






# The prevalence and causes of low vision and blindness amongst learners at the Akropong School for the Blind in Ghana



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**Background:** Low vision and blindness have significant implications, resulting in a generally reduced quality of life amongst the sufferers.

**Aim:** To determine the prevalence and causes of low vision and blindness amongst learners at the Akropong School for the Blind.

**Setting:** The study was conducted in Akropong School for the Blind, Ghana.

**Methods:** A cross-sectional study design was used. Eye examinations included measurements of presenting distance visual acuity (PDVA) with the Tumbling 'E' distance LogMAR chart. Anterior and posterior segments were examined with an ophthalmoscope and a slit lamp.

**Results:** Two hundred and sixty-eight ( $N = 268$ ) learners comprising 157 (58.6%) males and 111 (41.4%) females took part in this study and their ages ranged from 4 to 43 years (mean and standard deviation [SD] =  $15.79 \pm 6.15$  years). The results indicated that 76.1% were classified as blind and 23.9% of the learners had low vision. The leading cause of low vision was glaucoma (39.1%) followed by pseudophakia (21.9%) and retinopathy (18.8%). The most common causes of low vision and blindness based on pathology found on ocular anatomical structures were corneal opacity/phthisis bulbi (35.5%), followed by glaucoma (25%), cataract (13.4%) and retinopathy (10.8%).

**Conclusion:** The leading causes of low vision and blindness identified in this study were because of avoidable diseases such as corneal opacity/phthisis bulbi and glaucoma. This highlighted the need for adequate primary eye care services, equitable eye health workforce distribution and eye health awareness in Ghana to help prevent low vision and blindness.

**Keywords:** prevalence; low vision; blindness; Ghana; School for the Blind.

## Introduction

Optometrists are eye care providers who provide comprehensive eye and vision care services, including vision rehabilitation to the visually impaired.<sup>1</sup> These services are limited in developing countries such as Ghana because of the limited eye health workforce, which may result in a high prevalence of undetected visual problems and consequently, visual impairment.<sup>2</sup> Visual impairment contributes to poor academic performance amongst children in developing countries and as such, about 90% of children with blindness do not attend school.<sup>3</sup>

The World Health Organization (WHO)<sup>4</sup> defines blindness as:

[T]he inability to perceive light in the better eye and low vision refers to reduced visual functioning after standard refractive correction with visual acuity of worse than 6/18 to light perception, or a visual field of less than ten degrees from the point of fixation in the better eye.

To achieve the goal of eliminating avoidable blindness and visual impairment, periodic estimates on the causes of vision impairment are essential as the causes vary with geographical location and time.<sup>4</sup> The data may then be used in developing policies for eliminating visual impairment and also to initiate future eye care planning.

With this in mind, the Ghana National Blindness and Visual Impairment Study under the auspices of the Operation Eyesight Universal was conducted from February 2015 to November 2016.<sup>5</sup> This population-based study aimed at providing a comprehensive representation of national data on

blindness and visual impairment in Ghana. The study identified the prevalence of moderate and severe low vision to be 1.07% and blindness to be 0.74% in the general population.<sup>5</sup> The causes of low vision and blindness, especially in children, were not included in the study, revealing a gap in the research.

There are currently three Schools for the Blind in Ghana: Wa Methodist School located in the Upper West Region of Northern Ghana, Akropong School located in Southern Ghana and Wenchi Methodist Secondary School located in the Brong-Ahafo region of Central Ghana (enrols both visually impaired and sighted students).<sup>6</sup> Akafo and Hagan,<sup>7</sup> and Ntim-Amponsah and Amoaku<sup>8</sup> conducted surveys in Akropong School for the Blind to determine the causes of childhood visual impairment and blindness in 1989 and 2003, respectively. The study by Akafo and Hagan<sup>7</sup> reported that 80% of the 129 children examined were blind, with corneal opacity/phthisis bulbi, cataracts, glaucoma and chorioretinal disease being the major causes of blindness. The study by Ntim-Amponsah and Amoaku<sup>7</sup> reported that over 40% of the children had low vision and identified corneal diseases and cataracts as the major causes of blindness. However, both studies did not provide sufficient data on the causes of visual impairment amongst the children in this School for the Blind. In addition, the authors<sup>7,8</sup> based their diagnoses only on ocular structures affected and not the specific pathology on the structures. Furthermore, these studies at Akropong School for the Blind were conducted almost two decades ago.

