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Prevalence of Presbyopia, Spectacle Correction Coverage and Unmet Need, among Adults in Cross River State, Nigeria.

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Abstract

Purpose: To determine the prevalence of presbyopia, spectacle correction coverage and its unmet needs among adults 35 years and above in the study area.

Methods: This cross-sectional descriptive study design used multistage cluster random sampling procedure to select the 616 adults. Data was collected using an interviewer administered semi-structured questionnaire. Visual acuity at distance and near was tested with Snellen's chart at 6m and 40cm respectively. This was followed by eye examination. Presbyopia was defined as near visual acuity of N8 or worse. Relationship between variables were determined using chi square and multivariate analysis at 5% significant level.

Results: The average age of participants was 48.1 years \pm 10.4 (range, 35-88 years) and 330 (53.6 %) were males. The prevalence of presbyopia was 73.2% (95% Confidence interval [CI]: 69.5, 76.7). Multiple regression analysis showed that, female sex (Adjusted odds ratio [AOR] =1.58 (95% CI: 1.02, 2.38), older age (AOR =3.29 (95% CI: 1.02, 13.6), unemployment (β = 0.47, p = 0.016, AOR =1.59 (95% CI: 1.26, 4.55), lack of formal education (β = -3.67, p < 0.001, AOR =0.03 (95% CI: 0.007, 0.09) were significantly associated with presbyopia. The spectacle correction coverage and unmet presbyopic need were 40.8%, and 59.2% respectively.

Conclusion: The Prevalence of presbyopia and unmet presbyopic correction were high among the participants. This can be addressed through awareness creation and provision of accessible and affordable primary eye care services in the communities.

Keywords: Presbyopia; Spectacle correction; Spectacle coverage; unmet needs; prevalence

Introduction

Presbyopia is an age-related condition that results from gradual decline in the accommodative power of the eye, leading to inability to see at near

distance to perform near task¹. Presbyopia reduces an individual's ability to perform visual task at near distance². An early symptom of presbyopia includes unfitness to read at near, headache after reading,

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2. Ejimadu CS, Onua AA, Ani E. Onset of Presbyopia in a black population in Niger-Delta Nigeria. *World Journal of Ophthalmology and Vision Research*.2019; 2(4): 21-25.

eyestrain, and the need to read with more bright light. It affects the quality of life of the sufferer depending on their occupation and near work habit³. It was estimated in 2017, that about 1.09 billion people are living with presbyopia, among which 26 million people are visually impaired, because they were not corrected or under corrected in 2018⁴. There is a prediction that 21% of the world's population will be 60 years or older in 2050, and presbyopia is likely to become one of the most important visual concerns of the 21st century with its global prevalence predicted to increase⁵. Review of related literatures shows that in low- and middle-income countries, over half of adult above the age of 30 years are presbyopic, and most of them do not have corrective lenses⁶. Age is the major risk factors of presbyopia, while sex, alcohol, poor nutrition, ocular and systemic diseases are known as common risk factors⁷.

There are no current approved therapies that can reverse the normal ageing process that leads to presbyopia. The only options for presbyopia correction are optical corrections with medical devices (e.g. Spectacles, Contact lenses) or series of surgical intervention such as corneal inlays, corneal refractive procedures and intraocular lens replacement⁸.

The burden of presbyopia affects productivity. A lot of people with presbyopia are left uncorrected for several reasons: Being female, high cost of spectacles, illiteracy and not been aware about where to get presbyopic spectacle correct, availability and accessibility of eye care services were barriers for not using spectacles in people with presbyopia⁹. The prevalence of presbyopia varies from countries to countries. In a meta-Analysis of population- based data available, the prevalence of presbyopia was 35.6% in people age 35 years and above and increases to 40.3% for people aged 50 years and older. More than 90% of these individuals are in developing countries¹⁰. The prevalence of presbyopia is estimated to range from 43.8% in southern and eastern countries to 83.0% in western Asian, Australia, New Zealand, North America and Europe¹¹.

