






Demographic Characteristics and Causes of Visual Impairment in the White Nile State of Sudan: A Hospital-based Study

Atif Babiker Ali¹, Abdelaziz M. Elmadina^{2*}, Saif H. Alrasheed^{2,3}, Sulaiman Aldakhil², Mohammed Alluwimi², Roghia Abdarshead Derar¹

¹Department of Low Vision, Faculty of Optometry, Al-Neelain University, Khartoum, Sudan; ²Department of Optometry, College of Applied Medical Sciences, Qassim University, Buraydah, Saudi Arabia; ³Department of Binocular Vision, Faculty of Optometry, Al-Neelain University, Khartoum, Sudan

Abstract

Edited by: Ksenija Bogoeva-Kostovska
Citation: Ali AB, Elmadina AM, Alrasheed SH, Aldakhil S, Alluwimi M, Derar RA. Demographic Characteristics and Causes of Visual Impairment in the White Nile State of Sudan: A Hospital-based Study. Open Access Maced J Med Sci. 2022 Apr 16; 10(B):1566-1570. https://doi.org/10.3889/oamjms.2022.9028

Keywords: Causes of visual impairment; Demographic characteristics; Cataract; Glaucoma; Refractive errors
***Correspondence:** Abdelaziz M. Elmadina, Department of Optometry, College of Applied Medical Sciences, Qassim University, Buraydah, Saudi Arabia. E-mail: a.alkhalil@qu.edu.sa

Received: 16-Feb-2022

Revised: 02-Apr-2022

Accepted: 06-Apr-2022

Copyright: © 2022 Atif Babiker Ali, Abdelaziz M. Elmadina, Saif H. Alrasheed, Sulaiman Aldakhil, Mohammed Alluwimi, Roghia Abdarshead Derar

Funding: This research did not receive any financial support

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

Open Access: This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

BACKGROUND: The World Health Organization (WHO) states that visual impairment (VI) is a reduction of vision functions due to eye diseases, trauma, and congenital eye conditions. The current estimates indicate that more than 90% of people with vision impairment live in rural and developing countries.

AIM: This study aimed to determine demographic characteristics and causes of visual impairment in the White Nile State of Sudan.

METHODS: A cross-sectional retrospective hospital-based study, including all patients attending Kosti and Rabak eye hospitals from January to December 2017, was conducted. A total of 1,000 records reviewed, 300 of them met the required criteria and then included in this study, with a mean age of 59.8 ± 18.5 (ranged from 10 to 95) years old. Visual impairment was classified according to the International Classification of Diseases, 11th revision, 2018 (ICD-11).

RESULTS: The prevalence of VI was found at 28.5%. Based on best-corrected visual acuity (BCVA), six participants (2.0%) were mild VI, 32 (10.7%) had moderate VI, 152 (50.7%) had severe VI, and 110 (36.7%) were blind. VI was associated with patients age in children (3.6%) and reached (48.3) in older age ($p = 0.001$). VI was more common among males 158 (52.7%) than females, but statistically not significant ($p = 0.35$). The main causes of VI were cataract (52%), refractive errors (20.7%), glaucoma (16.3%), corneal disorders (5.3%), diabetic retinopathy (1.7%), and other causes (4%).

CONCLUSION: Visual impairment was high in the community and more prevalent among older age. Cataract was the leading cause of VI, then refractive errors and glaucoma. Among children, uncorrected refractive errors and cataracts were the common leading causes of VI. In adults, the main causes were cataracts, uncorrected refractive errors, and glaucoma.

