Prevalence and Determinants of Spectacle Nonwear Among Rural Chinese Secondary Schoolchildren

The Xichang Pediatric Refractive Error Study Report 3

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Objective: To study spectacle wear among rural Chinese children.

Methods: Visual acuity, refraction, spectacle wear, and visual function were measured.

Results: Among 1892 subjects (84.7% of the sample), the mean (SD) age was 14.7 (0.8) years. Among 948 children (50.1%) potentially benefiting from spectacle wear, 62.3% did not improve their visual acuity to better than 6/12. There were more likely to be wearing their spectacles. A common reason for nonwear (17.0%) was the belief that spectacles weaken the eyes. Among children without spectacles, 79.3% said their families would pay for them (mean, US $15).

Conclusions: Although half of the children could benefit from spectacle wear, 62.3% were not wearing appropriate correction. These children have significant uncorrected refractive errors. There is potential to support programs through spectacle sales.

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nonownership and nonwearing of spectacles and for wearing of inaccurate spectacles.

The methods of the X-PRES have been reported in detail elsewhere.13 Xichang is a rural village with a population of 109,673 (2002 census15) located in eastern Guangdong Province, People's Republic of China. The population depends largely on agriculture and farming, including the cultivation of fruit trees, ducks, and fish. The mean income in 2004 for agricultural workers in Jiedong County, to which Xichang belongs, was 4120 renminbi (RMB) (US $572),13 compared with 18,864 RMB (US $2620) for Guangdong Province as a whole in the same year.16 Eye services are provided through a freestanding eye clinic associated with the government-run medical clinic and supported by the Caring Is Hip program of the Li Kai Shing Foundation. Spectacles and refractive services are available for purchase at the clinic and at private optical shops in the village, although there are no local programs providing free spectacles. Annual government vision screening is provided in schools, but the effect of the program is undercut by its low specificity (<30%). Secondary school enrollment has been reported at greater than 91% for nearby areas of rural Guangdong Province.18

A school-based survey of refractive error and spectacle use was administered in Xichang from May 1, 2007, through July 15, 2007, as preparation for a program to increase spectacle wear among children with myopia in the region. The protocol was approved by the ethics committee at the Joint Shantou International Eye Center, the parent hospital for the Xichang Eye Clinic. Informed consent was obtained from parents of all participating children, and the principles of the Declaration of Helsinki were followed throughout the study.

**PARTICIPANTS**

Cluster-based random sampling was used to select 2235 children in middle school years 1 and 2 from all 3 middle schools in Xichang. Thirty-five classes were selected at random from 55 eligible classes at the 3 schools, with a mean class size of approximately 60 to 70 children. Parents of all children in selected classes were sent invitation letters explaining the objective and methods of the study. Parents were asked to return forms indicating whether they were willing for their children to participate in the study.

**ASSESSMENT OF VISION**

Uncorrected VA and VA wearing habitual refraction, if available, were measured by trained study personnel in well-lit areas during daylight hours at a distance of 6 m separately for each eye of each child. Children who did not have their spectacles at school were asked to bring them for vision assessment on another day. Identical illuminated tumbling E Snellen charts (Shantou City Medical Equipment Ltd, Shantou, People's Republic of China) were used for all testing. The nontested eye was covered by the subject using a handheld occluder, with proper occlusion and neutral head position monitored by the examiner. The right eye was tested first. A single optotype of each size was presented first, starting at 6/30. If a letter was failed, testing began 2 lines above, with the child being asked to read all optotypes on the line sequentially. A subject had to identify correctly more than half of the letters on a given line (eg, 3 of 5 or 4 of 6) to be considered as having that level of VA.

