Original Article

# PREVALENCE OF CHILDHOOD BLINDNESS AND SEVERE VISUAL IMPAIRMENT IN A RURAL COMMUNITY IN EDO STATE: THE KEY INFORMANT METHOD

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**ABSTRACT**

**Aim:** To describe the prevalence of childhood blindness and severe visual impairment in a rural community in Edo State using the key informant method.

**Methods**: This was a descriptive, population-based, cross-sectional study carried out in Ikpoba-Okha Local Government Area in Edo State. Fifty (50) trained key informants identified and referred children for further ocular examination, dilated fundoscopy where necessary and refraction after obtaining informed consent from the parents and the Local government authorities. Data obtained was recorded on the WHO/PBL eye examination record for children with blindness and low vision form and analyzed using SSPSS version 21.

**Results**: A total of 96 children were identified and referred by the key informants, but 84 children came to the examination centres on the scheduled days. Therefore, 87.5% of the identified children reported for examination. The prevalence of blindness/severe visual impairment was 0.15/1000 (95% CI: 0.11-0.19/1000). The prevalence of blindness was 0.10/1000(95% CI: 0.08-0.16/1000) and prevalence of severe visual impairment was 0.05/1000(95% CI: 0, 04-0.07/1000). The number of children that reported for examination was 84 and the number of children with blindness/severe visual impairment were 20, which brings the positive predictive value to 23.8%. Majority (90%) of the causes of blindness and severe visual impairment were avoidable (either preventable or treatable). The preventable causes accounted for 20.0% while the treatable causes were 70.0%. Cortical blindness from hydrocephalous was responsible in 10.0% of cases and this is unavoidable.

**Conclusion**: Majority of children from this study were therefore blind or severely visually impaired needlessly. Avoiding these needless blinding cases would require early case finding and timely intervention and follow-up.

**Key words**: Childhood blindness, severe visual impairment, key informant method.

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## Introduction

Blindness is defined by World Health Organization (WHO) as presenting visual acuity (VA) of less than 3/60 in the better eye or a visual field less than 10° in radius of central fixation while severe visual impairment is presenting visual acuity of less

than 6/60, but better than or equal to 3/60 in the better eye.[1] A child, according to WHO is an individual less than 16years of age.[1]

Childhood blindness remains a significant problem globally, especially in developing countries and accounts for 3.2% of the burden of blindness worldwide. Only about 6.5% of the blind children live in the developed countries.[2] It is estimated that 19million children are visually impaired, and of these, 1.4million are irreversibly blind for the rest of their lives and need visual rehabilitation for a full psychological and personal development.[3] When eye diseases and conditions that occur in early childhood are left untreated, they can result in visual impairment or blindness. Majority of blindness in children happens before the age of five; a period where 75% of learning is through visual perception.[4]

The prevalence of blindness and severe visual impairment in children varies according to socioeconomic development. It ranges from an estimate of 0.3 per 1000 children in high income countries to 1.5 per 1000 in low-income countries, making the overall prevalence of childhood blindness 0.75 per 1000 children.[5,6]

Blind children have a higher death rate than their sighted counterparts.[7] This may be partly due to the fact that some of the causes of childhood blindness and severe visual impairment are also important causes of childhood mortality. Also, blindness and severe visual impairment predisposes the individual to otherwise avoidable accidents both within and outside the home. About 66% of children with visual impairment also have other co-morbidities, such as intellectual disabilities, cerebral palsy or hearing loss.[7]

The control of childhood blindness is considered a high priority within the WHO VISION 2020: Right to Sight Initiative, [5] despite its relatively small contribution (3.2%) to the overall global prevalence of blindness. Rahi et al[8] in discussing the burden of childhood blindness, explained that, children who are born blind or become blind early in life have a total number of years of disability that is greater than persons who become blind later in life. Moreover, many of the causes of blindness and severe visual impairment in children are either preventable or treatable and are also found to be related to causes of childhood mortality. Ajibode and Olatunji in Nigeria reported that over 70% of causes of childhood blindness are either preventable or treatable.[9,10] Failure of visual maturation (amblyopia) cannot be corrected in adult life, so there is a level of urgency about treating childhood eye disease to avoid irreversible blindness.[11,12]

Corneal scarring is also the single most important cause of avoidable childhood blindness worldwide, followed by cataract and retinopathy of prematurity.[13] In some developing countries however, with the incorporation of vitamin A supplementation and measles immunization, there is a decrease in corneal scarring from xeropthalmia.[14]