Introduction

Global estimates indicate that there are around 285 million visually impaired people worldwide, 39 million of these are blind and the remaining is affected by low vision with many of them living in Africa [1], [2]. Visual impairment (VI) was classified according to the International Classification of Diseases, 11th revision, 2018 (ICD-11). Mild VI is defined as visual acuity (VA) worse than 6/12 to 6/18 of the best-corrected eye, while moderate VI is VA worse than 6/18 to 6/60. However, severe VI is defined as VA worse than 6/60 to 3/60, and blindness is defined as VA worse than 3/60 in the better eye with the best correction possible [3]. The prevalence of VI has continually been increasing over the years, thus imposing a heavy burden on the economy globally as well as in the communities [4], [5]. The current estimates indicate that more than 90% of people with vision impairment live in rural and developing countries [3], [5]. This geographical disparity

may be attributed to a higher prevalence of VI related to poverty or environmental conditions and reduced access to eye care services in poor nations [6], [7]. In terms of gender, women are at a higher risk of VI due to longer life expectancies and lack of access to health care services especially in rural areas [8], [9].

Fortunately, in Africa, the number of people with VI decreased slightly from 314 million in 2002–285 million in 2010. The observed decrease in the prevalence of VI globally and Africa may be attributed to the achievements of the VISION 2020 initiative [10]. The main causes of VI worldwide are refractive errors, cataracts, macular degeneration, and glaucoma [1], [11], [12]. According to age, VI is unequally distributed across age groups more than 82% of blind people who are older than 50 years. However, childhood blindness remains a significant problem, with an estimate of 1.4 million blind children who are younger than 15 years [13]. Age-related macular degenerations, glaucoma, and diabetic retinopathy are the leading

causes of blindness in the developed world [14]. The World Health Organization (WHO) estimates that 80% of VI cases are either avoidable or curable with early investigation and treatment [3]. This includes cataracts, onchocerciasis, trachoma, glaucoma, diabetic retinopathy, uncorrected refractive errors, and some cases of childhood blindness [3], [1].

Few studies were conducted in Sudan to estimate the prevalence and causes of VI. The study was performed by Ibrahim and Elimeiri [15] to estimate the prevalence and major causes of blindness among Sudanese adults attending ophthalmic services in Sudan in 2019. They reported that the prevalence of blindness was high, the majority were female of older age groups and glaucoma was the leading cause of blindness followed by cataract and diabetic retinopathy. Another study was conducted by Alrasheed *et al.* [2] to assess the prevalence of childhood VI and refractive error in the South Darfur State of Sudan. They reported that refractive error was a major cause of childhood VI among children in the South Darfur State. In another study done by Mohamed *et al.* [16], to determine the prevalence and causes of childhood VI in the Al-Gazira state of Sudan, they found that the prevalence of VI was 1.5% and uncorrected refractive errors were a major cause of childhood VI. Binnawi *et al.* [17] conducted a study to estimate the prevalence and causes of VI in people aged 50 years and older in the North Kordofan state of Sudan. They stated that the prevalence of blindness and VI was 8.37% and 9.06%, respectively. To the best of our knowledge, there is no study conducted in the White Nile State of Sudan to determine the causes and prevalence of VI. Therefore, the present study aimed to determine demographic characteristics and causes of visual impairment in the White Nile State of Sudan.

Materials and Methods

Study design

A cross-sectional retrospective hospital-based study was conducted to determine the leading causes of visual impairment in White Nile State-Sudan. Data were collected from all patients attending the Two Eye Hospitals (Kosti and Rabak) from January to December 2017.

Ethical consideration

Ethical approval was obtained from the Al-Neelain University Research Ethics Committee, and the study was performed according to the Declaration of Helsinki guidelines. Informed consent was waived due to the retrospective nature of the study. However, efforts

were made to ensure that patients' confidentiality was guaranteed. The collected data were saved confidentially, and no individual information was obtained.

Data collection procedures

A total of 1000 records were reviewed, 300 of them were satisfied with the required criteria and then included in this study, with a mean age of 59.8 ± 18.5 (ranged from 10 to 95) years older, 52% of whom were male, while 48% were female. Visual impairment was classified according to the International Classification of Diseases 11th revision, 2018 (ICD-11). Distance vision impairment: Mild VI is defined as VA worse than 6/12 to 6/18 of the best-corrected eye, while moderate VI is VA worse than 6/18 to 6/60. However, the severe VI defined as VA worse than 6/60 to 3/60 and blindness defined as VA worse than 3/60 in the better eye with the best correction possible.

