Randomized, Controlled Trial of an Educational Intervention to Promote Spectacle Use in Rural China

The See Well to Learn Well Study

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Objective: To test an educational intervention promoting the purchase of spectacles among Chinese children.

Design: Randomized, controlled trial.

Participants: Children in years 1 and 2 of all 20 junior and senior high schools (ages 12–17 years) in 3 rural townships in Guangdong, China.

Methods: Children underwent visual acuity (VA) testing, and parents of participants with presenting VA worse than 6/12 in either eye improving by more than 2 lines with cycloplegic refraction were recommended to purchase glasses. Children at 10 randomly selected schools received a lecture, video, and classroom demonstration promoting spectacle purchase.

Main Outcome Measures: Self-reported purchase of spectacles (primary outcome) and observed wear or possession of newly purchased glasses (secondary outcome) at follow-up examinations (mean, 219±87 days after the baseline visit).

Results: Among 15,404 eligible children, examinations were completed for 6,379 (74.6%) at intervention schools and 5,044 (73.6%) at control schools. Spectacles were recommended for 2,236 (35.1%) children at intervention schools and for 2,212 (43.9%) at control schools. Of these, 417 (25.7%) intervention school children and 537 (34.0%, P = 0.45) control school children reported buying glasses. Predictors of purchase in regression models included female gender (P = 0.02), worse uncorrected VA (P < 0.001), and higher absolute value of refractive error (P = 0.001). Neither the rate of self-reported purchase of glasses or observed wear or possession of newly purchased glasses differed between control schools and intervention schools in mixed-effect logistic regression models. Among children not purchasing glasses, 21.7% had better-eye VA of worse than 6/18.

Conclusions: An intervention based on extensive pilot testing and focus groups in the area failed to promote spectacle purchase or wear. The high burden of remaining uncorrected poor vision underscores the need to develop better interventions.

Financial Disclosure(s): The author(s) have no proprietary or commercial interest in any materials discussed in this article. Ophthalmology 2011;xx:xxx © 2011 by the American Academy of Ophthalmology.
Despite the relatively plentiful data on barriers to spectacle wear among school-aged children, few studies have evaluated strategies to promote spectacle use in this group. An intensive strategy of distraction and response blocking was demonstrated to be effective in a small, uncontrolled study of developmentally disabled children in Baltimore.\textsuperscript{12} In separate randomized trials, Zeng et al\textsuperscript{13} showed that ready-made spectacles were equally acceptable to and likely to be worn by Chinese secondary school children as compared with custom spectacles, and Wedner et al\textsuperscript{14} found that providing free spectacles increased rates of wear significantly when compared with providing a prescription only in Tanzania. However, the authors are unaware of any randomized trial that has studied educational interventions to increase purchase and wear of spectacles among school-aged children.

The See Well to Learn Well study is a school-based, randomized, controlled trial of interventions aimed at rural Chinese secondary school students with refractive error and uncorrected vision of 6/12 or worse in at least 1 eye. The goals of the trial were (1) to compare the rates of recommended purchase of spectacles after providing prescriptions (primary outcome), at the 6-month follow-up visit, between intervened and control schools; (2) to evaluate baseline factors such as age, gender, visual acuity, refractive error, and possession of spectacles as predictors of spectacle purchase; and (3) to assess observed wear or possession of purchased spectacles (secondary outcome).

Participants and Methods

The See Well to Learn Well project is a randomized, controlled trial of interventions to promote spectacle wear among approximately 15,000 secondary school children in 3 townships in the rural Chaoshan region of southern China. Written informed consent was obtained from at least 1 parent of all participants, the protocol was approved in full by institutional review boards at the Chinese University of Hong Kong and the Joint Shantou International Eye Center (Guangdong Province, China), and the tenets of the Declaration of Helsinki were followed throughout.

Schooling in China is compulsory until the age of 16 years, and school attendance in this age range is more than 90% in the study region.\textsuperscript{15} All schools in the target population area are government run, as is typical of most rural parts of eastern China.