Nirmalam et al[15] described the Key Informant Method (KIM), a method in estimating prevalence and causes of childhood blindness which involves the use of trained community volunteers to find blind children. This method gives a reliable data on prevalence and causes of childhood blindness and SVI in a community and is relatively fast and less expensive.[15] Key informants are people who live and/or work in their local community, who have a social role through their vocation,

and who are, therefore, likely to know the local context as well as the people about whom information is being sought.[15,16] Most information on the cause of blindness/severe visual impairment have been from studies of children in the blind schools.[12]

## Materials and Methods

This was a descriptive, population-based, cross-sectional study carried out in Ikpoba-Okha Local Government Area (LGA) which is one of the eighteen Local Government Areas in Edo State. The minimum sample size calculated for this survey was 47,000 but with the key informant method, there was coverage of a population of about 137,589 children. Children below 16years of age with visual acuity less than 6/60 in the better eye, living in Ikpoba Okha LGA, Edo State and whose parents gave consent were included in this study.

The approval for the study was obtained from the Ethics and Research Committee of the University of Benin Teaching Hospital (UBTH), Benin City and the Ikpoba-Okha Local Government Authority, Edo state. The study team included the principal researcher, two resident doctors, one optometrist, two ophthalmic nurses, one Primary Health Center (PHC) worker (local guide) and 50 key informants who were selected and trained. The researcher obtained all the necessary approvals, trained all study team members on their specific roles, performed anterior and posterior segments examinations, and took part in filling the questionnaires and refraction.

The key informants were recommended by the Primary Health Center (PHC) coordinator. Most of them were selected from an existing pool of volunteers usually contacted for health-related projects in the community such as immunization, public health campaigns and distribution of materials. The L.G.A. was divided into 3 zones and 3 primary health centres, namely Ogbeson PHC, Ugbekun PHC and Ologbo PHC were chosen as examination centers. Key informants were to refer children to the examination centre closest to the child's home on an agreed day and time for ocular examination by the researcher. Visual acuity was done by the optometrist using either the HOTV, picture test, or Snellen chart, depending on the age and developmental level of the children in a well-lit room. Refraction was also done by the optometrist assisted by the researcher who solely conducted anterior and posterior segment examinations. Dilated fundoscopy was carried out when indicated. The most likely cause of blindness was identified and a final diagnosis made. Ocular findings of those diagnosed as blind/SVI were recorded on the modified WHO/PBL eye examination record for children with blindness and low vision devices. The main anatomical site and the underlying aetiological causes of blindness and severe visual impairment were determined and recorded. If the causes were different in the two eyes, the most preventable or treatable cause was selected.

The children and their parents were counselled regarding the findings, especially those in whom solution was thought to be possible such as low vision, spectacles and cataract surgery. Some were referred to the University of Benin Teaching Hospital and the State Central Hospital for proper management. Others were referred to PHC social workers for educational/vocational counseling and rehabilitation.

Data obtained was recorded on the WHO/PBL eye examination record for children with blindness and low vision form and analyzed using SSPSS version 21.

## RESULTS

A total of 50 key informants were trained for the purpose of this study. Thirty-one (31) were females and nineteen (19) were males (table 1). Their ages ranged from 22 years and 53 years.

**Table I: TRAINED KEY INFORMANTS, NUMBER OF CHILDREN IDENTIFIED AND REPORTED IN IKPOBA OKHA LGA.**

| Key informants | Number trained n (%) | Number of children identified $n_1$ (%) | Number of children that reported $n_2$ (%) |
|---|---|---|---|
| Males | 19(38.0) | 39(40.6) | 35(41.7) |
| Females | 31(62.0) | 57(59.4) | 49(58.3) |
| Total | 50(100.0) | 96(100) | 84(100) |

A total of 96 children were identified and referred by the KIs, but 84 children came to the examination centers on the scheduled days (Table 1). Therefore, 87.5% of the identified children reported for examination.

The total number of children that met the inclusion criterion of VA of less than 6/60 were 20 children. These 20 children were further examined, consisting of 9 (45.0%) males and 11 (55.0%) females as shown in table III. Their ages ranged from 3 years to 14 years with a mean age of 7.45 years and the median of 8years. Table III also shows the sex distribution and number of children who were blind and severely visually impaired. Thirteen (65.0%) were blind and 7(35.0%) were severely visually impaired. Among the 35.0% that had SVI, twenty percent (4) were males while 15.0% (3) were females. Twenty-five percent (5) of males were blind, while blind females constituted 40.0% (8).

