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WORLD VIEW

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**Aim:** To investigate the aspects of spectacle correction of vision-impairing refractive error and presbyopia in those aged ⩾40 years in Timor-Leste.

**Method:** A population-based cross-sectional survey with cluster random sampling was used to select 50 clusters of 30 people. Those who had uncorrected or undercorrected refractive error (presenting acuity worse than 6/18, but at least 6/18 with pinhole), uncorrected or undercorrected presbyopia (near vision worse than N8), and/or who were using or had used spectacles were identified. Dispensing history, willingness to wear and willingness to pay for spectacles were elicited.

**Results:** Of 1470 people enumerated, 1414 were examined (96.2%). The ''met refractive error need'' in the sample was 2.2%, and the ''unmet refractive error need'' was 11.7%. The ''refractive error correction coverage'' was 15.7%. The ''met presbyopic need'' was 11.5%, and the ''unmet presbyopic need'' was 32.3%. The ''presbyopia correction coverage'' was 26.2%. Lower correction coverage was associated with rural domicile, illiteracy and farming. Of the sample, 96.0% were willing to wear spectacles correcting impaired vision. Of these, 17.0% were willing to pay US$3 (£1.52, €2.24) for spectacles, whereas 50.2% were unwilling to pay US$1 (£0.51, €0.75). Women and rural dwellers were less likely to be willing to pay at least US$1 for spectacles.

**Conclusion:** Refractive error and presbyopia correction coverage rates are low in Timor-Leste. There is a large need for spectacles, especially for elderly and illiterate people, farmers and rural dwellers: those least able to pay for them. An equitable cross-subsidisation spectacle system should be possible.

Uncorrected refractive error is a leading cause of vision impairment in many countries, regardless of prosperity.[1] Its age at onset means that its burden, defined as person-years afflicted, may be greater than that of cataract.[2] Visual impairment from any cause, including uncorrected refractive error, may be associated with morbidity and mortality.[3–7] Given its personal and societal burden, and its relatively simple and cost-effective remedy, refractive error has been included as a priority in the World Health Organization *Global initiative for the elimination of avoidable blindness: VISION 2020*.[8] Presbyopia has not been included in this World Health Organization initiative. However, given the high prevalence among those aged ⩾40 years, and its impact on quality of life, a case can be made for doing so.[9–11] The importance of spectacle provision to correct refractive error has been highlighted.[12–14]

Timor-Leste is a small Southeast Asian country of 925 000 people.[15] From a history of colonisation, it has recently emerged as an independent democracy. This was at considerable cost to the nation, including the collapse of civil instrumentalities. Health administration and services were no exception, and Timor-Leste's social and health indicators are currently among the poorest in the world.[16] Improvement is a priority for the new government and its Ministry of Health. This will be achieved, partly, through the rehabilitation of medical and health services, including those for eye care.

Today, permanent refraction services are available within government facilities—the referral hospital in Dili, the capital, and four rural eye clinics. Since 2003, these have been dispensing ready-made spectacles as part of a National Spectacle Program. This was strengthened in 2005 by the establishment of an optical workshop in Dili, which supplies ready-made and custom-made spectacles to government eye clinics. There are also private optical shops and a church-run refraction service in Dili. Visiting expatriate teams provide brief intermittent refraction services and mostly ready-made spectacles. Various government and private community health centres offer spectacles. These are generally donated ''recycled'' spectacles, either selected by potential users on a trial and error basis, or handed out by health workers with no training.

The Timor-Leste Ministry of Health is developing a National Eye Health Strategy and a corresponding 5-year Vision 2020 National Eye Care Plan, which includes refraction services and spectacle provision. However, no information was available on which to base this planning. A comprehensive and detailed national blindness survey to ascertain this and other data is beyond available resources. Therefore, a limited population-based cross-sectional rapid assessment survey of those aged ⩾40 years was substituted.

From this 2005 survey, this paper reports the results related to the spectacle correction of visually impairing refractive error and presbyopia in Timor-Leste.

## METHODS

This survey was based on the Rapid Assessment of Cataract Surgical Services protocol.[17 18] The detailed methods have been described elsewhere.[19]

Of Timor-Leste's 13 districts, 1 rural and 1 urban were chosen as the sample frame. With the exception of the need to examine the rural–urban dichotomy, no bias was exerted in this. By chance, the selected rural district was relatively close to the urban. A systematic random sampling strategy then identified 50 clusters, 25 being across all 6 subdistricts of both districts, with probability proportionate to the estimated subdistrict population size.