Participant Recruitment and Sample Size Calculations

At each junior and senior high school in the 3 townships of Fuyang, Xichang, and Liangying, Chaoshan region, Guangdong Province, all year 1 and year 2 classes (approximate age, 12–17 years) were enumerated, and 10 classes were selected at random. On the basis of a pilot study in Xichang,\textsuperscript{4} it was estimated that 411 children requiring spectacle correction in each of the study arms would allow the detection of a 10% difference in uptake of spectacles between intervention and control groups at a 5% level of significance and a power of 90%. In the pilot study, 985 (61.2%) of the 1892 recruited students had uncorrected vision of 6/12 or worse in either eye, and among them, 591 students (31.2%) could improve their visual acuity to better than 6/12 in both eyes with accurate refraction, either because of spectacle wear or the wearing of inaccurate spectacles at baseline. The average class size in the study area is approximately 60 students. To adjust for the cluster sampling design (randomization by school rather than individual student), a design effect of 3.63 was used, resulting in an estimated 500 children screened at each of 10 schools in each arm being required to obtain the necessary number of children for whom spectacles would be recommended. On the basis of a participation rate of 85% in the pilot study,\textsuperscript{4} 500/0.85 = approximately 600 participants, or 10 classes of 60 students each, were selected at each school, for a total of 6000 children in each wing.

Letters describing the study and offering the choice to participate were distributed to parents of all children in the selected classes. Study personnel informed each participating class on the day before examination that all children owning spectacles were requested to bring them to school the next day.

Randomization

A random number table and list of junior and senior high schools in the 3 selected communities was used to assign 10 schools to receive an educational intervention and 10 schools to serve as controls. The 20 schools included 18 junior high schools and 2 senior high schools (1 each in the intervention and control groups).

Baseline Data Collection

Among 15,404 children in the sample frame, 11,423 (74.2%) completed questionnaires and the examination (Fig 1). Children were administered written questionnaires requesting information on age, gender, and frequency of spectacle wear. No refraction data were available for parents, and prevalence of spectacle wear among adults is sufficiently low in the region that this is not a useful proxy for refractive error.

Visual acuity with and without habitual refraction, if available, was measured by trained study personnel in well-lighted areas of the school during daylight hours, at a distance of 5 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 a separate day, and vision was recorded both with and without glasses. Identical illuminated Snellen tumbling E vision charts (Shantou City Medical Equipment, Ltd., Shantou, China) were used for all testing. The non-tested eye was covered by the child using a hand-held 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 the 6/30 line. If a letter was failed, testing began 2 lines above, with the child being asked to read all optotypes on the line sequentially. A participant had to identify correctly more than half of the letters on a given line (e.g., 1 of 1, 2 of 2, 3 of 5, 4 of 6) to be considered to have achieved that level of acuity.

All children with uncorrected visual acuity (VA) of 6/12 or worse in either eye and a random 50% sample of children with VA better than 6/12 in both eyes (Fig 1) underwent cycloplegic autorefraction (Potec PRK-5000; Potec Co., Ltd., Seoul, Korea) with subjective refinement by an ophthalmologist in each eye, at least 30 minutes after receiving 1 drop of cyclopentolate 1% to both eyes every 5 minutes for a total of 2 drops in each eye. The power of children’s current spectacles (if worn) was measured bilaterally (Topcon CL-100; Topcon Corp., Tokyo, Japan).

Children meeting the following criteria were given a prescription for spectacles by the examining ophthalmologist, together with a note addressed to their parents recommending that glasses be purchased: all participants with presenting VA of 6/12 or worse in either eye (e.g., with or without spectacles) and whose vision could be improved by 2 lines or more in either eye with refraction, and children already having spectacles improving the vision to

Letters describing the study and offering the choice to participate were distributed to parents of all children in the selected classes. Study personnel informed each participating class on the day before examination that all children owning spectacles were requested to bring them to school the next day.
better than 6/12, but whose vision could be improved by 2 lines or more in either eye with refraction.