**TABLE II: AGE DISTRIBUTION OF CHILDREN THAT REPORTED FOR EXAMINATION IN IKPOBA-OKHA L.G.A.**

| Ages (years) | Males | Females | Total |
|---|---|---|---|
| 0-5 | 12(57.1) | 9(42.9) | 21(25.0) |
| 6-10 | 21(43.8) | 27(56.2) | 48(57.1) |
| 11-15 | 4(26.7) | 11(73.3) | 15(17.9) |
| Total | 37(44.0) | 47(56.0) | 84(100.0) |

Majority of the children that reported for examination were within the age group of 6-10 (57.1%). This is shown in Table 11

**Table III: NUMBER OF BLIND/SVI CHILDREN IDENTIFIED IN IKPOBA OKHA LGA**

| | MALES (%) | FEMALES (%) | TOTAL (%) |
|---|---|---|---|
| SVI | 4 (20.0) | 3 (15.0) | 7 (35.0) |
| BLIND | 5 (25.0) | 8 (40.0) | 13 (65.0) |
| TOTAL | 9 (45.0) | 11 (55.0) | 20 (100) |

**Table IV: AGE AND SEX CHARACTERISTICS OF BLIND/ SVI CHILDREN IDENTIFIED IN IKPOBA OKHA LGA**

| AGE (YEARS) | MALE (%) | FEMALE (%) | TOTAL (%) |
|---|---|---|---|
| **0-5** | 3(15.0) | 1(5.0) | 4 (20.0) |
| **6-10** | 5 (25.0) | 7(35.0) | 12 (60.0) |
| **11-15** | 1 (5.0) | 3(15.0) | 4 (20.0) |

Table IV shows the age distribution of the blind/SVI children. Majority of them were within the ages of 6-10 years (60.0%). Twenty percent of the children were aged 0-5 years.

**Table V: AGE OF ONSET OF LOSS OF VISION**

| | MALE (%) | FEMALE (%) | TOTAL (%) |
|---|---|---|---|
| FROM BIRTH | 1 (5.0) | 1(5.0) | 2 (10.0) |
| 0-1 YEAR | 3 (15.0) | 4 (20.0) | 7 (35.0) |
| >I YEAR | 4 (20.0) | 7 (35.0) | 11 (55.0) |

Over half of the children (55.0%) lost vision in childhood. Only 10.0% lost vision from birth as shown in the table V.

The population of children less than 16 years in the study population was 137,589. The prevalence of BL/SVI was 0.15/1000 (95% CI: 0.11-0.19/1000). The prevalence of BL was 0.10/1000(95% CI: 0.08-0.16/1000) and prevalence of SVI was 0.05/1000(95% CI: 0, 04-0.07/1000). The number of children that reported for examination was 84 and the number of children with BL/SVI were 20, which brings the positive predictive value to 23.8%.

Table VI outline the anatomical causes of blindness and SVI.

Abnormalities of the lens were responsible in 7 (35.0%) of the cases. three (15.0%) of these were operable cataracts, two (10.0%) had inoperable cataract and two (10.0%) had complications following cataract surgery. These complications were amblyopia and posterior capsular opacification. Two children had cortical blindness from hydrocephalous. Four (20.0%) of the children had uncorrected refractive error as the cause of their BL/SVI. Lesions affecting the whole globe were phthisis bulbi in 3(15.0%) children, with history of ophthalmia neonatorum in one and use of harmful TEM in two following itching and redness, and buphthalmos (congenital glaucoma) in one child. Corneal scarring was seen in 2 (10.0%) children each of who had measles and used harmful traditional eye medications respectively.

The commonest anatomical cause of BL/SVI was lens related, accounting for about one third (35.0%) of the cases. Operable cataract consisted of 42.8% of the lens-related causes (Fig. 1).