**BASIC QUESTIONNAIRE**

All 1892 study subjects (Figure 1) were given a basic self-administered questionnaire by study personnel before being told the results of their vision assessment. The basic questionnaire included questions about age, sex, parental education, history of spectacle wear, single most important reason for spectacle nonwear, and willingness to pay for spectacles (using a “bidding format”).19 The basic questionnaire included a Chinese translation of an instrument developed originally by Fletcher et al20 to assess self-reported visual function (VF) in rural Asia. This instrument has previously been validated for use in Chinese21,22 and is described elsewhere in detail.19 Briefly, the VF questionnaire assesses overall vision, visual perception, limitation in daily activities, peripheral vision, near vision, sensory adaptation, light-dark adaptation, visual search, color discrimination, glare disability, and depth perception. The questionnaire can be administered in 5 to 10 minutes. The overall VF scale score ranged from 0 (worst) to 100 (best).20 Because none of the activities described in the questionnaire were age specific, it was unnecessary to modify the original questionnaire for use in children.

**DETAILED EXAMINATION**

All subjects with uncorrected VA of 6/12 or worse OD or OS (n=985) and a 25% random sample of subjects with VA better than 6/12 OD (n=248) (Figure 1) underwent a detailed examination consisting of the following elements: (1) cycloplegia with cyclopentolate hydrochloride (Cyclogyl; Alcon Laboratories Inc, Fort Worth,
All statistical tests were 2-sided; analysis was used to assess potential factors associated with own-spectacle wear, 368 (38.8%) indicated that they did not currently own them (Figure 2). Among participating children, 1233 subjects underwent a more detailed examination that included refraction; 985 (79.9%) were children who had failed vision screening (uncorrected VA, ≤6/12 OD or OS), and 248 (20.1%) were children with normal VA in both eyes selected as part of a planned 25% random sample (which ultimately included 26.9% of children with normal VA).

The mean (SD) age of all 1892 examined children was 14.7 (0.8) years (age range, 11.4-17.1 years), 51.2% were female, and 26.4% were wearing spectacles. The mean (SD) self-reported VF of children failing screening (67.8 [15.9]) was significantly worse than that for children with normal VA (84.7 [11.3]) (P < .001).

Among 985 children failing vision screening, 948 (96.2%) had VA that could be improved to better than 6/12 OU with refraction. These children, 50.1% of the examined sample, had vision deficits that could benefit from spectacle wear and form the basis of the remaining analyses (Figure 2).

Among these 948 children who could benefit from spectacle wear, 368 (38.8%) indicated that they did not currently own them (Figure 2). Among 580 children owning spectacles, 104 (17.9%) could not present them at school, despite attempted reexamination at a later date. These children, 50.1% of the examined sample, had vision deficits that could benefit from spectacle wear and form the basis of the remaining analyses (Figure 2).

Among these 948 children who could benefit from spectacle wear, 368 (38.8%) indicated that they did not currently own them (Figure 2). Among 580 children owning spectacles, 104 (17.9%) could not present them at school, despite attempted reexamination at a later date. These children, 50.1% of the examined sample, had vision deficits that could benefit from spectacle wear and form the basis of the remaining analyses (Figure 2).
Among 948 children with poor uncorrected VA that could improve with refraction, those who did not own spectacles had significantly better self-reported VF but significantly worse VA at initial examination than children who owned spectacles (Table 1). Uncorrected VA was better and the refractive error less myopic among the spectacle nonwearers, although their mean refractive error was still in excess of 2 diopter (D) of myopia, and their mean uncorrected VA was worse than 6/12. Figure 3 shows the distribution of VA at initial examination among children owning and not owning spectacles.

Among 580 children with poor uncorrected VA who owned spectacles, girls were significantly more likely to wear them than were boys (Table 1). Among nonwearers of spectacles compared with wearers, self-reported VF was higher, but VA at initial examination was lower. Uncorrected VA was significantly better and the refractive error less myopic among spectacle nonwearers, although their mean refractive error was still almost −3.0 D, and their mean uncorrected VA was worse than 6/15. Figure 4 shows the distribution of VA at initial examination among children owning but not wearing spectacles.

