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Prevalence of refractive error, presbyopia and spectacle coverage in Kahama District, Tanzania: a rapid assessment of refractive error

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Background: In Tanzania, the prevalence of refractive error and presbyopia have not been comprehensively assessed, limiting appropriate planning and implementation of delivery of vision care. This study sought to determine the prevalence of refractive error and presbyopia, spectacle coverage and the barriers to uptake of refractive services in people aged 15 years and older in the Kahama district of Tanzania.

Methods: A cross-sectional community-based survey was conducted using 54 randomly selected clusters. Respondents 15 years and older were interviewed and underwent standardised clinical eye examinations. Uncorrected refractive error (URE) was defined as presenting vision worse than 6/12 that could be corrected to better than 6/12 using a pinhole. Spectacle coverage was defined as the proportion of need that was met (those that improved from unaided vision with their own spectacle correction).

Results: A total of 3,230 subjects (99.75 per cent of 3,240 eligible) participated in the study with 57.2 per cent males and the median age of participants was 35 years (inter-quartile range, 24 to 49). The prevalence of visual impairment was 10.4 per cent (95% CI 9.4 to 11.4) and was lower in those who had completed their primary school education (odds ratio (OR) 0.54, 95% CI: 0.40 to 0.72) and highest in subjects 40 years and older (OR 3.17, 95% CI: 2.14 to 4.70) and farmers (OR 8.57 95% CI: 2.27 to 32.43). Refractive error prevalence was 7.5 per cent (95% CI: 6.65 to 8.54) and this was highest in participants over 40 years (OR 1.60, 95% CI: 1.14 to 2.25) and in students (OR 3.64, 95% CI: 1.35 to 9.86). Prevalence of presbyopia was 46.5 per cent (773/1,663, 95% CI: 44.34 to 48.75). Spectacle coverage for refractive error and presbyopia was 1.69% (95% CI: 0 to 3.29) and 0.42% (95% CI: 0 to 1.26), respectively.

Conclusion: Uncorrected refractive error is a public health challenge in the Kahama district and sustainable service delivery and health promotion efforts are needed.

Key words: prevalence, rapid assessment of refractive errors, refractive error, spectacle coverage, Tanzania

Worldwide, there are over 624.8 million people who are vision-impaired, simply because they cannot access a simple eye examination and pair of glasses, either for distance or near visual impairment.[1,2] It has long been postulated that a link exists between avoidable blindness and poverty.[3–5] Eliminating avoidable blindness and visual impairment in poor communities would have a hugely positive impact on individuals and on the community at large by enabling them to contribute meaningfully to society, both economically and socially.[6]

The WHO estimates that out of the 153 million people who live with uncorrected refractive error (this excludes those who are presbyopic),[1,3] 13 million children (aged five to 15) and 45 million working-age adults (aged 16 to 49) are burdened by uncorrected refractive error.[1] Holden and colleagues[2] estimated that the total number of people aged above five years with uncorrected refractive error requiring correction to be 80.5 million and 79.1 million for people 40 years and older. Accurate prevalence data on uncorrected refractive error are required to mount an appropriate eye-care response, while maximising financial and human resources. Presently, large-scale population-based studies are implemented at great cost and time, requiring several skilled consultants and staff to obtain a measure of national refractive error prevalence.

Fragmented efforts have been undertaken in Tanzania to measure the prevalence of refractive error;[7–10] however, generalisations could not be made from these studies to the larger population due to sampling and methodological differences. A 2007 Rapid Assessment of Avoidable Blindness (RAAB) study conducted in the Kilimanjaro region of Tanzania, in a population aged 50 years and older, provided an overall picture and suggested that the prevalence of presbyopia was 89.2 per cent and the total spectacle coverage was just 17.65 per cent.[10] While 79.3 per cent of study participants were willing to buy spectacles, if available, the rate of unmet needs was still measurably high.[10]

This study aimed to determine the prevalence of refractive error, the spectacle coverage and the barriers to uptake of refractive services in people aged 15 years and older and the prevalence of presbyopia and spectacle coverage in people aged 35 years and older, in Kahama district.

