

# Teacher-to-parent communication and vision care-seeking behaviour among primary school students

K Du, J Huang, H Guan \*, J Zhao, Y Zhang, Y Shi

## ABSTRACT

**Introduction:** To determine the associations between teacher-to-parent communication and vision care-seeking behaviour among students.

**Methods:** This cross-sectional study included 19934 students from 252 primary schools in two prefectures in western China. Information regarding the sampled students was collected through questionnaires and vision examinations. Eligible students with uncorrected refractive error were allocated to four groups according to whether and how parents were informed about vision problems in their children: uninformed, informed by only teachers or only students, or informed by both. The relationship between teacher-to-parent communication and vision care-seeking behaviour was analysed by multiple logistic regression.

**Results:** Among valid responses (n=2922) analysed, 42.3% (n=1235) of parents were not informed about vision problems in their children. Teacher-to-parent communication enabled 35.9% (n=1050) of parents to learn about vision problems in their children. When only teachers informed parents, the odds of students having refraction examinations (odds ratio [OR]=1.499; P=0.002) and spectacles ownership (OR=1.755; P=0.002) were significantly higher than for students in the uninformed group. When both

students and teachers informed parents, the odds of students having refraction examinations (OR=5.565; P<0.001) and spectacles ownership (OR=7.935; P<0.001) were highest.

**Conclusions:** Knowledge of vision problems is an essential step in vision care for students. Teacher-to-parent communication concerning vision problems is positively associated with the rate of vision care-seeking behaviour. Teacher-to-parent communication provides an important route for parents to learn about vision problems in their children.

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### New knowledge added by this study

- Knowledge of vision problems is an essential step in vision care for students. More than 40% of parents were not informed by students or teachers about vision problems in their children.
- Teacher-to-parent communication is significantly associated with students having refraction examination and spectacles ownership.
- Teacher-to-parent communication provides an important method for parents to learn about vision problems in their children; it also reinforces the effects of students informing their parents.

### Implications for clinical practice or policy

- Policymakers should carefully consider the role of teachers in vision care for students; teacher-to-parent communication is a cost-effective way to enhance vision care-seeking behaviour among students.
- Teachers should participate in vision care for students, at least in the form of communication with parents.

## Introduction

Uncorrected refractive error is the leading cause of visual impairment among children worldwide; it affects nearly 13 million children under the age of 16 years, half of whom live in China.<sup>1</sup> Uncorrected refractive error can lead to various broader issues

if not treated in a timely manner.<sup>2</sup> Uncorrected refractive error in school-aged children reportedly has negative effects on academic performance,<sup>3</sup> physical and mental health, and quality of life.<sup>4</sup> Fortunately, over 80% of refractive error can be easily and safely corrected by accurately prescribed

spectacles.<sup>5</sup> However, the correction rate in rural areas in China is very low.<sup>6</sup> A study in 2014 revealed that in rural China, as few as one in six children needing spectacles actually wears them.<sup>7</sup>

The lack of vision problem awareness at the family level is an important contributing factor in the low rate of refractive correction in rural areas.<sup>8</sup> There are two main ways for parents to learn about vision problems in their children: from the children themselves and from their teachers. Information conveyed by a teacher is more likely to receive parental attention and cause parents to take action.<sup>9</sup> Teacher-to-parent communication (TPC) allows parents and teachers to exchange information, strengthen feelings of mutual obligation and trust, and coordinate efforts to help students thrive in terms of mental health, school engagement, and school performance.<sup>10,11</sup>

However, the relationship between TPC and vision care-seeking behaviour among students is not well-investigated, particularly in more realistic settings. Researchers have indicated that teachers have an important role in vision care for students. Chinese rural teachers can perform vision screening accurately for students with only moderate training.<sup>12</sup> Teachers can help to improve the uptake of spectacles and the use of spectacles among students who participate in free spectacles distribution programmes.<sup>13</sup> Considering the potentially important role of teachers in vision care for students, further analyses are needed regarding the interactions between TPC and vision care-seeking behaviour among students.