Children wearing inaccurate spectacles had worse VF, worse VA at initial examination and worse uncorrected VA, and more myopic refractive error than children wearing accurate spectacles (Table 1). The mean VA at initial examination among the 580 children who owned spectacles at the time of examination was significantly better and the refractive error less myopic among the spectacles wearers, self-reported VF was better and the refractive error less myopic among the spectacle nonwearers, although their mean refractive error was still almost −3.0 D, and their mean uncorrected VA was worse than 6/15.

Figure 3. Distribution of visual acuity (VA) at initial examination (mean of the 2 eyes, expressed as the minimum angle of resolution [ie, the decimal equivalent of the Snellen fraction]) among rural Chinese secondary schoolchildren owning (n=580) and not owning (n=386) spectacles among those who would benefit in either eye from spectacle wear.

Figure 4. Distribution of visual acuity (VA) at initial examination (mean of the 2 eyes, expressed as the minimum angle of resolution [ie, the decimal equivalent of the Snellen fraction]) among rural Chinese secondary schoolchildren wearing (n=476) and not wearing (n=104) spectacles among children who owned them at the time of examination (n=580).

Table 1. Characteristics of 948 Rural Chinese Secondary Schoolchildren With Uncorrected Visual Acuity (VA) Worse Than 6/12 in at Least 1 Eye and Whose Vision Can Be Improved With Spectacle Wear

<table>
<thead>
<tr>
<th>Variable</th>
<th>No (n=386)</th>
<th>Yes (n=580)</th>
<th>P Value</th>
<th>No (n=104)</th>
<th>Yes (n=476)</th>
<th>P Value</th>
<th>No (n=119)</th>
<th>Yes (n=357)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>14.68 (0.31)</td>
<td>14.70 (0.81)</td>
<td>.64</td>
<td>14.58 (0.79)</td>
<td>14.73 (0.82)</td>
<td>.10</td>
<td>14.62 (0.78)</td>
<td>14.76 (0.82)</td>
<td>.10</td>
</tr>
<tr>
<td>Sex, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>159 (43.2)</td>
<td>226 (39.0)</td>
<td>.20</td>
<td>62 (59.6)</td>
<td>164 (34.5)</td>
<td>&lt;.001</td>
<td>33 (27.7)</td>
<td>131 (36.7)</td>
<td>.08</td>
</tr>
<tr>
<td>Female</td>
<td>209 (56.8)</td>
<td>354 (61.0)</td>
<td>.33</td>
<td>42 (40.4)</td>
<td>312 (65.5)</td>
<td>.001</td>
<td>86 (72.3)</td>
<td>226 (63.3)</td>
<td>.001</td>
</tr>
<tr>
<td>Educational level of parents, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>78 (21.2)</td>
<td>143 (24.7)</td>
<td>.33</td>
<td>28 (26.9)</td>
<td>115 (24.2)</td>
<td>.55</td>
<td>28 (23.5)</td>
<td>87 (24.4)</td>
<td>.76</td>
</tr>
<tr>
<td>Junior high school</td>
<td>179 (48.6)</td>
<td>247 (42.6)</td>
<td></td>
<td>46 (44.2)</td>
<td>201 (42.2)</td>
<td>.001</td>
<td>50 (42.0)</td>
<td>151 (42.3)</td>
<td>.001</td>
</tr>
<tr>
<td>High school</td>
<td>107 (29.1)</td>
<td>183 (31.6)</td>
<td>.001</td>
<td>30 (28.8)</td>
<td>153 (32.1)</td>
<td>.001</td>
<td>38 (31.9)</td>
<td>115 (32.2)</td>
<td>.001</td>
</tr>
<tr>
<td>College</td>
<td>4 (1.1)</td>
<td>7 (1.2)</td>
<td>.001</td>
<td>0</td>
<td>7 (1.5)</td>
<td>.001</td>
<td>3 (2.5)</td>
<td>4 (1.1)</td>
<td>.001</td>
</tr>
<tr>
<td>Visual function, mean (SD)</td>
<td>75.2 (13.6)</td>
<td>63.5 (15.6)</td>
<td>&lt;.001</td>
<td>66.5 (13.9)</td>
<td>62.8 (15.8)</td>
<td>.03</td>
<td>59.7 (14.9)</td>
<td>63.9 (16.0)</td>
<td>.01</td>
</tr>
<tr>
<td>VA at initial examination, mean (SD)b</td>
<td>0.47 (0.18)</td>
<td>0.74 (0.28)</td>
<td>&lt;.001</td>
<td>0.37 (0.16)</td>
<td>0.82 (0.24)</td>
<td>&lt;.001</td>
<td>0.52 (0.12)</td>
<td>0.92 (0.18)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Uncorrected VA, mean (SD)c</td>
<td>0.37 (0.08)</td>
<td>0.27 (0.14)</td>
<td>&lt;.001</td>
<td>0.37 (0.16)</td>
<td>0.25 (0.12)</td>
<td>&lt;.001</td>
<td>0.19 (0.08)</td>
<td>0.27 (0.12)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Spherical equivalent, mean (SD), Db,c</td>
<td>−2.06 (1.15)</td>
<td>−3.41 (1.48)</td>
<td>&lt;.001</td>
<td>−2.78 (1.32)</td>
<td>−3.55 (1.47)</td>
<td>&lt;.001</td>
<td>−4.42 (1.56)</td>
<td>−3.26 (1.32)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

