar to a study carried out by Mehari in a rural central hospital in Ethiopia, where the children's ages ranged from 3 months to 15 years, with a mean age of 9.37 ± 4.95 years.¹⁰

Blindness and visual impairment

The commonest overall cause of blindness and visual impairment in our study was refractive error. This was closely followed by corneal opacities and cataracts. This result is similar to a community study of 241 children that was carried out in Botswana, where refractive error was the commonest avoidable or treatable cause of blindness and visual impairment, contributing 38%, while congenital cataract contributed to 31% of such impairment.¹¹ The WHO estimates that 13 million children aged 5 to 15 years worldwide are visually impaired from uncorrected refractive errors.¹² Similarly, in central Ethiopia refractive errors (47.1%) followed by keratitis and corneal opacity (16%), amblyopia (14.3%), and ocular trauma (11.8%) have been shown to be the common causes of bilateral visual impairment.¹⁰

Another cause of visual impairment was trauma, which was implicated in 71.4% of cases among boys in this study and 28.6% of cases among girls. The proportion of children who were blind or visually impaired from trauma increased with age and occurred most commonly in the 11- to 15-year age group. This may be associated with increased risky activity or potentially hazardous



play with increasing age, especially among boys. A similar study by Nallasamy et al. also found a high proportion of preventable visual impairment to be trauma-related.¹¹

Overall, glaucoma made a relatively small contribution to blindness and visual impairment in this study. Conversely, among Nigerian adults, glaucoma has previously been rated as the second most frequent cause of visual impairment.¹³ Lawan, in a study of congenital ocular adnexae in Nigeria, found that glaucoma constituted a relatively small proportion (8.4%) of all causes of visual impairment but was responsible for causing blindness in about 95% of cases.¹⁴ These observations suggest that some children still end up blind or visually impaired despite adequate treatment¹³ and remind us that, although childhood glaucoma is rare, it causes long-term disability continuing into adulthood.¹⁵

Blindness

The main causes of blindness among children included in this study were corneal opacity (31.1%) and globe abnormalities (22.9%), followed by cataract (18.9%); refractive error was rarely associated with blindness. This pattern was similar to results from Ethiopia, where corneal disease was shown to be associated with 27.0% of blindness cases, followed by trauma as the second most common cause of blindness.¹⁰ In Morocco, hereditary pathologies (25.9%) and refractive error (14.8%) have been shown to be frequent causes of childhood blindness.⁷ In Israel, Mezer et al. found that the incidence of cortical visual impairment was higher than that of the retinal diseases following a cohort study of children less than 18 years of age.¹⁶ The reduction of loss of vision in children from retinitis pigmentosa was thought to have been due to continuous reduction in consanguineous marriages in the region.¹⁶ Comparatively, in South East Nigeria, Aghaji et al. found that the most common anatomical site of blindness was the lens (33.9%) among children at 3 schools for the blind, while cortical visual impairment was common among younger students at these schools.¹⁷ Differences between the results of these 2 studies (in Israel and South East Nigeria) and those from our study may be related to differences in setting (a blind register and schools for blind children, respectively, as compared to our study, which was carried out in a hospital setting).

Severe visual impairment

Khandekar et al., in their review, found that the aetiology patterns of childhood blindness and visual acuity were divided according to 3 groups of high-, middle-, and low-income nations.⁸ Cataract was the main cause of severe visual impairment in our study and is now replacing vitamin A deficiency and measles keratopathy as the main cause of blindness among children in Africa in some populations.¹⁷ However, constraints of inadequate manpower and equipment for management in many parts of Africa¹⁸ including Nigeria, still exists.