In this study, our overall goal was to identify the associations between TPC and vision care-seeking behaviour among students. Specifically, when teachers informed students' parents that their children could not see the blackboard clearly, we assessed whether the information sharing interacted with vision care-seeking behaviour among students, including refraction examinations and spectacles ownership. To meet this goal, we had three specific objectives. First, we documented the rates of vision care-seeking behaviour in four groups, according to whether and how the parents were informed about vision problems in their children. Second, we explored the relationship between TPC and refraction examination history. Third, we investigated the association between spectacles ownership and TPC.

## Methods

### Setting

The data analysed in this study were collected in two adjacent provinces (Gansu and Shaanxi) of western China in September 2012. In each of the provinces, one prefecture that is of the province was chosen for

## 在小學生中家校溝通與視力保健尋求行為

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引言：確定在學生中家校溝通與視力保健尋求行為之間的關聯。

方法：這項橫斷面研究包括來自中國西部兩個州的252所小學共19934名學生。通過問卷調查和視力檢查收集有關抽樣學生的信息。根據父母是否以及如何告知其孩子的視力問題，將符合條件的未矯正屈光不正學生分為四組：未知情、僅由教師或僅由學生告知，或兩者告知。採用多元邏輯迴歸分析家校溝通與視力保健尋求行為之間的關係。

結果：在分析的有效回答（n=2922）中，42.3%（n=1235）的父母沒有被告知他們孩子的視力問題。家校溝通讓35.9%（n=1050）的家長了解孩子的視力問題。當只有教師通知家長時，學生進行驗光檢查的機率（優勢比=1.499；P=0.002）和擁有眼鏡的機率（優勢比=1.755；P=0.002）顯著高於未知情組的學生。當學生和老師都通知家長時，學生接受驗光檢查的機率（優勢比=5.565；P<0.001）和擁有眼鏡的機率（優勢比=7.935；P<0.001）最高。

結論：了解視力問題是學生視力保健的重要步驟。家校有關視力問題的溝通與視力保健尋求行為的比率呈正相關。家校溝通對家長了解孩子的視力問題提供重要途徑。

this study: Tianshui prefecture in Gansu and Yulin prefecture in Shaanxi. For sample selection, we obtained a list of all rural primary schools in each prefecture. We randomly selected 252 townships, then randomly selected one school per township for inclusion in the study. Within each school, one class was randomly chosen in each of the fourth and fifth grades. This cross-sectional study was approved by Stanford University (No. ISRCTN03252665, registration site: <http://isrctn.org>).

### Data collection

The data collected in this study included three parts: a standardised maths test, questionnaires, and a vision screening. The standardised maths test was timed (25 min) and proctored by two study enumerators at each school. Mathematics testing was conducted to reduce the effect of home learning on performance; this facilitated greater focus on classroom learning.<sup>7</sup> We standardised the baseline maths score, such that the mean score was 0 and the standard deviation was 1.

Questionnaires were used to collect data from students, including grade, gender, boarding status, the main caregivers, parental education, and siblings. A parental questionnaire asked whether any family members wore spectacles and whether the parents thought spectacles were useful. Family wealth was calculated by summing the values, as reported in the China Rural Household Survey Yearbook,<sup>14</sup> of the items on the list of 13 durable consumer goods owned by the family. A parental questionnaire asked about ownership of 13 selected items as an index of

family wealth. The distance from the school to the county seat was approximated using Google Maps (Google LLC, Mountain View [CA], United States).

Vision care-seeking behaviour was measured via self-reporting on the questionnaires administered to students; it included refraction examination history (defined as undergoing a refraction examination in a professional institution before the day of questionnaire administration) and spectacle ownership (defined as the possession of spectacles before the day of questionnaire administration). To reduce the measurement error, we also asked these two questions to each student's parents. Individuals with inconsistent answers were excluded from the study.