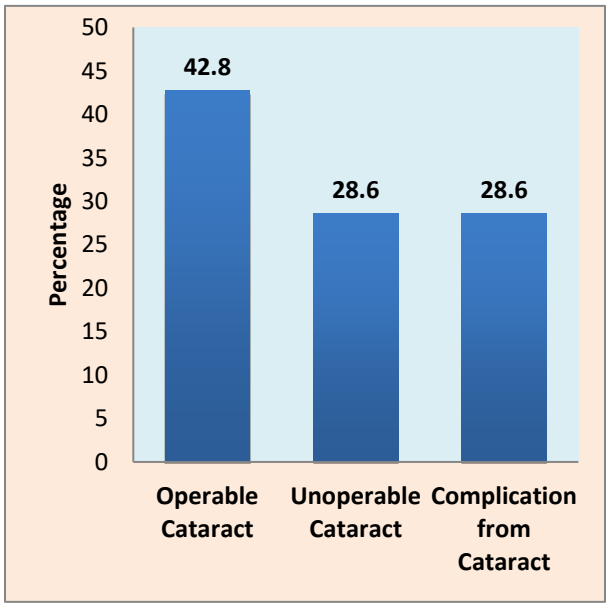
Figure II shows that in majority of the children the underlying aetiology was undetermined /unknown (50.0%). The second most common aetiology was the postnatal/ infancy/ childhood factors (25.0%). Other aetiologic categories such as intrauterine factors were seen in 4(20.0%) and perinatal/neonatal factors accounted for blindness in 5.0% of the children.

Table VII showed that majority (90%) of the causes of blindness and severe visual impairment were avoidable (either preventable or treatable). The preventable causes accounted for 20.0% while the treatable causes were 70.0%.

**Table VI: ANATOMICAL SITE OF ABNORMALITIES**

| Anatomical Site | Major n (%) | Minor n (%) |
|---|---|---|
| Whole Globe | 4 (20.0) | |
| Phthisis bulbi | | 3(15.0) |
| Buphthalmos | | 1(5.0) |
| Cornea | 2(10.0) | |
| Scarring | | 2(10.0) |
| Lens | 7(35.0) | |
| Cataract | | 5(25.0) |
| Amblyopia | | 2(10.0) |
| Retina | 0(0.0) | |
| Optic Nerve | 1(5.0) | |
| Atrophy | | 1(5.0) |
| Normal Globe | 6(30.0) | |
| Refractive Error | | 4(20.0) |
| Cortical Blindness | | 2(10.0) |
| Total | 20(100.0) | 20(100.0) |

**Figure I: DISTRIBUTION OF LENS RELATED CAUSES**




## DISCUSSION

The key informant method was employed in this study to mitigate the difficulty encountered in conducting population-based studies on prevalence and causes of childhood blindness namely, the need for large sample sizes which would provide precise estimates of prevalence and reliable information on causes.[16] The key informant method offers an alternative way to true population-based study and has been used to estimate childhood blindness in previous studies.[16,17,18] Using this method, the positive predictive value in this study was 23.8%, which was comparably close to other studies from Malawi[19] (25%) and Iran[20] (22%).

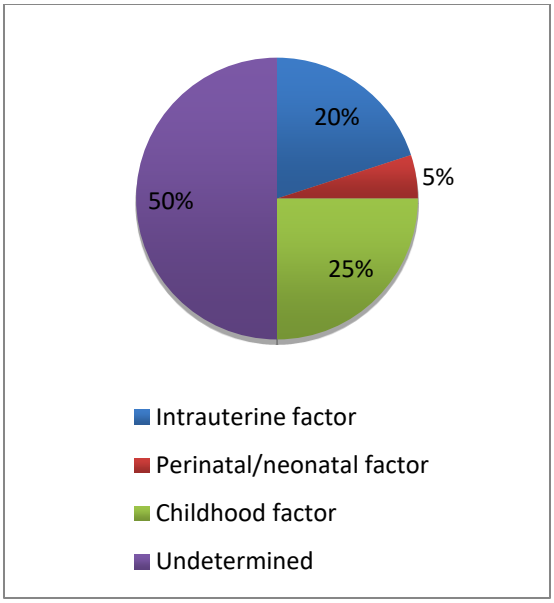



**Figure II: AETIOLOGICAL CLASSIFICATION OF CAUSES OF BLINDNESS/SVI IN IKPOBA OKHA LGA**

**Table VII: DISTRIBUTION OF AVOIDABLE (PREVENTABLE/TREATABLE) AND UNAVOIDABLE CAUSES OF BLINDNESS/SVIIN IKPOBAOKHA LGA**

| CAUSES | n % | Total % |
|---|---|---|
| **Preventable** | | 20.0 |
| Corneal scar (from measles) | 2(10.0) | |
| Rubella | 2(10.0) | |
| **Treatable** | | 70.0 |
| Cataract | 5(25.0) | |
| Uncorrected refractive error | 4(20.0) | |
| Phthisis bulbi (ophthalmia Neonatorun and infection) | 3(15.0) | |
| Glaucoma | 1(5.0) | |
| Optic atrophy | 1(5.0) | |
| **Unavoidable** | | 10.0 |
| Cortical Blindness (Hydrocephalous) | 2(10.0) | |
| Total | 20(100.0) | 100.0 |

