ORIGINAL ARTICLE

Childhood Vision Impairment and Refractive Error in Zimbabwe: A Hospital-based Retrospective Study

Michael Agyemang Kwarteng¹,²*, Chido Cleopatra Katsvanga¹, Samuel Kyei¹,³

ABSTRACT

BACKGROUND: The objective of this study was to determine the causes and distribution of vision impairment and refractive error among children in Zimbabwe.

METHODS: A hospital-based retrospective cross-sectional study was conducted among children (3-16) who attended the Eye Institute, Harare, Zimbabwe, from January 2010 to December 2020. Patients’ records were collated, and variables such as visual acuity, ocular morbidities, and vision impairment were analysed.

RESULTS: During this time, 1038 children with a mean age of 10.63 ± 3.54 years visited the facility. The majority of them were males (53.2%). Prior to treatment, 9.9% of the children had vision impairment which reduced to 3.5% after intervention. Uncorrected refractive error accounted for the majority of vision impairment (67.0%), followed by keratoconus (7.8%), corneal opacity/ulceration (6.8%), and amblyopia (6.8%), among other conditions. Astigmatism (60.6%) was the most prevalent type of refractive error followed by myopia (37.5%).

CONCLUSION: The prevalence of childhood vision impairment is higher than that found in similar hospital-based studies conducted in Africa. The most common reason for childhood vision impairment was uncorrected refractive error.

KEYWORDS: Vision impairment, childhood, Zimbabwe, refractive error, keratoconus

INTRODUCTION

The global estimates of both near and distance vision impairment stands at 2.2 billion of which almost half are preventable and or unavoidable (1). It is evident that majority of these cases of vision impairment are due to uncorrected refractive error (1). Even though cases of vision impairment are common among persons aged 50 years and older, it poses a critical developmental challenge when it affects children besides the huge global financial burden of productivity loss of 244 billion United States dollars due to myopia alone (2,3).

The three main domains in which vision impairment influences the cognitive development of children includes its effects on experience, mobility, and self-control in respect to the environment (4). These have consequential effect on children’s development,
restricting their participation in socio-physical, educational and in later life employment prospects.

Apart from these, early vision impairment among children affect language development as they have limited access to the environment and differential verbal feedback from people within the community (5). This is because vision plays a key role in the perception of objects in totality and context but the visually impaired children depend on sequential observation. This is to say, they see and touch only a part of objects which builds up limited information of an image component (6). The visually impaired have also been found to have high incidence of psychiatry disorders notably anxiety and depressive tendencies (7,8). These undoubtedly have enormous impact on their quality of life given their comparatively extended disability-adjusted life years (9).

This study is the first to focus on vision impairment and refractive error among children in Zimbabwe to ascertain their distinctiveness with respect to vision impairment and refractive error and other associated factors. This is intended to inform the appropriate cohort public health intervention.

MATERIALS AND METHODS

The hospital-based retrospective cross-sectional investigation was carried out at the Eye Institute, a private facility in Harare. The facility has the following eye care staff; Ophthalmologists, Optometrists, Ophthalmic nurses, and Opticians. The facility has 10 branches across the country, however, the main branch where this study was conducted has the full complement of the eye health workers, provides surgical services and receives referral from the 9 branches and other care facilities. Paediatric medical records were collected from 2010 to 2020 for children aged 3 to 16 years. The data collection spanned from April to November 2021.

Inclusion and exclusion criteria: The study included records of children who visited the facility between January 2010 and December 2020. The data included only information of their maiden medical visit. Medical records that contained insufficient information were excluded.

Data collection procedure: A data extraction sheet was used to collect socio-demographic (age, sex, and residence) and clinical profile (presenting visual acuity, best-corrected visual acuity, cause of visual impairment and refractive status).

Data analysis: The Statistical Package for Social Sciences (SPSS) version 21 from IBM was used to analyse the data (SPSS Inc, Chicago, IL, USA). The prevalence rate of vision impairment was determined using descriptive statistics for visual acuity ranges, age-specific central tendency measurements, and gender-specific frequency distributions.

Ethical consideration: The Research Ethics Committee of the Bindura University of Science Education approved the study protocol (reference number 0004/2021). The study complied with the tenets of the Declaration of Helsinki.