Data collection procedures

The data were entered into an Excel sheet and then analyzed using SPSS version 21 and GraphPad prism. Descriptive analysis was carried out to calculate the means with frequencies and proportions for the categorical variables, p -value ≤ 0.05 was considered significant for all inferential analyses.

Results

A total of 300 out of 1,000 patients from Kosti and Rabak eye Hospital records were included in this study. The mean age of the participants was 59.8 ± 18.5 (range: from 10 to 95) years older, 52% of whom were male, while 48% were female. With regard to the refractive condition, 36.7% were myopic, 13.3% hypermetropic, and 50% with faint fundus reflex.

The prevalence of VI was found at 28.5%. Based on BCVA, 6 (2.0%) had mild VI, 32 (10.7%) had moderate VI, 152 (50.7%) had severe VI, and 110 (36.7%) were blind, as illustrated in Table 1. Cataract was the major leading cause of VI in the current study (52%), followed by uncorrected refractive error (20.7%), glaucoma (16.3%), diabetic retinopathy (5.3%), corneal opacity (1.6%), and other causes (4.3%), as shown in Figure 1.

Table 1: Distribution of visual impairment among participants according to gender

Classification of VI	Male		Female		Total (%)	p-value
	n	%	n	%		
Mild VI	6	2.0	0.0	0.0	6 (2.0)	0.35
Moderate VI	17	5.7	15	5.0	32 (10.7)	
Severe VI	81	27	71	23.7	152 (50.7)	
Blindness	54	18	56	18.7	110 (36.7)	
	158	52.7	142	47.3	300 (100)	

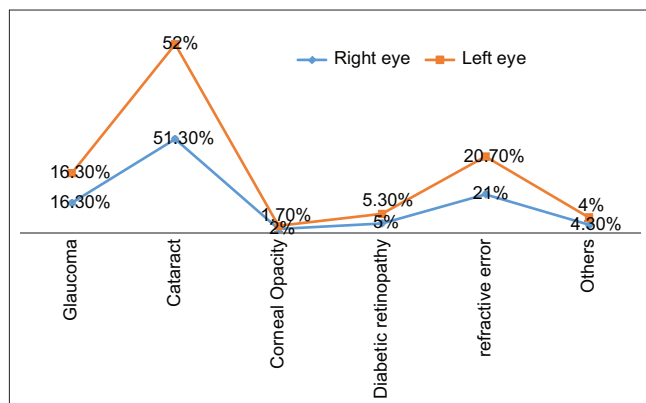


Figure 1: Causes of visual impairment in the right and left eyes

Blindness and severe visual impairment were slightly high among males 52.7% and 27%, respectively, while moderate visual impairment some in males and females, the VI was not statistically associated with gender ($p = 0.35$), as shown in Table 1.

Regarding the distribution of VI according to the participant's age, findings revealed that only 3.6% of visually impaired patients were children, 43% were adults, and 48.3% were elders. Among children, the leading cause of VI was uncorrected refractive errors 45.5% followed by cataract 36.4%. The major causes of VI among adults and elderly were cataract 51.9%, followed by uncorrected refractive errors and glaucoma 20.1% and 17%, respectively. The causes of VI were significantly associated with patients' age as indicated by the Pearson Chi-square test ($\chi^2 = 31$; $p = 0.001$), as shown in Figure 2.

