



Pattern of Refractive Errors Distribution among Ophthalmic Patients at a Leprosarium in Kano State, Nigeria

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Abstract

Background: Uncorrected refractive errors are the main causes of moderate and severe visual impairment. **Aim:** The aim of this study was to determine the pattern of Refractive Error distribution among leprosy population attending Yadakunya leprosy hospital, Kano. **Methods:** A Cross sectional descriptive study was conducted on 283 participants aged 14 years and above. Examination of the external and internal ocular structures of the participants was performed with pen torch and ophthalmoscope. Visual acuity was assessed/measured unaided and pinhole method with a Bailey-Lovie design tumbling E chart at 4 meters. The objective refraction was carried out with streak retinoscopes, followed by subjective refraction. **Results:** Out of the 283 participants, 171 (60.4%) were males, 112 (39.6%) were females and the mean age was 46.8 ±18 years. The prevalence of refractive error in this study was 86.9%. The predominant refractive errors among the participants with normal to mild low vision were astigmatism 92 (32.5%), hypermetropia 59 (20.9%) and myopia 39 (13.8%), while among those with low vision and blindness were astigmatism 44 (40.4%), hypermetropia 30 (27.5%) and myopia 20 (18%). **Conclusion:** The high frequency of refractive error (86.9%) in this study revealed that leprosy could have contributed to the refractive error status of the participants. Therefore, a focus on the optical correction of refractive errors and low vision rehabilitation would lead to a significant reduction in the burden of avoidable blindness among leprosy patients who utilize Yadakunya leprosy hospital for eye care services.

Keyword: Refractive Errors, Low vision, Blindness, Leprosy, Kano.

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Introduction:

Worldwide, uncorrected refractive errors (UREs) are the main causes of moderate and severe visual impairment (VI) and the second leading cause of blindness, accounting for an estimated 153 million and 8 million affected persons, respectively, despite the fact that correction of refractive errors (REs) with appropriate spectacles is one of the most cost-effective interventions in eye health (Resnikoff et al., 2008). Refractive error (RE) is a condition in which the optical system of a non-accommodating eye fails to bring parallel rays of light to focus on the fovea. It is caused by an incongruity between the axial length of the eye and the powers of the optical elements of the eye (Megbelayin, 2013). Refractive

errors (myopia, hyperopia and astigmatism) affect the whole spectrum of the population without regard to age, gender, race and ethnic group.

Leprosy is a chronic granulomatous disease caused by the *Bacillus Mycobacterium leprae*, which primarily affects the skin and peripheral nerves (facial and trigeminal), (Gill et al., 2005; Reddy and Raju, 2009).

The prevalence of low vision and blindness is higher among leprosy patients than in the wider population and it occurs as a complication of the disease or as part of the ageing process (Nguyen, 2007). The prevalence of low vision (0.52–1.30logMAR;

< 6/18 –3/60) and blindness (1.32 – 4.0logMAR; < 3/60 – NPL) among patients living with leprosy in Kano State has been reported to be 13.0% and 25.0% respectively (Okpo *et al.*, 2018).

Visible impairments (deformities), activity limitations and/or stigma may lead to restrictions in social participation, such as problems in family relations, marriage, education or employment (Britton and Lockwood, 2005). The most common causes of visual disability and blindness in leprosy are corneal disease secondary to lagophthalmos and corneal anaesthesia, chronic anterior uveitis and cataract (Reddy and Raju, 2009; Okpo *et al.*, 2019; Hogeweg and Keunen, 2005; Ebeigbej and Kio, 2011).

Refractive error and need for spectacle correction among leprosy patients have not been studied (Hogeweg and Keunen, 2005). No previous studies on pattern of refractive error distribution among leprous patients could be found in the literature reviewed. Related studies found were those carried out on participants who have no history of leprosy. Therefore, this study would provide relevant information for eye care planning and provide data for comparison with findings from similar studies in the future. The purpose of this study was to determine the pattern of Refractive Errors distribution among ophthalmic patients of Yadakunya leprosy settlement village in Kano State, Nigeria, with a view of developing result-oriented intervention programs in the state.