Most of the blind children identified in this study were in the age group 6-10 years (60%), and about 80.0% were less than 11years of age. This is in contrast to the Bangladesh study where over half of the studied children were aged 11-15 years.[16] Early and appropriate intervention in this age group (less than 11years) may still yield positive outcome. The prevalence of childhood blindness and SVI from this study was 0.15 per 1000 children. This is in keeping with other studies in Nigeria by Duke et al [17] and Mohammed et al[18] (0.09-0.22/1000 and 0.20/1000) respectively where key informant method was used and it closely correlates with the findings from a study in Tanzania (0.17/1000).[21] This was however lower than studies done in Ethiopia[12] and Malawi[19] where the prevalence were 0.6/1000 and 0.8/1000 children respectively.

The observed decrease in prevalence could be because Ikpoba-Okha is a semi-urban community with some good health facilities, and functional PHCs. Furthermore, the measles vaccination coverage and the vitamin A supplementation in this community is reported to be very high.[22] Therefore it is expected that with good coverage and good health facilities, there will be low prevalence of diseases associated with vitamin A deficiency and measles. Another possible reason for this low prevalence may be underestimation, which may be due to under recruitment of affected children by key informants. Key informants had to rely on parental and community members report as the first stage for identification. In the study done in Ethiopia, the KIs, apart for relying on parental or community reports were also given Snellen charts and metre rule to assess the visual acuity.[12] Other reasons could be that the more remote households, whose children may have a different risk of blindness

or visual impairment, were less likely to be visited by a KI. In this study, five KIs did not refer any children (these KIs were sent to the urban part of the community). Demissie and Solomon in their study recruited three community mobilizers to supervise the KIs.[12] In this study however, the PHC coordinator foresaw the activities of the KIs.

It is not an uncommon practice for family/parents of the blind or disabled children to shield such children from the public due to socio-cultural beliefs which stem from blame and stigma. They may refuse to give access to such children to be screened.

The commonest anatomical cause of BL/SVI was lens-related, accounting for about one third (35.0%) of the cases. The percentage of blindness /SVI from lens-related cause found in this study was similar to community based-studies done in Nigeria[17] and elsewhere[12,15,19,21] using the key informant method. In these studies, lens abnormalities accounted for 33-35% of the causes of childhood blindness and severe visual impairment. This finding was also similar to other studies done in Nigeria[23,24] that reported lens-related causes as the commonest anatomical site of abnormality, accounting for 30.4% and 24.2% respectively even though the studies were in schools for the blind. With significant reductions in preventable causes of blindness, cataract is becoming a more prominent cause of treatable blindness in children in many developing countries.[16,25] This suggests that in a typical developing country with no routine rubella immunisation and limited or no paediatric ophthalmology services, there may be a resultant increase in childhood blindness from congenital cataract.[26]

Amongst the children assessed, one child had been diagnosed of bilateral cataract in a tertiary hospital, but the parental fear of a bad surgical outcome made them refuse surgery. This scenario is common in developing countries. Blindness due to childhood cataract in developing countries is primarily a result of inadequate surgical services, delayed presentation and/or poor follow-up.[25,27]

Population-based surveys using key informants suggest that 15–35% of childhood blindness is due to congenital or developmental cataract.[12,18,21] Cataract has been opined to be the most important cause of treatable childhood blindness and severe visual impairment, and about two hundred thousand children are blind from cataract worldwide.[28] It is now replacing corneal scarring as the leading cause of childhood blindness and low vision in Sub Saharan African countries and the rest of the developing world.[25] In Nigeria, 7,500 children are said to be blind due to cataract.[29] Childhood cataract deserves special attention as its management is different from adult cataract and requires a lot of surgical expertise and postoperative care.[30] Research suggests that post-operative follow-up, is still a challenge in Sub-Sahara Africa.[25] Some authors have argued that restoring the sight of one cataract blind child is equivalent to restoring the sight of ten elderly adults blind from cataract.[31] This is probably because of the number of blind years associated with childhood blindness. There is the need therefore, to find these children and refer them. Prevailing evidence suggests that it is essential to engage with the community in order to identify children needing assessment.[19,32] The finding of a reduction in the prevalence of preventable causes of

childhood blindness in this study is also corroborated by other studies.[16,27,31]

Globally, around 12.8 million children between five and fifteen years of age have visual impairment as a result of uncorrected or inadequately corrected refractive error.[11] A normal globe with uncorrected refractive error was responsible for about 20.0% of cases in this study. This is comparable to the study done in Ethiopia where refractive error was responsible in 17% of cases.[12] In contrast, Duke et al[17] in Cross Rivers, Nigeria reported that only 9.4% of childhood blindness and SVI was due to refractive error. All the children with refractive error in this present study had their visual acuity improved with refraction. This implies that they would not have been included in this study if they had spectacle correction already.