Cluster sampling was undertaken using a spin-the-bottle then random-walk process to identify households. All adults aged ⩾40 years within each household were enumerated by trained Timorese fieldworkers until the required 30 participants for that cluster were enrolled. These people were invited to

**Abbreviations:** PCC, presbyopic correction coverage; RECC, refractive error correction coverage

participate in an interview investigating the use of eye-care services and vision-related quality of life, and to also have an eye and vision examination. Informed consent was obtained before all data collection and examinations. Communications occurred in Tetum, the local language, or another language, depending on the participant's preference.

Participants were asked whether they were currently using, or had ever used, spectacles to improve their vision. The reasons for no longer wearing spectacles were ascertained from previous users. All users, current and previous, were questioned about their spectacles, including where and by whom they were dispensed, and at what price. Willingness to wear spectacles to improve vision and willingness to pay for them, using the current US$1 (£0.51, €0.75) and US$3 (£1.52, €2.24) price points of spectacles within the National Spectacle Program, were also assessed.

The vision examination used a modified near acuity chart, simplified 3 m chart with tumbling E optotypes equal to standard Snellen sizes 18, 60 and 120, and pinhole. No refraction was undertaken. The anterior segment was assessed using loupe magnification and a torch. The status of the visually important central lens was determined and the posterior segment examined in a dimly lit room, using a direct ophthalmoscope through an undilated pupil.

### Study definitions

Uncorrected refractive error was considered present when, in the absence of any significant findings on internal and external eye examination, an eye presented with visual acuity worse than 6/18 and then improved to at least 6/18 with pinhole. In the event of more than one probable cause of impairment, the attributed cause was the condition most easily treated if each of the contributing conditions were considered to be individually treatable to a vision of 6/18 or better.

Table 1 contains the definitions of blindness, low vision, vision impairment, presbyopia requiring correction, unmet and met refractive error and presbyopia need, and refractive error and presbyopic correction coverage (PCC). These are similar to those in recent publications.[12 13]

### Data analysis and reporting

Point prevalence estimates and 95% CIs were calculated. Strength of association (Fisher's exact test) was described using odds ratios (ORs) with their 95% CIs, and a p value $\leqslant 0.05$ was considered significant.

The 2004 national census became available after the survey.[15] This permitted sample data adjustment for age, gender and domicile. Adjusted estimates were used to extrapolate to the entire country.

SPSS V.12 was used for data analysis.

## RESULTS

Of the 1470 people enumerated, 1414 were examined (96.2%). In all, 26 participants were not available during the survey and 30 refused participation. Data from these 56 were not considered in the analysis. Table 2 includes the demographic details of participants.

### Current and previous use of spectacles

Of all participants, 15.1% (214/1414) were currently using spectacles: 0.6% (9/1414) for distance only, 12.2% (173/1414) for presbyopia only and 2.3% (32/1414) for both distance and near.

An additional 8.2% (116/1414) had previously worn spectacles, but were no longer doing so at the time of the survey. The main reasons provided for cessation of use were not seeing well with the spectacles (43.1%) or breakage (24.1%; fig 1).

### Refractive error coverage

Three people wearing distance spectacles did not see 6/18 with pinhole and were excluded from this analysis. In all, 31 participants presented with spectacle-corrected vision of at least 6/18. The ''met refractive error need'' was thus 2.2% (31/1414; table 2).

There were 166 participants with vision impairment as a result of undercorrected (n = 7) or uncorrected (n = 159) refractive error. The ''unmet refractive error need'' was thus 11.7% (166/1414; table 2).

The refractive error correction coverage (RECC) for the sample was 15.7%. The RECC was significantly higher for urban (38.7%) than for rural dwellers (5.2%), for literate (50.9%) than for illiterate (2.8%), and for those in paid employment (27.8%) and unemployed (25.0%) than for subsistence farmers (2.4%). RECC was not significantly different for gender, age or marital status (table 2).

The probability of having uncorrected refractive error was associated with increasing age (reference category 40–49 years; OR 2.93, 95% CI 1.76 to 4.86 for persons aged 50–59 years; OR 4.9, 95% CI 2.96 to 8.10 for persons aged 60–69 years; and OR 7.43, 95% CI 4.53 to 12.2 for persons aged $\geqslant$70 years), illiteracy (OR 2.9; 95% CI 1.8 to 4.48), not being married (OR 1.9; 95% CI 1.36 to 2.66), farming compared with paid employment (OR 2.85; 95% CI 1.55 to 5.25) and rural domicile (OR 3.47; 95% CI 2.37 to 5.06). There was no significant association with gender or with unemployment compared with employment.