METHODS

Sampling

The Kahama district located in the Shinyanga region in Tanzania was chosen for this study due to its similarities in terms of socioeconomic status to the general population in Tanzania.[11] The estimated population of Kahama in 2002 was 596,456[13] and the study population consisted of subjects aged 15 years and older. A community-based, cross-sectional study was conducted employing multistage cluster sampling. Fifty-four clusters were selected using a systematic random sampling method with probability proportional to size (PPS).

The prevalence of refractive error in Tanzania was unknown at the time of this study. Using available literature, the prevalence of uncorrected refractive error was estimated to be 2.7 per cent.[7–10] With a precision of 20 per cent, significance level at five per cent, an allowance of 0.05 alpha error and study power of 80 per cent, the sample of approximately 1,900 was calculated to accurately estimate the prevalence of uncorrected refractive error.

When employing the cluster sampling method variation in demographic characteristics will be reduced as certain people from the same geographic area can share certain common characteristics.[11] The decrease in the variation in characteristics was addressed by a correcting factor known as the design effect (DEFF). Taking into account the design effect, the sample of 1,900 was multiplied by 1.5 (the customary design effect for selected cluster sizes of 50 or more respondents); therefore, the result was a sample of 2,850.

Assuming a 10 per cent non-participation rate, the sample was increased, resulting in a sample of 3,135. This was to reduce selection bias due to non-respondents. The final sample size was rounded up to 3,240.

Study procedures and resources

Sixteen fieldworkers and five optometrists were recruited and trained to ensure standardisation of study procedures. The study procedure involved three days of training, which included piloting, enumeration, data collection and clinical examination.

The fieldworkers and optometrists were divided into four groups, which comprised one optometrist, three fieldworkers and one supervisor. Apart from providing clinical examinations, diagnosing ocular conditions of the participants, counselling and giving referral advice, the optometrists were also responsible for providing ready-made glasses to participants where necessary. Fieldworkers were tasked with facilitating, enumerating and interviewing eligible participants. The field supervisors' main responsibilities included guiding the team and providing geographical information on the villages.

Inter-observer variability was tested for visual acuity, diagnosis and management of participants. Fifteen study participants were chosen,[12] tested and examined by separate study teams to elicit a kappa value (level of agreement) and the kappa values were 0.8 (95% CI: 0.77 to 0.98), which were above the acceptable limits (0.6).

A pilot study was conducted on the third day of training. Teams went into a community, which did not form part of the larger study, to enumerate and examine participants. The pilot study assisted the team in identifying the operational challenges in the study. Recommendations and improvements were noted and incorporated into the roll-out of the larger study.

Eligible subjects in each household within the identified cluster included all persons aged 15 years and older. Only persons who had been residing in the household for the last six months or more were enumerated. In cases where the inhabitants of the house were unavailable, the household was removed from the study after two return visits. This process continued until enumerators visited all the houses in that area or until 60 people had been enumerated.

A random starting point in each cluster was identified by first identifying the centre of the cluster by the enumeration team. In consultation with the local leaders, the number of lanes emanating from the central point was identified and the number was recorded on little slips of paper. A local community member randomly picked one of the slips to identify the direction in which the enumeration team can proceed.

In each cluster, the random walk method was employed to enumerate the households and examine the first 60 people (this number is usually determined based on the sample size and availability of population in the cluster) aged 15 years and older after identifying the random starting point in the cluster.

Clinical examination

Clinical examinations were conducted by optometrists following a standardised protocol. Distance visual acuity and unaided vision were measured monocularly using a modified Snellen chart (6/60 line and 6/12 line) with Tumbling 'E' optotype at six metres. Respondents unable to see the 6/60 letter were then tested at 3.0 m and then 1.0 m. Participants were then tested with multiple pinholes, if visual acuity was less than 6/12.