Age groupings

All cases of retinoblastoma were recorded among the 0- to 5-year age group. This is not surprising because retinoblastoma usually presents between before and up to 18 months of age, while all cases would have manifested by the age of 3 years.¹⁹ Most of the other causes of blindness and visual impairment, such as corneal opacities, cataract, globe abnormalities, glaucoma (Table 4) were mainly seen in the 0- to 5-year age group. This can be explained by the observation that parents and guardians tend to bring their children within this younger age range to the hospital more frequently than when they are older, probably because of the increased vulnerability of infants and younger children.



International Monetary Fund income levels and blindness status

Koay et al., in their recent comparative study, showed that the lower income countries still had the highest proportion of avoidable causes of childhood blindness (60%). In Malaysia, a middle-income country, cataract and retinopathy of prematurity (ROP) were among the prevalent aetiologies of childhood blindness.²⁰ In the Republic of Suriname, cataract and congenital causes were responsible for most of the blindness and severe visual impairment, while ROP was more frequent than cataract among the treatable causes.²¹

In Africa, regional differences and gradually improving socioeconomic status certainly appear to affect causes of childhood blindness, as corneal causes are also showing a decline.²² Kishiki et al., in their study, found poor knowledge, inadequate training, rarity of eye diseases in children and their referrals as causes hindering eye care in children in the Eastern Mediterranean Region as well as in Africa.²³ They suggested that improvement in the suboptimal availability and utilisation of health resources could be attained through the incorporation of pictures in the practical manuals used in the training of primary eye care workers in order to help with blindness prevention.²³

Study limitations

The paucity of data on hospital-based studies in other parts of Africa and Asia was responsible for comparisons with community-based studies in the Discussion section.

Conclusions

Refractive error and cataract were the most common avoidable causes of blindness and visual impairment among children attending this eye clinic. We advocate for adequate well-trained manpower and provision of necessary equipment in hospitals to reduce the burden caused by blindness and visual impairment among children. Offering specialist treatment, especially through subsidised refractive services and cataract surgeries are required. Public health education for uptake of services towards prevention is also necessary to reduce treatable causes.

References

1. World Health Organization (WHO). Definition of key terms: consolidated ARV guidelines, June 2013 [Internet]. Geneva: WHO; 2013 [cited 2017 Jul 7]. Available from www.who.int/hiv/pub/guidelines/arv2013/intro/keyterms/en/.
2. World Health Organization (WHO). International classification of diseases, revision 9. Geneva: WHO. 241-7.
3. World Health Organization (WHO). Change the definition of blindness [Internet]. Geneva: WHO; 2008 [cited 2017 Jul 5]. Available from: <http://www.who.int/blindness/Change%20the%20Definition%20of%20Blindness.pdf>.
4. World Health Organization (WHO). Global initiative for the elimination of avoidable blindness [Internet]. Geneva: WHO; 1997 [cited 2017 Jul 5]. Available from: <http://apps.who.int/iris/handle/10665/63748>.