Methods

This study was carried out among the leprous population visiting Yadakunya leprosy hospital at Yadakunya leprosy settlement village for eye care. Yadakunya is a Leprosy village, with a population of about 5,595, located near Yadakunya Leprosy Hospital (where this study was carried out). (Kano Municipal L.G.A, 2007) It is located in the North-Eastern part of Kano City under Ungogo Local Government Area of Kano State Nigeria. This research was a cross sectional descriptive study and the aim was to

determine the pattern of refractive error distribution among ophthalmic patients with leprosy. It was carried out at Yadakunya leprosy hospital for a period of six months (from February 1st, to July 1st, 2016).

Instruments used for data collection included: a check list to extract variables of interest from the medical records of the patients, semi structured questionnaire, and clinical examination equipment. Inclusion criteria included: Signing/thumb printing a written consent form and diagnosed with leprosy > age 6 years (who were able to express and understand the procedure) and above. Patients who visited the hospital eye department and whose names were found in the register were included in the study; they were followed up, invited back to the hospital and formed the study population. The purpose of this study was clearly explained before written informed consent was obtained from each of the patient for eye examination. The pre-tested study questionnaire was administered to eligible participants through the help of ophthalmic nurses. For each consenting participant, data on age, sex, and duration since diagnosis of leprosy were recorded. Examination of the external and internal ocular structures of the participants was performed by an Optometrist using a pen torch and a direct ophthalmoscope.

The World Health Organization (WHO) classification of blindness and low vision (WHO, 2008) was used in classification of patient's visual impairment. Visual impairment was defined as visual acuity range of 0.52 – 4.0 logMAR (< 6/18 – No Light Perception [Snellen meter equivalent]). Visual acuity of 0.52–1.30 logMAR (< 6/18 –3/60 [Snellen meter equivalent]) was classified as low vision. 1.32 – 4.0 logMAR (< 3/60 –No light perception [Snellen meter equivalent]) was classified as blindness. Visual impairment included moderate visual impairment; severe visual impairment and blindness. Spherical equivalent (SE) was calculated as half the cylinder plus the spherical component. Emmetropia was defined as SE < ±0.50 D and cylindrical error < -0.75 D. Refractive errors were classified as: Myopia ≥ -0.5 D,

hypermetropia $\geq +0.5$ D and Astigmatism (minus cylinder format) as a cylindrical error $\geq - 0.75$ D.

After taking the ocular history, VA was tested with a Sloan Letters and Baily-Lovie design tumbling Es illiterate logMAR charts at distance and near distances respectively. The charts were used to measure presenting (habitual), pinhole and best corrected visual acuity. Where a participant could not see the largest acuity letters at the standard viewing distance of 4 meters, the distance was halved to measure the VA. The VA values were then converted to the standard distance equivalent (by adding 0.3 logMAR to the distance halved). Pinhole disc was used to detect if reduced VA was due to refractive error or eye disease/ anomaly. The objective refraction was carried out with streak retinoscopes (Keller) at 1/3 of a meter, followed by subjective refraction. The subjective refraction was done starting with the retinoscopic findings as the participants were directed to VA chart. The monocular spherical

and cylindrical components were determined, refined, followed by binocular balancing. The final subjective refraction was taken as individual existing Refractive error. The data obtained was analyzed using the descriptive statistics of the Statistical Package IBM SPSS version 20. Data was presented using frequency distribution tables.

Ethical approval was obtained from the Ethical committee, Aminu Kano Teaching Hospital Kano and the Health Service Management Board Kano State.

Result

Out of a total of the 303 registered patients in the Yadakunya Leprosy hospitals eye clinic, 283 (93.4%) [Comprising 171 males and 112 females in a ratio of 1.53:1] met the inclusion criteria (Table 1). Twenty patients were excluded (six (1.98%) for declined consent while 14 (4.62%) patients were absent during the screening exercise for the study). The age of participants ranged from 14 to 89 years with a mean of 48.6, and standard deviation of 18 years.

Table 1: Demographic characteristics of participants.

