Are presbyopes willing to pay for spectacles? A Cross-sectional study

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Research note

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Abstract

Objective Cross-sectional study design were used to assess willingness to pay for spectacles among south Gondar presbyopic population. Results Of the total 322 people participating in the study, only 53.4% (172) were experienced by spectacles users. The median gross monthly income of participants was US$ 75.0 (ranged US$ 7.1 - 321.4) and the mean amount of money willing to pay for a pair of spectacles was US$ 17.9 (ranged US$ 1.1-107.1). Participants who were willing to pay US$ 12.5 for a pair of spectacles from a government optical accounted for 63.0% (95% CI: 57.8-68.3), while those willing to pay the minimum international pair of spectacle price US$ 5.6 were accounted 73.9% (95% CI: 68.9-79.2) and spectacle from local private optical price US$ 17.8 accounted 46.6% (95% CI: 40.4-52.2). Multivariate logistic regression analysis indicated factors such as age (P=0.049), occupation (0.001), monthly income (0.001) and history of the previous spectacle wear (0.005) to be significantly associated with willingness to pay for a pair of spectacles. Public willingness to pay for a pair of spectacle has to be supported with the accessible provision of spectacles to increase spectacle coverage among presbyopic individuals.

Background

Presbyopia is a physiological, age-related change leads to loss of lens accommodation and an inability to focus at near [1]. It manifests between the ages of 40-45 years [2-4] but still reports confirm occurrence as early as 30 years of age [1,5-7].

An estimated 1.272 billion people are presbyopic in the world, of which 244 million are uncorrected and reach up to 94% of cases in lower-income countries. It affects working age group and contributes an estimated 25.367 billion dollars productivity loss [8,9]. In sub-Saharan Africa, the proportion of visual impairment due to uncorrected refractive error for the presbyopic age group ranged from 12.3% to 57.1% [10]. A population-based study in East Africa reported the prevalence of presbyopia range from 61.7%–85.4% [11,12]. Similarly, the prevalence rate of presbyopia was 62% in rural Tanzania [13] and 68.7% in Ethiopia [14]. Therefore, it is a significant public health challenge [1].

The mainstay of presbyopia correction is a spectacle. It is an effective, economical option for low and middle-income countries. In Rwanda, 95% of cases could manage with spectacle with a cost range from $ 0.46 to 4.0 US dollars hence with the provision of spectacle correction predicted average productivity gains were estimated 10% of GDP [15]. According to Patel et al. a high proportion of people (69%) especially men were able to afford spectacles at a price that covered including the shipping cost [1]. Similarly, the mean cost of spectacle in different states of Zambia ranges from US$ 4.0-20.0 [16].

Few population-based studies have been conducted to estimate the willingness to pay for refractive services and spectacles using different methods such as open-ended questions [17] or binary-with-follow-up [18]. For spectacle, about 82.9% of study participants were willing to pay at least US$ 0.10 in Timor-Leste [19] and 76.6% were willing to pay at least US$ 0.38 in Cambodia [18]. In Zanzibar the mean amount willing to pay for spectacles was US$ 3.14 [20].
Centralized and limited spectacle manufacturing workshop, additional costs such as transport and undetermined willingness to pay for a pair of spectacles challenges the presbyopia intervention program. Therefore, this study assessed willingness to pay for a pair of spectacles among the presbyopic population of the South Gondar administrative zone.

Methods

The cross-sectional study design was implemented. This study was conducted between January to March 2018 in Debre-Tabor, South Gondar zone. Debre-Tabor hospital is a general hospital with an eye care unit. The eye care unit run by an optometrist, cataract surgeon, and ophthalmic nurses. The ophthalmic service mainly involving refraction, cataract surgery, minor surgery, medical therapy, and referral. The ophthalmic unit lacks a workshop to provide spectacle following refraction. Therefore, spectacle provision is dependent on visiting outreach service or required to travel to Gondar where tertiary eye care center with the functional optical workshop exists.

University of Gondar in collaboration with Vision Aid Overseas conducted an outreach service in January 2018. On this service, a total of 3220 subjects were screened and of this 1018 were presbyopic. Presbyopic subjects underwent for complete eye examination and those who were willing to use spectacle were included in the study. Using a single proportion formula by considering 82.9% proportion and 4% marginal error, the calculated sample size was 340 subjects. The sampling procedure was using a simple random sampling technique.