### Presbyopia coverage

Eleven people wearing near spectacles did not see 6/18 with pinhole and were excluded from this analysis. In all, 162 participants presented with spectacle corrected near vision of at least N8. The ''met presbyopic need'' was thus 11.5% (162/1414; table 2).

In all, 457 participants could not see N8 at near vision because of undercorrected (n = 32) or uncorrected (n = 425) presbyopia. The ''unmet presbyopic need'' was thus 32.3% (457/1414; table 2).

The PCC for the sample was 26.2%. The PCC was significantly higher for men (31.2%) than for women (21.0%), for married (28.8%) than for not married (18.5%), for urban (33.4%) than for rural dwellers (17.4%), for literate (53.3%) than for illiterate (8.3%), and for those in paid employment (53.6%) than for unemployed (26.4%) and subsistence farmers (9.9%). PCC was not significantly different between age groups (table 2).

The probability of having uncorrected presbyopia was associated with illiteracy (OR 1.70; 95% CI 1.33 to 2.18), and with farming compared with paid employment (OR 1.58; 95% CI 1.10 to 2.28) and rural domicile (OR 3.47; 95% CI 2.37 to 5.06). There was no significant association with gender, age, domicile and marital status, or with unemployment compared with employment.

### Willingness to wear spectacles

Only 4.0% (56/1414) of the sample indicated that they would be unwilling to use spectacles for the improvement of vision in the future. The main reasons provided were cosmesis (41.1%; 23/56) and embarrassment (37.5%; 21/56), with neither being gender biased. Perceived inability to afford spectacles was a factor for 16.1% (9/56) of the sample (fig 2). Unwillingness to wear spectacles was associated with illiteracy (OR 2.3, 95% CI 1.2 to 4.8), but not with gender or rural living.

### Dispensing history

An accurate dispensing history for 260 of the 330 current or previously used spectacles (78.8%), including cost, was elicited (table 3). The unit price ranged from US$0 to US$60 (£30.44,

**Table 1** Definitions and assumptions associated with blindness, low vision, vision impairment, unmet and met refractive error and presbyopic need, and refractive error and presbyopia coverage rates

| | |
|---|---|
| **Vision** | |
| Blindness | Presenting distance vision worse than 6/60 in the better eye |
| Low vision | Presenting distance vision worse than 6/18, but at least 6/60, in the better eye |
| Vision impairment | Presenting distance vision worse than 6/18 in the better eye (being the combination of low vision and blindness) |
| **Refractive error** | |
| Refractive error requiring correction<br>Individuals with distance vision worse than 6/18 in the better eye, who do improve to at least 6/18 with pinhole, will benefit from refractive error correction | Assumptions<br>● Individuals with uncorrected vision of 6/18 or better in the better eye, do not have vision-impairing refractive error and do not require refractive error correction<br>● Individuals with uncorrected vision of worse than 6/18 in the better eye, with vision that does not improve to at least 6/18 with pinhole, will not benefit from refractive error correction<br>● Individuals with uncorrected vision of worse than 6/18 in the better eye, with vision that does improve to at least 6/18 with pinhole, will require refractive error correction<br>● Individuals with corrected vision of worse than 6/18 in the better eye, improving to at least 6/18 with pinhole, have undercorrected refractive error and will require replacement spectacles<br>● Individuals wearing distance spectacles that provide vision of 6/18 or better in the better eye have a visually significant refractive error and require those spectacles to achieve this vision |
| UREN<br>A measure of the combined uncorrected and undercorrected refractive error in a defined population | UREN = number with refractive error and presenting vision, with correction if used, of worse than 6/18 in the better eye<br>$\text{UREN in the sample (\%)} = 100 \times \frac{\text{number with refractive error and presenting vision, with correction if used, of worse than 6/18 in the better eye}}{\text{number of people in the sample population}}$ |
| MREN<br>A measure of the penetration of correction of refractive error to 6/18 or better in a defined population | MREN = number with vision-impairing refractive error who wear distance spectacles and have presenting corrected vision of 6/18 or better in the better eye<br>$\text{MREN in the sample (\%)} = 100 \times \frac{\text{number with vision impairing refractive error who wear distance spectacles and have presenting corrected vision of 6/18 or better in the better eye}}{\text{number of people in the sample population}}$ |
| RECC<br>A measure of vision-impairing refractive error that is corrected to 6/18 or better | $\text{RECC \%} = 100 \times \frac{\text{MREN}}{\text{MREN+UREN}}$ |
| **Presbyopia** | |
| Presbyopia requiring correction:<br>Individuals aged ⩾40 years with binocular near vision of worse than N8, who have at least 6/18 distance vision with pinhole, will benefit from presbyopic correction | Assumptions:<br>● Individuals <40 years who cannot see N8 unaided binocularly may have a refractive error but not presbyopia<br>● Individuals aged ⩾40 years who do not see N8 binocularly and have distance vision worse than 6/18 in the better eye with pinhole will not benefit from presbyopic correction<br>● Individuals aged ⩾40 years who see N8 unaided binocularly do not require presbyopic correction<br>● Individuals aged ⩾40 years with no near correction and who cannot see N8 binocularly have presbyopia requiring correction<br>● Individuals aged ⩾40 years wearing near correction who cannot see N8 binocularly have presbyopia requiring correction<br>● Individuals aged ⩾40 years and wearing near correction that provide vision of N8 or better binocularly have vision-impairing presbyopia and require spectacles to achieve this vision |
| UPN<br>A measure of the combined uncorrected and undercorrected presbyopia in a defined population | UPN = number aged ⩾40 years and presenting near vision, with correction if used, of worse than N8 binocularly |