a To better than 6/12 OU.

b Mean of the 2 eyes; VA is expressed as the minimum angle of resolution (ie, the decimal equivalent of the Snellen fraction) for ease of interpretation, although the logarithm of this value is used for statistical calculations.

c Unavailable for 1 child with full examination.
Univariate Model

Multivariate Model

Table 2. Ownership of Spectacles and Potential Predictors Among 948 Rural Chinese Secondary Schoolchildren With Uncorrected Visual Acuity (VA) of 6/12 or Worse OD or OS Whose VA Can Be Improved to Better Than 6/12 OU

<table>
<thead>
<tr>
<th>Variable</th>
<th>Own Spectacles</th>
<th>Univariate Model</th>
<th>Multivariate Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (n=368)</td>
<td>Yes (n=580)</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td>14.68 (0.81)</td>
<td>14.70 (0.81)</td>
<td>1.04</td>
</tr>
<tr>
<td>Sex, No. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>159 (41.3)</td>
<td>226 (58.7)</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>Female</td>
<td>209 (37.1)</td>
<td>354 (62.9)</td>
<td>1.19</td>
</tr>
<tr>
<td>Visual function, mean (SD)</td>
<td>75.19 (13.56)</td>
<td>63.49 (15.56)</td>
<td>0.95</td>
</tr>
<tr>
<td>Uncorrected VA, mean (SD)c,d</td>
<td>0.47 (0.18)</td>
<td>0.27 (0.14)</td>
<td>1.77</td>
</tr>
<tr>
<td>Best-corrected VA, mean (SD)c,d</td>
<td>1.08 (0.14)</td>
<td>1.05 (0.13)</td>
<td>1.44</td>
</tr>
<tr>
<td>Spherical equivalent, mean (SD), Dc</td>
<td>−2.06 (1.15)</td>
<td>−3.41 (1.48)</td>
<td>0.42</td>
</tr>
</tbody>
</table>

a Adjusted for other factors in logistic regression model.
b Reference group for comparisons.
c Mean of the 2 eyes; VA is expressed as the minimum angle of resolution (ie, the decimal equivalent of the Snellen fraction) for ease of interpretation, although the logarithm of this value is used for statistical calculations.
d Odds ratio per 0.1-U increase in logarithm of the minimum angle of resolution.