The most recently published study on visual impairment in children in Ghana is a survey conducted in 2017 at Wa Methodist School for the Blind,<sup>6</sup> located in Northern Ghana. This study reported that the prevalence of low vision and blindness was 67% and 33%, respectively. Regional inequality in human development (education and health) is substantial in Ghana, with the northern regions massively disadvantaged, particularly in terms of medical services compared to the southern regions.<sup>9</sup> These regional disparities may affect the health and eye profiles of children in the different regions of Ghana. With more recent information, a pattern of changes in low vision and blindness of the learners in the school can be identified. The aim of this study was, therefore, to determine the prevalence and causes of low vision and blindness amongst the learners in Akropong School for the Blind to assess the need for services and to compare the results with other studies.

## Methods

A cross-sectional study design was used to determine the prevalence and causes of low vision and blindness amongst learners at the Akropong School for the Blind in Ghana, which is situated in South Ghana. Akropong School for the Blind is a mixed school with day and boarding learners and caters to learners from kindergarten, primary, junior high school and vocational departments. The school admits learners with blindness and the visually impaired. All 375 learners enrolled in the school in 2019 were included in the study sample using a purposive sampling approach.

## Data collection

A structured questionnaire was used to collect demographic data such as the age and gender of the participants. To complete the eye examination, a clinical form specifically designed for this study was used to record distance and near visual acuities and causes of low vision and blindness.

Visual acuity (VA) was measured with the Tumbling 'E' distance logMAR chart at a distance of four metres. The VA was recorded and classified according to the WHO classification of low vision and blindness (Table 1). For the purpose of this study, blindness was defined as no perception of light (NPL) and light perception (PL) in the better eye and low vision as VA worse than 6/18 to perception of light with residual vision. The examination of the anterior segment was performed using a slit lamp biomicroscope. Assessment of the posterior segment was conducted with an ophthalmoscope and slit lamp biomicroscope, using a 90 D diagnostic lens through a dilated pupil. The causes of low vision and blindness were identified based on pathology found for ocular anatomical structures.

## Data analysis

Data collected were analysed using the International Business Machines Corporation's Statistical Package for Social Sciences (IBM SPSS) version 21 (SPSS Inc, Chicago, IL, United States [US]). Descriptive analysis of ranges of VA, measures of central tendency for age and frequencies for gender were performed and the prevalence rates of low vision and blindness were determined. A Pearson chi-square test was used to determine associations amongst the proportion of age groups and causes of low vision and blindness.

## Ethical considerations

The study was approved by the Ghana Health Service Ethical Review Committee (Protocol identity number: GHS-ERC: 017/08/18) and the Biomedical Research Ethics Committee of the University of KwaZulu-Natal (reference: BE 688/18). The study adhered to the tenets of the Declaration of Helsinki involving human subjects. Informed assent and consent were obtained from each learner and their parents and/or guardians, respectively, after the nature of the study was explained. There were no risks and/or discomfort associated with participating in the study and no financial remunerations were offered to the learners. Participation in the study was voluntary and learners were informed that they could

**Table 1:** WHO classification of low vision and blindness according to VA<sup>8</sup>

Classification	Type	Visual acuity in logMAR
Low vision	Moderate low vision	0.52 – 1.00
	Severe low vision	1.02 – 1.30
	Profound low vision	1.32 – 1.80
Blindness	Near-total blindness	1.82 – 3.00
	Total blindness	4.0 (NPL)

Source: Kumah EK, Wiafe B, Baffoe IO. Ghana national blindness and visual impairment study [homepage on the Internet]. 2017 [cited 2018 Feb 2]. Available from: [https://www.iapb.org/wp-content/uploads/2020/09/Ghana-Study-BVIS-8\\_6\\_2017\\_-Final-edit.pdf](https://www.iapb.org/wp-content/uploads/2020/09/Ghana-Study-BVIS-8_6_2017_-Final-edit.pdf)

NPL, no perception of light; logMAR, Logarithm of the Minimum Angle of Resolution.

withdraw their participation at any point without facing any penalties or losing treatment or other benefits to which they would usually be entitled.