Teacher-to-parent communication was measured by asking parents whether they had been informed by teachers that their children could not see the blackboard clearly. Students were also asked whether they had informed their parents about their vision problems. Based on the responses to these

two questions, we allocated all students with vision problems into four groups: neither teachers nor students informed parents (uninformed group), only students informed parents, only teachers informed parents, and both teachers and students informed parents (Fig).

### Visual acuity assessment and refraction

After completion of the maths test and questionnaires, a two-part eye examination was administered to students by a team of qualified optometrists who followed a prescribed protocol to ensure standardisation and quality.

First, visual acuity screenings were administered using Early Treatment Diabetic Retinopathy Study eye charts, which are regarded as the worldwide standard for accurate visual acuity measurement.<sup>15</sup> Visual acuity values, measured by the Early Treatment Diabetic Retinopathy Study eye charts, were transformed into logarithm of the minimum angle of resolution (logMAR) units; logMAR is one

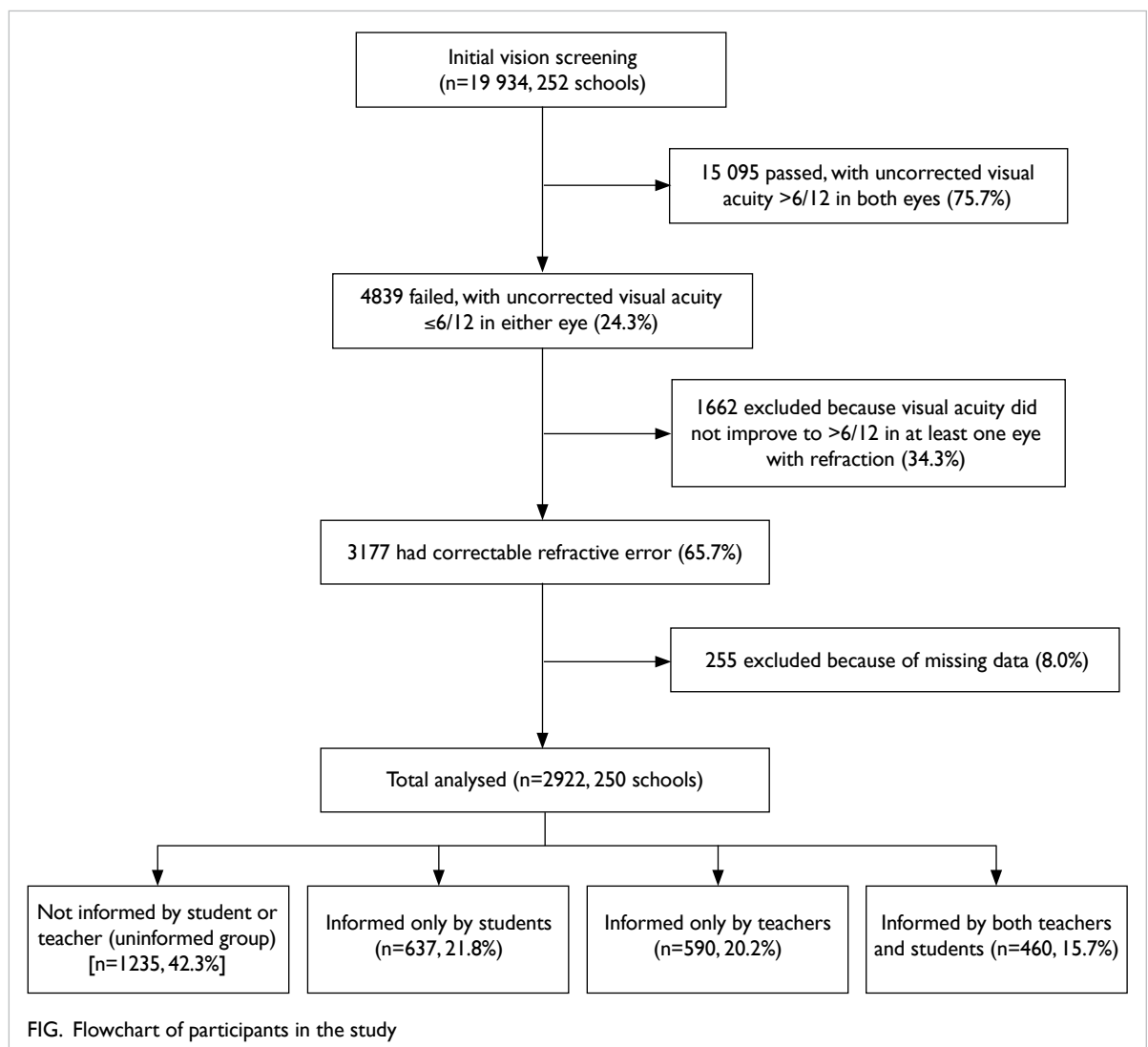


FIG. Flowchart of participants in the study

of the most commonly used continuous scales in the field of ophthalmology/optometry.<sup>3,15</sup> Students who failed the visual acuity screening test (using a visual acuity cut-off of  $\leq 6/12$  in either eye) were enrolled in a second vision test.

The second vision test was conducted by a team of one optometrist, one nurse, and one staff assistant. Children with uncorrected visual acuity  $\leq 6/12$  in either eye underwent cycloplegia with up to 3 drops each of cyclopentolate 1% and proparacaine hydrochloride 0.5%. To ensure that vision problems among the students could be treated using spectacles, the students were examined via automated refraction (Topcon KR 8900; Topcon, Tokyo, Japan) and subjective refinement by a local optometrist who had previously been trained by experienced optometrists from Zhongshan Ophthalmic Center.

Vision problems in the students could be corrected using spectacles if they met the following criteria: first, an uncorrected (ie, without spectacles) visual acuity of  $\leq 6/12$  in either eye and refractive error within the limits associated with significantly greater improvement in visual acuity upon correction (myopia  $\leq -0.75$  dioptres, hyperopia  $\geq 2.00$  dioptres, or astigmatism [non-spherical refractive error]  $\geq 1.00$  dioptres)<sup>7</sup>; second, visual acuity improvement to  $>6/12$  in both eyes was possible with spectacles.