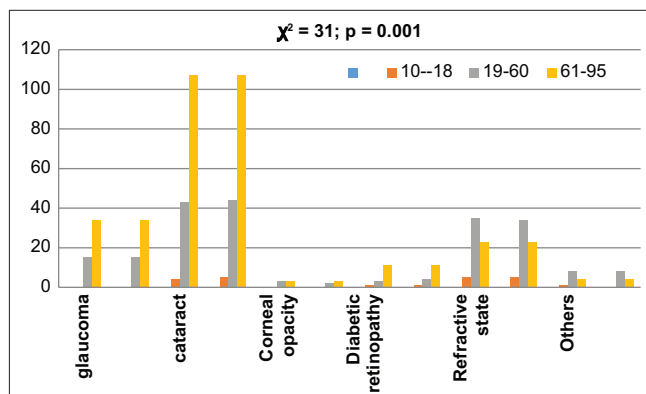


Figure 2: Distribution of the causes of VI among participants according age group

Independent t-test did not show a statistically significant difference in VA between males and females ($t = 1.76$, $p = 0.079$). Paired sample t-test reveals no statistical significant difference in VA between right and left eyes ($t = -1.261$, and $p = 0.208$). Results analysis shows an inverse correlation between age and vision (RE: $r = -0.31$, LE: $r = -0.19$; $p = 0.001$). While Pearson Chi-square test indicates no statistical significant difference between causes of VI in males and females ($\chi^2 = 6.57$; $p = 0.35$). However, in terms of age obtained

by Pearson Chi-square test, a higher percentage of the older age group had visual impairment when compared with the younger group ($\chi^2 = 37.9$; $p = 0.001$), as illustrated in Figure 3.

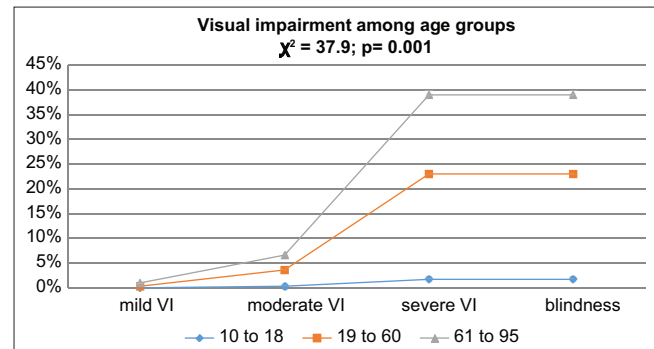


Figure 3: The distribution of VI among participants according to age groups

Discussion

Visual impairment is considered a public health concern worldwide. It impairs the quality of life and has an impact on career choices and job opportunities, and the socioeconomic burden on society. In the present study, VI was categorized according to the International Classification of Diseases 11th revision 2018 (ICD-11). In this hospital-based study, the prevalence of VI was 28.5% of the whole patients attending eye clinics during January–December 2017. This was higher than the prevalence reported by Binnawi *et al.* [17] in North Kordofan State of Sudan (8.37%) and by Assefa *et al.* [18] in Ethiopia (16.8%). The high rate of visual impairment may be principally attributed to the difference in study design, environmental differences, the age range of participants, gender differences, and sample sizes. This high prevalence of VI may reflect poor accessibility to eye care services among the community.

In this study, cataracts and uncorrected refractive error were the major leading cause of visual impairment in this rural community. These findings are remarkably comparable to other reported studies [17], [19] from Sudan, in which they showed that the cataract and uncorrected refractive errors were the leading causes of VI. Moreover, the findings of the current study are in consistent with the global estimation of visual impairment [10]. approximately 72.3% of the causes of VI were avoidable by early diagnosis and treatment similar to the findings of the previous study [10]. Inconsistent with many previous studies [20], [21], there was a significant association between age and visual impairment. The risk of visual impairment increases with age due to chronic eye diseases such as retinopathies, cataracts, and aging processes [3]. In an aging eye, many pathological and optical changes appear and produce an advanced

reduction in visual functions leading to VI [22]. Cataract was the major leading cause of VI in adults responsible for 51.9%. The high cataract rate as a cause of VI is comparable with the findings reported in the national guideline for the prevention of blindness [23]. However, among children cataract is due to genetic disorders and eye injuries. Systemic diseases such as diabetes result in osmotic overhydrating of the lens which leads to cataract formation this common in old age [24].