## Results

### Demographics

Two hundred and sixty-eight of the 375 learners participated in the study, resulting in a response rate of 71.5%. Their ages ranged from 4 to 43 years (mean age and standard deviation [SD] = 15.79 ± 6.15 years). More than half of the participants (58.6%) were males and 41.4% were females.

### Prevalence of low vision and blindness in the better eye

Two hundred and four (76.1%) participants were classified as blind. The prevalence of low vision was 23.9% (64 participants) (95% confidence interval [CI]: 18.8–29.0). Table 2 shows the

**TABLE 2:** Prevalence of low vision and blindness.

Parameters	Classification	
	Blindness (n)	LV (n)
<b>Age group (in years)</b>		
0–5	10	1
6–10	28	11
11–15	62	15
16–20	64	30
21–25	24	6
26–30	10	1
30+	6	-
<b>Gender</b>		
Male	117	40
Female	87	24
<b>Total</b>	<b>204</b>	<b>64</b>

LV, low vision.

**TABLE 3:** Classification of low vision and blindness.

Distance VA	VA logMAR	Gender				Total	
		Male		Female		n	%
		n	%	n	%		
Moderate low vision	0.52–1.00	1	0.4	3	1.1	4	1.5
Severe low vision	1.02–1.30	21	7.8	7	2.6	28	10.5
Profound low vision	1.32–1.80	7	2.6	5	1.9	12	4.5
Near-total blindness	1.82–3.00	26	9.7	20	7.5	46	17.2
Total blindness	4.0 (NPL)	102	38.1	76	28.4	178	66.4
<b>Total</b>	-	<b>157</b>	<b>58.6</b>	<b>111</b>	<b>41.4</b>	<b>268</b>	<b>100.0</b>

VA, visual acuity; NPL, no perception of light; logMAR, Logarithm of the Minimum Angle of Resolution.

**TABLE 4:** Causes of low vision and blindness in the better eye.

Cause	Blindness		Low vision		Total	
	Male	Female	Male	Female	n	%
Cornea opacity/phthisis bulbi	59	31	3	2	95	35.5
Glaucoma	18	24	15	10	67	25.0
Cataract	20	9	4	3	36	13.4
Retinopathy	11	6	8	4	29	10.8
Complicated pseudophakia	4	4	10	4	22	8.2
Optic atrophy	1	10	0	1	12	4.5
Anophthalmos	1	2	-	-	3	1.1
Unknown	3	0	-	-	3	1.1
Trachoma	0	1	-	-	1	0.4
<b>Total</b>	<b>117</b>	<b>87</b>	<b>40</b>	<b>24</b>	<b>268</b>	<b>100.0</b>

prevalence of low vision and blindness according to the participants' age and gender. Participants in the age group 16–20 years formed the majority in the prevalence of low vision and blindness.

### Classification of low vision and blindness

Table 3 shows that 16.5% of the participants had moderate (0.52–1.00 logMAR) to profound (1.32–1.80 logMAR) low vision in the better eye. It was also noted that 66.4% of the participants were classified as having total blindness (VA = NPL). The rest (17.2%) fell in the near-total blindness (VA < 1.80 logMAR) category according to the level of vision impairment.

### Causes of low vision and blindness

The most common causes of low vision and blindness in this population were corneal opacities/phthisis bulbi (35.5%), glaucoma (25%), cataract (13.4%), retinopathy (10.8%) and complicated pseudophakia (8.2%). Other causes are shown in Table 4.