## Statistical methods

Descriptive statistical analyses were performed to summarise the demographics of the students and to compare the proportions of students who had undergone refraction examination and owned spectacles among four groups by using the Chi squared test and one-way analysis of variance. Refraction examination and spectacle ownership were both regarded as dummy variables that equalled one if the corresponding behaviour had occurred before the study.

Multiple logistic regression was conducted to ascertain the relationship between TPC and vision care-seeking behaviour, including refraction examination history and spectacle ownership. In all regression analyses, the same covariates were controlled. Variables included standardised maths score, grade (grade 5=1), sex (male=1), boarding status (boarding at school=1), logMAR (continuous scale of visual acuity), whether parents are the main caregivers (yes=1), parental education for both mother and father (completed  $\geq 12$  years of education=1), siblings (at least one sibling=1), whether any family members wear spectacles (yes=1), whether parents think spectacles are useful (yes=1), family wealth, and distance from school to the county seat. A P value of  $<0.05$  was regarded as a statistically significant difference. All analyses were performed using Stata 14.1 (Stata Corp, College Station [TX], United States).

## Results

Among 19934 students in 252 schools, 4839 (24.3%) students failed the vision screening. In total, 3177 (65.7%) students in 250 schools were eligible for spectacles to improve visual acuity (two schools were excluded because no students at either school met the inclusion criteria). After the exclusion of students with missing information, the remaining 2922 students were divided into four subgroups. In our study, 42.3% (n=1235) of parents were not informed by either their children or their children's teachers. Teacher-to-parent communication enabled 35.9% (n=1050) of parents to learn about vision problems in their children. In total, 20.2% (n=590) parents were informed only by teachers and 15.7% (n=460) were informed by both teachers and students, respectively (Fig).