Table 3. Wearing of Spectacles and Potential Predictors Among 580 Rural Chinese Secondary Schoolchildren Whose Visual Acuity (VA) Can Be Improved to Better Than 6/12 OU and Who Own Spectacles

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wear Spectacles</th>
<th>Univariate Model</th>
<th>Multivariate Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (n=104)</td>
<td>Yes (n=476)</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td>14.58 (0.79)</td>
<td>14.73 (0.82)</td>
<td>1.25</td>
</tr>
<tr>
<td>Sex, No. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>62 (27.4)</td>
<td>164 (72.6)</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>Female</td>
<td>42 (11.9)</td>
<td>312 (88.1)</td>
<td>2.81</td>
</tr>
<tr>
<td>Visual function, mean (SD)</td>
<td>66.52 (13.92)</td>
<td>62.83 (15.84)</td>
<td>0.98</td>
</tr>
<tr>
<td>Uncorrected VA, mean (SD)c,d</td>
<td>0.37 (0.16)</td>
<td>0.25 (0.12)</td>
<td>1.52</td>
</tr>
<tr>
<td>Best-corrected VA, mean (SD)c,d</td>
<td>1.06 (0.13)</td>
<td>1.05 (0.12)</td>
<td>1.05</td>
</tr>
<tr>
<td>Spherical equivalent, mean (SD), Dc</td>
<td>−2.78 (1.32)</td>
<td>−3.55 (1.47)</td>
<td>0.68</td>
</tr>
</tbody>
</table>

a Adjusted for other factors in logistic regression model.
b Reference group for comparisons.
c Mean of the 2 eyes; VA is expressed as the minimum angle of resolution (ie, the decimal equivalent of the Snellen fraction) for ease of interpretation, although the logarithm of this value is used for statistical calculations.
d Odds ratio per 0.1-U increase in logarithm of the minimum angle of resolution.

tial examination among the children with inaccurate spectacles was approximately 6/12.

In models of spectacle ownership and wear among children potentially benefiting from spectacles, lower self-reported VF, worse uncorrected VA, and more myopic spherical equivalent refraction were predictive of owning spectacles (Table 2 and Table 3), and older age, female sex, and worse uncorrected VA were associated with spectacle wear among those who owned them (Table 4) Best-corrected VA was not predictive of spectacle wear or ownership.

In addition to observed spectacle wear, data were collected about children’s self-reported frequency of wearing spectacles and reasons for nonwear. Decreasing frequency of self-reported spectacle wear was associated with increasing self-reported VF, worse VA at initial examination, better uncorrected VA, and less myopic refractive error (P < .001, test for trend) (Table 4). However, children reporting that they “sometimes” wore spectacles still had a mean spherical equivalent of almost −3 D and a mean uncorrected VA worse than 6/15.

The most common reasons for nonwearing of spectacles, accounting for almost three-fourths of nonwearers, were “Wear only when needed or on special occasions” and “Worried spectacles will make eyes weak.” These findings are summarized in Table 4.

Among all children participating in the study, 85.2% (1612 of 1892) indicated that their families would be willing to pay something for spectacles if needed. Although children already owning spectacles were significantly (P < .001) more willing to pay for them, 79.3% (292 of 368) of children who would benefit from but did not own spectacles were willing to pay something. Among children willing to pay for spectacles, the mean amount was US $15, with the following groups willing to pay significantly more: those already owning spectacles (P < .001), wearers whose VA was improved with spectacles (P = .04), and those whose parents had at least a high school education (P < .001).

Although half of the middle school children in this rural Chinese setting could benefit from refraction, almost two-thirds of these did not own or wear spectacles or had inaccurate correction. This is similar to the proportion of
myopia is associated with significant improvement in VF.24 of recent evidence that correction of modest amounts (Figures 3 and 4). This is particularly concerning in light visual deficits are present among many children and 6/12 to 6/15 or worse, respectively. More signifi-

and spectacle-wearing peers. 

