Visual function and vision-related quality of life in presbyopic adult population of Northwestern Nigeria

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ABSTRACT

Purpose: To determine the impact of uncorrected presbyopia on vision-related quality of life (QoL) and visual function (VF) among adults 40 years and older in Bungudu local government area (LGA) of Zamfara State, Nigeria. **Materials and Methods:** A population-based cross-sectional study in Bungudu LGA of Zamfara State Nigeria was conducted in 2012. Six-hundred and fifty persons at least 40 years of age were examined using a two-stage cluster random sampling-based on probability proportional to size. Presbyopia was defined as the inability to read N8 at 40 cm in an indoor illumination using LogMAR E-chart. Demographic information comprising of age, sex, occupation, and educational level among others was obtained from a pilot tested VF-14 and modified vision-related QoL questionnaire by trained interviewer. **Results:** Out Of the 650 subjects enumerated 635 were examined given a response rate of 97.7%. The mean age of participants was 53.59 years (95% confidence interval:52.75%-54.43%). The crude prevalence of presbyopia was 30.4%, (95% CI: 26.8%-34.1%). The mean VF score of persons with presbyopia was 85.09, (95% CI: 83.09%-87.09%) and being female was strongly associated with high VF scores ($P = 0.003$). The VFs most impaired were the ability to read, write, use mobile phones, and thread needles. The higher the degree of presbyopia the lower the mean VF score ($P = 0.00$). **Conclusion:** Uncorrected presbyopia is associated with functional visual impairment and reduce QoL especially in the ability to read, write, and usage of mobile cell phones among adults 40 years and older in Bungudu District.

Key words: Ageing, Nigeria, presbyopia, quality-of-life, visual function

INTRODUCTION

Uncorrected presbyopia impacts negatively on visual function (VF) and quality of life (QoL) of affected persons.[1] The symptoms of uncorrected presbyopia such as difficulty performing near work, fatigue, headache, and eyestrain, may adversely affect the QoL of affected persons in varying degree depending on their occupation and near work habit. Modernization has made the use of devices requiring good near vision such as computers and mobile cell phones more widespread increasing the need for a good near vision. Globally, 419 million people are prevented from performing near tasks in the way they are supposed to, because of uncorrected presbyopia.[2]

Based on the degree of near visual acuity (VA), near visual impairment (NVI) have been categorized[3] as mild, moderate, severe, and near vision blindness using the presenting binocular near vision. Mild NVI is an acuity of <20/40-20/63 (<6/12-6/19); moderate NVI <20/63-20/200 (<6/19-6/60); severe NVI <20/200-20/400 (<6/60-3/60); and near vision blindness as a near acuity of <20/400 (<3/60). Studies[1,4] have reported increasing difficulty in reading, harvesting grains, sewing, and recognizing the small object as the main complaints of

people with presbyopia. Presbyopes are also more likely than nonpresbyopes to report not being satisfied with near vision and general health.[4] In a rural Tanzania population,[5] being presbyopic increased the odds of reporting some difficulty with near-vision tasks by two-fold and severe difficulty by more than eight-fold. A study from China[6] reported that difficulties with activities of daily living and resulting social impediments were commonly associated with presbyopia. Elderly people in Ibadan, Nigeria, were more likely to have significant decrease in QoL due to problems with near vision than those of distance vision.[7]

There is a paucity of data on functional visual impairment and vision-related QoL associated with presbyopia in Nigeria. Zamfara State Government with support from an International NGDO has been implementing a comprehensive eye care program since 2010[8] with a target of achieving the goals of Vision 2020: The Right to Sight. The aim of this study was to provide data on the impact of presbyopia on vision-related QoL in an adult population of Northwestern Nigeria. The specific objectives were to determine the mean VF scores of persons with presbyopia; to determine the near vision functions most impaired in the study population; to determine the relationship between the degrees of presbyopia and the mean VF score; and to determine the QoL score of persons with presbyopia. The findings from this study will provide data to stakeholders for evidence-based planning; advocacy; and eye care services delivery in Zamfara and nearby states in Nigeria.

MATERIALS AND METHODS

Ethical considerations
Ethical approval was obtained from the Human Research and Ethics Committee of the National Eye Centre (NEC), Kaduna, Nigeria. Approval was also given by Zamfara State Ministry of Health and Bungudu local government area (LGA). The research also adhered to the tenets of Helsinki declaration. All persons examined signed informed consent.