Parents were recommended to obtain glasses at vision centers located within local, government-run hospitals in each of the 3 townships where the study took place. Each of these vision centers had been provided by Project Vision, a Hong Kong-based non-governmental organization, with the following: equipment for refraction and dispensing of spectacles, high-quality children’s frames, and 3 or 6 months of refraction training by optometrists at a tertiary center in nearby Shantou City. The trained personnel, who had various backgrounds, took part in the study screening examinations in their own townships. Spectacles were available at the vision centers at a cost of US$10 and up. Vision centers were located within 10 miles of the homes of all children in the study. Other refractive services in this area were offered by unlicensed private shops, staffed by persons without formal refraction training, providing glasses on the basis of noncycloplegic automated refraction or subjective refraction with loose lenses.

**Educational Intervention**

Pilot studies and focus groups in the area had identified the following major barriers to spectacle purchase and wear among children of this age: children’s lack of awareness of poor vision and lack of understanding of refractive error, and the mistaken belief among children and their teachers that spectacle wear is harmful to children’s eyes. On this basis, an educational intervention with the following components was carried out at the 10 selected schools within 4 weeks of the initial visit by trained study personnel for children recommended to receive glasses and their teachers: (1) presentation of a 10-minute cartoon video in mandarin Chinese explaining refractive error and its correction with glasses; (2) an interactive lecture in mandarin and chaoshanhuia (the local dialect) delivered by young, trained ophthalmologists from the nearby Joint Shantou International Eye Center explaining the benefits of spectacle correction of refractive error and specifically stating that wearing glasses improves vision and does not harm the eyes; (3) an interactive, classroom-based demonstration carried out by study personnel where children were asked to read typical homework assignments from the classroom blackboard, written to be visible with 6/6 vision, while seated at a distance of 6 m in the usual classroom seating. Children then were given self-refracting glasses (Adspecs; Adlens, Ltd., Oxford, UK) and were directed to adjust the spectacle power to optimize vision in each eye and then to read the assignments again. The purpose of this demonstration was to make children aware of their poor vision and of the potential impact of corrected VA in the classroom setting.

**Follow-up and Outcome Assessment**

Announced follow-up visits were carried out at all schools at approximately 6 months after the initial visit, and children recommended to receive spectacles were identified from lists prepared by study personnel. Staff were not masked as to the randomization status of schools at the time of follow-up. Pilot studies had shown that most spectacle purchases among children in the area occurred during 6-week winter and summer vacations. Interventions thus were timed wherever possible to occur soon before these vacations, and follow-up occurred after a vacation period, although not always immediately after. Only children in years 1 and 2 were selected to participate in the study, because children in year 3 of
junior or senior high school would graduate and likely move to another school, complicating follow-up.

Children recommended to receive spectacles underwent examination of presenting and uncorrected vision and cycloplegic automated refraction with refinement by an ophthalmologist, as described above. The power of spectacles and spectacle-corrected vision were measured when glasses were available. Children were asked if they had purchased spectacles (primary outcome), their observed use (defined either as wear or possession of the glasses at school) of newly purchased spectacles at the time of examination was recorded (secondary outcome), and those indicating spectacles had been purchased were asked about frequency of wear. Reasons for nonpurchase of spectacles were surveyed among children who reported not buying glasses.

Statistical Methods

Differences between the intervention and control groups and between children present at follow-up and those lost to follow-up were assessed using mixed-effects linear regression for continuous data and mixed-effects logistic regression for categorical data at the student level, taking into account the cluster-randomized trial design, in which schools rather than students were assigned randomly to an intervention.

The primary study outcome of having obtained spectacles or not also was analyzed using a mixed-effects logistic regression model, which accounted for the cluster-randomized design. Potential predictors in the model were selected a priori from among factors previously identified in pilot testing to be linked to myopia and spectacle wear, including age, gender, presenting visual acuity, uncorrected visual acuity, best-corrected visual acuity, spherical equivalent refractive error in the better-seeing eye, and owning spectacles at baseline. Additionally, randomization group assignment was included in the model to adjust for the impact of the intervention on spectacle purchase. All fixed-effect variables significant at the 0.05 level in univariate analyses then were entered into multiple mixed-effects logistic regression models. Random effects also were included in the model: the school-specific mean intercepts with random variation among the students. Odds ratios and 95% confidence intervals were calculated for all potential predictors. Power to detect a 10% difference in the primary outcome (self-reported spectacle purchase) between groups at a significance level of 5% was determined taking into account the intraclass correlation coefficient within schools (0.055).