selves as having better VF than their spectacle-owning 

ter self-reported VF but worse VA at initial examination 

When adjusting for the higher myopia prevalence among 

 była a significant predictor of spectacle ownership or wear 

Children who did not own or wear spectacles had bet-

vision among children who have a better estimate of their 

visual deficits among these children were significant. The 

mean refractive error and uncorrected VA of children not 

VA at initial examination, these children as a whole consider them-

menstruation, these children as a whole consider them-

fessional examination, these children as a whole consider them-

reasons for spectacle nonwear among those reporting at least 

frequently amenable to educational strategies is the belief 

Data from urban regions of China further underscore the 

widely among children with inaccurate spectacles should be 

Self-reported and observed spectacle wear and own-

ing among children with inaccurate spectacles should be 

60% without necessary spectacles reported by He et al.11 

Children who did not own or wear spectacles had bet-

ter self-reported VF but worse VA at initial examination 

vision among children who have a better estimate of their 

children not wearing or owning spectacles were 2 to 3 D of myopia 

and 6/12 to 6/15 or worse, respectively. More significant 

that for children with normal uncorrected VA (84.7 

0.001). Children owning spectacles were in-

9.8% of current owners (n=119) 

had inaccurate correction (n=119) 

and wore spectacles. It is not 

doubled, from 37.2% to 69.5%. The fact that more than 

full benefit from refractive correction might be almost 

24.1% rate of current owners 

and were unaware of what their best-corrected VA might be. If outreach efforts demonstrated directly to children 

what their corrected VA could be, it is possible that spec-

wear might be improved. If children currently not 

owning spectacles could be persuaded to obtain and wear 

accurate correction at the 82.1% rate of current owners 

in this population, the proportion of children achieving 

full benefit from refractive correction might be almost 

doubled, from 37.2% to 69.5%. The fact that more than 

79.3% of children would be willing to pay for spec-

8.1% of current owners (n=119) 

the mean figure of US $15, suggests that such pro-

grams might be self-supporting. 

An important cause of spectacle nonwear that is po-

entially amenable to educational strategies is the belief 

that spectacles weaken the eyes. In fact, available evi-

dence suggests that reducing or delaying spectacle wear 

is not successful in reducing myopia progression.25 

Even among children wearing accurate spectacles, the 

mean (SD) VF (63.9 [16.0]) was significantly worse than 

that for children with normal uncorrected VA (84.7 

[11.3]) (P<.001). Children owning spectacles were in-

structed to answer the VF questions on the basis of their 

corrected VA, which for these children was between 6/6 

and 6/7.5. Self-reported VF in the school setting may be 

sensitive to modest decrements in vision, consistent with 

reports that spectacle correction of vision in the 6/7.5 to 

6/9 range significantly improves children's VF.24 Alter-

atively, it is possible that subtle distortions not readily 

Table 4. Self-reported Spectacle Wear Among 687 Rural Chinese Secondary Schoolchildren Who Indicated That They Had Ever Worn Spectacles and Reasons for Nonwear Among 389 Children Who Admitted to at Least Occasionally Not Wearing Spectacles

