



## Original Article

**Refraction Services in A Mission Tertiary Hospital in North-Central Nigeria: A 5 -Year Retrospective Review**Alfin RJ<sup>1</sup>, Adejoh OM<sup>2</sup>, Malu KN<sup>3</sup>

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**ABSTRACT**

**Background:** Globally, uncorrected refractive error (URE) is the leading cause of visual impairment. This condition can be treated simply through provision of eye examination and corrective spectacles. Hence, periodic evaluation is vital for safeguarding the quality and sustainability of refractive services. **Aim:** To evaluate the refraction services at a mission Tertiary Hospital in Jos, between 2017 and 2021. **Materials and methods:** Records of consecutive refractions and spectacles dispensed between January 2017 and December 2021 were reviewed. Data regarding age, gender, type of refractive error, number of spectacles dispensed and cost of spectacles for each year were retrieved from the records. The eye with the better vision was used to classify the patient's refraction status. Data was analyzed using Statistical Package for the Social Sciences 21. **Results:** A total of 4904 refractions were performed within the five years under review. Presbyopia co-existing with other forms of refractive errors was 1517 (30.9%) and presbyopia alone 1252 (25.5%). Myopia was seen in 1206 cases (24.6%), astigmatism in 791 (16.1%) and hypermetropia in 138 (2.8%). The total number of spectacles dispensed was 4352 (88.7%) and 2731 (62.7%) cost less than N10,000 (\$22.6). Type of refractive error was the only factor found to significantly influence the uptake of spectacles. The highest uptake was for presbyopia alone (91.4%), followed by compound astigmatism (89.2%) and the least being hypermetropia (84.1%). **Conclusion.** The five-year review of refraction services revealed a steady rise in the total number of refractions performed with corresponding increase in uptake of spectacles.

**Keywords:** Refraction, spectacle, dispensed.

**INTRODUCTION**

In 2021, 596 million persons in the world were reported to have distant visual impairment (VI), while an additional 510 million were visually impaired for near.<sup>1</sup> Uncorrected refractive error (URE) has been identified as the leading cause of moderate to severe visual impairment (MSVI) and the second cause of blindness in all regions of the world.<sup>1</sup> In Nigeria, URE is responsible for 78% of

mild visual impairment (MVI) and 57% of moderate visual impairment (MoVI) among adults aged 40

years and older.<sup>2</sup> Similarly, URE is the second most common cause of VI among those 50 years and older in Plateau state Nigeria.<sup>3</sup>

In many instances, URE can be avoided or treated, simply by providing affected persons with access to eye examination and a pair of corrective spectacles.<sup>4</sup> For an efficient refractive service delivery, the necessary equipment, suitable work

space and adequate supply of affordable spectacles should be in place.<sup>5</sup> Hence, the role of periodical review of new and existing refraction services.

In Nigeria, majority of the surveys on URE are among school age children with only a few focusing on adult population.<sup>6,7,8</sup> Refraction services in Nigeria are rarely investigated or reported, making it difficult to track progress or otherwise. The authors did not come across studies in the published literatures, evaluating hospital-based refraction services in Nigeria. For the first time, this study evaluated the existing refraction and spectacle dispensing records of a mission tertiary hospital to assess the frequency and pattern of refractions performed, calculate the proportion of spectacles dispensed and determine the factors associated with spectacle uptake, from 2017-2021.

### Materials and methods

This is a retrospective, cross-sectional review of routine refraction and spectacle dispensing records at a mission Tertiary Hospital in Jos, from January 2017 to December 2021 collated within a three months-period (March to May 2022).

The study was conducted at the ophthalmology department of a mission Tertiary Hospital in Jos North Local Government area of Plateau state. The mission hospital was established in 1959, upgraded to a Teaching Hospital in 2010.<sup>9</sup> The hospital has an ophthalmology department, consisting of an eye clinic, inbuilt dedicated eye theatre, an established optometry/optical unit. The optometry and optical unit are manned by two optometrists and two dispensing opticians under the supervision of four ophthalmologists. The hospital serves the immediate environ, receives referrals from primary and secondary facilities from within and outside the city center as well as from neighboring states of Nasarawa, Benue, Bauchi and Kaduna.

Records of final subjective refraction in the better eye and spectacles dispensed, collected in the optometry and optical units, were reviewed by the authors. The optometrists and opticians retrieved information on patients age and gender, type of refractive correction, cost and proportion of spectacles dispensed. These were documented in a proforma specifically developed by the authors for the purpose of this study. Refractive error was categorized as myopia, hyperopia, astigmatism, presbyopia alone and any distant correction in combination with presbyopia.