Study design
This was a population-based cross-sectional survey conducted in April 2012 in Bungudu LGA of Zamfara State, Nigeria. Persons 40 years of age and older who have spent at least 6 months in the community were the study population.

Person(s) whose presenting distance VA is less than 6/60 on Snellen chart and did not improve with pinhole (PH); and individuals with mental or other incapacitating illnesses whose vision cannot be tested were excluded from the study.

Sample size determination
A minimum sample size of 646 was calculated using the formula: $n = \dfrac{z^2 \, pq}{d^2}$

Where, n = required sample size, z = standard normal deviation, p = expected prevalence, q = (1 − p), d = degree

of accuracy and multiplied by the design effect, z = 1.96 (95%), p = 55%, d = 0.05 (5%), design effect = 1.7.

Sampling technique
Thirteen clusters of 50 persons were selected using a two-stage random sampling with probability proportional to size. The selection of subjects in a sampling unit was by "spin-the-bottle method" at the center of the cluster, then random-walk process to identify households. All eligible persons in a selected household were included in the survey until the required numbers in a cluster were obtained. In situations where the required number of participants was not obtained in a cluster, a neighboring village was sampled for completion.

Examination/refraction procedures
The survey team comprised of an ophthalmologist, ophthalmic nurse (ON), enumerator, and a village guide.

The enumerator obtained demographic information comprising of age and sex of participants after the consent was signed. The memory of historical events was used to estimate age where necessary.

An ON assessed the distance VA of all subjects using the Snellen tumbling E-chart at 6 m in ambient outdoor illumination under shade. Pinhole VA was done on all subjects who had VA <6/18 in either eye. Correct identification of 3 out of 5 optotypes in a line constituted success at reading that line.

The ophthalmologist conducted objective and subjective refraction for subjects with VA <6/18 after demonstrating improvement of at least one Snellen acuity line when tested with a PH in either eye. Subjects presenting with a vision of ≥6/18 proceeded to near vision test. Participants with the presenting vision of at least 6/60 but <6/18 without PH improvement also proceeded to have near vision test.

Near vision was tested at 40 cm, with best distance correction where applicable, using LogMAR near E-chart under ambient indoor illumination. The distance was maintained using a rope string of 40 cm length attached to the chart at one end and on the forehead of the subject at the other end. Correct identification of 3 out of 5 characters constituted a success in reading a line. The end point of near vision testing was N8 optotypes. Those with presbyopic spectacles were further assessed with the available correction. Any subject who could not correctly read the optotypes on N8 line had near refraction by addition of spherical plus lenses in increments of 0.25 D monocularly, and then binocularly until the subject read N8 or additional lenses yielded no further improvement in line reading. A person was diagnosed presbyopic if he or she cannot read the N8 optotype at 40 cm with the distance correction if required. Under-corrected presbyopia was present in a subject presenting with near vision spectacles but fails to read N8.

Interview of participants

The ophthalmologist interviewed all subjects with uncorrected or under-corrected presbyopia. The interview questions included the impact of near vision on various activities; problems with near vision; spectacles use; and prior consultation by eye care professionals. VFs covered in the interview comprised writing, recognizing small objects, cooking, farming (harvesting of grains), reading, sewing (threading a needle), using a mobile phone, and getting dressed up. Participants were asked first if they regularly conducted the particular activity. If the answer was "yes," they were then asked to rate the difficulty that they experience for their near-vision performance for each activity-based on a rating of 1-5 where:

1. No difficulty,
2. Mild difficulty,
3. Moderate difficulty,
4. Severe difficulty, and
5. Do not undertake the task (not applicable).

Participants were instructed that this was a linear increase in severity, and other factors that did not relate to their near vision (e.g., mobility, distance vision) were not relevant to this question.

They were asked how much satisfaction they had with their "distance vision," "near vision," and "general health." Their level of satisfaction was recorded as:

1. Very good,
2. Good,
3. Moderate,
4. Bad, and
5. Very bad.

These ratings correspond to 100%, 75%, 50%, 25%, and 0% scores, respectively.