### Association between age groups and causes of low vision and blindness

Pearson chi-square tests were used to determine associations amongst the proportion of age groups and causes of low vision and blindness in the better eye. There was a statistically significant difference ( $p < 0.05$ ) in the proportion of age groups (11–15 and 16–20) and cornea opacity/phthisis bulbi and age groups (6–10 and 30 years and older) and cataract as the cause of low vision and blindness in the better eye (Table 5). The remaining conditions showed no statistically significant difference ( $p > 0.05$ ) in the

**TABLE 5:** Causes of low vision and blindness in the better eye according to age group.

Causes	Age groups							Total
	0–5	6–10	11–15	16–20	21–25	26–30	30+	
Cornea opacity/phthisis bulbi	5†,‡	15†,‡	35‡	22†	14†,‡	3†,‡	1†,‡	95
Glaucoma	3†	13†	18†	27†	4†	1†	1†	67
Cataract	0†,‡	2‡	10†,‡	14†,‡	5†,‡	2†,‡	3†	36
Retinopathy	2†	4†	6†	12†	3†	2†	0†	29
Complicated pseudophakia	0†	2†	4†	12†	2†	1†	1†	22
Optic atrophy	1†	2†	3†	4†	1†	1†	0†	12
Anophthalmos	0†	1†	1†	1†	0†	0†	0†	3
Unknown	0†	0†	0†	1†	1†	1†	0†	3
Trachoma	0†	0†	0†	1†	0†	0†	0†	1
<b>Total</b>	<b>11</b>	<b>39</b>	<b>77</b>	<b>94</b>	<b>30</b>	<b>11</b>	<b>6</b>	<b>268</b>

†, did not differ significantly amongst age groups; ‡, did not differ significantly amongst age groups.

**TABLE 6:** Association between the proportion of gender and causes of low vision and blindness.

Causes	Blindness		Low vision		Total	
	Male	Female	Male	Female	n	%
Cornea opacity/phthisis bulbi	59†	31‡	3§	2§	95	35.5
Glaucoma	18†	24‡	15§	10§	67	25
Cataract	20†	9†	4§	3§	36	13.4
Retinopathy	11†	6†	8§	4§	29	10.8
Complicated pseudophakia	4†	4†	10§	4§	22	8.2
Optic atrophy	1†	10‡	0§	1§	12	4.5
Anophthalmos	1†	2†	-	-	3	1.1
Unknown	3†	0†	-	-	3	1.1
Trachoma	0†	1†	-	-	1	0.4
<b>Total</b>	<b>117</b>	<b>87</b>	<b>40</b>	<b>24</b>	<b>268</b>	<b>100</b>

Note: Each superscript symbol denotes a subset of gender whose column proportions do not differ significantly from each other at the 0.05 level.

†, did not differ significantly amongst participants with blindness; ‡, differed significantly amongst participants with blindness; §, did not differ significantly amongst participants with low vision.

proportion of age groups and the causes of low vision and blindness in the better eye.

### Association between gender and causes of low vision and blindness

Pearson chi-square tests were used to determine associations between the proportion of gender and causes of blindness and low vision in the better eye. There was no statistically significant difference ( $p > 0.05$ ) in the proportion of gender and the causes of low vision. However, there was a statistically significant difference ( $p < 0.05$ ) in the proportion of gender and the causes of blindness such as cornea opacity/phthisis bulbi, glaucoma and optic atrophy as shown in Table 6.

## Discussion

This study determined the prevalence and causes of low vision and blindness at Akropong School for the Blind. The prevalence of low vision based on presenting VA was 23.9% and the major anatomical causes of low vision and blindness were corneal opacity/phthisis bulbi, followed by glaucoma and cataracts. These causes of low vision and blindness are mostly avoidable, which could be a reflection of the inadequacy of primary and secondary eye care services and a skewed eye health workforce distribution in the administrative regions of Ghana.<sup>10</sup> To illustrate this skewed workforce distribution, there are 91 ophthalmologists representing an ophthalmologist to population ratio of 1:311 080 in the public sector in Ghana, which is not enough

to adequately address the eye care needs of the country and does not meet the VISION 2020 target of 1 ophthalmologist per 250 000 population. However, the proportion of the population served by the eye care workforce in the public sector is not known in Ghana. Also, the availability of primary eye care services in the public sector is limited with only 44% of the total optometric workforce employed in that sector.<sup>10</sup> The leading ocular conditions in this study such as corneal ulceration, which lead to corneal opacity/phthisis bulbi, along with glaucoma are managed at the primary level by optometrists in Ghana. Surgical cases such as cataracts are referred to the secondary level for further management by ophthalmologists. Furthermore, 42% of public health facilities are equipped with basic eye care equipment and most of them at the district level lack specialised equipment.<sup>10</sup> This could lead to difficulty in diagnosing and managing these conditions, which results in vision impairment and blindness at the primary level.