Corneal scarring has often been considered the major cause of blindness in children in the poorest countries.[7] Corneal scarring from measles infection/ Vit A deficiency as a major cause of childhood blindness/SVI is reducing in developing countries due to measles immunization and Vit. A supplementation.[12,16,25]

In this study, corneal scarring resulting from measles infection and use of harmful traditional eye medication was seen in 2(10.0%) of the children. Various studies in different regions of Nigeria reported that corneal scarring contributed greatly as a cause of childhood blindness with values ranging from 42.8% to 86.7%. [17,18, 23,33] Corneal scarring was the second commonest cause of blindness/SVI in children accounting for 28% of cases in Ethiopia,[12] which was however higher than what was found in this study.

Conditions affecting the whole globe were seen in 20% of the children. Phthisis bulbi was the cause of blindness in 3(15.0%) children, while congenital glaucoma (buphthalmos) was the cause of blindness/SVI in about 5.0% of children identified in this study. Ezegwui et al[23] found that 17.4% of blindness/SVI were due to phthisis bulbi and 9.3% was from buphthalmos, which is comparable to this study. Kello et al[34] however reported that phthisis bulbi (62.4%) was a prominent cause of blindness in children attending schools for the blind in Ethiopia. Nineteen percent (19.0%) of the causes of childhood blindness/SVI were from lesions of the whole globe in Cross Rivers, Nigeria,[17] which is similar to the finding in this study. Whole globe lesions were the commonest finding in the report by Umeh et al[35] affecting 30.7%. Childhood blindness resulting from glaucoma was seen in 4.1% and 11.4% of cases in Bangladesh and South_West Ethiopia respectively.

Optic atrophy from poorly treated meningitis constituted about 5.0% of the causes of blindness in this study. This finding was lower than that seen in Bangladesh[16] and in Cross River, Nigeria.[17]

Aetiologically, majority of the causes of childhood blindness/SVI was unknown (50.0%) and childhood factors constituted 25.0% in this study. This is similar to findings in other regions of Nigeria and elsewhere.[10,17,36,37] Alagaratam et al[38] in Edinburgh reported that perinatal-related blindness (40.0%), hereditary disease (26.0%) and developmental factors (26.0%) were the three common aetiological categories. Unlike the study done in Lorestan Province of Iran where majority of cases had hereditary aetiology (70.0%),[20] this study found no hereditary contribution.

The study found that majority (90%.0%) of the causes of childhood blindness and SVI are avoidable; 20% were preventable and 70% treatable. This was in contrast to the findings in Sokoto State, Nigeria where 80.0% were from preventable causes and 20.0% from treatable causes.[18] This study revealed that high proportion of the causes were treatable rather than preventable. These treatable causes were due to uncorrected refractive error and un-operated cataract. A Bangladesh study [15] using the same method also found similar results, where preventable and treatable causes contributed 26.0% and 45.0% respectively. In Ethiopia also, almost 90.0% of the causes were avoidable.[12] In contrast, developed countries like the United Kingdom reported that 75% of the causes of childhood blindness/SVI were neither preventable nor treatable.[39] Goggin et al in Republic of Ireland also, reported that avoidable conditions were by far less common than non-avoidable.[40]

In conclusion, majority of children from this study were therefore blind or severely visually impaired needlessly. Cataract, refractive error, glaucoma and ophthalmia neonatorum are all treatable conditions. Avoiding these needless blinding cases would require early case finding and timely intervention and follow-up. A significant proportion of the causes of blindness/SVI are avoidable and their aetiological factors are preventable or treatable with cheap and cost-effective intervention measures like health education, measles vaccination, simple refraction and distribution of correction glasses as well as timely cataract surgery and monitoring.

The results in this study therefore, provide useful baseline information for future studies and planning of prevention, special education and medical services in this area.

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