ORIGINAL RESEARCH

Epidemiology and trends in the uptake of refractive error services in Harare, Zimbabwe: a hospital-based retrospective study

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Abstract

Aim

The study aimed to determine the epidemiology and evaluate the trends in the uptake of refractive error services in Harare.

Methods

A clinic-based retrospective study at the Greenwood Park Eye Centre and its three subsidiaries was conducted from January 1, 2015 to December 31, 2020.

Results

12,216 patients' records were retrieved, out of which 1074 (8.79%) had refractive error cases. The prevalence of visual impairment at presentation was 5.80% [95% CI: 5.39 – 6.23]. Among those with refractive error, the sample prevalence of visual impairment before correction was 41.30% [CI: 38.3 – 44.3, 95%], and 2.20% [95% CI: 1.4 – 3.3] after correction. There was inconsistency in the percentage utilization of refractive error services, with the highest being 42.60% in 2015. Refractive error types were related to age, employment position, and type of visual impairment prior to refractive error treatment.

Conclusion

There was a low percentage of refractive error services uptake in urban Zimbabwe.

Keywords: refractive error, visual impairment, refractive services, Zimbabwe

Introduction

Visual impairment impacts quality of life and productivity negatively and can lead to loss of educational and employment opportunities[1,2]. Over 2.2 billion people are visually impaired worldwide, with about half living with preventable eye conditions[1,2]. Uncorrected refractive error remains the leading and most easily avoidable cause of visual impairment[3]. Despite the rise in popularity of laser surgery, the dominant and cheapest treatment for refractive error correction remains eyeglasses or contact lenses[1,2]. A larger number of persons with refractive error could have their vision restored by this means. More than 500 million people, predominantly in developing countries, have uncorrected refractive errors as the cause of their impaired vision[1,2]. Studies in Africa have reported high cost to the end-user of eyeglasses or contact lenses as a major barrier to the uptake of refractive error services[4–6].

Few studies[5,6] have evaluated trends in refractive service uptake in Africa, with little or no evidence in Zimbabwe[7]. However, among the rural population, a significant percentage (56.8%) of individuals reportedly have visual impairment[7]. Consequently, advocacy for the advancement of equitable and inclusive strategies to increase access to quality refractive services in Zimbabwe has always lacked the necessary evidence to justify this course of action[7]. Greenwood Park Eye Centre and its three subsidiaries (Optinova Eye Care Services) is a private eye care institution that has the full array of eye care professionals providing refractive error services to those covered by insurance (government and private insurers) and uninsured eye care seekers in Harare and beyond. The centre is patronised massively due to its indigenous ownership and long-standing track record in the provision of comprehensive eye care. Meanwhile, there is paucity of information on the dynamics of the uptake of refractive error services in Zimbabwe which can be utilized to inform health promotion policies and eye care strategies. Therefore, this study aimed at determining the epidemiology and trends in the uptake of refractive services in an urban setting in Zimbabwe.

Methods

This was a clinic-based retrospective study conducted at the Greenwood Park Eye Centre premises and three of its affiliates located in the central part of Harare, Zimbabwe. The eye centres were managed by three optometrists with Doctor of Optometry qualifications who examined patients. This study involved a review of patients' records with a history of access to refractive error services at the centres from January 1, 2015 - December 31, 2020. Information was collected on the recorded visual acuity, clinical refraction, anterior and posterior segment eye examinations, and demographics.

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Table 1 Demographics on the uptake of refractive error services according to sex

Demographics		Sex of Patient		Total (%)	P-value
		Male	Female		
Age group	Children (0 - 17)	112	182	294 (9.3)	P<0.001
	Youth (18 - 35)	459	860	1319 (41.7)	
	Adults (36 - 59)	544	721	1265 (40.0)	
	Elderly (> 59)	143	142	285 (9.0)	
Employment	Employed	857	1208	2065 (65.3)	P<0.001
	Unemployed	1	79	80 (2.5)	
	Pensioner	83	58	141 (4.5)	
	Self Employed	45	70	115 (3.6)	
	Student	272	490	762 (24.1)	
Residence	Urban	1174	1756	2930 (92.6)	0.551
	Peri-urban	43	73	116 (3.7)	
	Rural	41	76	117 (3.7)	
Total		1258	1905	3163 (100)	

Table 2 Demographics on the distribution of refractive error according to sex

Demographics		Sex of Patient		Total (%)	P-value
		Male	Female		
Age group	Children (0 - 17)	40_a	44_a	84 (7.8)	P<0.001
	Youth (18 - 35)	145_a	302_b	447 (41.6)	
	Adults (36 - 59)	192_a	241_b	433 (40.3)	
	Elderly (> 59)	58_a	52_b	110 (10.2)	
Employment Status	Employed	304_a	401_b	705 (65.6)	P<0.001
	Unemployed	0_a	38_b	38 (3.5)	
	Pensioner	28_a	21_b	56 (5.2)	
	Self Employed	16_a	29_a	45 (4.2)	
	Student	87_a	150_a	239 (22.0)	
Residence	Urban	414	585	999 (93.0)	0.069
	Peri-urban	13	36	49 (4.6)	
	Rural	8	18	26 (2.4)	
Total		435	639	1074 (100)	

Each subscript letter denotes a subset of sex categories whose column proportions do not differ significantly from each other at the 0.05 level.