The mean ( $\pm$  standard deviation) age of all students with vision problems was  $10.51 \pm 1.10$  years (range, 8-15). Among all respondents, 1418 (48.5%) were boys and 1504 (51.5%) were girls. Most students' main caregivers were their parents (86.4%). Other participants' characteristics are shown in Table 1, including the comparison of characteristics among the four groups.

The rate of vision care-seeking behaviour among all students was very low. The number of students who received vision care services decreased gradually at each step. In all, 57.7% (n=1687) of parents were informed about vision problems in their children; only 32.7% (n=954) of all parents took their children for refraction examinations. Finally, only 19.2% (n=560) of students owned spectacles before the study (Table 2). The rates of vision care-seeking behaviour significantly differed among the four groups. When comparing the rates of refraction examination history and spectacle ownership among three types of informed groups with the uninformed group, we found significant differences ( $P < 0.001$ ) in all comparisons (Table 2). In the uninformed group, comparatively few parents took their children to receive a refraction examination and/or obtained spectacles for their children. In the group where parents were informed only by students, more children had undergone refraction examinations and/or owned spectacles than in the group where parents were informed only by teachers. When both teachers and students informed parents, the rates of refraction examinations and spectacles ownership were highest among the four groups.

In the multiple logistic regression analyses of potential predictors of refraction examination, we found that information sharing (including TPC) was significantly associated with refraction examination history (Table 3). Compared with the uninformed group, the odds of students having a refraction examination was higher in each of the other three groups. When only teachers informed parents, the

TABLE 1. Characteristics of children with correctable refractive error, stratified according to subgroup\* (n=2922 included in subgroup analyses)

| Characteristics                                   | All screened children (n=2922) | Uninformed group (n=1235) | Informed only by students (n=637) | Informed only by teachers (n=590) | Informed by both students and teachers (n=460) | P value‡ |
|---|--------------------------------|---------------------------|-----------------------------------|-----------------------------------|--|----------|
| Age, y  | 10.51 ± 1.10                   | 10.52 ± 1.09              | 10.58 ± 1.09                      | 10.41 ± 1.11                      | 10.54 ± 1.09                                   | 0.041    |
| Standardised maths score                          | 0.24 ± 0.99                    | 0.22 ± 0.98               | 0.20 ± 1.00                       | 0.28 ± 0.96                       | 0.28 ± 1.00                                    | 0.314    |
| Grade 5   | 1790 (61.3%)                   | 747 (60.5%)               | 423 (66.4%)                       | 329 (55.8%)                       | 291 (63.3%)                                    | 0.001    |
| Male sex  | 1418 (48.5%)                   | 601 (48.7%)               | 297 (46.6%)                       | 302 (51.2%)                       | 218 (47.4%)                                    | 0.417    |
| Boarding at school                                | 643 (22.0%)                    | 292 (23.6%)               | 119 (18.7%)                       | 134 (22.7%)                       | 98 (21.3%)                                     | 0.096    |
| Visual acuity (logMAR)†                           | 0.63 ± 0.21                    | 0.58 ± 0.19               | 0.69 ± 0.20                       | 0.59 ± 0.21                       | 0.74 ± 0.21                                    | <0.001   |
| Parents are the main caregivers                   | 2525 (86.4%)                   | 1043 (84.5%)              | 555 (87.1%)                       | 527 (89.3%)                       | 400 (87.0%)                                    | 0.034    |
| One or both parents have ≥12 years of education   | 587 (20.1%)                    | 215 (17.4%)               | 131 (20.6%)                       | 121 (20.5%)                       | 120 (26.1%)                                    | 0.001    |
| At least one sibling                              | 1013 (34.7%)                   | 454 (36.8%)               | 236 (37.0%)                       | 190 (32.2%)                       | 133 (28.9%)                                    | 0.006    |
| At least one other family member wears spectacles | 1007 (34.5%)                   | 365 (29.6%)               | 261 (41.0%)                       | 197 (33.4%)                       | 184 (40.0%)                                    | <0.001   |
| Parents think spectacles are useful               | 997 (34.1%)                    | 378 (30.6%)               | 247 (38.8%)                       | 194 (32.9%)                       | 178 (38.7%)                                    | 0.001    |
| Family wealth                                     |                                |                           |                                   |                                   |  | 0.001    |
| Bottom tercile                                    | 744 (25.5%)                    | 331 (26.8%)               | 156 (24.5%)                       | 150 (25.4%)                       | 107 (23.3%)                                    |          |
| Middle tercile                                    | 923 (31.6%)                    | 427 (34.6%)               | 220 (34.5%)                       | 155 (26.3%)                       | 121 (26.3%)                                    |          |
| Top tercile                                       | 1255 (43.0%)                   | 477 (38.6%)               | 261 (41.0%)                       | 285 (48.3%)                       | 232 (50.4%)                                    |          |
| Distance from school to county seat               |                                |                           |                                   |                                   |  | 0.016    |
| Bottom tercile                                    | 766 (26.2%)                    | 323 (26.2%)               | 181 (28.4%)                       | 147 (24.9%)                       | 115 (25.0%)                                    |          |
| Middle tercile                                    | 1026 (35.1%)                   | 445 (36.0%)               | 227 (35.6%)                       | 203 (34.4%)                       | 151 (32.8%)                                    |          |
| Top tercile                                       | 1130 (38.7%)                   | 467 (37.8%)               | 229 (35.9%)                       | 240 (40.7%)                       | 194 (42.2%)                                    |          |