RESULTS

Demographics: There were 1038 (94.9%) out of 1094 folders which met the inclusion criteria and were included in the analysis. Majority were males, 552 (53.2%). The mean age was 10.63 ± 3.54 years with a range of 3 to 16 years. Most (63.7%) of the patients were less than 10 years and majority (82.4%) of them resided in urban centres (Table 1).

| Demographics | Male (%) | Female (%) | Total (%) |
|--------------|---------|------------|-----------|
| Age groups   |         |            |           |
| < 10         | 330 (66.3) | 331 (66.3) | 661 (63.7) |
| ≥ 10         | 222 (63.2) | 155 (63.2) | 377 (63.2) |
| Location     |         |            |           |
| Urban        | 461 (63.2) | 394 (63.2) | 855 (63.2) |
| Periurban    | 91 (63.2) | 92 (63.2) | 183 (63.2) |
| Total        | 552 (53.2) | 486 (46.8) | 1038 (100) |

Table 1: Demographics of patients, Zimbabwe, 2010-2020.
Prevalence of vision impairment: The prevalence of presenting vision impairment in the better eye was 9.9% [95% CI: 8.17 – 11.9] and 3.5% [95% CI: 2.44 – 4.77] after intervention. At presentation, children with mild to moderate vision impairment were 89 (8.6%) as opposed to 28 (2.7%) after intervention. This constitutes 68.5% reduction of vision impairment after intervention. On the other hand, the number of children who presented with blindness reduced from 14 to 8, almost halving the number of children with blindness after the intervention (Table 2).

Table 1: Prevalence of vision impairment, Zimbabwe, 2010-2020.

| Vision impairment | Sex of patients | Total (%) | P-value |
|-------------------|----------------|-----------|---------|
|                   | Female | Male |         |         |
| Normal (0.0 – 0.3 logMAR) | 442  | 493 | 935 (90.1) | 0.761 |
| Mild (0.32 – 0.5 logMAR)   | 27    | 33  | 60 (5.8)   |         |
| Moderate (0.52 – 1.0 logMAR) | 11  | 18  | 29 (2.8)   |         |
| Blindness (1.32 – 4.0 logMAR) | 6   | 8   | 14 (1.3)   |         |
| Normal (0.0 – 0.3 logMAR) | 474  | 528 | 1002 (96.5) | 0.358 |

1 = Presenting best visual acuity; 2 = best-corrected visual acuity

Causes of presenting childhood vision impairment: The principal cause of childhood vision impairment was uncorrected refractive error (67.0%). Corneal diseases and amblyopia constituted the second tier (21.4%) causes of vision impairment. Cataract, leukocoria, glaucoma and retinopathy contributed marginally (11.6%) to the causes of vision impairment as against refractive error, keratoconus, corneal opacity and amblyopia. However, no female presented with cataract (Table 3).

Table 2: Causes of presenting childhood vision impairment, Zimbabwe, 2010-2020.

| Cause of vision impairment       | Sex of patients | Total (%) | P-value |
|----------------------------------|----------------|-----------|---------|
|                                  | Female | Male |         |         |
| Refractive error                 | 31     | 38  | 69 (67.0) | 0.454 |
| Keratoconus                      | 2      | 6   | 8 (7.8)   |         |
| Corneal opacity/ulceration       | 2      | 5   | 7 (6.8)   |         |
| Amblyopia                        | 4      | 3   | 7 (6.8)   |         |
| Cataract                         | 0      | 4   | 4 (3.9)   |         |
| Leukocoria                       | 2      | 1   | 3 (2.9)   |         |
| Retinopathy                      | 2      | 1   | 3 (2.9)   |         |
| Glaucoma                         | 1      | 1   | 2 (1.9)   |         |
| Total                            | 44     | 59  | 103 (100) |         |

Distribution of refractive error: Astigmatism was the most prevalent (60.6%) type of refractive error followed by myopia (37.5%) of which most (90.9%) of them had low myopia. Hypermetropia constituted the least of the refractive errors, however, their high magnitude could predispose
children to amblyopic tendencies (Table 4). The classification of refractive error was based on the
study by Naidoo et al (10).