In 2015, the global unmet need of presbyopia was 45% (95% CI, 23%-27%)¹². In a population base cross sectional study carried out in Ghana, the near vision spectacle correction coverage for presbyopia was 25%, 33% met need and 64% Unmet need. Among those that needed spectacle, 22% were not aware of the available services¹³. According to Ajibodo¹⁴, in a population based cross sectional study conducted in Southwest Nigeria, found that

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the prevalence of presbyopia was 80.9%, 22.9% “met need” and 58% unmet need with presbyopic correction coverage of 28.4% in the study population. A prevalence of presbyopia of 55.5% (95% CI, 51.3 - 60.1) and presbyopic spectacle correction coverage of 38% was reported in a study conducted in a Local Government Area of Cross River State¹⁵. For a condition that affects most adults regardless of race and gender, very few population-based surveys have been done. No current study covering the entire state has been conducted, thereby making it difficult to draw conclusions on the prevalence of presbyopia, and unmet need in the general population. This gap in knowledge will affect planning for eye care programme in the state. This study therefore aims to assess the prevalence of presbyopia, spectacle correction coverage, and unmet need of adults aged 35 years and older in Cross River State, Nigeria.

Materials and methods

Study design

This was a cross sectional descriptive study using quantitative methods of data collection. The study was conducted in Cross River State, Nigeria between May 2021 to August 2021 among adults 35 years and above.

Sample size determination

The minimal sample size of 646 was determined considering a 95 percent confidence level, a 5% margin of error, 55.5% estimated proportion from a previous study¹⁵, using 1.5 for the design effect, and allowing for 10% non-response rate. This was done using the formula for cross sectional studies

$n = (Z^2pq)/d^2$ by Lwanga, Lemeshow, and World Health Organization.¹⁶ A total number of 616 out of the 646 respondents agreed to participate in the study across the state.

Sampling Procedure

Multistage cluster random sampling procedure was used to select the respondents for this study. The study area, Cross River State, is made up of three senatorial districts. From each senatorial district one Local Government Area (LGA) was selected using simple random sampling technique. The LGAs selected were Obanliku, Yakurr and Calabar municipality from Northern, Central and Southern Senatorial districts respectively. Three wards were further selected from each LGA using simple random sampling procedure, making a total of nine wards. Seventy houses were selected from each ward using simple random sampling technique by balloting. Only one eligible respondent (adult 35 years and above) was selected from each household. The eye examination and administration of questionnaire for the consenting adult was done either at home or office of the selected respondent.

Instruments for data collection.

The semi structured questionnaire used for this study was in accordance with the WHO standardized protocol for assessing prevalence of Visual impairment caused by presbyopia¹². The components of the questionnaire were categorized into two sections (socio-demographic information of respondents and eye examination results).

Face to face validity of the questionnaire was done by specialists in the field of study in the department to

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evaluate the content clarity, accuracy and adequacy of the instruments before data collection. They confirmed the accuracy of the instrument to elicit the right information. The reliability coefficient was calculated to test for the internal validity of response and to determine if the instrument is reliable for the study, this was done using Cronbach Alpha Test in SPSS. The test result gave a value of 0.802 for the questionnaire. The participants were examined and interviewed in the comfort of their homes and workplaces as the case maybe.

Instruments used for eye test

Snellen's acuity chart was used to test for distance Visual Acuity (VA), Snellen's near acuity optotype, Time New Roman Font test chart, trial lens for subjective and objective refraction, pen light for external eye examination, pin hole for pin hole acuity and occluder to cover one eye at a time. The distance and near Visual Acuity (VA) of participants were tested by the researcher who is an Optometrist (AH) assisted by an Ophthalmic Nurse using the Snellen chart at six meters and 40cm respectively under a normal illumination. This was done after obtaining the demographic information of the participant. Objective and subjective refraction was carried out by AH on participants with presenting VA of less than 6/9 who had an improvement of at least one Snellen acuity line with a pin hole in either eye. Presbyopia was defined as near VA of N8 optotype or worse at 40cm with distance correction in place. In addition, if a person was able to identify correctly three out of five characters, the person is said to have successfully read a line in

this study. Individuals who were unable to read the N6 optotype with their distance correction in place were classified as presbyopes¹². Spectacle for near vision was provided at no cost to those presbyopes who had no reading spectacle at the time of this study, but this was done after completion of data collection, in other to avoid bias.

Inclusion and Exclusion Criteria

Individuals aged 35years and above, who reside in Cross River state and have lived in the state for not less than six months were eligible to participate in this study. Studies have shown that in black population, presbyopia sets in between 30 and 44 years^{5,17}. Adults 35 years and above who were critically ill at the time of the study and those with distance visual acuity less than 6/60 with no improvement with pinhole testing were excluded from the study. All subjects who were excluded from this study due to visual impairment were given a referral letter to the nearest eye care facility for further eye investigation and treatment.