Pre-tests were taken to refine and validate the questionnaire. Using structured questioner optometrists collected demographic and socioeconomic data, history of spectacles uses, source of spectacles and future preferences. Willingness to pay was determined by comparing participants stated willingness to pay against the University of Gondar referral government eye hospital (200 kilometers away from the study area) opticals minimum spectacle price US $12.5. Each study participant underwent vision screening, complete eye examination and refractive assessment by optometrists. Presenting unaided distance and near visions were taken in an illuminated room for each eye separately using the Snellen 6-meter chart for distance and reduced Snellen reading E-chart for near vision. Presenting a distance vision of less than 6/18 in the better eye was considered as visually impaired. Presbyopia was defined as a presenting near vision acuity worse than 6/15 (N8) at 40 centimeters or if the addition of at least +1.00DS was required to improve near vision to at least N 8 on top of distance correction if needed.

Data was entered and analyzed using Statistical Package for Social Science (SPSS version 20, Chicago, IL, USA). Descriptive statistics were summarized with the same package. Significance was set at less than 5%. willingness to pay for spectacles was analyzed using logistic regression to determine associated factors. One-way ANOVA and one-sample t-test were used to compare the mean difference of willingness to pay across sources.

Results
Out of 340 recruited subjects, 322 gave valid, complete responses and included in the analysis. The mean age of study participants was 51 ± 7.8 years (ranged 35 to 73). Of the total 322 subjects, 73.3% (236) were male, 72.4% (233) were urban residents and 46.0% (148) were government employees (table 1).

In addition to presbyopia, 14.6% (47) subjects were visually impaired at distance. Subjects who were aware of the existence of eye care services in the town accounted for 84.8% (273) but only 58.4% (188) had a history of a previous eye examination. Table 1 summarized sociodemographic and economic characteristics of study participants.

In terms of the previous history of using spectacle, only 53.4% (172) of the study, participants were experienced users. Within that group, those who obtained spectacles from street sellers accounted for 38.4% (66), outreach suppliers 25.0% (43), private optical outlets 25.0% (43) and government optical outlets 11.6% (20). Whereas, in the future, if spectacle wear at all recommended, 51.9% (167) subjects would prefer to use government-owned optical outlets, followed by 45.0% (145) from outreach services and 3.1% (10) from private opticals. The motives behind these choices were to seek better quality in 49.1% (158) followed by the cost of 47.2% (152) and fast supply in 3.7% (12).

*Others (Daily laborer, Housewife, Retired)*

The median gross monthly income of participants was US$ 75.0 (range US$ 7.1 - 321.4). Of the total study participants, 63.0% (95% CI, 57.8-68.3) were willing to pay a minimum local government optical spectacle price of US$ 12.5. While 73.9% (95% CI, 68.9-79.2%) participants could afford a minimum international pair of spectacles price US$ 5.6 and only 46.6% (95% CI, 40.4-52.2) could afford a local private spectacle priced of US$ 17.8.

The mean amount of money which study participants were willing to pay for a pair of spectacles was US$17.9 (range US$1.1-107.1). The difference between this mean and the international spectacle price (US$ 5.6) was US$ 12.25 (p=0.003, 95% CI, 10.8-14.0). Similarly, the difference with nearby local government optical outlet (University of Gondar referral eye hospital) spectacle price ($12.5 USD) was US$ 5.4 (p= 0.003, 95% CI, 3.8-7.2)

The ANOVA test showed that the mean amount of money willing to pay for a pair of spectacles among optical sources varies significantly (p =0.0001). The mean difference of willingness to pay for outreach supplies compared to the government optical outlets was US$ 12.5 (p=0.0001, 95% CI, 8.9-16.2) and the mean difference in outreach supply compared with private optical outlets was US$ 18.1 (p=0.0001. 95% CI, 7.6-28.6).

Multivariate logistic regression analysis indicated factors such as gender, religion, place of residence, visual status, history of eye examination and awareness of eye care services availability had no association with the willingness to pay for spectacle. While factors such as age (P=0.049), occupation
(0.001), monthly income (0.001) and history of the previous spectacle wear (0.005) was significantly associated with willingness to pay as summarized in table 2.

Participants within the age group \( \leq 49 \) years were 6.2 times (CI:1.526-11.353) and age group from 50-59 years were 5.9 times (CI: 1.341-25.907) more willing to pay compared to those in the age group of 60 years and above. With respect to occupation, government employees were 7.2 times more willing to pay (CI: 1.748-30.042) than the rest of the cohort (table 2).

Household monthly income was significantly associated with willingness to pay for spectacles. Hence participants who earned between US$ 53.6- 107.0 were 24 times (CI: 8.600-66.272) and those who earned more than US$ 107.1 were 48 times (CI: 8.591-71.758) more willing to pay compared to those who earned less than US$ 53.0 (table 2).

Participants who were experienced spectacle users were 4 times (CI: 1.526-11.353) more willing to pay when compared to neophytes as represented in table 2.