The interview proceeded to questions on difficulty in carrying out daily tasks that were vision specific and graded as:

1. Never,
2. Sometimes,
3. Often,
4. Very often, and
5. Extreme/cannot do.

The questions asked included difficulty in carrying out activities such as going down steps or stairs, noticing obstacles while walking alone, and recognition of the face of persons among several others. Questions were then asked on how their vision affected psychosocial functions and recorded as above. The questions were "how often have you been hesitant to participate in social functions," "how often have you found that you are ashamed or embarrassed," "how often have you felt that you are a burden on others," and "how often do you worry that you may lose your remaining sight." Finally, participants were asked to consider their vision in typical tasks of daily life such as, reading newspaper, recognizing objects on a postcard size (11 cm × 16 cm) photograph, recognizing faces of people from across the room, reading road signs, and picking out details in pictures from a distance of 20 m. They were then asked how much difficulty they had with their vision and were recorded as:

1. None,
2. Mild,
3. Moderate,
4. Severe, and
5. Extreme/cannot do.

All collected data were entered into a modified VF-14 vision-related QoL questionnaire for each participant.

Data analysis

Data were analyzed with SPSS for windows version 16.0 (SPSS Inc., Chicago, IL, USA) by a statistician. Visual functioning and QoL scores were also calculated by allocating scores of 4, 3, 2, 1, and 0 to "no difficulty," "mild difficulty," "moderate difficulty," and "extreme difficulty/cannot" in carrying out an activity, respectively. Multiplying the score for the individual by 25 provide the highest score of 100 and lowest of zero. Any activity not applicable to any participant was excluded from the scoring. The mean scores were compared for age, gender, and degree of presbyopia among participants. A *P* value of 0.05 or less was considered statistical significant for all analyses.

RESULTS

A total of 635 subjects were examined out of 650 enumerated constituting a response rate of 97.7% as shown in Table 1. The mean age of participants was 53.59 years, (95% confidence interval [CI]: 52.75%-54.43%). Females constituted the majority of the subjects that were not examined (13/15 = 86%) due to absenteeism or refusal. One-hundred ninety-three persons were unable to read N8 Optotype at 40 cm and thus diagnosed with presbyopia.

The mean VF score of all the participants with presbyopia was (95% CI 83.09%-87.09%). The lowest mean score (82.36) was obtained in persons 70 years and above [Table 2]. The mean VF score of the female participants was 87.95 .for males, showing a strong association of high

Table 1: Age and sex distribution of individuals examined

Age group (years)	Male *n* (%)	Female *n* (%)	Total *n* (%)	*P*
40-49	148 (23.3)	121 (19.1)	269 (42.4)	0.011*
50-59	104 (26.9)	62 (9.8)	166 (26.2)	0.567
60-69	86 (22.3)	51 (8.0)	137 (21.5)	0.591
≥70	48 (7.5)	15 (2.4)	63 (9.9)	0.008*
Total	386 (60.8)	249 (39.2)	635 (100)	

*Statistically significant

VF scores with being female (*P* = 0.003). The VFs that recorded the lowest scores were the use of mobile phones writing, the wind blowing of grains, reading, and threading a needle. The older a presbyope, the more the difficulty using a mobile cell phone. None of the presbyopes aged 40-49 years had difficulty recognizing close objects or faces of people near-by. Figure 1 shows the relationship of VF score and the severity of presbyopia. The higher the degree of presbyopia, the lower the mean VF scores (*P* < 0.005).

The mean QoL score of participants with presbyopia was (95% CI: 76.72%-79.52%). The mean score was higher for persons 40-49 years and lowest in the 70 years and above (*P* < 0.0005) as shown in Table 3. The mean QoL scores for male and female participants with presbyopia were 65.57 and 67.81, respectively (*P* = 0.237). The higher the degree of presbyopia, the lower the reported level of satisfaction with both distant and near vision [Figure 2]. The mean QoL score generally decreases with increasing age although this was only statistically significant in response to "noticing obstacles while walking," "going down stairs," and "carrying out outdoor activities." Psychosocial activities such as hesitation to participate in social functions recorded higher mean scores [Table 4].

DISCUSSION

This high response rate recorded in this study, attributable to adequate community mobilization, should be a reflection of QoL and visual functional impairment associated with presbyopia in the target and possibly nearby population. The result of this population-based study on presbyopia will further add to the existing knowledge from few similar studies conducted in Nigeria and other parts of Africa. Since the amplitude of accommodation continues to recede with age,[9] there is a need to take actions that will improve the negative impact of presbyopia on the QoL.