Presenting and uncorrected (without spectacles if presenting with spectacles) near vision were measured binocularly in all subjects 35 years and older using a logMAR chart with Tumbling 'E' optotype at 40 cm and recorded as the smallest line with at least four of the five optotypes read correctly.

Those with near visual acuity worse than 6/12 were tested with additional lenses appropriate for their age to obtain binocular visual acuity and their acuity was recorded. The anterior segment and fundus were evaluated with direct ophthalmoscopy. A principal cause of visual impairment was assigned for all eyes with uncorrected vision of 6/12 or worse and the principal cause of blindness was determined for all eyes with uncorrected vision of 3/60 or worse. Subjects with visual impairment were referred to the nearest eye-care facilities for further management.

Those who had uncorrected refractive error and/or uncorrected presbyopia were asked the reasons they did not seek management. This was done using a questionnaire with close-ended questions, whereby the participants could choose a maximum of three reasons.

Definitions used in the study

People with presenting distance vision worse than 6/12 but which could be improved to 6/12 or better with a pinhole in the better eye, were classified as having uncorrected refractive error. People who were 35 years and older, with presenting distance vision better than 6/12 and presenting near vision worse than 6/12 at 40 cm were classified as having uncorrected presbyopia. Visual impairment was defined as presenting vision worse than 6/12 but better than or equal to 6/60 in the better eye, while severe visual impairment was defined as presenting vision worse than 6/60 but better than or equal to 3/60 in the better eye. Blindness was defined as presenting vision worse than 3/60 in the better eye. Spectacle coverage was calculated using the following formula:

$$\text{Spectacle coverage} = ([\text{met need}]/[(\text{met need}) + (\text{unmet need})]) \times 100\%,$$

whereby 'met need' was defined as the number of subjects with spectacles having binocular unaided vision of 6/12 but improved to or were better than 6/12. 'Unmet need' was defined as the number of subjects, without spectacles, whose near vision was 6/12 of worse but improved to 6/12 or better with correction.

Ethics approval

Ethics approval was obtained from the Medical Research Coordinating Committee for National Institute Medical Research (NIMR), Tanzania. Written informed consent was obtained from the participants. The research protocol adhered to the tenets of the Declaration of Helsinki governing research involving human subjects.

Data analysis

Data were entered into a database, cleaned and analysed using STATA 10 (StataCorp LP, College Station, Texas, USA). The significance level was fixed at five per cent. Chi-square and Fisher's exact tests were used to determine the statistical significance of the differences in proportions. Multivariate analyses on presbyopia and spectacle coverage (odds ratio with 95% CI) for categories with a p-value less than 0.25 were conducted. Age group, gender and education were used as explanatory variables for the initial model and were followed by stepwise regression.

RESULTS

Of the 3,240 eligible subjects, 3,230 people (99.7 per cent response rate) participated in the study and this high participation was achieved by using four teams who remained in the selected communities throughout the data collection period. There were 1,849 males (57.2 per cent). The age of the participants was not normally distributed (Shapiro–Wilk test, $p < 0.01$) and the median age was 35 years (inter-quartile range, IQR: 24 to 49 years). The median age for males was 36 years (IQR: 25 to 50 years) and the median age for females was 33 years (IQR: 22 to 47 years).

Most of the subjects had completed primary school and were engaged in farming or agricultural activities as a source of income. The demographic profiles of the participants are shown in Table 1.