**Table 1** Continued

UPN in the sample (%) = 100 × number aged ≥40 years and presenting vision, with correction if used, of worse than N8 binocularly at near / number of people in the sample population

MPN
A measure of the penetration of correction of presbyopiaMPN = number aged ≥40 years with vision impairing presbyopia who wear near spectacles and have presenting corrected vision of N8 or better binocularly to N8 or better binocularly in a defined population

MPN in the sample (%) = 100 × number aged ≥40 years with vision impairing presbyopia who wear near spectacles and have presenting corrected vision of N8 or better binocularly / number of people in the sample population

PCC
A measure of presbyopia requiring correction that is corrected to N8 or better binocularly in those aged ≥40 years

$$PCC\ \% = 100 \times \frac{MPN}{MPN+UPN}$$

MPN, met presbyopic need; MREN, met refractive error need; PCC, presbyopic correction coverage; RECC, refractive error correction coverage; UPN, unmet presbyopic need; UREN, unmet refractive error need.

€44.72), with a median price of US$2 (interquartile range US$0–3.50). Almost half of the spectacles (114; 43.8%) were acquired at no cost, whereas 12.3% (32) were more expensive than US$10 (£5.07, €7.45). Private optical shops provided appliances at the highest median price, and were the only distributors not to have supplied any free spectacles.

### Willingness to pay for spectacles

Of the 96% (1358/1414) of the sample prepared to use spectacles in the future if required for better vision, 30.0% (408/1358) were willing to pay US$3 per pair and 43.3% (588/1358) were unwilling to pay as much as US$1. The age–gender–domicile-adjusted prevalence of willingness to pay US$3 was 17.0% (95% CI 15.0 to 19.0) and unwillingness to pay US$1 was 50.2% (95% CI 47.6 to 52.8; table 4). For both of these, there was no difference between urban-dwelling men and women, but rural-dwelling men, and men overall, were more likely to be willing to pay US$3 compared with their female counterparts. Rural dwelling women, and women overall, were more likely to be unwilling to pay at least US$1. The urban population was more likely to be willing to pay US$3, whereas the rural population was more likely to be unwilling to pay at least US$1 (table 4).

Willingness to pay US$3 was associated with current or previous use of spectacles (OR 6.6, 95% CI 5.0 to 8.6), whereas unwillingness to pay US$1 was associated with no previous use of spectacles (OR 4.4, 95% CI 3.3 to 6.0).

## DISCUSSION

This survey, which only considered people aged ⩾40 years, estimated the age–gender–domicile-adjusted prevalence (standardised to the 2004 census) of low vision in Timor-Leste to be 17.7%, and blindness 7.4%.[20] As in many other countries,[2] uncorrected refractive error is a significant treatable cause of vision impairment in Timor-Leste, with an estimated 27 500 (SD 3500) people aged ⩾40 years having refractive error-induced vision impairment.[20] Even without additionally quantifying uncorrected refractive error in those aged <40 years, this represents a significant burden for individuals and their communities.