Sample size and sampling method

A convenient purposive sampling technique was used as we looked at all the refractive error cases in the facilities. The study included all users' files with a record of access to refractive error services, and only clinical information from the initial visit were included. Records lacking explicit patient information were excluded. Visual impairment was defined as visual acuity worse than 6/12 (0.3 LogMAR)[1,2]. Refractive error was classified as follows; Myopia, spherical equivalent (SE) ≤ -0.50DS, hyperopia as SE ≥ +0.50DS and astigmatism as < -0.50DC in the better-seeing eye[8].

Data collection procedure and tools

Data extraction worksheets were used to collect information

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Table 3 Trends in the uptake of refractive error services

Year	Rate of uptake of refractive services		Uptake of refractive services		
	%	CI 95%	Male	Female	Total (%)
2015	42.60	39.45 – 45.80	119	290	409 (12.9)
2016	27.43	25.72 – 29.20	396	312	708 (22.4)
2017	23.56	22.11 – 25.07	321	438	759 (24.0)
2018	20.65	19.07 – 22.30	113	398	511 (16.2)
2019	21.76	20.09 – 23.50	201	299	500 (15.8)
2020	40.47	36.76 – 44.26	108	168	276 (8.7)
Total	25.89	25.12 – 26.68	1258	1905	3163 (100)

on socio-demographics as well as the patients' clinical profile. Age, sex, employment, and place of residence were among the socio-demographic data. The clinical profile involved presenting visual acuity at distance and best-corrected visual acuity (VA), as well as refractive status. The presenting and best-corrected visual acuities were measured under photopic conditions at 6 meters using Snellen visual acuity charts with luminance that ranged from 85 to 300 cd/m^2. Non-cycloplegic refractive error was determined using a KR 9000 Autorefractor on all patients (Perlong Medical Equipment Co., Ltd., Jiangsu, China).

Data analysis

The Statistical Package for the Social Sciences (IBM SPSS) version 21 was used to analyse the data (SPSS Inc, Chicago, USA). Descriptive statistics were computed for all variables, and normality tests were performed. Frequencies were used to represent categorical data. Chi-square test was used to determine association and Bonferonni post hoc test was done to find specific differences between groups, (P<0.05).

Ethics approval and consent to participate

The study adhered to the tenets of the Declaration of Helsinki, and ethical approval for the study was obtained from the Research Ethics Committee, Bindura University of Science Education (BUSEREC/0008/2021). Permission was sought from the management of Greenwood Park Eye Centre and its subsidiaries. All data and records generated throughout the study were handled with strict confidentiality in conformity with the institutional policies.

Results

Out of the 12,216 patients' records retrieved from the eye centres' archives, 3,163 (25.89%) accessed refractive error services, out of whom 1,258 (39.8%) were males, and 1,905 (60.2%) were females. Some 1,074 (33.96%) of the patients had refractive errors (639 (59.5%) females) and 708 (22.38%) had other vision impairments. The mean age of patients was 37.20 ± 15.51 years (range: 2 - 97 years). A statistically significant difference (P<0.001) was observed for sex distribution for the uptake of refractive error services and correction (Table 1).

The majority of patients who sought refractive services were youth (18-35 years) (41.7%), followed by adults (36-59 years) (40.0%). Most (92.6%) of the patients resided in the urban centre (See Table 1). Among those with refractive error, the youth (18-35 years) and those employed (which includes the self-employed) formed the majority. There was a significant association between sex, age group and employment status among those with refractive error (P < 0.05), (Table 2).

Trends in the uptake of refractive error services and visual impairment

Refractive error was classed as per visual acuity in the better seeing eye after non-cycloplegic auto-refraction, and most of the patients were dispensed spectacles. The need for refractive error services declined rapidly in 2015 and 2016, followed by a sustained decrease from 2016 to 2018 then an uptick from 2018 to 2019. Between 2019 and 2020, the rate grew dramatically (See Table 3). The total sample prevalence of visual impairment (n = 12,216) was 5.80% [95% CI: 5.39 – 6.23]. The highest prevalence of visual impairment was in 2020 (see Table 4). The overall prevalence of refractive error (n = 12,216) was 8.79% [95% CI: 8.30–9.31], with 86.96% [95% CI: 84.80–88.92] using corrective lenses (n = 1074). Among those with refractive error (n = 1074), the prevalence of visual impairment before correction was 41.30% [95% CI: 38.3 – 44.3], and 2.20% [95% CI: 1.4 – 3.3] after correction. Myopia (72.2%) was the most prevalent kind of refractive error, followed by hyperopia (22.2%) and astigmatism (5.7%). Chi-square analysis revealed a statistically significant relationship between the kind of refractive error and the age group, occupational position, and type of visual impairment prior to treatment (see Table 5).