In terms of gender, there was no significant association between gender and visual impairment. This is inconsistent with the preceding study [25] reported that there is a significant association between gender and visual impairment and contrarily, blindness was reported to be more common in men. The authors attributed that the females being at risk of VI this mainly due to their longer life expectancy and in poorer societies; there is lack to access eye care services. This study had some limitations; first, this was a retrospective nature study. Patients' information was sometimes incomplete, and there were missing records. Second, the study used an age group stratification. A difference in the stratification of age groups, with older than 18 years being the dominant age group in the study may have caused inconsistency from others, especially that this group may be associated with a high prevalence of VI. Third, the study came from a hospital referral practice and may not reflect the demographics of the general Sudanese population. Despite the limitations mentioned, the present study provides information about the demographic characteristics and causes of visual impairment in the White Nile State of Sudan.

Conclusion

Visual impairment was high in the community and more prevalent among old age. Cataract was the leading cause of visual impairment then refractive errors and glaucoma. Among children, refractive errors and cataracts were the common leading causes of visual impairment, while in adults the main causes were cataracts, uncorrected refractive errors, and glaucoma.

References

- Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol*. 2012;96(5):614-8. <https://doi.org/10.1136/bjophthalmol-2011-300539> PMID:22133988
- Alrasheed SH, Naidoo KS, Clarke-Farr PC. Prevalence of visual impairment and refractive error in school aged children in South Darfur State of Sudan. *Afr Vision Eye Health*. 2016;75(1):a355. <https://doi.org/10.4102/aveh.v75i1.355>
- World Health Organization. Visual Impairment and Blindness Fact Sheet No. 282. World Health Organization; May, 2014. Available from: <http://www.who.int/mediacentre/factsheets/fs282/en/>. [Last accessed on 2022 Jan 28].
- Naidoo KS, Jaggernath J. Uncorrected refractive errors. *Indian J Ophthalmol*. 2012;60(5):432. <https://doi.org/10.4103/0301-4738.100543> PMID:31007213
- Alrasheed SH, Naidoo KS, Clarke-Farr PC, Binnawi KH. Building consensus for the development of child eye care services in South Darfur State in Sudan using the Delphi technique. *Afr J Prm Health Care Med*. 2018;10(1):a1767. <https://doi.org/10.4102/phcfm.v10i1.1767> PMID:30456975
- Oduntan AO. Prevalence and causes of low vision and blindness worldwide. *Afr Vision Eye Health*. 2005;64(2):44-57. <https://doi.org/10.4102/aveh.v64i2.214>
- Mohamed ZD, Abdu M, Alrasheed SH. Management plan for childhood visual impairment in traditional quranic boarding schools in Al-Gazira State of Sudan. *Al-Basar Int J Ophthalmol*. 2018;5(1):1. https://doi.org/10.4103/bijo.bijo_8_18
- Esteban JN, Martinez MS, Navalon PG, Serrano OP, Patino JC, Purón MC, et al. Visual impairment, and quality of life: Gender differences in the elderly in Cuenca, Spain. *Qual Life Res*. 2008;17(1):37-45. <https://doi.org/10.1007/s11136-007-9280-7> PMID:18026851
- Doyal L, Das-Bhaumik RG. Sex, gender, and blindness: A new framework for equity. *BMJ Open Ophthalmol*. 2018;3(1):e000135. <https://doi.org/10.1136/bmjophth-2017-000135> PMID:30246151
- Resnikoff S, Pascolini D, Etya'Ale D, Kocur I, Pararajasegaram R, Pokharel GP, et al. Global data on visual impairment in the year 2002. *Bull World Health Organization*. 2004;82:844-51. PMID:15640920
- Ackland P. Ten years to VISION 2020: How are we doing? *Community Eye Health*. 2010;23(74):54. PMID:21311668
- Maberley DA, Hollands H, Chuo J, Tam G, Konkall J, Roesch M, et al. The prevalence of low vision and blindness in Canada. *Eye*. 2006;20(3):341-6. <https://doi.org/10.1038/sj.eye.6701879>
- Alrasheed SH, Naidoo KS, Clarke-Farr PC. Childhood eye care services in South Darfur State of Sudan: Learner and parent perspectives. *Afr Vision Eye Health*. 2016;75(1):a315. <https://doi.org/10.4102/aveh.v75i1.315>
- Bunce C, Wormald R. Leading causes of certification for blindness and partial sight in England & Wales. *BMC Public Health*. 2006;6(1):1-7. <https://doi.org/10.1186/1471-2458-6-58> PMID:16524463
- Ibrahim MK, Elnimeiri MK. Prevalence and causes of blindness among Sudanese adults attending outreach ophthalmic services in Sudan-2019. *Al Neelain Med J* 2020;24:1858-6279.
- Mohamed ZD, Binnawi KH, Abdu M. Prevalence and causes of childhood blindness and visual impairment in quranic boarding schools in Al-Gazira state of Sudan. *Sudanese J Ophthalmol*. 2017;9(2):44. https://doi.org/10.4103/sjophthal.sjophthal_1_18
- Binnawi KH, Mohamed AH, AlkhairAlshafae B, Abdalla Z, Alsanosi M, Alnoor H, et al. Prevalence and causes of blindness and visual impairment in population aged 50 years and over in North Kordofan State, Sudan. *Al-Basar Int J Ophthalmol*. 2015;3(1):6. <https://doi.org/10.4103/1858-6538.169308>
- Assefa NL, Admas AW, Adimasu NF. Prevalence and associated factors of visual impairment among adults at Debre Berhan town, North Shewa, Ethiopia. *BMC Ophthalmol*. 2020;20(1):1-8. <https://doi.org/10.1186/s12886-020-01586-8>