Variable	Frequency (n)		Percentage (%)			
Sex						
Male	171		60.42			
Female	112		39.58			
Total	283		(100)			
Age						
	Male	(%)	Female	(%)	Total	(%)
<15	19	(6.71)	8	(2.83)	27	(9.54)
15 – 29	27	(9.54)	22	(7.77)	49	(17.31)
30 – 49	50	(17.67)	24	(8.48)	74	(26.15)
50 – 69	47	(16.61)	35	(12.37)	82	(28.98)
70 >	28	(9.89)	23	(8.13)	51	(18.02)
Total	171	(60.42)	112	(39.58)	283	(100)
Occupation						
Farmers	82	(29)	59	(20.9)	141	(49.8)
Dependents	11	(3.9)	26	(9.2)	37	(13.1)
Civil Servants	16	(5.7)	3	(1.1)	19	(6.7)
Traders	18	(6.4)	8	(2.8)	26	(9.2)
Artisans	20	(7.1)	6	(2.1)	26	(9.2)
Others	24	(8.5)	10	(3.5)	34	(12.0)
Total	171	(60.4)	112	(39.6)	283	(100)

Level of Education					
None	143	(50.5)	98	(34.6)	241 (85.2)
Primary	16	(5.7)	10	(3.5)	26 (9.2)
Secondary	12	(4.2)	4	(1.4)	16 (5.7)
Tertiary	0	(0)	0	(0)	0 (0)
Total	171	(60.4)	112	(39.6)	283 (100)

The Participants between the ages of 50 to 69 years had the highest frequency of 82 (28.98%), followed by those between ages 30 to 49 years 74 (26.98%) while those below the age of 15 years had the least 27 (9.54%). (Tab. 1)

Majority of the participants were farmers 141 (49.8%), followed by Dependents 37 (13.1%) while Civil Servants 19 (6.7%) was very few (Tab. 1). None of the participants had tertiary education while majority of the participants 241 (85.2%) did not see the four walls of the class room (Tab. 1).

Table 2: Percentage distributions of refractive errors among the male and female participants

Type	Male	%	Female	%	Total	Percentages (%)
Emmetropia	26	9.2	11	3.9	37	13.1
Astigmatism	51	18.0	41	14.5	92	32.5
Myopia	23	8.1	16	5.7	39	13.8
Hyperopia	31	11.0	28	9.9	59	20.9
MAP	14	5.0	7	2.5	21	7.4
HAP	26	9.2	9	3.2	34	12.0
Total	171	60.4	112	39.6	283	100

Key: Myopic Astigmatic Presbyopia (MAP) Hyperopic Astigmatic Presbyopia (HAP)
Prevalence Refractive Error = 86.9%.

The predominant refractive errors for participants with normal to mild Low Vision were astigmatism 32.5%, hypermetropia 20.9% and myopia 13.8%, while those with Low Vision and Blindness were astigmatism

40.4%, hypermetropia 27.5% and myopia 18%. Thirty seven (13.1%) participants were emmetropic, hence the frequency of refractive error is 86.9% (Table 2).

Table 3: Pattern of refractive errors distribution among the participants with low vision and blindness with their best corrected VA.

TYPES	SEX		TOTAL	PERCENTAGE (%)
	M	F		
Emmetropia	7	1	8	7.3
Astigmatism	20	24	44	40.4
Myopia	10	10	20	18.4
Hyperopia	16	14	30	27.5
Presbyopia	5	2	7	6.4
TOTAL	58	51	109	100

Astigmatism was found among forty four (40.4%) out of 109 participants who had low vision or blindness (Table 3).

Discussion

This study was a cross sectional descriptive survey involving people living with leprosy at Yadakunya leprosy settlement village. Most of the patients were above 50years of age. The

mean age was 48.6 years (range 14 – 89 years). Aging has been shown to be associated with leprosy-related ocular complications and visual loss (Mpyet and Solomon, 2005; Thompson *et al.*, 2006) Ocular morbidity

tends to increase as the leprosy patients increase in age, as found in this study, which clearly shows the need for accessible and affordable eye health facilities for persons living with leprosy. There were more males than females in this study which is similar to that reported in the study carried out in Osiomo leprosarium in Edo state, Nigeria (Ebeigbej and Kio, 2011) and North Eastern Nigeria (Lawan and Okpo, 2008). One reason suggested for this preponderance in previous studies is that the male lifestyle generally exposes them to greater risks of infection, while women may tend not to seek medical help even when it is required (Ebeigbej and Kio, 2011). Women are more concern about their physical appearance than men and more often refrained from social activities.

Out of 283 participants, 141 (49.8%) were farmers and 37 (13.1%) dependents. The unemployed participants (dependents, house wives and beggars) had the total of 71 (25.1%) while the employed were 212 (74.9%). A population of 212 (74.9%) out 283 were employed. This high percentage of 74.9 revealed that leprosy among participants did not affect their employment status. None of them had the privilege of attending tertiary institution due to poverty and stigmatization, hence only 19 (6.7%) were civil servants. Many of the participants who lost their fingers due to leprosy could not perform their trade or farming, they resorted to begging to earn a living.