### Inclusion criteria

All refractions performed and documented in the refraction records of the hospital from January 2017 to December 2021.

### Exclusion criteria

All refractions with  $\geq 30\%$  incomplete data were excluded from analysis.

### Data management

Data collected was entered into Statistical package for Social Sciences version 21 (IBM SPSS statistics for Windows, version-21.0 Armonk, NY: IBM Corp) and analyzed. Frequency distribution tables were generated for all variables of interest. Chi-square test was used to check for association between spectacle uptake and age, gender, type of refractive error and cost of spectacles. Results are presented in the form of tables, graphs and charts. For all variables of interest, a P value of  $<0.05$  was considered statistically significant.

### Study definitions

1. Myopia: Refractive error of at least  $-0.50\text{Ds}$
2. Hyperopia: Refractive error of at least  $+0.50\text{Ds}$
3. Simple astigmatism: Refractive error of at least  $-0.25\text{Dc}$
4. Compound Astigmatism: Refractive error of at least  $-0.50\text{Ds} + 0.25\text{Dc}$  or  $-0.25\text{Dc}$
5. Astigmatism: Simple and compound Astigmatism group together
6. Presbyopia: At least  $+1.0\text{Ds}$  reading addition in a patient with difficulty in reading small letter prints despite having best distant optical correction in place.
7. Distant correction: Either of the following: myopia, hyperopia or astigmatism as defined above.
8. Presbyopia co-existing with other refractive errors: Presbyopia co-existing with either myopia, hypermetropia or astigmatism as defined above.

## RESULTS

A total of 5392 refractions were performed between January 2017 and December 2021. Four hundred and eighty-eight (9.1%) were excluded from analysis because data was incomplete, bringing the number of

eligible refractions to 4904. A large proportion 3991 (81.4%) of the patients refracted were adults, and most were females 2854 (58.2%), with half of them (53.2%) in their fifth decade of life or more (See table 1).

The highest number of refractions, 1560 (31.8%) were performed in 2021 and the least number 391 (8.0%) was in 2017. It was observed that the total number of refractions, declined from 1100 in 2019 to 915 in 2020 before sharply rising to 1560 in 2021. The predominant refractive error type was presbyopia co-existing with other forms of refractive error 1517 (30.9%), followed by presbyopia alone 1252 (25.5%), myopia 1206(24.6) and hypermetropia was the least 138 (2.8%). The overall proportion of spectacles dispensed was 4342 (88.5%) with more than half of them 2731 (62.9%)

Table 1: Demographic data of patients refracted between January 2017 to December 2021

Variables (N = 4904)	Frequency (%)
<b>Age group (years)</b>	
< 11	276(5.6)
11-20	844 (17.2)
21-30	473 (9.6)
31-40	702(14.3)
41-50	1370 (27.9)
51-60	788 (16.1)
>60	451 (9.2)
<b>Sex</b>	
Male	2050 (41.8)
Female	2854 (58.2)

Table 2: Pattern of refractions performed from January 2017 to December 2021

Variables (N= 4904)	Frequency (%)
<b>Frequency of refractions by year</b>	
2017	391 (8.0)
2018	938 (19.1)
2019	1100 (22.4)
2020	915 (18.7)
2021	1560 (31.8)
<b>Types of refractive errors</b>	
Myopia	1206 (24.6)
Hypermetropia	138 (2.8)
Astigmatism	791 (16.1)
Presbyopia alone	1252 (25.5)
Presbyopia + other distant refractive error	1517 (30.9)
<b>Spectacle dispensed</b>	

Yes 4352 (88.7)  
No 552 (11.3)

**Cost (N) of spectacle dispensed to 4352 patients**

<10,000 2731 (62.7)  
10,000-20,000 1402 (32.2)  
>20,000 209 (4.8)  
Cost not indicated 10 (0.2)

N= Total number

costing less than N10,000 (\$22.6 at an exchange rate of N440 to 1USD). Summary statistic of the five years refraction records are presented on table 2. and 2021. The only exception was the year 2020, where a decline was observed for myopia, astigmatism and presbyopia which was followed by a sharp rise in 2021. Of these, presbyopia showed the sharpest rise in 2021. See figure 1.