A second mixed-effects logistic regression model also was examined, exploring essentially the identical predictors, with the outcome of observed spectacle wear or possession of spectacles at school and including only those children stating that they had purchased new glasses since the baseline examination. All statistical analyses were performed using the statistical software SPSS version 17 (SPSS, Inc., Chicago, IL) and STATA/SE version 11 (Stata Corp., College Station, TX).

### Results

A total of 15,404 children were eligible for examination at 20 schools in the sample frame, among whom 8551 (55.5%) were randomized to the intervention promoting spectacle purchase at 10 schools, and 6853 (44.5%) were randomized to no intervention at 10 schools. Examinations were completed on 6379 (74.6%) of children at schools randomized to the intervention and 5044 (73.6%) of children at control schools. Children not completing examinations were older (P = 0.008) and were more likely to be boys (P = 0.001). At schools in the intervention arm, 2236 children (35.1%) were recommended to obtain glasses on the basis of having an improvement in visual acuity of 2 lines or more with refraction in either eye. At control schools, 2122 children (43.9%) were recommended glasses on the same basis. Only those children advised to purchase spectacles in the intervention group received education promoting spectacle purchase and wear.

Children in the intervention schools were more likely to be girls (60.0% vs. 54.4%; P = 0.026), although age, presenting visual acuity, uncorrected visual acuity, best-corrected visual acuity, and spherical equivalent refractive error in the better-seeing eye and the proportion owning spectacles at baseline did not differ between the intervention and control groups (Table 1).

Follow-up occurred at a mean of 219±87 days after the baseline visit. In the intervention group, 1622 children (72.5%) were available at follow-up, as were 1578 children (71.3%) in the control group. Children not present at the follow-up examination were less likely to be girls (51.4% vs. 59.5%; P<0.001) and to have owned spectacles at baseline (50.5% vs. 55.3%; P = 0.008). Age, myopic refractive error, randomization to the intervention group, presenting visual acuity, uncorrected visual acuity, and best-corrected visual acuity in the better-seeing eye did not differ between children with and without follow-up (Table 2).

Among children in the intervention group recommended to obtain glasses, 417 (25.7%) did so, whereas the figure for the control group was significantly higher (n = 537 [34.0%]; P = 0.45). The rates at the various schools ranged from 11.4% to 51.6% (with the highest and lowest rates both occurring at control schools).

In mixed-effect univariate logistic analyses, purchase of spectacles was associated significantly with female gender (P<0.001),
Table 2. Characteristics of Children Recommended to Obtain Spectacles, Comparing Those Present at Follow-up with Those Lost to Follow-up among the Intervention and Control Groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Children (n = 4448)</th>
<th>Children with Follow-up (n = 3200)</th>
<th>Children without Follow-up (n = 1248)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (SD), yrs</td>
<td>14.1 (3.35)</td>
<td>14.1 (3.47)</td>
<td>14.4 (2.98)</td>
<td>0.136</td>
</tr>
<tr>
<td>Girls (%)</td>
<td>2544 (57.2%)</td>
<td>1903 (59.5%)</td>
<td>641 (51.4%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median presenting vision in better-seeing eye</td>
<td>0.50 (0.24)</td>
<td>0.50 (0.24)</td>
<td>0.50 (0.24)</td>
<td>0.696</td>
</tr>
<tr>
<td>Median uncorrected vision in better-seeing eye</td>
<td>0.41 (0.25)</td>
<td>0.40 (0.24)</td>
<td>0.40 (0.25)</td>
<td>0.534</td>
</tr>
<tr>
<td>Median best-corrected vision in better-seeing eye</td>
<td>1.00 (0.12)</td>
<td>1.00 (0.12)</td>
<td>1.00 (0.12)</td>
<td>0.989</td>
</tr>
<tr>
<td>Mean refractive error (SD), D</td>
<td>−2.61 (1.80)</td>
<td>−2.63 (1.81)</td>
<td>−2.54 (1.78)</td>
<td>0.105</td>
</tr>
<tr>
<td>Own spectacles at baseline</td>
<td>2400 (54.0%)</td>
<td>1770 (55.3%)</td>
<td>630 (50.5%)</td>
<td>0.008</td>
</tr>
<tr>
<td>Randomized to intervention (%)</td>
<td>2236 (50.3%)</td>
<td>1622 (50.7%)</td>
<td>614 (49.2%)</td>
<td>0.998</td>
</tr>
</tbody>
</table>