Although generally forgotten or underestimated in low-resource countries, particularly for rural residents, uncorrected presbyopia is also burdensome.[9–11] The estimated unmet need for presbyopic correction was 32.3% in the survey sample. Adjusted for age, this equates to approximately 60 000 people in Timor-Leste.

The RECC for the survey sample was only 15.7% and PCC was 26.2%, being significantly lower for rural dwellers, those who are illiterate and whose primary source of income is farming. In addition, lower PCC values were associated with being female and not married. The low values of these service indicators may be a result of reluctance to wear spectacles because of cultural or other factors. However, this was not the case—96% of survey participants indicated that they would be willing to use spectacles for the improvement of vision. Instead, the indicators are likely to be low because appliances are unavailable, inaccessible or unaffordable.

Availability and accessibility will be improved by developing spectacle-dispensing networks throughout Timor-Leste. These will have to be particularly responsive to the needs of current underusers (table 2), especially rural dwellers. Assuming that only separate distance and near corrections were available, approximately 87 500 spectacles would be required to satisfy the current need. If all these were dispensed immediately, the population did not age and spectacles remained functional for 3 years, then perhaps 37 000 spectacles would be required annually to replace these and those currently in use. From the

**Table 2** Prevalence of met need, unmet need and coverage of refractive error in the sample associated with gender, literacy, domicile, age, marital status and employment

| | | Refractive error | | | | Presbyopia | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | n | Met refractive error need | Unmet refractive error need | Refractive error correction coverage | p Value* | Met presbyopic need | Unmet presbyopic need | Presbyopia correction coverage | p Value* |
| Age (years) | | | | | | | | | |
| 40–49 | 602 | 7 (1.2) | 26 (4.3) | 21.2 | 0.599 | 77 (12.8) | 185 (30.7) | 29.4 | 0.100 |
| 50–59 | 343 | 9 (2.6) | 40 (11.7) | 18.4 | | 51 (14.9) | 134 (39.1) | 27.6 | |
| 60–69 | 254 | 8 (3.1) | 46 (18.1) | 14.8 | | 23 (9.1) | 79 (31.1) | 22.5 | |
| ⩾70 | 215 | 7 (3.3) | 54 (25.1) | 11.5 | | 11 (5.1) | 59 (27.4) | 15.7 | |
| Gender | | | | | | | | | |
| Male | 721 | 19 (2.6) | 84 (11.7) | 18.4 | 0.329 | 98 (13.6) | 216 (30.0) | 31.2 | 0.005 |
| Female | 693 | 12 (1.7) | 82 (11.8) | 12.8 | | 64 (9.2) | 241 (34.8) | 21.0 | |
| Marital status | | | | | | | | | |
| Married | 1033 | 20 (1.9) | 101 (9.8) | 16.5 | 0.841 | 133 (12.9) | 329 (31.8) | 28.8 | 0.011 |
| Not married† | 381 | 11 (2.9) | 65 (17.1) | 14.5 | | 29 (7.6) | 128 (33.6) | 18.5 | |
| Literacy | | | | | | | | | |
| Literate | 463 | 27 (5.8) | 26 (5.6) | 50.9 | <0.001 | 131 (28.3) | 115 (24.8) | 53.3 | <0.001 |
| Illiterate | 951 | 4 (0.4) | 140 (14.7) | 2.8 | | 31 (3.3) | 342 (36.0) | 8.3 | |
| Domicile | | | | | | | | | |
| Urban | 671 | 24 (3.6) | 38 (5.7) | 38.7 | <0.001 | 113 (16.8) | 225 (33.5) | 33.4 | <0.001 |
| Rural | 743 | 7 (0.9) | 128 (17.2) | 5.2 | | 49 (6.6) | 232 (31.2) | 17.4 | |
| Employment | | | | | | | | | |
| Unemployed | 724 | 24 (3.3) | 72 (9.9) | 25.0 | 0.001 | 84 (11.6) | 234 (32.3) | 26.4 | <0.001 |
| Farming | 490 | 2 (0.4) | 81 (16.5) | 2.4 | | 19 (3.9) | 172 (35.1) | 9.9 | |
| Paid employee | 200 | 5 (2.5) | 13 (6.5) | 27.8 | | 59 (29.5) | 51 (25.5) | 53.6 | |
| Total | 1414 | 31 (2.2) | 166 (11.7) | 15.7 | | 162 (11.5) | 457 (32.3) | 26.2 | |

Values are n (%).
*Comparing coverage.
†Includes 340 widowers/widows, 23 single and 18 divorced.

beginning of the year to March 2006, the Dili optical workshop facility supplied 2300 spectacles, only 35% of which were dispensed to rural residents.