	Number (%)
Age group (years)	
15–19	502 (15.5)
20–24	355 (11.0)
25–29	355 (11.0)
30–34	355 (11.0)
35–39	316 (9.8)
>40	1,347 (41.7)
Gender	
Male	1,849 (57.2)
Female	1,381 (42.8)
Spectacle wear	
Yes	55 (1.7)
No	3,175 (98.3)
Education	
No formal schooling	630 (19.5)
Primary school incomplete	630 (19.5)
Primary school complete	1,437 (44.5)
Secondary school incomplete	265 (8.2)
Secondary school/higher complete	252 (7.8)
Don't know	16 (0.5)
Occupation	
Professional	41 (1.3)
Teacher	139 (4.3)
Shopkeeper	42 (1.3)
Clerical job	21 (0.7)
Labourer-construction work	20 (0.6)
Labourer-farm/agriculture	2,286 (70.8)
Home duties	62 (1.9)
Armed-service	16 (0.5)
Student/trainee	281 (8.7)
Do not work	184 (5.7)
Others	138 (4.2)

Table 1. Basic demographic characteristics of the respondents

Table 2 lists the reasons given for why participants discontinued their spectacle wear. Out of the 3,175 respondents who were not presently wearing spectacles, 60 had discontinued their spectacle wear. Of these, 26 (43.3 per cent) reported that they had scratched the lenses or broken the glasses.

The crude prevalence of visual impairment was 6.9 per cent (n = 223), while the prevalence of severe visual impairment was 2.2 per cent (n = 71) with 1.3 per cent (n = 42) blind. After adjusting for age and gender, the prevalence of visual impairment was 10.4 per cent (95% CI: 9.4 to 11.4). Compared to those 15 to 19 years old, participants aged 25 to 39 years were twice as likely to present with visual impairment, while participants aged 40 years and older were 3.2 times more likely to present with visual impairment. Compared to those who worked as professionals, there was a higher prevalence of visual impairment, in increasing order, among construction workers, teachers, students, clerks, the unemployed and farmers, with odds ratios (OR) ranging from 3.68 to 8.57.

Those who had completed their primary school education were significantly less likely to present with visual impairment (OR 0.54, 95% CI: 0.40 to 0.72) as compared to those who had no formal schooling (Table 3). In terms of age, subjects within age groups 25 to 29 years (OR 1.77, 95% CI 1.05 to 2.97), 30 to 34 years (OR 1.73, 95% CI: 1.02 to 2.93) and 40 years and above (OR 3.17, 95% CI 2.14 to 4.70) were more likely to have visual impairment as compared to those 15 to 19 years old (Table 3). Occupation was significantly related to the prevalence of visual impairment ($p < 0.01$). Compared to professionals, those who engaged in farming activities were 8.57 times (95% CI: 2.27 to 32.43) more likely to have visual impairment, followed by the unemployed (OR 5.71, 95% CI: 1.65 to 19.78) and clerks (OR 5.7, 95% CI: 1.05 to 30.8).

The prevalence of uncorrected refractive error was 7.5 per cent (n = 242) (95% CI: 6.65 to 8.54) with the highest prevalence in participants above the age of 40 years (OR 1.60, 95% CI: 1.14 to 2.25). Applying this figure to the population shows that there are 44,734 people (95% CI 39,664 to 50,937) with uncorrected refractive error in the Kahama district. Significantly higher prevalence of uncorrected refractive error was observed in students (OR 3.64, 95% CI: 1.35 to 9.86), the unemployed (OR 2.88, 95% CI: 1.31 to 6.36) and farmers (OR 2.38, 95% CI: 1.26 to 4.48) as compared to professionals. A breakdown of the participants' demography, visual impairment and uncorrected refractive errors is provided in Table 3.