5. World Health Organization. Vision 2020 global initiative for the elimination of avoidable blindness: action plan 2006–2011 [Internet]. Geneva: WHO; 2007 [cited 2017 Jul 5] Available from http://www.who.int/blindness/Vision2020_report.pdf.
6. Gilbert C. New issues in childhood blindness. *Community Eye Health*. 2001;14(40):53–6.
7. Santos-Bueso E, Dorrzoro-Ramírez E, Gegúndez-Fernández JA, Vinuesa-Silva JM, Vinuesa-Silva I, García-Sánchez J. Causes of childhood blindness in a developing country and an underdeveloped country. *J Fr Ophthalmol*. 2015 May;38(5):427-30. doi: 10.1016/j.jfo.2014.09.018. Epub 2015 Apr 15.
8. Khandekar R, Kishore H, Mansu RM, Awan H. The status of childhood blindness and functional low vision in the Eastern Mediterranean region in 2012. *Middle East Afr J Ophthalmol*. 2014 Oct-Dec;21(4):336-43. doi: 10.4103/0974-9233.142273.
9. Courtright P, Hutchinson AK, Lewallen S. Visual impairment in children in middle- and lower-income countries. *Arch Dis Child*. 2011 Dec;96(12):1129-34. doi: 10.1136/archdischild-2011-300093. Epub 2011 Aug 24.
10. Mehari ZA. Pattern of childhood ocular morbidity in rural eye hospital, Central Ethiopia. *BMC Ophthalmol*. 2014 Apr 15;14:50. doi: 10.1186/1471-2415-14-50.
11. Nallasamy S, Anniger WV, Quinn GE, Kroener B, Zetola NM, Nkomazana O. Survey of childhood blindness and visual impairment in Botswana. *Br J Ophthalmol*. 2011 Oct;95(10):1365-70. doi: 10.1136/bjo.2010.189068. Epub 2011 Jan 17.
12. Sharma A, Congdon N, Patel M, Gilbert C. School-based approaches to the correction of refractive error in children. *Surv Ophthalmol*. 2012 May-Jun;57(3):272-83. doi: 10.1016/j.survophthal.2011.11.002. Epub 2012 Mar 6.
13. Abdull MM, Sivasubramaniam S, Murthy GV, et al. Causes of blindness and visual impairment in Nigeria: the Nigeria national blindness and visual impairment survey. *Invest Ophthalmol Vis Sci*. 2009 Sep;50(9):4114-20. doi: 10.1167/iops.09-3507. Epub 2009 Apr 22.
14. Lawan A. Congenital eye and adnexial anomalies in Kano, a five year review. *Niger J Med*. 2008 Jan-Mar;17(1):37-9.
15. Biglan AW. Glaucoma in children: are we making progress? *J AAPOS*. 2006 Feb;10(1):7-21.
16. Mezer E, Chetrit A, Kalter-Leibovici O, Kinori M, Ben-Zion I, Wagnanski-Jaffe T. Trends in the incidence and causes of severe visual impairment and blindness in children from Israel. *J AAPOS*. 2015 Jun;19(3):260-5.e1. doi: 10.1016/j.jaapos.2015.04.002.
17. Aghaji A, Okoye O, Bowman R. Causes and emerging trends of childhood blindness: findings from schools for the blind in Southeast Nigeria. *Br J Ophthalmol*. 2015 Jun;99(6):727-31. doi: 10.1136/bjophthalmol-2014-305490. Epub 2014 Dec 3.
18. Randrianotahina HC, Nkumbe HE. Pediatric cataract surgery in Madagascar. *Niger J Clin Pract*. 2014 Jan-Feb;17(1):14-7. doi: 10.4103/1119-3077.122824.
19. Bowling B. *Kanski's clinical ophthalmology: a systematic approach*. 8th ed. Elsevier; 2015.
20. Koay CL, Patel DK, Tajunisah I, Subrayan V, Lansingh VC. A comparative analysis of avoidable causes of childhood blindness in Malaysia with low income, middle income and high income countries. *Int Ophthalmol*. 2015 Apr;35(2):201-7. doi: 10.1007/s10792-014-9932-x. Epub 2014 Mar 22.



21. Heijthuisen AA, Beunders VA, Jiawan D, et al. Causes of severe visual impairment and blindness in children in the Republic of Suriname. *Br J Ophthalmol*. 2013 Jul;97(7):812-5. doi: 10.1136/bjophthalmol-2011-301000. Epub 2013 Apr 20.
22. Kong L, Fry M, Al-Samarraie M, Gilbert C, Steinkuller PG. An update on progress and the changing epidemiology of causes of childhood blindness worldwide. *J AAPOS*. 2012 Dec;16(6):501-7. doi: 10.1016/j.jaapos.2012.09.004.
23. Kishiki E, Hogeweg M, Dieleman M, Lewallen S, Courtright P. Is the existing knowledge and skills of health workers regarding eye care in children sufficient to meet needs? *Int Health*. 2012 Dec;4(4):303-6. doi: 10.1016/j.inhe.2012.08.001.