These calculations of the need for spectacles are based on extrapolations of estimates affected by assumptions (similar to previous studies[11 12]) about who is likely and unlikely to benefit from their use. It is assumed that individuals with 6/18 or worse vision, not improving to at least 6/18 with pinhole, will not require spectacles. This, for example, excludes a person with pinhole improvement in visual acuity from 6/60 to 6/24, even though this improvement may be significant for that individual. It is also assumed that individuals with 6/18 or better vision will not require spectacles. This excludes individuals with lower refractive errors from the calculations. However, those with low hyperopia and/or astigmatism may benefit from the use of spectacles.

Also, although appropriate to a rapid assessment, the vision and ocular examination methods on which these data are based have limitations. Diagnosis may be compromised by not using biomicroscopy or dilated-pupil posterior segment assessment. Relying on pinhole acuity rather than on refraction and best correction, and attributing a single cause to vision reduction as per the Rapid Assessment of Cataract Surgical Services protocol, such that, for example, when uncorrected refractive error and lens opacity coexist, refractive error, with its easier and less expensive treatment, is nominated as the cause, may underestimate the prevalence of ocular disease.

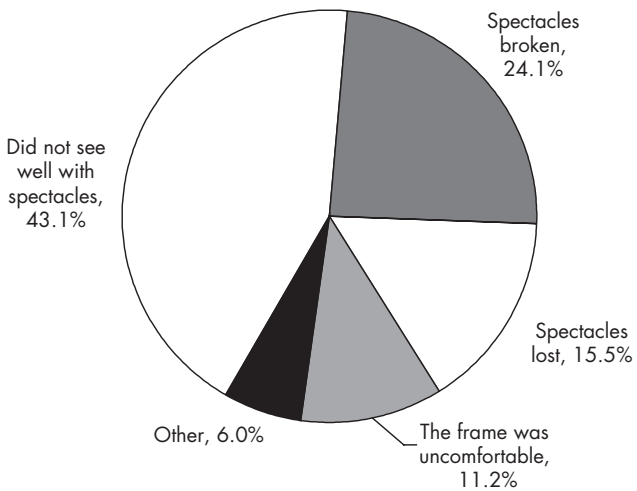


**Figure 1** Reasons for no longer using spectacles, provided by participants who had previously worn spectacles but were no longer doing so (n = 116).

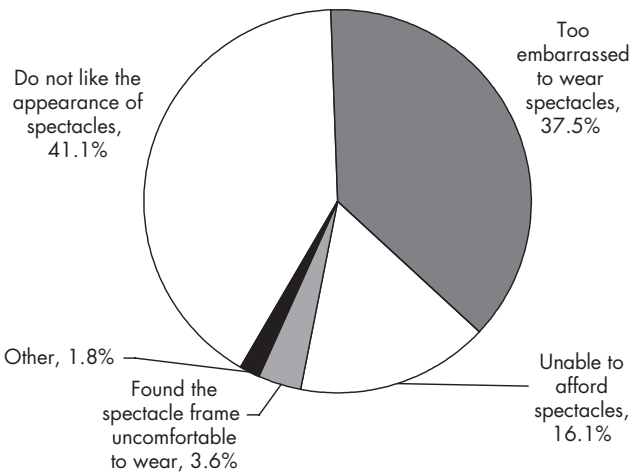


**Figure 2** Reasons provided for unwillingness to use spectacles in the future, despite being required for vision improvement (n = 56).