Method of Data Analysis

Data were first entered and cleaned with Microsoft Excel 2016 and were transferred to Statistical Package for the Social Sciences (SPSS) Version 23 for data analysis. Descriptive statistics, tables, frequencies, and percentages were used in classifying and presenting the variables. Chi-square statistics was used to check for associations between independent variables (socio demographic factors) and the prevalence of presbyopia. Factors that were found to be significant in the chi-square analysis

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12. Fricke JR, Tahhan N, Resnikoff S, Papas E, Burnette A, Ho SM, Nadunilath T, Naidoo, KS. Global prevalence of presbyopia and vision impairment from uncorrected presbyopia. *American Academy of Ophthalmology*. 2018; 125(10): 1492-1499.
17. Ejimadu CS, Onua AA, Ani E. Onset of Presbyopia in a Black Population in Niger-Delta, Nigeria. *W J Ophthalmol & Vision Res*. 2019; 2(4): WJOVR.MS.ID.000542

were modeled using multiple logistic regressions at 95% confidence interval.

Presbyopic spectacle correction coverage (PSCC) was calculated with the formula: PSCC (%) =

$$\frac{\text{Met presbyopic need}}{\text{met presbyopic need} + \text{unmet presbyopic need}} \times 100^{18}$$

Ethical consideration

Ethical approval was obtained from the Cross River State Health Research Ethics Committee of Ministry of Health Calabar with REC No. CRSMOH/RP/REC/2021/167. Verbal informed consent was obtained from all participants prior to their participation in interviews or eye examination. The right to privacy and anonymity of the participants in the study were strictly adhered to by the researchers and respondents were assured that information provided would be used for research purposes only.

Results

Six hundred and sixteen respondents (n=616) participated in the study, giving a response rate of 96.3%. The sociodemographic characteristics of the participants are presented in Table 1. Slightly over half of the respondents (53.6%) were males. The average age of participants was 48.06 years \pm 10.4 (with a range of 35-88 years). Most respondents (29.1%) had attained secondary education while primary education (14.8%) was the least attained level of education. The area of residence of respondents was almost proportionate as most respondents (33.6%) resided in the southern senatorial district, 33.3% Northern Senatorial district and 33.1% Central senatorial district of Cross River state. Most respondents (45.1%) were self-employed, (41.2%) were married and (58.4%) were Christians (Table 1).

Table 1: Sociodemographic Characteristics of the study respondents

Variables	Frequency (n=616)	Percent (%)
Gender		
Male	330	53.6
Female	286	46.4
Age (in years)	Mean Age = 48.06	SD = 10.41
35-44	280	45.5
45-54	155	25.2
55-64	119	19.3
65-74	54	8.8
>74	8	1.3
Educational attainment		
No formal education	95	15.4
Primary education	91	14.8
Secondary education	179	29.1
Diploma	67	10.9
University degree (Bachelors/ professional)	164	26.6
Postgraduate degree (Masters/ Ph.D)	20	3.2
Residence		
Northern Senatorial district	205	33.3
Central senatorial district	204	33.1
Southern senatorial district	207	33.6





Employment status

Paid employee	181	29.4
Self-employed	278	45.1
Unemployed	157	25.5

Marital Status

Single	176	28.6
Married	254	41.2
Separated/divorced	117	19.0
Widowed	69	11.2

Religion

Islam	69	11.2
Christianity	360	58.4
African traditional	178	28.9
Others	9	1.5

SD= Standard deviation

The point prevalence of presbyopia is shown in Figure 1 below. Four hundred and fifty-one persons (73.2%) across the three senatorial districts of Cross River State were unable to read the N8 optotype and thus were diagnosed with presbyopia (0.732, 95% CI: 0.695, 0.767). Specifically, more females (51%) than males (49%) were diagnosed of presbyopia in the study area. The presbyopia spectacle coverage shows that out of 451 respondents who could not read the N8 optotype, only 184 (40.8%) had

spectacle correction for presbyopia while 267 (59.2%) of these respondents requires spectacle correction for presbyopia but did not have it (unmet presbyopic need).

The Spectacle coverage (%) = $\frac{184}{184+267} = 40.8\%$.