Table 3: Distribution of Refractive error according to sex, Zimbabwe, 2010-2020.

| Refractive error (range)          | Female | Male | Total (%) |
|----------------------------------|--------|------|-----------|
| Astigmatism (-0.75 to -6.00 D)   | 83     | 77   | 160 (60.6) |
| Myopia (-0.50 to -9.50 D)        | 48     | 51   | 99 (37.5)  |
| Myopia (-0.50 to -5.75 D)        | 42     | 48   | 90 (90.9)  |
| High myopia (-6.00 to -9.50 D)   | 6      | 3    | 9 (9.1)    |
| Hypermetropia (+2.00 to +14 D)   | 1      | 4    | 5 (1.9)    |
| Moderate (+2.00 to +5.00 D)      | 0      | 2    | 2 (4.0)    |
| High (≥ +5.25 D)                 | 1      | 2    | 3 (6.0)    |
| Total                            | 132    | 132  | 264 (100)  |

Myopia ≥ -0.50 DS, Hyperopia ≥ +2.00 DS, Astigmatism > -0.50 D in isolation or association with hypermetropia or myopia

DISCUSSION

This hospital-based cross-sectional study determined the prevalence, causes and distribution of vision impairment and refractive error among children attending a private tertiary referral facility in Zimbabwe. Optometrists in Zimbabwe are only found in the private sector; patients would have to rely on private care providers for their refractive error services. The proportion of vision impairment at presentation was reduced more than two folds after intervention (Table 2). This could be due to the fact that uncorrected refractive error which constituted the most cause of the vision impairment is easily treatable with optical aids.

A lower prevalence was recorded for presenting childhood vision impairment in this study compared to a population-based study by Tagoh et al. (11), which reported 78.6% as the prevalence for childhood vision impairment. The rural milieu in which Tagoh et al. (11) performed their investigation could have played a role in explaining the disparity in the prevalence. In addition, the study's methodology and the availability of subjects may have contributed to its high incidence. Furthermore, people in rural areas of Zimbabwe are more inclined to wait for services provided by government-sponsored and non-governmental organization programs than people in urban areas because of the high expense of accessing health care (12, 13).

This research shows that the prevalence of vision impairment was higher than in similar hospital-based studies in Africa. The prevalence of childhood (5–15 year) vision impairment was 1.3% in Cameroon (14) and 2.5% in South African (15) children (6–18 years). These analyses produced results that differed from the current research results because public eye care facilities for refractive services are readily available and easily accessible in Cameroon and South Africa, and patients would be going to different centers hence making the prevalence lower, whereas this is not the case in Zimbabwe.

Uncorrected refractive error was the most common cause of vision impairment, which is in line with studies in Africa and less developed countries (11, 16, 17). In contrast, in industrialized countries, the new trends are retinal dystrophies and optic neuropathies as the primary causes of childhood vision impairment (18). However, uncorrected refractive error remains the leading global cause of vision impairment and cataract as the main cause of blindness (1). In a study by Penda et al. (14), glaucoma was the most common cause of vision loss among Cameroonian children. Disparities between regions may be attributable to difference in access to eye care and preventative measures for childhood ocular disorders, such as refractive services, which could improve with low cost spectacles and ease of accessibility. It is worth noting that keratoconus was the second most common cause of vision impairment in this
The authors are grateful to the management of the Eye Institute, Harare, Zimbabwe for granting the permission to use their facility as the study centre.