**Table 3** Source and cost of spectacles

| | Provider | | | | | |
|---|---|---|---|---|---|---|
| | Private optical shop | Hospital eye clinic | Community health clinic | Visiting teams* | Other | Total |
| Spectacles dispensed | 32 (12.3) | 135 (51.9) | 37 (14.2) | 46 (17.7) | 10 (3.8) | 260 (100) |
| Cost (US$) | | | | | | |
| Free | 0 (0.0) | 63 (46.7) | 21 (56.8) | 28 (60.9) | 2 (20.0) | 114 (43.8) |
| >0 to ⩽3 | 10 (31.3) | 45 (33.3) | 4 (10.8) | 16 (34.8) | 3 (30.0) | 78 (30.0) |
| >3 to ⩽10 | 12 (37.5) | 16 (11.9) | 5 (13.5) | 2 (4.3) | 1 (10.0) | 36 (13.8) |
| >10 | 10 (31.3) | 11 (8.1) | 7 (18.9) | 0 (0.0) | 4 (40.0) | 32 (12.3) |
| Median cost (US$) | 7.00 | 1.50 | 0 | 0.00 | 6.12 | 2.00 |
| Cost, IQR (US$) | 2.50–15.00 | 0–3.00 | 0–3.75 | 0.00, 2.00 | 1.50, 52.50 | 0.00, 3.50 |
| Cost, range (US$) | 0.50–50.00 | 0–60.00 | 0–60.00 | 0.00–7.00 | 0.00–60.00 | 0.00–60.00 |

Values are n (%).
*Australian, Indonesian, Portuguese and American teams.

**Table 4** Adjusted prevalence of willingness to pay for spectacles

| | Willing to pay US$3 for spectacles | | | Not willing to pay US$1 for spectacles | | |
|---|---|---|---|---|---|---|
| | Age-adjusted prevalence | | Age–gender-adjusted prevalence | Age-adjusted prevalence | | Age–gender-adjusted prevalence |
| | Male | Female | | Male | Female | |
| Urban | 51.6 (46.0 to 57.2) | 46.0 (40.8 to 51.1) | 48.9 (45.1 to 52.7) | 24.2 (19.4 to 29.0) | 25.9 (21.4 to 30.4) | 26.9 (23.5 to 30.3) |
| Rural | 20.3 (16.4 to 24.2) | 11.6 (8.2 to 15.1) | 12.3 (10.0 to 14.7) | 42.5 (37.7 to 47.3) | 54.9 (49.6 to 60.3) | 53.6 (50.1 to 57.2) |
| Overall prevalence (age–gender–domicile adjusted) | 25.0 (21.8 to 28.2) | 15.2 (12.5 to 17.9) | 17.0 (15.0 to 19.0) | 40.4 (36.9 to 44.0) | 51.5 (47.8 to 55.2) | 50.2 (47.6 to 52.8) |

Values are % (95% CI).

So, although the numbers calculated are useful for planning, they should not be considered as absolute values.

Despite the high prevalence of poverty in Timor-Leste, with 40% of people living on less than US$0.55/day (£0.28, €0.41),[16] affordability of spectacles need not be a barrier to usage. Ready-made spectacles, which have been shown to be suitable correction for a significant proportion of refractive errors,[21 22] can be landed in the country at a cost of US$0.60–0.70 per unit. These may be made available to vulnerable groups, while still maintaining a financially sustainable system through cross subsidisation from sales of custom-made appliances to the wealthier groups. Given that the urban private sector is unlikely to be interested in spectacle provision to the rural poor (table 3), that the government is unlikely to be able to afford the provision of low or no cost spectacles to all, and that sponsorship by visiting teams is unlikely to occur indefinitely, cross subsidisation is most likely to be achieved by a public–private mix, integrated with government services.

Investigations into willingness to pay have been undertaken for Vision 2020 priority areas such as cataract surgery[23 24] and azithromycin for trachoma control.[25] However, this study is the first published account of willingness to pay for spectacles. It has helped establish the appropriateness of the National Spectacle Program's current pricing structure. Even so, its utility would have been enhanced by determining the maximum price that each individual was willing to pay for spectacles. For example, quantification of what lesser amount would be acceptable and possible for those unwilling to pay US$1 for spectacles (table 4) would assist refinement of a cross-subsidisation protocol.

Although the rapid assessment method used has limitations,[19 20] the results of this study have proved valuable in the planning of refractive error services and a financially self-sustaining spectacle supply system within the Timor-Leste National Eye Care Plan. An equitable cross-subsidisation spectacle system based on self-selection[26] should allow most people requiring refractive error or presbyopia correction to obtain spectacles.

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Competing interests: The International Centre for Eyecare Education, Sydney, Australia, distributes and receives financial benefit from the sale of readymade spectacles in developing countries. However, the authors, who were previously employees of this organisation, have no personal pecuniary interest in the manufacture, distribution or sale of spectacles. The authors have no pecuniary interest in any product mentioned or in the outcome of this survey. Nor has any other conflict of interest been identified.

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