The prevalence of uncorrected presbyopia among people 35 years and above (n = 1,663) in Kahama district was 46.5 per cent (95% CI: 44.34 to 48.75). Participants with incomplete secondary education and participants with secondary education and higher were significantly more likely to have presbyopia ($p < 0.001$ and $p = 0.024$, respectively) compared to those who did not have any formal schooling. As expected, an

	Visual impairment OR† (95% CI‡)	Refractive error OR† (95% CI‡)
Gender		
Male	1	1
Female	1.16 (0.90–1.48)	0.96 (0.73–1.25)
Education		
No formal schooling	1	1
Primary school incomplete	0.77 (0.55–1.07)	—
Primary school complete	0.54 (0.40–0.72)*	—
Secondary school incomplete	0.62 (0.35–1.10)	—
Secondary school/higher complete	0.58 (0.33–1.02)	1.52 (0.90–2.54)
Age (years)		
15–19	1	1
20–29	1.77 (1.05–2.97)*	1.46 (0.91–2.36)
30–34	1.73 (1.02–2.93)*	—
35–39	1.53 (0.87–2.69)	1.36 (0.82–2.25)
≥ 40	3.17 (2.14–4.70)*	1.60 (1.14–2.25)*
Occupation		
Professional	1	1
Teacher	4.05 (1.13–14.53)*	2.06 (0.86–4.92)
Clerical job	5.70 (1.05–30.8)*	—
Construction	3.68 (1.14–11.91)*	—
Farm/agriculture	8.57 (2.27–32.43)*	2.38 (1.26–4.48)*
Student/trainee	4.35 (1.17–16.22)*	3.64 (1.35–9.86)*
Do not work	5.71 (1.65–19.78)*	2.88 (1.31–6.36)*
Others	2.60 (0.68–9.91)	2.15 (0.89–5.21)

† OR: odds ratio
‡ CI: confidence Interval
* $p < 0.05$

Table 2. Prevalence of vision impairment and refractive error and demographic profile

increasing trend was observed in the prevalence of presbyopia from the ages of 35 to 74 years, where the ORs increased from 4.94 to 19.84 ($p < 0.001$). The OR then showed a decreasing trend, from 13.53 in age group 75 to 79 years to 4.32 in participants 80 years and older. A breakdown of the participants' demography and presbyopia is provided in Table 4.

Overall, there were 55 individuals in the sample who wore spectacles; however, only four individuals were corrected to a visual acuity of 6/12 or better. Hence, spectacle coverage for refractive error in Kahama district was 1.69 per cent (95% CI: 0 to 3.29). The numbers of participants with spectacle wear for refractive error and presbyopia was too low to generate meaningful comparisons between other demographic profiles.

One of the objectives of the study was to identify why people with refractive error or presbyopia, despite the availability of services, did not wear spectacles. Figure 1 depicts the different barriers to uptake of refractive services identified during the research. Only 227 out of the 237 examined subjects with uncorrected refractive error or presbyopia responded to this question. The highest number of subjects 72 (31 per cent) responded that they were aware of a problem but did not feel the need for consultation. This was followed by 34 subjects (15 per cent), who expressed that they were too occupied with other health-related issues. There were 32 people (14 per cent), who were unaware of the problem. Twenty-two subjects (10 per cent) could not afford the cost of spectacles.

DISCUSSION

Overall, the study found that there was moderate prevalence of people with visual impairment, uncorrected refractive error and uncorrected presbyopia in Kahama district. Despite the high prevalence of refractive error and presbyopia, the spectacle coverage was low in both instances. The combination of high prevalence and low coverage presents a challenge, as this reduces work productivity and economic opportunities, thus reducing the person's quality of life in this community of Kahama, the main income of which is from farming activities (Table 1).

In seeking to determine the barriers to uptake of refractive services, one of the most important findings was that there seemed to be a low replacement rate among those who had been prescribed spectacles. To prompt timely replacement, spectacle wear must be perceived as a pertinent activity that has a positive influence on the quality of life, work productivity and other aspects of life. Hence, there is a continuous need for the community to be educated on the benefits of spectacle wear and to increase their eye-care awareness.