Abbreviations: logMAR = logarithm of the minimum angle of resolution; SD = standard deviation

\* Data are shown as No. (%) or mean ± SD, unless otherwise specified

† An increase of 0.1 in logMAR units indicates a one-line decrease on the vision chart used in this study; a higher logMAR value is indicative of worse vision

‡ Difference in characteristics among the four groups compared via one-way analysis of variance

TABLE 2. Vision care-seeking behaviours among subgroups of children with correctable refractive error (n=2922)

|  | Refraction examination* | P value | Spectacles ownership* | P value |
|--|-------------------------|---------|-----------------------|---------|
| Uninformed group (n=1235)                      | 224 (18.1%)             | -       | 81 (6.6%)             | -       |
| Informed only by students (n=637)              | 282 (44.3%)             | <0.001† | 193 (30.3%)           | <0.001† |
| Informed only by teachers (n=590)              | 159 (27.0%)             | <0.001† | 73 (12.4%)            | <0.001† |
| Informed by both teachers and students (n=460) | 289 (62.8%)             | <0.001† | 213 (46.3%)           | <0.001† |
| Total (n=2922)                                 | 954 (32.7%)             | <0.001‡ | 560 (19.2%)           | <0.001‡ |

\* Data are shown as No. (%) of students in the group who had engaged in this behaviour before this study

† P values were derived from the Chi squared test comparing each of the three informed groups with the uninformed group

‡ P values were derived from one-way analysis of variance among the four groups

odds ratio (OR) was 1.499, which was lower than in the group where only students informed parents (OR=2.839). When both students and teachers informed parents, the odds of students having a refraction examination was highest (OR=5.565). Additionally, the following characteristics were significantly positively associated with refraction

examination history: receiving a better maths score (P=0.031), being male (P=0.015), having a worse visual ability (P<0.001), having at least one other family member who wears spectacles (P<0.001), being in the top wealth tercile (P<0.018), and having parents who think that spectacles are useful (P<0.001) [Table 3].