- PMid:32746798
19. Binnawi KH. Progress in blindness prevention in North Sudan (2003-2010). *Sudanese J Ophthalmol*. 2013;5(1):3. <https://doi.org/10.4103/1858-540X.118638>
 20. Davies-Kershaw HR, Hackett RA, Cadar D, Herbert A, Orrell M, Steptoe A. Vision impairment and risk of dementia: Findings from the English Longitudinal Study of Ageing. *J Am Geriatr Soc*. 2018;66(9):1823-9. <https://doi.org/10.1111/jgs.15456>
PMid:30098017
 21. Abdi Ahmed Z, Alrasheed SH, Alghamdi W. Prevalence of refractive error and visual impairment among school-age children of Hargeisa, Somaliland, Somalia. *East Mediterr Health J*. 2020;26(11):1362-70. <https://doi.org/10.26719/emhj.20.077>
PMid:33226104
 22. Naidoo K, Gichuhi S, Basáñez MG, Flaxman SR, Jonas JB, Keeffe J, *et al*. Prevalence and causes of vision loss in sub-Saharan Africa: 1990–2010. *Br J Ophthalmol*. 2014;98(5):612-8. <https://doi.org/10.1136/bjophthalmol-2013-304081>
PMid:24568870
 23. World Health Organization. Global Initiative for the Elimination of Avoidable Blindness. Action Plan 2006–2011; 2017. Available from: http://www.who.int/blindness/vision2020_report.pdf. [Last accessed on 2022 Feb 02].
 24. Robinson BL, Lieberman LJ. Effects of visual impairment, gender, and age on self-determination. *J Vis Impair Blind*. 2004;98(6):351-66. <https://doi.org/10.1177/0145482X0409800604>
 25. Park HW, Lee W, Yoon JH. Gender-related effects of vision impairment characteristics on depression in Korea. *Ophthalmic Epidemiol*. 2018;25(2):105-12. <https://doi.org/10.1080/09286586.2017.1361453>
PMid:29157064