The presbyopia spectacle correction coverage in the study population during the study period was 40.8%. Specifically, more females (50.6%) had no spectacles compared to 49.4% of men who also had no spectacle correction.

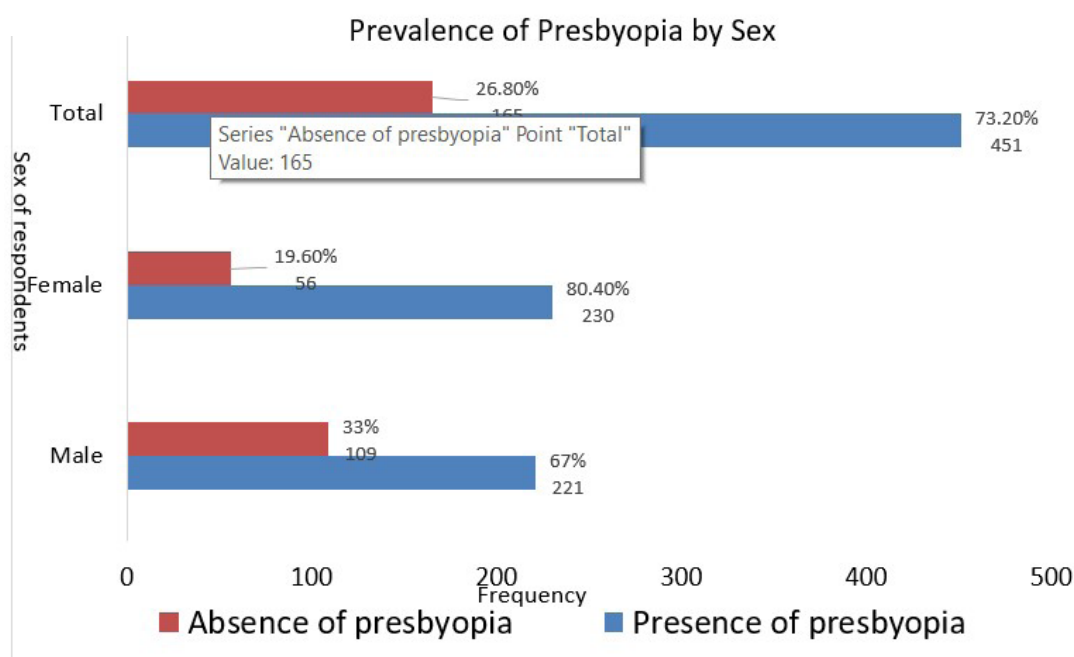


Figure 1 Prevalence of Presbyopia by Sex among adults in Cross River State, Nigeria

As can be seen by the cross-tabulated *P*- values presented in Table 2, significant associations were recorded only between age ($\chi^2 = 51.61, p < 0.001$), gender ($\chi^2 = 14.13, p < 0.001$), educational attainment ($\chi^2 = 8.97, p < 0.001$), employment status ($\chi^2 = 12.25, p = 0.002$) marital status ($\chi^2 = 13.81, p = 0.003$) and the prevalence of presbyopia. Other sociodemographic variables such as place of residence and religion had no significant associations with the prevalence of presbyopia among the study respondents.

Table 2: Relationship between sociodemographic characteristics of respondents and prevalence of presbyopia

Variables	Presence of presbyopia (N, %)	Absence of presbyopia (N, %)	<i>p</i> -Value
Gender			< 0.001**
Male	221 (67.0)	109 (33.0)	
Female	230 (80.4)	56 (19.6)	
Age (in years)			< 0.001**
34-44	242 (86.4)	38 (13.6)	
45-54	98 (63.2)	57 (36.8)	
55-64	67 (56.3)	52 (43.7)	
65-74	37 (68.5)	17 (31.5)	
>74	7 (87.5)	1 (12.5)	
Educational attainment			<0.001**
No formal education	90 (94.7)	5 (5.3)	
Primary education	79 (86.8)	12 (13.2)	
Secondary education	137 (76.5)	42 (23.5)	
Diploma	46 (68.7)	21 (31.3)	
University degree (Bachelors/professional)	90 (54.9)	74 (45.1)	
Postgraduate degree (Masters/Ph.D)	9 (45.0)	11 (55.0)	
Residence			0.175
Northern Senatorial district	141 (68.8)	64 (31.2)	
Central senatorial district	151 (74.0)	53 (26.0)	
Southern senatorial district	159 (76.8)	48 (23.2)	
Employment status			0.002*
Paid employee	115 (63.5)	66 (36.5)	
Self-employed	215 (77.3)	63 (22.7)	
Unemployed	121 (77.1)	36 (22.9)	
Marital Status			0.003*
Single	141 (80.1)	35 (19.9)	
Married	191 (75.2)	63 (24.8)	
Separated/divorced	72 (61.5)	45 (38.5)	
Widowed	47 (68.1)	22 (31.9)	
Religion			0.108
Islam	51 (73.9)	18 (26.1)	
Christianity	273 (75.8)	87 (24.2)	
African traditional	119 (66.9)	59 (33.1)	
Others	8 (88.9)	1 (11.1)	