There were more males than females in this study, possibly reflecting the trend observed in many countries of Africa, where males have a generally higher chance of being sent to schools than their female counterparts.<sup>11,12,13</sup> Cultural and tradition practices in Ghana give preference to males over females in education.<sup>14</sup> The gender ratio in this study is slightly lower than the reported studies in other developing countries like Ethiopia<sup>11,12</sup> (1.8:1) and India<sup>15</sup> (1.7:1).

It is interesting to note that the number of participants examined in this study was higher compared to a previous



study conducted at the same school by Akafo and Hagan,<sup>7</sup> who reported that there were 129 registered participants in 1989, whilst a study conducted in 2003 reported that 199 learners were registered at the school.<sup>8</sup> A previous study conducted at Wa Methodist School for the Blind examined 190 participants in 2014.<sup>6</sup> These results may indicate that over the years, parents and caregivers have become aware of visual impairment and blindness amongst their children and the need to offer these children an opportunity to be educated at the appropriate schools for the blind.<sup>16</sup> This could also be indicative of the failures at the primary care levels to identify, diagnose comprehensively and appropriately manage these conditions because of inadequate specialised equipment at the district level, hence increasing the number of cases that go untreated and end up at these schools.

The mean age of the participants was  $15.79 \pm 6.15$  years and 127 (47.4%) participants were younger than 16 years. Late presentation to schools and the quest for vocational training might have led learners of age 30 and over being present in the school. These results are similar to those reported in Ethiopia,<sup>11,12</sup> Nigeria<sup>13</sup> and Burundi.<sup>17</sup> Poor academic performance because of limited braille educational materials and late start of school have been cited as contributing factors to adults admitted in Schools for the Blind in Africa.<sup>11,12</sup> It has been reported that these learners experience academic challenges, which retards their progress.<sup>11,12</sup> Other researchers<sup>11,17</sup> have reported that learners, mostly those admitted to boarding schools, receive little or no support from their guardians, resulting in slow academic progress. In addition, there are limited career opportunities for persons with visual impairment post-basic schooling, which may be the reason that they remain in vocational schools into adulthood.<sup>18</sup>

A low vision prevalence rate of 43.7% was previously reported at the same school by Ntim-Amponsah and Amoaku,<sup>8</sup> which is almost twice the rate found in the current study. The decrease in the prevalence rate of low vision might have resulted from the increased awareness of eye health amongst parents/guardians of the participants as well as the Ghanaian society at large.<sup>19</sup> Improvement in socioeconomic development and health care could have also contributed to this result.<sup>20</sup> There has also been a general increase in access to eye care services and corrective devices in Ghana.<sup>10</sup> Furthermore, better screening protocols, developed for school entry based on previous findings, might have also influenced the prevalence of low vision amongst the learners and contributed to the integration of learners with low vision into mainstream schools.<sup>8,21</sup>

A similar study amongst learners in a School for the Blind in Nigeria reported a lower prevalence rate for low vision (13.3%).<sup>13</sup> This reduced prevalence rate was reported to be because of the advancement of primary eye care, especially ophthalmology and optometric practices in Nigeria.<sup>22</sup> Ophthalmologists to population ratio in Nigeria is higher

(3.3 million) than the reported average ratio (2.2 million) for other sub-Saharan regions.<sup>22</sup> This shows that increased ophthalmological services can reduce the prevalence of low vision and blindness.