A Bonferonni post-hoc analysis on the type of refractive error and age group, occupational position and type of visual impairment prior to treatment showed the proportion of the sub groups that had significant associations (Table 5).

Discussion

This study found the prevalence of refractive error and visual impairment to be 8.79% and 5.80%, respectively. This indicates a relatively low prevalence of refractive error and visual impairment compared to the outcome [uncorrected refractive error (54.2%) and visual impairment (56.8%)] of a population-based study conducted among rural Zimbabweans[7]. It is plausible to ascribe the low refractive error prevalence to poor uptake of refractive error services in

a cosmopolitan city in Zimbabwe, possibly due to exorbitant cost to the end-users.

Malu and Ojabo[9] reported a comparatively higher uptake of refractive error in a private eye facility in Nigeria. This variation could be due to socioeconomic disparities, cultural differences and variability in sample size. Studies have shown an association between socio-economic status and eye health[7,10], and earlier investigations have demonstrated a higher prevalence of refractive error and visual impairment among urbanites than in rural dwellers due to high socio-economic indices in urban centres[10–14].

Consistent with the results of previous hospital-based studies in developing countries[15–18], myopia had the highest prevalence. Contrarily, hyperopia was the most occurring refractive error recorded among rural Zimbabweans[7]. The findings of the current study corroborate those in Bhutan and Australia in which significant rural-urban differences in myopia prevalence were reported[19,20]. These variations could be ascribed to differences in socioeconomic indices, educational pressure and time spent outdoors. It is also worth noting that other hospital-based studies in developing countries have reported astigmatism as the commonest refractive error[21,22].

The relatively high refractive error prevalence (59.5%) reported in females by the current study could be attributed to the fact that more females accessed refractive error services compared to males due to the high health-seeking awareness level among females[23]. The findings might prove to be reasonable when compared to what other hospital-based studies have reported[24–26]. Several school-based studies have also indicated a more frequent occurrence of myopia in females than males[27–31]. In contrast, sex prevalence of myopia was the reverse in some hospital-based studies conducted in Yemen[32] and Nigeria[33]. The reason for this variation could not be determined and requires further consideration.

The prevalence of visual impairment at presentation in the present study replicates the findings of Hashemi et al.[34] in a rural setting. However, it is comparatively low when compared to studies conducted in Zimbabwe[7] and in a hospital-setting in South Africa[35]. We found that correction with spectacle and contact lenses reduced the total prevalence of visual impairment remarkably. Budenz et al.[36], reported a reduction in visual impairment from 17.1% to 6.7% after refraction and correction with spectacle in a population-based study in Ghana. Consistent with the current findings, other hospital-based studies have reported higher prevalence of visual impairment in females than in males[24,25]. Studies suggest that the biological effects of female hormones, and socioeconomic factors could affect the uptake of eye care services[37,38].

Coverage of refractive correction varies in different parts of the world and among sex and age[39–43]. We found a correction coverage of 86.96%, which is substantially high when compared to the findings of earlier studies[39–43]. This suggests that the clinical population had a high uptake, but refractive error services, especially if translated to other socioeconomic circumstances in Zimbabwe, would not. Unlike previous studies, ours found higher spectacle covering in females[39–43]. Zimbabwe has a shortage of eye care professionals, making refractive services expensive (benchmark US$30.0 to see a doctor, US$120 for single vision, and US$400 for progressive spectacles). The high uptake of the refractive error correction can also be attributed to the young age of most of the patients, who would require good visual function for their respective jobs to increase productivity and improve their quality of life, albeit the expensive cost of care.

The dramatic growth in the rate of refractive error and the need for refractive error services from 2019 to 2020 can be attributed to the excessive near work, increased digital device use, less outdoor time and increased sedentary lifestyle that resulted from imposed covid 19 restrictions[44,45]. Several studies[44,45] have reported dramatic increases in myopia, the most common refractive error, during and after covid[19]. High Body Mass Index (BMI) resulting partly from a sedentary lifestyle has also been reported to be associated with myopia[46]. Importantly, the BMI may not necessarily be the cause but the possible excessive near work and digital device use associated with a sedentary lifestyle.

Although this study presents important findings on the prevalence of visual impairment and uptake of refractive error correction, it is associated with limitations. The study design severely limits any inference from population-level prevalence. Also, patients' records did not have level of education, making it difficult to verify a stronger relationship between type of refractive error and educational pressure. Nonetheless, the use of only non-cycloplegic refraction might have resulted in more myopic cases since patients with latent hyperopia may be missed especially in children.

In summary, there was a low percentage of refractive error services uptake in urban Zimbabwe. Refractive error types were related to age, employment, and type of visual impairment prior to refractive error treatment. The percentage of visual impairment after correction was low, indicating the importance of extending refractive error services provision.

Authors' contributions

SK conceptualized, and SK and MAK designed the research project. MAK and VEK carried out data the data collection. SK, MAK, BOA and VEK analysed and interpreted the data. EZ and MAK wrote the original draft. MAK wrote the reviews and EZ, BOA edited the manuscript. All authors read and approved the final manuscript.

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Declaration of competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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