**Discussion**

Although the different method makes comparison difficult, in this study spectacle coverage was twice as high as in a Zanzibar study [20]. Inclusion of more urban resident and literate study participants could increase the coverage. Spectacle wear was higher among literate, male, government employees, urban residents and age group from 50-59 years. Spectacles were mainly obtained from unauthorized street vendors in the study area or elsewhere. Although spectacles from street vendors are easily available, they are of poor quality. In the study area, there was limited access either to the government or privately-owned optical outlets. However, in the future, study participants showed preference to get their spectacles from government-owned optical outlets anticipating quality spectacle with fair costs.

The mean amount of money willing to pay for a pair of spectacles was US$ 19.0 (ranged from US$ 1.1 to111.0). It was nearly 3 times higher than the standard international cost of spectacles (US $ 5.7 equivalent with US$ 3.0 in 2006) and 1.5 times higher than the nearby local government optical outlet's price. However, there was no neither government or nor privately-owned optical outlets available in the study area. Hence it costs an extra $ 10.0 USD for transport to get access to optical shops 200 kilometers away from the study area with a week-long waiting period. This constraint could be a major reason why communities have to depend on outreach spectacle supply and street vendors.

More than two-thirds of the study participants were willing to pay a quarter of their monthly income for a pair of spectacles. The proportion of willingness to pay was above that finding in a study done in Timor-Leste (31.6%) [19]. Similarly, the mean paying capacity was above to that of finding in other studies [18-20]. This could be explained by participants different socio-economic status, literacy, and variety implementation methods. However, the cost of a pair of spectacles at a government owned optical outlet was higher than the price quoted in the studies of Heidi RL et al [20] and Jacqueline et al [19]. This might
be because of limited available options, extended custom procedures for importation and the lack of optical production sites.

Being in the age group of fewer than 60 years of age and being a government employee were independently associated with a willingness to pay for a pair of spectacles. This correlates well with studies conducted in Cambodia [18] and Timor-Leste [19]. Higher salaries, higher near visual demand and an independent income source are likely to increase the willingness to pay. A monthly income greater than $53.5 USD is independently associated with a willingness to pay for a pair of spectacles. This finding is supported by previous studies [18,19]. Experienced spectacle users were independently associated with a willingness to pay for a pair of spectacles which might be because of a better understanding of the benefits of using spectacles for close tasks. However, this was contradicted by the Cambodia [18] and Timor-Leste [19] studies.

The opportunity afforded by participants' willingness to pay for a pair of spectacles should be utilized to establish sustainable optical service in order to increase presbyopic spectacle coverage. Providing refraction service and spectacle prescriptions alone cannot reverse poor spectacle coverage and assure quality unless optical workshop services are compulsorily linked with refractive services.

**Limitations**

Although attempts were made to limit responder bias during the interviews, questions may not guarantee validated responses to assess the willingness and the exact amount to pay. Being conducted on an outreach site might inflated spectacle coverage and is likely to increase the proportion of willingness to pay.

**Declarations**

**Ethics approval and consent of participate**

Ethical clearance was obtained from the School of Medicine, University of Gondar College of Medicine and Health Sciences, ethical review committee. Support letter from department of optometry were obtained. The purpose of the study was explained to each participant and written informed consent was obtained from each study participant before starting interview. Confidentiality was kept by coding personal identity and locking data with a password. Spectacle were dispensed to the participants after the interview.

**Consent for publication**

Not applicable

**Availability of data and material**
The data used to support the findings of this study are available from the corresponding author upon request.

**Competing interests**

The authors declare that they have no competing interests.

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The authors received no funding.

**Authors’ contributions**

HWA wrote the proposal, analyzed the data, and drafted the manuscript. ASC participated in data analysis and revised subsequent drafts of the paper. Both authors read and approved the final manuscript.

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Tables

Table 1: Sociodemographic and economic characteristics of study participants
| Variables               | Frequency (N=322) | Percent (%) |
|------------------------|-------------------|-------------|
| Gender: Male           | 236               | 73.3        |
| Gender: Female         | 86                | 26.7        |
| Age category           |                   |             |
| (years): 50-59         |                   |             |
| Age category ≤49       | 138               | 42.9        |
|                       | 130               | 40.4        |
|                       | 54                | 16.8        |
| Age category ≥60       |                   |             |
| Residential area: Urban| 233               | 72.4        |
|                       | 89                | 27.6        |
| Rural                 |                   |             |
| Religion: Christian    | 294               | 91.3        |
|                       | 28                | 8.7         |
| Muslim                |                   |             |
| Educational status:    |                   |             |
| Literate              | 293               | 91.0        |
|                       | 29                | 9.0         |
| Illiterate            |                   |             |
| Occupation: Gove employ| 148               | 46.0        |
|                       | 59                | 18.9        |
|                       | 62                | 18.6        |
|                       | 53                | 16.5        |
| Occupation: Private business | 127           | 39.4        |
|                       | 83                | 25.8        |
| Household monthly Income (US$): | 112 | 34.8 |
| ≤53.6                 |                   |             |
| 53.61-107.1           |                   |             |
Table 2: Associated factors with willingness to pay the minimum local government spectacle price.