P-value= Probability value; *Statistical significance based on *p*-Value <0.05; ** Statistical significance based on *p*-value < 0.001

Table 3 shows the multivariate logistic regression analysis of the Sociodemographic variables and other factors associated with the prevalence of presbyopia after adjusting for all potential confounders that were found significant in the chi-square analysis. The multivariable analysis showed that respondents aged 45-54 years ($\beta = 0.35$, $p < 0.001$, AOR =1.10 (95% CI: 0.28, 4.41), 55-64 years ($\beta = 0.44$, $p < 0.001$, AOR =1.11 (95% CI: 0.59, 2.07), 65-74 years ($\beta = 0.60$, $p = 0.001$, AOR =1.22 (95% CI: 0.63, 2.39), and > 74 years ($\beta = 1.19$, $p < 0.001$, AOR =3.29 (95% CI: 1.02, 13.6) were significantly more likely than the younger ages (35-44 years) to develop presbyopia. Female gender was found to be significantly associated with prevalence of presbyopia. That is, females were 1.56 times more likely to be affected by presbyopia than their male counterparts, ($\beta = 0.44$, $p = 0.041$, AOR =1.58 (95% CI: 1.02, 2.38). In terms of educational attainment, respondents with primary ($\beta = -1.29$, $p = 0.023$, AOR =0.28 (95% CI: 0.09, 0.84), Secondary ($\beta = -1.95$, $p < 0.001$, AOR =0.14 (95% CI: 0.05, 0.38), Diploma ($\beta = -2.36$, $p < 0.001$, AOR =0.09 (95% CI: 0.03, 0.29), Undergraduate ($\beta = -2.84$, $p < 0.001$, AOR =0.06 (95% CI: 0.02, 0.16), and postgraduate ($\beta = -3.67$, $p < 0.001$, AOR =0.03 (95% CI: 0.007, 0.09) education were less likely than those with no formal education to develop presbyopia in the study population. Additionally, there was a statistically significant relationship between being unemployed and prevalence of presbyopia in the study population. This implies that those who were unemployed were 1.59 times more likely than the paid employees to develop presbyopia in the study population, ($\beta = 0.47$, $p = 0.016$, AOR =1.59 (95% CI: 1.26, 4.55).

Table 3: Multivariate analysis of sociodemographic correlates and prevalence of Presbyopia

Variables	AOR	95% CI	P- Value
Gender			
Male	1	-	-
Female	1.56	1.02, 2.38	0.041*
Age (in years)			
34-44	1	-	-
45-54	1.10	0.28, 4.41	< 0.001**
55-64	1.11	0.59, 2.07	< 0.001**
65-74	1.22	0.63, 2.39	0.001*
>74	3.29	1.02, 13.6	< 0.001**
Educational attainment			
No formal education	1	-	-
Primary education	0.28	0.09, 0.84	0.023*
Secondary education	0.14	0.05, 0.38	<0.001**
Diploma	0.09	0.03, 0.29	<0.001**
University degree (Bachelors/ professional)	0.06	0.02, 0.16	<0.001**
Postgraduate degree (Masters/ Ph.D)	0.03	0.007, 0.09	<0.001**





Employment Status

Paid employee	1	-	-
Self-employed	1.48	0.91, 2.40	0.114
Unemployed	1.59	1.26, 4.55	0.016*

Marital Status

Single	1	-	-
Married	0.95	0.55, 1.64	0.840
Separated/divorced	0.57	0.29, 1.10	0.095
Widowed	0.91	0.37, 2.26	0.913

*P-value= Probability value; *Statistical significance based on p-Value < 0.05; ** Statistical significance based on p-value < 0.001; AOR= Adjusted Odds Ratio; CI= Confidence Interval*

Discussion

This study set out to determine the prevalence of presbyopia, spectacle correction coverage, and unmet spectacle needs among adult in Cross River State, Nigeria. From the result of this study, about two-third of the participants had presbyopia and over 50% of them who need spectacle correction for presbyopia do not have it. The prevalence of presbyopia was statistically significantly associated with female gender, increasing age, lower level of education and unemployed/retired respondents. The place of residence, religion and marital status were not significantly associated with the prevalence of presbyopia.