REFERENCES

1. World Health Organization. World Report on Vision. 2019. [https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment].
2. Loh KY, Ogle J. Age related visual impairment in the elderly. Med J Malaysia. 2004; 59(4): 562-8.
3. Naidoo KS, Fricke TR, Frick KD, Jong M, Naduvilath TJ, Resnikoff S, et al. Potential lost productivity resulting from the global burden of myopia: systematic review, meta-analysis, and modeling. Ophthalmology. 2019; 126(3): 338–346.
4. Shoham N, Eskinazi M, Hayes JF, Lewis G, Theodorsson M, Cooper C. Associations between psychosis and visual acuity impairment: A systematic review and meta-analysis. Acta Psychiatr Scand. 2021; 144(1): 6–27. doi: 10.1111/acps.13330.
5. Perez-Pereira M, Conti-Ramsden G. Language Development and Social Interaction in Blind Children (1st ed.). Psychology Press, London. 1999. [https://doi.org/10.4324/9780203776087]
6. Pandey RK. Comparative Study of Adjustment of Visually Impaired Students. Universal J Educational Res. 2018; 6(11): 2562-2571. DOI: 10.13189/ujer.2018.061121.
7. Ishhtiaq R, Chaudhary MH, Rana MA, Jamil AR. Psychosocial implications of blindness and low vision in students of a school for children with blindness. Pak J Med Sci. 2016; 32(2):43-434. doi:10.12669/pjms.322.8737
8. Augestad LB. Mental Health among children and young adults with visual impairments: a systematic review. J Vis Impairment & Blindness. 2017; 111(5):411-425. 
9. Khorrami-Nejad M, Sarabandi A, Akbari M-R, Askarizadeh F. The impact of visual impairment on quality of life. Med Hypothesis Discov Innov Ophthalmol. 2016;5(3):96–103.
10. Naidoo KS, Raghunandan A, Mashige KP, Govender P, Holden BA, Pokharel GP, et al. Refractive error and visual impairment in African children in South Africa. *Invest Ophthal Vis Sci.* 2003; 44(9): 3764-70.

11. Tagoh S, Kyei S, Kwarteng MA, Aboagye E. Prevalence of refractive error and visual impairment among rural dwellers in Mashonaland Central Province, Zimbabwe. *J Curr Ophthalmol.* 2020; 32: 402-7.

12. Nhapi TG. Socioeconomic Barriers to Universal Health Coverage in Zimbabwe: Present Issues and Pathways Toward Progress. *J Developing Societies.* 2019; 35(1):153-174.

13. Mutenga, T. High medical costs hit Zimbabwe. (2016). Retrieved from http://www.financialgazette.co.zw/high-medical-costs-hit-zimbabwe/

14. Penda CI, Betoko RM, Bebey FS, Mimbou GE, Eposse C, Eboumbou PE, et al. Causes of Visual Impairment in Children Aged 5 to 15 Years: An Observational Study in Cameroon. *Health Sci Dis.* 2020; 21(10): 54-58

15. Maake MM, Oduntan OA. Prevalence and causes of visual impairment in patients seen at Nkhensani Hospital Eye Clinic, South Africa. *Afr J Prim Health Care Fam Med.* 2015;7(1):728.

16. Naipal S, Rampersad N. A review of visual impairment. *Afr Vision Eye Health.* 2018; 77(1): a393.

17. Atowa UC, Hansraj R, Wajuhiian SO. Visual problems: a review of prevalence studies on visual impairment in school-age children. *Int J Ophthalmol.* 2019;12(6):1037-1043.

18. Pham C, Sheth SJ, Keeffe JE, Carden SM. New trends in childhood vision impairment in a developed country. *J American Assoc Pediatr Ophthalmol Strab.* 2017 Dec 1;21(6):496-8.

19. Akowuah PK, Kobia-Acuah E, Donkor R, Adjei-Anag J, Ankamah-Lomotey S. Keratoconus in Africa: A systematic review and meta-analysis. *Ophthalmic Physiol Opt.* 2021 Jul;41(4):736-747.

20. Masiwa LE, Moodley V. A review of corneal imaging methods for the early diagnosis of pre-clinical Keratoconus. *J Optometry.* 2020; 13: 269-275.

21. He M, Zeng J, Liu Y, Xu J, Pokharel GP, Ellwein LB. Refractive error and visual impairment in urban children in southern china. *Invest Ophthalmol Vis Sci.* 2004; 45(3): 793-9.

22. Maul E, Barroso S, Munoz SR, Sperduto RD, Ellwein LB. Refractive Error Study in Children: results from La Florida, Chile. *Am J Ophthalmol.* 2000; 129(4): 445-54.

23. Ovenseri-Ogbomo G, Osuagwu UL, Ekpenyong BN, Agho K, Ekure E, Ndep AO, et al. Systematic review and meta-analysis of myopia prevalence in African school children. *PLoS One.* 2022 Feb 3; 17(2):e0263335.

24. Gong JF, Xie HL, Mao XJ, Zhu XB, Xie ZK, Yang HH, et al. Relevant factors of estrogen changes of myopia in adolescent females. *Chin Med J (Engl).* 2015; 128(5): 659-663.