D = diopters; SD = standard deviation.
Boldface values in the table indicate those results which are statistically significant at the P < 0.05 level.

with worse uncorrected visual acuity (P < 0.001), with best-corrected visual acuity (P < 0.001), with higher absolute value of spherical equivalent refractive error (P < 0.001), with owning spectacles at baseline (P < 0.001), and with longer elapsed time between the baseline and assessment visit (P < 0.001; Table 3). In mixed-effect multivariate logistic regression analyses, the associations with female gender (P = 0.017), uncorrected visual acuity (P < 0.001), higher absolute value of spherical equivalent refractive error (P = 0.001), and longer elapsed time before follow-up (P < 0.001) remained significant (Table 3). The lack of a significant adjusted difference between control and intervention groups in spectacle purchase remained when only the school with lowest uptake, only the school with highest uptake, or both outlying schools were removed from the analysis (data not shown). Power to detect a 10% difference in self-reported spectacle purchase between groups at a significance level of 5% was more than 90%.

Among 2246 children not obtaining spectacles as recommended, 2170 (96.6%) provided their reason for not having done so. Among 1139 children with glasses at baseline who did not purchase recommended new spectacles, satisfaction with current spectacles or the feeling that current spectacles were not needed (n = 662 [58.0%]) was the most common reason, whereas far fewer children indicated that new glasses were too expensive (n = 92 [8.0%]) or that they were concerned about symptoms with glasses wear or possession of spectacles was associated significantly with female gender (P = 0.003), worse uncorrected visual acuity (P < 0.001), and absolute value of refractive error in the better-seeing eye (P < 0.001; Table 4). In multivariate analyses, self-reported wear was associated with female gender (P = 0.003) and worse uncorrected visual acuity (P = 0.014; Table 4).

Figure 2 depicts the distribution of presenting visual acuity in the better-seeing eye for children not having purchased spectacles as recommended. Among these 2246 children, 487 (21.7%) had visual acuity of 6/18 or worse in the better-seeing eye.

**Discussion**

Pilot testing and focus groups in this region demonstrated that poor understanding of the benefits of spectacle

Table 3. Mixed-Effects Logistic Regression Model Comparing Children Who Did and Did Not Obtain Spectacles

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Univariate Analysis</th>
<th>Multivariate Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio</td>
<td>95% Confidence Interval</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>0.944</td>
<td>0.878–1.01</td>
</tr>
<tr>
<td>Female gender</td>
<td>1.36</td>
<td>1.16–1.60</td>
</tr>
<tr>
<td>Uncorrected VA in better-seeing eye</td>
<td>0.099</td>
<td>0.067–0.148</td>
</tr>
<tr>
<td>Best-corrected VA in better-seeing eye</td>
<td>0.310</td>
<td>0.153–0.628</td>
</tr>
<tr>
<td>Absolute value of refractive error in better-seeing eye (D)</td>
<td>1.27</td>
<td>1.21–1.33</td>
</tr>
<tr>
<td>Having spectacles at baseline</td>
<td>1.88</td>
<td>1.56–2.27</td>
</tr>
<tr>
<td>Time between baseline and follow-up visit (days)</td>
<td>1.01</td>
<td>1.01–1.01</td>
</tr>
<tr>
<td>Randomized to intervention group</td>
<td>0.844</td>
<td>0.545–1.31</td>
</tr>
</tbody>
</table>