The mean age of participants in this study is similar to a study conducted in Gwagwalada, Nigeria.[4] The

number of females examined was less than their male counterparts; of the 15 persons that refused/absent during examination 13 were females. The high refusal rate (86% of refusals) among females contributed to the significant difference in the number examined, this was due to lack of consent by their dominant male spouses. This study revealed that the mean VF and QoL scores of

Table 2: Mean VF score by age group of presbyopes

Variable	Mean VF score in age group (years)					*P*
	40-49	50-59	60-69	≥70	Total	
Use of mobile phone	25.96	15.00	9.31	8.75	15.16	0.033*
Writing	29.33	24.00	19.12	30.63	25.52	0.491
Wind blowing of grains	38.46	41.50	23.53	10.00	29.40	0.003*
Reading	34.62	34.00	27.45	41.88	34.07	0.434
Threading a needle	32.21	32.00	35.78	45.63	35.88	0.261
Weeding	30.77	44.00	37.75	43.75	38.73	0.480
Cooking	69.23	47.50	32.35	10.00	41.58	<0.0005*
Harvesting	34.62	47.00	42.16	43.75	41.71	0.627
Sorting out rice/grains	67.31	50.00	39.22	17.50	45.08	<0.0005*
Cutting fingernails	86.54	82.50	81.86	65.00	79.79	0.025*
Dressing children	95.19	92.00	88.24	67.50	86.79	<0.0005*
Recognizing close objects	100.00	93.37	93.63	89.38	94.37	0.026*
Recognizing faces close by	100.00	94.50	93.00	89.38	94.53	0.023*
Switching on light/adjusting lamps	98.08	96.43	99.51	95.63	97.53	0.476

*Statistically significant. VF – Visual function

Table 3: Mean quality of life score of presbyopes by age group

Age group (years)	Sample (*n*)	Mean score (95% CI)	Minimum	Maximum	SD
40-49	52	83.27 (81.25-85.29)	68	98	7.40
50-59	50	78.17 (74.91-81.43)	45	98	11.78
60-69	51	77.19 (75.05-79.33)	63	96	7.80
70+	40	72.54 (69.59-75.49)	48	92	9.53
Total	193	78.12 (69.59-75.49)	45	98	9.91

CI – Confidence interval; SD – Standard deviation
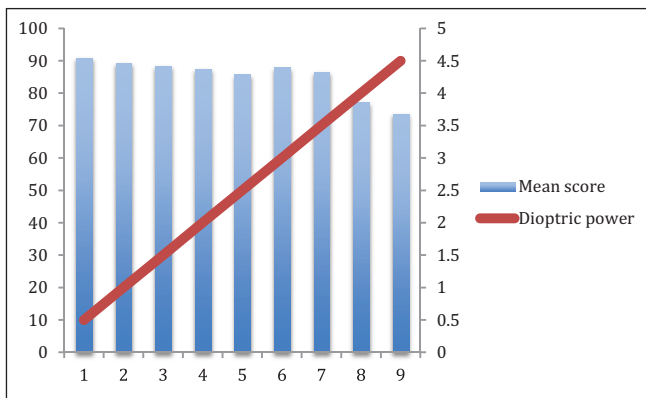

Figure 1: The relationship between the degree of presbyopia and mean visual function score
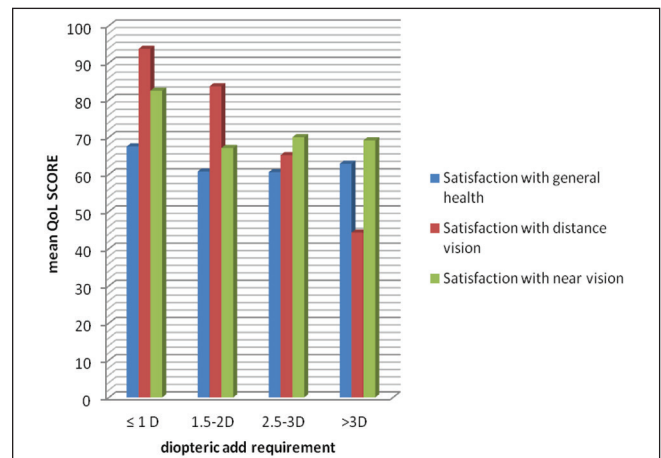