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%)</th>
<th>Visual Function, Mean (SD)</th>
<th>VA at Initial Examination, Mean (SD)</th>
<th>Uncorrected VA, Mean (SD)</th>
<th>Spherical Equivalent, Mean (SD), D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported spectacle wear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>298 (43.4)</td>
<td>61.2 (16.1)</td>
<td>0.78 (0.27)</td>
<td>0.25 (0.15)</td>
<td>−3.82 (1.86)</td>
</tr>
<tr>
<td>Occasionallyb</td>
<td>349 (50.8)</td>
<td>66.2 (15.1)</td>
<td>0.72 (0.31)</td>
<td>0.37 (0.24)</td>
<td>−2.94 (1.73)</td>
</tr>
<tr>
<td>No</td>
<td>40 (5.8)</td>
<td>71.4 (16.0)</td>
<td>0.63 (0.41)</td>
<td>0.63 (0.41)</td>
<td>−2.51 (2.38)</td>
</tr>
<tr>
<td>Reasons for spectacle nonwear among those reporting at least occasionally not wearing spectacles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not need spectacles, do not help</td>
<td>389 (56.6)c</td>
<td>66.7 (15.2)</td>
<td>0.71 (0.32)</td>
<td>0.40 (0.27)</td>
<td>−2.90 (1.80)</td>
</tr>
<tr>
<td>Broke or lost spectacles</td>
<td>28 (7.4)</td>
<td>70.9 (14.9)</td>
<td>0.75 (0.43)</td>
<td>0.73 (0.43)</td>
<td>−3.18 (3.62)</td>
</tr>
<tr>
<td>Headache or other symptoms</td>
<td>20 (5.3)</td>
<td>63.8 (15.1)</td>
<td>0.54 (0.39)</td>
<td>0.35 (0.23)</td>
<td>−3.22 (1.81)</td>
</tr>
<tr>
<td>Teased or embarrassed about spectacles</td>
<td>24 (6.4)</td>
<td>72.1 (12.4)</td>
<td>0.77 (0.33)</td>
<td>0.53 (0.36)</td>
<td>−2.58 (2.34)</td>
</tr>
<tr>
<td>Wear only when needed or on special occasions</td>
<td>12 (3.2)</td>
<td>61.3 (13.2)</td>
<td>0.77 (0.35)</td>
<td>0.45 (0.38)</td>
<td>−1.91 (2.59)</td>
</tr>
<tr>
<td>Worried spectacles will make eyes weak</td>
<td>211 (56.1)</td>
<td>66.4 (15.5)</td>
<td>0.73 (0.30)</td>
<td>0.35 (0.21)</td>
<td>−3.02 (1.60)</td>
</tr>
<tr>
<td>Forgot spectacles</td>
<td>64 (17.0)</td>
<td>65.8 (14.6)</td>
<td>0.66 (0.30)</td>
<td>0.35 (0.21)</td>
<td>−2.82 (1.38)</td>
</tr>
<tr>
<td>Other</td>
<td>14 (3.7)</td>
<td>72.7 (16.3)</td>
<td>0.64 (0.31)</td>
<td>0.51 (0.30)</td>
<td>−1.99 (0.92)</td>
</tr>
</tbody>
</table>

Abbreviation: VA, visual acuity.

a Mean of the 2 eyes; VA is expressed as the minimum angle of resolution (ie, the decimal equivalent of the Snellen fraction) for ease of interpretation, although the logarithm of this value is used for statistical calculations.

b P<.001, test for trend among the 3 groups according to spectacle wear status.

c Missing for 13 subjects.
measurable by Snellen charts (such as micropiswa introduced by myopic correction) influenced subject responses. Vision-related quality of life with refractive surgery has been reported to exceed that with spectacles.26 More studies are needed to better understand the phenomenon of poor self-reported VF among spectacle-wearing children with good corrected VA, as well as its implications for programs aimed at improving vision through enhanced spectacle wear.

The results of the X-PRES must be understood in the context of its limitations. Although 87.0% of the subjects in our sample were examined, parental consent could not be obtained for 13.0% of students, and we could not obtain even demographic information about these children. Therefore, we cannot exclude the possibility that unexamined children differed in important ways from those who elected to participate. Our sample was school-based rather than population based. School attendance is compulsory for children in this age range, and findings from nearby areas of rural Guangdong Province indicate that secondary school enrollment rates exceed 91%.28 Still, our results must be applied with caution to the local population, let alone the population of rural China.

It was impractical in this setting to perform unannounced examinations of spectacle wear as has been reported for studies in Mexico10 and South Africa.27 This limits comparisons with these other data and implies that spectacle wear as measured herein likely overrepresents actual day-day use, underestimating the extent of visual disability associated with spectacle nonwear.

Finally, our willingness-to-pay data for spectacle purchase were based on the responses of the children and may not represent the attitudes of parents making the actual expenditure. Nevertheless, the willingness-to-pay data obtained from children demonstrated associations in the expected direction: children who owned spectacles were willing to pay more than those who did not, as were those with correction that improved their vision optimally compared with those whose spectacles did not.

Despite its limitations, the present article represents the first large school-based study of which we are aware to report detailed patterns and determinants of spectacle use in China. Understanding these behaviors is a critical prerequisite to redressing the severe burden of uncorrected refractive error in rural China. Separate reports from the X-PRES describe the effect of interventions to increase the uptake of refractive services in this population.28

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