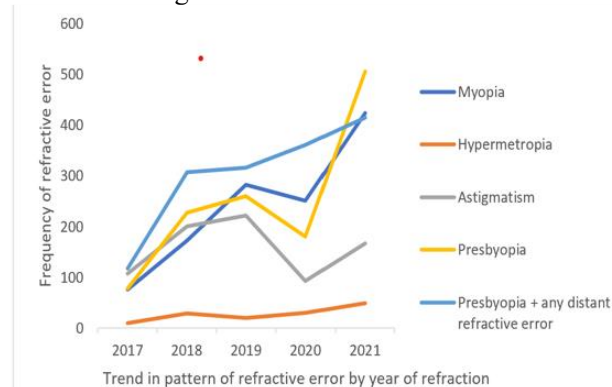


Figure 1: Trend of refractive errors by types from 2017 to 2021

Table 3: Proportion of spectacles dispensed between 2017 and 2021

Year	Spectacle dispensed		
	Yes N (%)	No N (%)	Total (%)
2017	349 (89.3)	42 (10.7)	391 (100)
2018	877 (93.5)	61 (6.5)	938 (100)
2019	939 (85.4)	161 (14.6)	1100 (100)
2020	807 (88.2)	108 (11.8)	921(100)
2021	1380 (88.5)	180 (11.5)	1560 (100)
<b>Total</b>	<b>4352 (88.7)</b>	<b>552 (11.3)</b>	<b>4904 (100)</b>

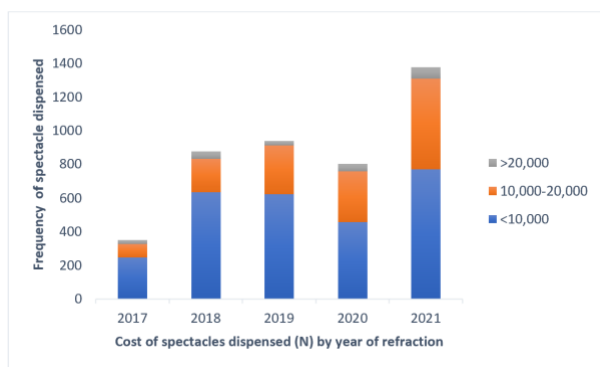


Figure 2: Cost of spectacles dispensed between 2017 to 2021

The five years average spectacle uptake was 88.7% with each year being above 80.0%. There was an initial yearly increase in the proportion of spectacles dispensed until 2019 and 2020, when a decline was observed which was followed by a slight rise by the year 2021 as shown on table 3.

Figure 2 is a graphical representation of the change in the proportion spectacles dispensed between 2017 and 2021 by cost. The pattern across the five years were similar with majority of the spectacles costing less than N10,000 (\$22.6 at an exchange rate of N440 to1USD).

Table 4: Relationship between type of refractive error and spectacle uptake from 2017 to 2021

Type of refractive error	Spectacle dispensed		Total	X <sup>2</sup> (p-value)
	Yes (%)	No (%)		
Myopia	1055 (87.5)	151 (12.5)	1206 (100)	<b>14.570 (0.012)*</b>
Hypermetropia	116 (84.1)	22 (15.9)	138 (100)	
Simple astigmatism	491 (87.7)	69 (12.3)	560 (100)	
Compound astigmatism	206 (89.2)	25 (10.8)	231 (100)	
Presbyopia alone	1144 (91.4)	108 (8.6)	1252 (100)	
Presbyopia+ any distant refractive error	1340 (88.3)	177 (11.7)	1517 (100)	
<b>Total</b>	<b>4352 (88.7)</b>	<b>552 (11.3)</b>	<b>4904 (100)</b>	

Degree of freedom = 5, X<sup>2</sup>= chi-square P value, \*statistically significant

Type of refractive error was the only factor that showed significant association with spectacle uptake (p value = 0.012) as shown on table 4. Even though spectacle uptake was above 80% for all categories of refractive error, presbyopia alone was observed to have the highest uptake of 91.4%, closely followed by compound astigmatism (89.2%) and presbyopia in combination with any distant refractive error (88.3%). Hypermetropia had the least uptake of 84.1% as seen on table 4. Patients age, gender and cost of spectacles did not significantly influence spectacle uptake.

## DISCUSSION

This retrospective study evaluated the refraction services at a mission tertiary hospital in Jos, north-central Nigeria over a five-year period. The key findings of this study are the yearly rise in number of refractions performed and the high spectacle uptake.