The most common reason (78.3 per cent) for discontinuing spectacle wear was the participants' spectacles being scratched, broken or lost. Uncoated plastic was the most commonly used form of lenses. Despite its inherent advantages of being shatter-resistant, lightweight and good optical quality,[9,10] these lenses are not scratch-resistant.[14,15] For instance, some occupations such as farming and construction work, involve activities which, in all likelihood, will increase the possibility of spectacle damage and scratched lenses. Once damaged or scratched, the optical quality of the lenses will change and vision will be affected. To provide effective refractive services, provision of affordable and good-quality spectacles is imperative;[16–17] however, we do not suggest glass lenses for a community which might have a high risk of occupational hazards from their working activities.

Our findings found that those engaging in farming or agricultural activities are almost 8.5 times more likely to have visual impairment. Engaging in agricultural activities means that farmers are exposed to ultraviolet radiation as a result of spending many hours in the sun. This could increase their odds of developing some form of lens opacity and visual impairment. Several studies.[18–22] have shown that increasing

	Odds ratio (95% CI†)	p-value
Education		
No formal schooling	1	
Primary school incomplete	1.33 (0.96–1.83)	0.083
Primary school complete	1.29 (0.98–1.70)	0.072
Secondary school incomplete	3.58 (1.85–6.93)	<0.01
Secondary school/higher complete	1.71 (1.07–2.72)	0.024
Age (years)		
35–39	1	
55–59	4.92 (3.28–7.39)	<0.01
60–64	8.51 (5.63–12.87)	<0.01
65–69	12.85 (8.36–19.76)	<0.01
70–74	19.84 (11.84–33.23)	<0.01
75–79	13.53 (8.29–22.09)	<0.01
80–84	9.28 (5.38–16.02)	<0.01
85–89	6.80 (3.85–12.04)	<0.01
>89	4.32 (2.56–7.31)	<0.01
Occupation		
Professional	1	
Teacher	0.51 (0.30–0.87)	0.013

† CI: confidence interval

Table 3. Association between presbyopia and demographic profile

ultraviolet exposure can increase the occurrence of lens opacities. Those in the working age group involved in construction and agricultural work may also be exposed to occupational hazards, which could result in ocular injuries. This warrants the need for precautionary measures to be put into place. A suitable health and safety policy could include the provision of protective goggles while working. Farmers are not averse to using protective goggles[23–25] as this significantly reduces the risk of occupational hazards from farming activities.

Those who are unemployed had a significantly higher prevalence of visual impairment (OR 5.71, 95% CI: 1.65 to 19.78). Evidence has shown that unemployment is interconnected with living conditions, lifestyle and health problems.[26–30] Those who are unemployed usually live in conditions associated with low hygiene, which might expose them to communicable diseases that can cause ocular infections and in turn visual impairment.[31] They are also less likely to access health-care due to priority and affordability issues.[28] All these conditions may have a detrimental effect on the health of community members and particularly on their ocular health. The high proportion of students with visual impairment is of concern, as this could directly and negatively impact on their academic performance,[32] their psychological growth[33,34] and their future employment opportunities.[1]

There are limited comparative studies for Tanzania due to methodology differences but studies conducted using similar rapid assessment methods in Eritrea,[11] Mozambique (J Loughman, personal communication) and India[35] reported lower prevalences of uncorrected refractive error, which were 6.4, 2.6 and 4.8 per cent, respectively. Studies conducted in Eritrea and Andhra Pradesh also showed higher spectacle use compared to our study.[11,35]

Chan and colleagues[11] reported a lower prevalence of uncorrected presbyopia in Eritrea (32.9 per cent) compared to the Kahama District; however, higher prevalences of uncorrected presbyopia were reported in Andhra Pradesh (63.7 per cent),[35] rural Tanzania (61.7 per cent),[36] rural Kenya (85.4 per cent)[37] and Zanzibar (89.2 per cent)[38] The definitions used for the rural Tanzania, rural Kenya and Zanzibar studies were different: presbyopia was defined as an improvement of at least one line on a near visual acuity chart with an addition of a plus lens.[36–38] The sample included in these studies was adults aged 50 years and older.[36–38]