TABLE 3. Multiple logistic regression analyses of potential predictors of refraction examination (n=2922)

| Variables   | Coefficient | Standard error | P value | Odds ratio (95% confidence interval) |
|---|-------------|----------------|---------|--------------------------------------|
| Informed group (uninformed group as reference)                    |             |                |         |                                      |
| Informed only by students   | 1.043       | 0.333          | <0.001  | 2.839 (2.256-3.572)                  |
| Informed only by teachers   | 0.405       | 0.192          | 0.002   | 1.499 (1.167-1.926)                  |
| Informed by teachers and students                                 | 1.717       | 0.723          | <0.001  | 5.565 (4.314-7.180)                  |
| Standardised maths score  | 0.102       | 0.052          | 0.031   | 1.108 (1.010-1.215)                  |
| Grade 5 (1=yes)   | 0.058       | 0.099          | 0.532   | 1.060 (0.883-1.272)                  |
| Male sex (1=yes)  | 0.220       | 0.113          | 0.015   | 1.246 (1.043-1.489)                  |
| Boarding at school (1=yes)  | -0.076      | 0.114          | 0.535   | 0.926 (0.728-1.180)                  |
| Visual acuity (logMAR)  | 2.043       | 1.742          | <0.001  | 7.716 (4.957-12.010)                 |
| Parents are the main caregivers (1=yes)                           | 0.229       | 0.169          | 0.088   | 1.257 (0.966-1.637)                  |
| One or both parents have ≥12 years of education (1=yes)           | 0.204       | 0.136          | 0.067   | 1.227 (0.986-1.525)                  |
| At least one sibling (1=yes)                                      | -0.266      | 0.078          | 0.009   | 0.766 (0.627-0.936)                  |
| At least one other family member wears spectacles (1=yes)         | 0.368       | 0.137          | <0.001  | 1.445 (1.199-1.741)                  |
| Parents think spectacles are useful (1=yes)                       | 0.349       | 0.130          | <0.001  | 1.418 (1.185-1.697)                  |
| Family wealth (bottom tercile as reference)                       |             |                |         |                                      |
| Middle tercile  | 0.010       | 0.125          | 0.937   | 1.009 (0.793-1.286)                  |
| Top tercile   | 0.286       | 0.160          | 0.018   | 1.330 (1.051-1.685)                  |
| Distance from school to county seat (bottom tercile as reference) |             |                |         |                                      |
| Middle tercile  | -0.327      | 0.089          | 0.008   | 0.721 (0.567-0.918)                  |
| Top tercile   | -0.233      | 0.102          | 0.070   | 0.792 (0.615-1.019)                  |

Abbreviation: logMAR = logarithm of the minimum angle of resolution

Multiple logistic regression analyses were used to estimate the relationship between TPC and spectacles ownership (Table 4). Teacher-to-parent communication was significantly positively associated with spectacles ownership, regardless of whether students informed parents about their vision problems. The odds of students having spectacles ownership in the group where parents were informed by both teachers and students (OR=7.935) was almost 1.8 times that in the group where parents were informed only by students (OR=4.413). The odds of students having spectacles ownership in the group where parents were informed by students only was twice that in the group where parents were informed only by teachers (OR=1.755). Furthermore, the following characteristics were significantly positively associated with spectacles ownership: having worse visual acuity (P<0.001), having parents as the main caregivers (P<0.017), having at least one other family member who wears spectacles (P<0.001), and having parents who think spectacles are useful (P<0.001). Notably, students with at least one sibling (P=0.003) were more unlikely to purchase spectacles (Table 4).