Overall, there was a slight female predominance (58.1%). This is in keeping with recent gender distribution of patients taking up refraction services in various eye care facilities in Nigeria and demonstrates a paradigm shift in access and utilization of eye care services in which women were previously disadvantaged.<sup>10,11-13</sup>

The relatively high frequency of presbyopia co-existing with other forms of refractive error (RE); 31.0% and presbyopia alone (25.7%) in our study is not unexpected as 67.4% of the patients refracted were 40 years or older. This compare favorably with results obtained from similar studies.<sup>12,14,15</sup> Abraham and Megbelayin<sup>12</sup> reported presbyopia co-existing with other forms of RE in 40.4% and presbyopia alone in 31.8% of ophthalmic outpatients presenting to the University of Uyo Teaching Hospital, South-west Nigeria. This contrast markedly with results of the Nigeria National Blindness and Visual impairment survey which reported astigmatism as the most frequent RE (58.7%) among Nigerians aged 40 years and above. Astigmatism was found only in 16.4% of all refractions in our study facility.<sup>16</sup> Other hospital-based surveys from Ogun (68.4%, 40.0%), Osun (55. 8%) all in south-west Nigeria and Kano (41.0%) Northwest Nigeria as well as in and South Africa (21.0%) also reported astigmatism as the predominant RE among their study population.<sup>10,13,14,17</sup>

In our study, myopia was the third most common RE seen in 24.4% of cases. Several authors had reported myopia as the most frequent RE especially among school aged children with a second

peak among the elderly owing to nuclear sclerosis, while others had documented hypermetropia as the most predominant.<sup>11,15,18-23</sup> The index study recorded only 2.7% hypermetropia. The wide variations in pattern of refractive errors observed between these studies could be attributed to differences in study methodology, definition of refractive error, environmental factors such as level of literacy and excessive near work. A previous study assessing the pattern of refractive error presentation between December 2010 and May 2011 in the current study facility revealed myopia and presbyopia as responsible for 50.0% and 43.0% of all RE respectively.<sup>16</sup> The observed variation could possibly be due to the predominance of adult population in the current study when compared to the preceding survey.

Worthy of note, is the high spectacle uptake (88.7%) observed in this mission tertiary hospital in contrast to reports from some government facilities where spectacles have frequently been reported as unavailable for patients uptake.<sup>24</sup> This buttresses the enormous role of the private sector in bridging the gap in the delivery of eye care services. The urban setting of this mission hospital could be a contributory factor for spectacle acceptance. As many rural communities and facilities had reported low spectacle uptake due to cultural beliefs, peer pressure and low visual requirements.<sup>24</sup>

In this study, type of refractive error was the only factor found to be significantly associated with spectacle uptake. Patients with presbyopia alone, compound astigmatism and presbyopia in combination with any distant refractive error had the highest spectacle uptake. This is at variance with findings from a community study in Mozambique where cost and lack of felt need were identified as significant barriers to uptake of refraction services.<sup>25</sup> The explanation might be that urban dwellers who present to tertiary eye care facilities already have significant visual impairment with good health seeking behavior when compared to their rural counterparts. To promote spectacle uptake, attractive and durable spectacles needs to be provided at affordable rates as spectacles gotten at no cost have not been shown to be enough motivation for uptake or compliance.<sup>26</sup>

Overall, spectacle uptake was observed to have increased with yearly increase in the number of refractions performed. The only exception was between 2019 and 2020 where both the number of refractions and the proportion of spectacles dispensed declined before rising again by 2021. This finding did not come as a surprise, as this period

coincided with the peak of the COVID-19 pandemic. Many eye care providers across the globe have also reported reduction in number of patients presenting to care facilities during the lock down, worsened by the induced financial hardship and fear of contacting the infection from hospital contacts.<sup>27,28</sup>

The strength of this study lies in its large sample size and the inclusion of presbyopia alone and in combination with other RE types which is often not included in many studies. The limitation however is that of hospital-based retrospective studies, in which hospital records are often incomplete and procedures might not have been standardized. Moreover, records of visual outcomes before and after refraction would have provided additional information relevant for estimating the distant and near effective refractive error coverage.<sup>29</sup> his limitation however, presents a potential area for future research.

## CONCLUSION

The five years review of refraction services revealed a steady yearly rise in the number of refractions performed in this mission tertiary facility. Spectacle uptake was correspondingly high and influenced only by type of refractive error. The data generated from this study has identified gaps in routine data collection and storage and the potential for scaling up the quality and scope of the existing refraction services in the study facility. It also exposed some of the challenges the COVID-19 pandemic posed to many eye care facilities and indeed the effect it had on services and supply.

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