The finding of this study is similar to a study conducted in Nicaragua, Brazil, the prevalence of presbyopia was 79.6%¹⁹, in South Africa²⁰ 77% was reported. It is also in agreement with a

study conducted in Southwest Nigeria, out of the 662-participant examined, the prevalence of presbyopia was 80.8% (95% CI, 77.4-83.7)⁶. In a study conducted in Owerri, Nigeria, the prevalence of presbyopia was 70.9% and 75.0% for study and control groups respectively²¹. It is however higher when compared to some studies carried out in Nigeria. In a cross – sectional descriptive study carried out in Kwara State, Nigeria, the prevalence of presbyopia was 59.7%²², in Gwagwalada Abuja, the prevalence was 55%²³, Abuja, Nigeria, 55%²⁴ and Calabar South in Cross River State¹⁵ 55% prevalence of presbyopia. The higher prevalence of presbyopia in this study may be due to lack of awareness and accessible primary eye care services in the communities. Variations in the definition of presbyopia across studies may be another reason for comparability issues.

- Fafiolu VO, Ajibod HA, Onabolu OO, Jagun KO, Bodunde OT, Otolana TO. The impact of presbyopia on the quality of life in a semi-urban community in Southwest Nigeria. *Afr Vision Eye Health*. 2020; 79(1): a548.
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Almost all studies reviewed found a statistically significant positive association between age and the prevalence of presbyopia^{9,15-25}. Similar to previous studies^{9,26-30}, the prevalence of presbyopia was significantly more among females than males in this study. In a population based cross sectional study conducted in Prakasan District, South Indian, using multivariable analysis, found that functional presbyopia was significantly associated with female gender, no education and lack of spectacle use²³. The reason for this difference may be related to variation in the near task performed by both sexes, which indicates that females are involved in more near task activities such as sorting rice, sewing, weeding, cooking food, winnowing grain, dressing children, lighting and adjusting lamps more than men³⁰. However, this was in contrast to a study on prevalence of Presbyopia in Calabar South, Nigeria which used Chi-square test for assessing relationships between categorical variables. It indicated no significant association between gender and prevalence of presbyopia among the study participants. However, more female participants

132 (58.9%) compared to males 102 (51.5%) had presbyopia¹⁵. The difference could be due to the smaller sample size and the use of only univariate analysis which does not consider the influence of confounding variables that may have hidden the relationship between the variables.

Also, the burden of unmet spectacle need was more on the females than the males in this study. This may be due to the fact that the females unlike the males were more likely not able to pay for their spectacles and rely on other persons to pay for their spectacles^{29,30}. More than 50% of those who need spectacle correction for presbyopia in this study did not have it, which could be an indication of poor delivery of accessible and affordable eye care services. This finding is higher than the global unmet need for presbyopia correction (45%)¹² but similar to studies carried out in Nigeria and elsewhere in the developing countries^{15, 20, 24, 31},

Limitations and strengths

The findings of this study should be interpreted with caution due to the following limitations. Firstly, the

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measurement of visual acuity may lack consistency because of the variations in illumination while taking visual acuities at the various locations during the study, which may lead to underestimation or overestimation of the near visual acuity. Secondly, the selection of participants who are 35 years and above may have excluded early presbyopes from the study, since the onset of presbyopia in black population is between 30 and 44 years^{5,17}.

Additionally, due to the cross-sectional design used, and findings may be due to chance, it is therefore not possible to establish causation. However, at the analysis stage of the research, strong statistical analysis was conducted to control for potential confounders to reduce bias, which is one of the strengths of this study.

Conclusion

This study found that the burden of presbyopia and unmet spectacle correction need in Cross River State are high and there remains a need for optical services which could in turn increase productivity and quality of life. The Government intervention and those of other agencies towards the provision of accessible and affordable eye care services should target females, older people, the unemployed and people with no formal education.

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