The most common anatomical causes of low vision and blindness amongst the participants were consistent with reports from similar studies conducted over the years in Schools for the Blind in Ghana.<sup>6,7,8</sup> In all of these studies, including the current study, corneal opacity/phthisis bulbi, cataract and glaucoma were the major causes of blindness and low vision. The findings in this study are also consistent with those of Okoye et al.<sup>13</sup> and Onakpoya et al.<sup>23</sup> who conducted their studies in Nigeria. Furthermore, in other parts of Africa, anatomical anomalies contributing to visual loss have been recorded as a corneal opacity/phthisis bulbi followed by whole globe lesions and lens-related disorders, amongst others.<sup>24</sup> The major causes of low vision and blindness reported in African studies did not change appreciably from 1995 to 2009,<sup>24</sup> indicating no marked regional variations amongst learners in schools for the blind in many African countries. The regional findings support the need for an increase in primary eye care services and associated workforce in Africa as well as the need for an equitable distribution and promotion of these services.

In contrast to the above-mentioned African studies, in Brazil, Couto et al.<sup>25</sup> reported the main causes of blindness to be retinopathy of prematurity (21%), optic nerve atrophy (18%) and congenital glaucoma (16%). A review study of blindness and low vision in America and the Caribbean found the major causes of low vision to be cataract, retinopathy of prematurity, optic atrophy and glaucoma.<sup>26</sup> The differences in the most common cause of blindness may be because of regional variations as a consequence of varying access to care, socioeconomic status and prevention measures for childhood diseases such as corneal opacity/phthisis bulbi, cataract and glaucoma amongst others, which could be positively impacted upon by low cost and improved access to eye care services. In developing countries such as Ghana, the high cost and poor access to eye care services make avoidable eye diseases such as glaucoma and cataract very common, which is evident in this study.<sup>10,27</sup>

The proportion of participants with cornea opacity/phthisis bulbi and cataract differed significantly amongst age groups (Table 5). The reason for this difference could not be determined in this study. However, a high mortality rate of 53 per 1000 for children in Ghana might have contributed to the difference in proportion amongst the age groups.<sup>28</sup> There is a high premature death amongst children with disabilities compared to those with no disabilities, which leads to fall out of learners as they progress in school. Participants younger than 11 years were less likely to have a cataract and complicated pseudophakia compared to those of age 11 years and older. This might be because of late

presentation of participants with cataract for surgery<sup>27,29,30,31</sup> and late complications from cataract surgeries such as posterior subcapsular opacities as a result of inadequate follow-ups.<sup>27,32,33</sup> Also, glaucoma and corneal opacities were more prevalent amongst those between ages 11 and 20 years, possibly because of the progressive nature of glaucoma and being more active (therefore more exposed to corneal insults), respectively. In addition, conditions, such as measles, vitamin A deficiency and severe keratoconus, which can cause corneal insults, might have influenced these results.

A significant proportion of males were blind from cornea opacity/phthisis bulbi compared to females. The aetiology of ocular conditions was not within the scope of this study. However, studies in other parts of Africa have reported that males have a higher risk of corneal blindness than females.<sup>34,35</sup> This is because of the incidence of cornea trauma amongst male children as a result of playing with pointed objects.<sup>34,35</sup> Previous studies in Ghana did not report on the association of gender with leading causes of low vision and blindness. Also, a significant proportion of females were blind from glaucoma and optic atrophy compared to males. This finding is similar to studies on glaucoma, but there is no substantive evidence of gender predilection for glaucoma and optic atrophy.<sup>36,37</sup>

In summary, the prevalence of low vision in this study was low compared to previous studies. The main cause of low vision in this study was glaucoma and the most common anatomical cause of low vision and blindness was corneal opacity/phthisis bulbi. This information can be used to inform stakeholders in the healthcare system in Ghana to increase eye care services in this region to further minimise avoidable causes of low vision and blindness.

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## Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

## Authors' contributions

M.A.K., K.P.M., K.S.N., S.B.B-K. and P.G-P. contributed equally to the design and implementation of this research, to the analysis of the results and to the writing of this manuscript.

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## Data availability

The authors confirm that data supporting the findings in this study are available within this article.

## Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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