D = diopters; VA = visual acuity.
Boldface values in the table indicate those results which are statistically significant at the P < 0.05 level.
wear and the fear that glasses would harm the eyes, rather than cost, were the major barriers to use of refractive correction among children. Thus, an educational intervention was planned aimed at demonstrating to children the limitations of their uncorrected vision in the classroom setting and at providing correct information about the safety of spectacle wear. Although a survey conducted at the time of follow-up confirmed the expected major reasons for failure to obtain spectacles, the present educational intervention was ineffective in increasing rates of spectacle purchase. Rates of observed wear and possession of spectacles among children who had purchased them also did not differ between groups. Both of these differences remained statistically insignificant for all groups when stratifying children by age (more or less than the median of 15 years), gender, uncorrected visual acuity (including only children with visual acuity of worse than 6/12, worse than 6/18, and worse than 6/24, respectively, in the better-seeing eye) and possession of glasses at baseline (data not shown).

A recent review of the published literature concluded that interventions that successfully improve adherence with recommended treatments generally are complex, including

Table 4. Mixed-Effects Logistic Regression Model Comparing Observed Spectacle Wear or Possession of Spectacles at School among Children Stating That They Had Purchased Glasses in the Intervention and Control Groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Univariate Analysis</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio</td>
<td>95% CI</td>
<td>P Value</td>
<td>Odds Ratio</td>
<td>95% CI</td>
<td>P Value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>1.14</td>
<td>0.952–1.36</td>
<td>0.158</td>
<td>1.12</td>
<td>0.935–1.35</td>
<td>0.21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female gender</td>
<td>1.76</td>
<td>1.20–2.56</td>
<td>0.003</td>
<td>1.78</td>
<td>1.21–2.62</td>
<td>0.003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncorrected VA in better-seeing eye</td>
<td>0.177</td>
<td>0.079–0.394</td>
<td>&lt;0.001</td>
<td>0.287</td>
<td>0.106–0.774</td>
<td>0.014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Best-corrected VA in better-seeing eye</td>
<td>0.750</td>
<td>0.139–4.06</td>
<td>0.739</td>
<td>1.75</td>
<td>0.300–10.2</td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absolute value of refractive error in better-seeing eye (D)</td>
<td>1.27</td>
<td>1.11–1.44</td>
<td>&lt;0.001</td>
<td>1.13</td>
<td>0.968–1.31</td>
<td>0.12</td>
<td></td>
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</tr>
<tr>
<td>Having spectacles at baseline</td>
<td>1.70</td>
<td>1.12–2.57</td>
<td>0.012</td>
<td>1.17</td>
<td>0.741–1.85</td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Randomized to intervention group</td>
<td>0.697</td>
<td>0.365–1.33</td>
<td>0.275</td>
<td>0.690</td>
<td>0.358–1.33</td>
<td>0.27</td>
<td></td>
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</tbody>
</table>

D = diopters; VA = visual acuity. Boldface values indicate those results which are statistically significant at the P < 0.05 level.
combinations of different methods. Although the current study included multimedia presentations, lectures, and classroom demonstrations, for practical reasons of cost, short-term interventions were selected and were timed strategically to coincide with observed patterns of spectacle purchase during vacation time. The principal goal of the intervention was to increase purchase rates over the relatively short term, rather than to effect long-term behavior change regarding spectacle wear, which likely would have necessitated sustained interventions not practical in this setting. Similarly, limited resources dictated that face-to-face interaction with parents, who play a key role in the decision to purchase glasses, were not practical. Low rates of attendance at parent meetings was observed during pilot testing. A previously tested strategy of having teachers call the parents of children requiring spectacles resulted in purchase rates in this same target population similar to those observed in the present study. Door-to-door distribution of educational materials or telephone calls aimed at families might have improved spectacle uptake, but it is not clear that such efforts would be sustainable for governments or nongovernmental organizations in this region.

The finding that children previously owning glasses were more likely to purchase new ones is consistent with previous reports in this region among both school-aged children and adults. Although children with better uncorrected vision were less likely to purchase spectacles, also consistent with previous studies in this area, a significant burden of uncorrected vision remained among those children who did not obtain recommended glasses. Nearly 1 in 4 such children had vision of 6/18 or worse in the better-seeing eye (Fig 2). Children with uncorrected refractive error in this range have been demonstrated to have poor visual function, which can be improved significantly with refractive correction.