As no previous studies on refractive errors among leprosy population could be found in the literature, refractive findings in this study are compared with refractive errors data obtained for non-leprosy populations from relevant study sites. The predominant errors were astigmatism 32.5%, hypermetropia 20.9% and myopia 13.8% (Table 4). These findings were in agreement with the findings in previous studies conducted among non-leprosy cohorts in Kano, Nigeria (Lawan and Okpo, 2008), University community, Zaria, (Abah *et al.*, 2010) the Nigeria National Blindness and Visual Impairment Study

(Kyari *et al.*, 2009) and in Bayelsa state, Nigeria (Korye-Egbe *et al.*, 2010).

In this study, of the 283 participants, 246 (86.9%) had refractive error, which was comprised of 145 (58.1%) male and Female 101 (41.1%). The higher frequency for male could be as a result of the reason earlier stated (that the male lifestyle generally exposes them to greater risks of infection, while women may tend not to seek medical help even when it is required). (Ebeigbej and Kio, 2011) However, considering the relative frequency of the refractive error in table 4, the probability of astigmatism indicates 3 patients in every 10 cases of refractive errors. The occurrence was the same proportion among the males and females. Therefore, there is no gender difference in leprosy infection as well as refractive findings in this study.

The frequency of refractive error 246 (86.9%) in this study was very high. This revealed that leprosy could have contributed to their refractive error. However, the prevalence of ocular involvement in leprosy is influenced by many variables such as geographical regions, climate, environmental conditions, ethnic groups, social status; (Ffytche, 1991) type and duration of the disease, type and duration of treatment received, type and number of reactions of leprosy; (Ffytche, 1991a) newly diagnosed patients (Daniel, 2002) /institutionalized patients (Khan, 2002) /non institutionalized patients (Ayanniyi, 2011).

Corneal involvement in leprosy is known to be influenced by factors such as lagophthalmos, ectropion, and corneal anaesthesia (Ebeigbej and Kio, 2011). The alteration of the corneal curvature due to ocular effects of leprosy result to acquired astigmatism. This may be due to several conditions such as dysplasia or abnormal growth of tissue on the cornea, e.g, pterygium, which was highly common among the participants. Though, pterygium is a non-leprosy related cause of visual impairment, it was seen among the participants. Evidence

has shown that most cases of pterygium result in with-the-rule astigmatism as shown in other studies (Ayanniyetal 2011; Shelke, 2014). Also, infections of the cornea, either bacterial or viral (typically herpetic) may induce astigmatism during the infection, or from resultant scarring (Ayanniyi, (2010). These might have contributed to the high prevalence of astigmatism in the present study. However, this was contrary to the findings in studies among general (non-leprous) populations, which showed myopia to be leading type of refractive error (Ayanniyi, (2010); Williams, 2015). Also, it is contrary to findings in another study which showed presbyopia to be the most common type of refractive error (Williams, 2015; Abraham and Megbelayi, 2015; Abdu and Okpo, 2011). Myopia was less common than hyperopia in this study. This agrees with earlier studies in Kaduna, Nigeria, a city which is located in the same region of the country (Bagaiya and Pam, 2003). However, different from the findings of the study carried out in Uyo, Nigeria, (Shelke, 2014) a different part of the country. It is important that leprous populations should be provided with refractive services regularly. This will improve their living standard and performance.

Conclusion

Astigmatism 32.5%, hypermetropia 20.9% and myopia 13.8%, were the predominant refractive errors among this study population. There is no gender difference in leprosy infection as well as refractive findings in this study. High percentage of 74.9 in this study revealed that leprosy among participants did not affect their employment status. The very high frequency of refractive error (86.9%) in this study revealed that leprosy could have contributed to the refractive error statue of the participants. This study showed a significant improvement in vision, following refraction and optical compensation, therefore a focus on the optical correction of refractive errors and low vision rehabilitation would lead to a significant reduction in the burden of avoidable blindness among leprous patients who utilize Yadakunya leprosy hospital for

eye care services. In line with VISION 2020, The Right to Sight, the data presented in this study will help in planning results-oriented eye health intervention programmes for people living with leprosy in Kano state, Nigeria

Conflicts of interest

There are no conflicts of interest

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