The prevalence of presbyopia was significantly higher in those who have some form of secondary education and those who have not completed their secondary school education. Similar findings were reported by Patel and West[39] in rural Tanzania. This study found that the overall spectacle coverage for both refractive error and presbyopia was low. Although the participants were from economically productive age groups with high visual demands, which would suggest that they noticed blurred vision early, prompting them to seek visual correction, this was not the case in Kahama district. The barriers to the use of spectacles include their not being a priority, lack of money[38] and awareness of the ocular condition but felt no need for consultation.[11]

The strength of this study lies in the adequate sample size, a representative sample of the district and a high response rate, thus making our estimates reliable and accurate. The limitation of this study is that by using a cut-off of 6/12 for detecting visual impairment due to refractive error, people with low refractive error and hyperopia and people with nuclear cataract with a presenting vision of 6/18 in the better eye improved to 6/12 may have been missed. This may have caused a slight underestimation in the prevalence of uncorrected refractive error in the region.

Another limitation of the study is that if a presbyopic individual has low uncorrected myopia, he or she will have normal distance vision (presenting vision of 6/12 or better) but will present with no near visual impairment. This could have underestimated the prevalence of presbyopia; however, for those who have their own habitual distance prescriptions, near vision was measured wearing their distance prescription.

Uncorrected refractive error is a significant public health challenge in the Kahama district, as a large number of people, although aware of their visual problems, do not seek an eye examination. If we translate the prevalence into actual numbers, there were approximately 47,357 to 59,713 people in Kahama with uncorrected refractive error. If we extrapolate this to the population of Tanzania, there were approximately 4.5 to 5.5 million people with uncorrected refractive error. This makes sustainable service delivery and health promotion efforts all the more imperative. Empirical

	Odds ratio (95%CI)	p-value
Education		
No formal schooling	1	
Primary school incomplete	1.33 (0.96–1.83)	0.083
Primary school complete	1.29 (0.98–1.70)	0.072
Secondary school incomplete	3.58 (1.85–6.93)	0.000
Secondary school/higher complete	1.71 (1.07–2.72)	0.024
Age		
35–39	1	
55–59	4.92 (3.28–7.39)	0.000
60–64	8.51 (5.63–12.87)	0.000
65–69	12.85 (8.36–19.76)	0.000
70–74	19.84 (11.84–33.23)	0.000
75–79	13.53 (8.29–22.09)	0.000
80–84	9.28 (5.38–16.02)	0.000
85–89	6.80 (3.85–12.04)	0.000
>89	4.32 (2.56–7.31)	0.000
Occupation		
Professional	1	
Teacher	0.51 (0.30–0.87)	0.013

CI: confidence interval

Table 4. Prevalence of presbyopia and demographic profile

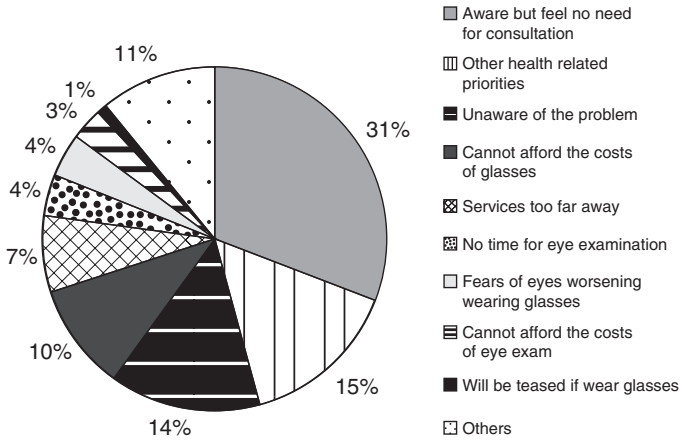

Figure 1. Barriers to uptake of refractive services

findings will also assist the local Ministry of Health officials in their planning of refractive error services, which may include outreach programs and vision centres in the Kahama district.

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