This study has practical implications for educational programs to promote spectacle purchase, which are now becoming increasingly common. Although one may apply these results to other environments and educational interventions only with caution, the current study suggests that purely school-based interventions focused on children may have some limitations. An alternative method may be for local hospitals and other facilities offering refraction services to follow up school-based screening with telephone calls to families of children needing glasses who do not purchase glasses. It is possible that the cost of such an approach may be sustained by the sale of spectacles. The results of the current study present 1 potential barrier to this strategy: among those children who did obtain spectacles, only 16.2% (154/951) purchased them at the vision center that participated in the initial screening. Children were encouraged to go to these centers because each has a suitable range of inexpensive (US$10), accurate, and age-appropriate glasses available. It may be that a similar limited yield would be encountered in other areas with multiple providers of glasses. An alternative approach may be to provide community-based entrepreneurs with lists of families of children requiring spectacles. Household visits to sell reading glasses to parents and other older family members may be a sustainable strategy to underscore to parents the importance of good vision and to encourage them to purchase glasses for children.

A randomized controlled trial in Tanzania has suggested that provision of free spectacles can improve uptake when compared with recommendations for purchase. However, evidence from Mexico and South Africa suggests that spectacle retention may be poor among children given free glasses, and the financial sustainability of this intervention is uncertain in many settings.

The strengths of the current study include the fact that it covered all schools in 3 townships. This area has more than 90% school attendance, and the sample thus was likely to have been representative of the local population. The intervention was practical to carry out on a large scale at modest cost, was timed to suit local purchasing patterns during school vacations, and was based on detailed pilot studies in the area. The power to have detected even a modest difference in the primary outcome between groups was good when determined with a method taking into account the intraclass correlation coefficient within schools. There was reasonably good balance between intervention and control groups at baseline and with regard to follow-up rates.

The shortcomings of the study must also be acknowledged. In addition to the limitations imposed as described previously by financial constraints and the uncertain applicability of these results to other settings and intervention types, the randomization by school may have somewhat increased the possibility of unmeasured confounders affecting the results. Although the clustering imposed by this approach was adjusted for, socioeconomic or other differences might have existed between the relatively small number of schools (10 in each treatment group). The likelihood of this is somewhat reduced by the fact that the results remained unchanged even when schools with the highest and lowest rates of spectacle purchase were removed from the analysis. Nonetheless, future school-based trials in this setting may want to consider randomization by class as a practical alternative to reduce undesirable effects of inter-school differences.

The main outcome measure was dependent on children’s self-report of having purchased spectacles, although actual spectacle use was verified by examination. The relatively long and variable follow-up time required to give families the chance to purchase spectacles during school vacations does raise the possibility of recall bias among children regarding purchase. There was substantial variation in follow-up time between schools because of the need to accommodate examination periods and shorter holidays. Although the attempt was made to minimize the potential impact by adjusting for follow-up time, an effect likely biasing toward a null result cannot be excluded. Although the educational intervention was carried out by trained, local, native-speaking health professionals, it is possible that persons with more extensive training in carrying out educational interventions might have had greater success in promoting the desired behavior changes. The sustainability of such an approach in this rural setting is uncertain, however. An additional methodologic limitation is the use of Snellen rather than logarithm of the minimum angle of resolution vision charts, and a protocol for vision measure-
ment that does not conform exactly with the World Health Organization guideline that 4 to 5 letters of 6 on a line should be identified correctly before the line is considered to have been seen. This likely would have led to overestimation of children’s vision because of their having had a 1 in 4 chance of correctly guessing the orientation of each letter.

The high prevalence of uncorrected refractive error at baseline (>35%), failure to increase the low rate of uptake of services with the tested intervention, and the significant residual vision disability among those not obtaining recommended spectacles all suggest the need to develop and test other strategies to promote spectacle wear in rural China.

References