| Factor                                    | Yes     | No     |
|-------------------------------------------|---------|--------|
| Presence of visual impairment: Yes        | 47      | 275    |
|                                           | 14.6    | 85.4   |
| Previous eye examination: Yes             | 188     | 134    |
|                                           | 58.4    | 41.6   |
| Eye care service awareness: Yes           | 273     | 49     |
|                                           | 84.8    | 15.2   |
| Previous spectacle wears: Yes              | 172     | 150    |
|                                           | 53.4    | 46.6   |
|                                           |         |        |
| Variable     | Willingness to pay US$ 12.5 |         |         |
|--------------|----------------------------|---------|---------|
|              | Willing                    | Unwilling | COR     | AOR     |
| **Gender:**  |                            |          |         |         |
| Male         | 152 (64.4%)                | 84 (35.6%) | 1.242(0.749-2.060) | 2.194(0.787-6.116) |
| Female       | 51 (59.3%)                 | 35 (40.7%) | 1       | 1       |
| **Age(years):** |                  |          |         |         |
| ≤49          | 89 (64.5%)                 | 49 (35.5%) | 2.448(1.288-4.653) | 6.287(1.231-32.110) * |
| 50-59        | 91 (70.0%)                 | 39 (30.0%) | 3.145 (1.630-6.067) | 5.894 (1.341-25.907) * |
| ≥60          | 23 (42.6%)                 | 31 (57.4%) | 1       | 1       |
| **Residency:** |                         |          |         |         |
| Urban        | 184 (79.0%)                | 49 (21.0%) | 0.072(0.040-0.131) | 4.337(0.912-20.627) |
| Rural        | 19 (21.3%)                 | 70 (78.7%) | 1.312 | 1       |
| **Religion:** |                         |          |         |         |
| Christian    | 196 (66.7%)                | 98 (33.3%) | 6.00 (2.466-14.598) | 2.862 (0.528-15.503) |
| Muslim       | 7 (25.0%)                  | 21 (75.0%) | 1       | 1       |
| **Occupation:** |                        |          |         |         |
| Gov employ   | 140 (94.6%)                | 8 (5.4%)  | 53.846 (20.861-138.985) | 7.247 (1.748-30.042) * |
| Private B    | 41 (67.2%)                 | 18 (32.8%) | 6.308 (2.770-14.364) | 1.880 (0.476-7.418) |
| Farmer       | 9 (15.0%)                  | 53 (85.0%) | 0.543 (0.211-1.397) | 0.605 (0.081-4.508) |
| Others       | 13 (24.5%)                 | 40 (75.5%) | 1       | 1       |
| **HM income:** |                      |          |         |         |
| ≤1500        | 18 (16.1%)                 | 94 (83.9%) | 1       | 1       |
| 1501-3000    | 104 (81.9%)                | 23 (18.1%) | 23.614(12.000-46.467) | 23.873 (8.600-66.272) * |
| ≥3001        | 81 (97.6%)                 | 2 (2.4%)  | 211.500(47.629-939.181) | 48.319 (8.591-71.758) * |
| **Presence of:** |                     |          |         |         |
| VI           | 17 (36.2%)                 | 30 (63.8%) | 0.271 (0.142-0.932) | 0.932 (0.270-3.218) |
| No           | 186 (67.6%)                | 89 (32.4%) | 0.518 | 1       | 1       |
|                | Yes           | No            | AECS availability | PSW            |
|----------------|---------------|---------------|-------------------|----------------|
| **Yes**        | 134 (71.3%)   | 54 (28.7%)    | 2.338 (1.471-3.715) | 1.256 (0.425-3.710) |
| **No**         | 69 (51.5%)    | 65 (48.5%)    | 1                 | 1              |
| **AECS availability** | Yes 187 (68.5%) | 86 (31.5%) | 4.485 (2.343-8.585) | 1.780 (0.444-7.141) |
| **No**         | 16 (32.7%)    | 33 (67.3%)    | 1                 | 1              |
| **PSW**        | Yes 143 (83.1%) | 29 (16.9%) | 7.397 (4.416-12.389) | 4.162 (1.526-11.353) * |
| **No**         | 60 (40.0%)    | 90 (60.0%)    | 1                 | 1              |

Others (housewife, retired, daily laborer), PSW= Previous Spectacle Wear, AECS availability= Aware of eye care service availability, HEE=History of Eye ExaminationVI= Visual Impairment at distance, HMI= Household Monthly Income, Gov= Government, B=Business, US$=United States Dollar, * p-value < 0.05