Figure 2: Mean quality of life score of participants by the degree of presbyopia

Table 4: Mean QoL score per activity of daily living across age group

Activity	Mean QoL score in age groups (years)				P
	40-49	50-59	60-69	≥70	
Difficulty going to activities outside of the house	100.00	98.00	96.57	90.00	<0.0005*
How much difficulty do you have with your vision in carrying out vision-related activities	75.48	67.00	66.18	58.13	<0.0005*
Difficulty noticing obstacles, walking	97.60	91.00	93.63	81.88	0.002*
How often do you worry that you may lose your remaining sight	79.33	65.50	68.14	60.00	0.015*
Difficulty searching for something in crowded area	99.04	96.00	95.59	90.63	0.050*
Difficulty going down steps or stairs	36.54	29.00	19.61	13.75	0.054*
Difficulty carrying out your usual work	93.27	89.50	89.71	83.75	0.073
Difficulty seeing level in containers	100.00	100.00	100.00	96.25	0.074
Difficulty seeing irregularities in path	99.52	94.00	97.06	94.38	0.087
Hesitant to participate in social functions	100.00	98.00	100.00	100.00	0.205
Difficulty seeing close objects	82.69	87.00	88.73	90.63	0.249
Difficulty seeing because of glare	82.21	81.00	75.00	71.88	0.262
Difficulty seeing when coming inside after being in bright sunlight	87.02	86.00	90.20	82.50	0.318
Difficulty recognizing faces of a person standing near you	97.60	96.00	93.63	93.13	0.360
Difficulty seeing differences in colors	98.08	97.50	100.00	98.75	0.404
Feels you are a burden on others	100.00	98.50	100.00	100.00	0.416
Ashamed or embarrassed	100.00	99.00	100.00	100.00	0.416
Difficulty doing activities that requires you to see well close up	84.13	85.00	89.22	86.88	0.541

*Statistically significant. QoL – Quality of life

presbyopes were high (more than 75), and the higher the dioptric add required to read N8 at 40 cm, the lower the mean score, implying negative impact on VF. The lowest VF scores were in relation to ability to read, write, and use mobile cell phones. Similar studies[1,4] have reported increasing difficulty in reading, harvesting grains, sewing, and recognizing small objects as the main complaints of people with presbyopia. The visual impairment associated with the use of mobile cell phones among the rural populace with presbyopia in this study underscores how advancement in technology brings out new challenges in ophthalmic practice. The use of near vision spectacles will, therefore, allow easy use of mobile cell phones for communication and promote business in addition to other multiple benefits.

Our study found that the higher the dioptric requirement the more difficulty in "noticing obstacles, walking" (*P* = 0.014), and "recognizing faces of a person standing near-by" (*P* = 0.023). Other ocular and systemic conditions associated with increasing age might have influenced this finding since the older participants are more prone to other age-related diseases. A similar study[4] in Nigeria has reported presbyopes to have less satisfaction with their distance and near vision. In rural Tanzania,[5] being presbyopic increased the odds of reporting some difficulty with near-vision tasks by two-fold and severe difficulty by more than eight-fold.

The fact that presbyopia mainly affect near vision may explain why severity of presbyopia had minimal impact on psychosocial activities such as "Hesitant to participate in social functions," "Ashamed or embarrassed," and "Feels you are a burden on others." This finding contrast the findings of a study from China[6] that reported limitations in social functions although the authors were not specific as per the functions affected.

The onset of presbyopia influences near work habits of individuals and as such no uniform method can accurately detect it among different persons. In this study, the inability to read N8 at 40 cm with LogMAR near chart may have underdiagnosed participants with presbyopia whose habitual near work distance is <40 cm. The questions on VF and QoL were subjective, and rating of the amount of difficulty in carrying out an activity may be difficult considering the low literacy level of participants in this study.[10] Also being a descriptive study, other confounders not isolated, may have contributed to decrease VF and QoL scores.

CONCLUSION

Uncorrected presbyopia is associated with functional visual impairment and reduces QoL especially in the ability to read, write, and use of mobile phones. The study populations have a need for awareness creation on presbyopia and provision of accessible and affordable near vision spectacles services to improve the QoL of affected persons.

Conflicts of interest

There are no conflicts of interest.

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