## Discussion

### Factors affecting vision care-seeking behaviour

In this study, we found that the rate of vision care-seeking behaviour was very low in our sample area, similar to previous results.<sup>16,17</sup> There are two possible reasons for the low vision care-seeking behaviour rate. First, parents may not know that their children cannot see the blackboard clearly; thus, they will not actively seek vision care services. Second, the number of students receiving vision care services has been decreasing throughout the process of three stages: parental knowledge that their children have vision problems, parental action to ensure their children undergo refraction examinations, and parental acquisition of spectacles for their children. Furthermore, despite sufficient information, many parents do not seek vision care services because of misinformation or misunderstanding.<sup>18,19</sup>

Knowledge of vision problems is the initial aspect of the vision care-seeking process for students. The rates of refraction examination history

TABLE 4. Multiple logistic regression analyses of potential predictors of spectacles ownership (n=2922)

| Variables   | Coefficient | Standard error | P value | Odds ratio (95% confidence interval) |
|---|-------------|----------------|---------|--------------------------------------|
| Informed group (uninformed group as reference)                    |             |                |         |                                      |
| Informed only by students   | 1.485       | 0.697          | <0.001  | 4.413 (3.238-6.015)                  |
| Informed only by teachers   | 0.563       | 0.324          | 0.002   | 1.755 (1.222-2.521)                  |
| Informed by teachers and students                                 | 2.071       | 1.322          | <0.001  | 7.935 (5.724-10.999)                 |
| Standardised maths score  | 0.095       | 0.067          | 0.122   | 1.099 (0.975-1.240)                  |
| Grade 5 (1=yes)   | 0.119       | 0.134          | 0.318   | 1.126 (0.892-1.422)                  |
| Male sex (1=yes)  | 0.087       | 0.125          | 0.450   | 1.090 (0.871-1.365)                  |
| Boarding at school (1=yes)  | 0.067       | 0.167          | 0.668   | 1.069 (0.787-1.454)                  |
| Visual acuity (logMAR)  | 3.981       | 16.754         | <0.001  | 53.550 (29.003-98.871)               |
| Parents are the main caregivers (1=yes)                           | 0.420       | 0.267          | 0.017   | 1.522 (1.079-2.147)                  |
| One or both parents have ≥12 years of education (1=yes)           | 0.072       | 0.149          | 0.603   | 1.075 (0.819-1.411)                  |
| At least one sibling (1=yes)                                      | -0.392      | 0.089          | 0.003   | 0.676 (0.522-0.874)                  |
| At least one other family member wears spectacles (1=yes)         | 0.717       | 0.246          | <0.001  | 2.049 (1.618-2.593)                  |
| Parents think spectacles are useful (1=yes)                       | 0.784       | 0.253          | <0.001  | 2.191 (1.746-2.748)                  |
| Family wealth (bottom tercile as reference)                       |             |                |         |                                      |
| Middle tercile  | 0.010       | 0.160          | 0.948   | 1.010 (0.740-1.379)                  |
| Top tercile   | 0.229       | 0.199          | 0.148   | 1.258 (0.922-1.716)                  |
| Distance from school to county seat (bottom tercile as reference) |             |                |         |                                      |
| Middle tercile  | -0.189      | 0.125          | 0.213   | 0.828 (0.615-1.115)                  |
| Top tercile   | -0.245      | 0.124          | 0.122   | 0.783 (0.573-1.068)                  |

Abbreviation: logMAR = logarithm of the minimum angle of resolution

(18.1%) and spectacles ownership (6.6%) were the lowest in the uninformed group, which comprised more than 40% of parents in this study. When parents were informed by students and/or teachers, the rate of vision care-seeking behaviour was much higher. Teacher-to-parent communication provides an important method for parents to learn about vision problems in their children. In this study, 20.2% of parents learned about their children’s vision problems only from teachers.

**Effects of teacher-to-parent communication on vision care-seeking behaviour**

Although a considerable proportion of students did not receive vision care in the care-seeking process, TPC can reduce this to some extent. When both teachers and students informed parents, the rate of spectacles ownership was the highest. In the group that parents were informed by both teachers and students, 46% of students finally received spectacles, which is 7-times more students than in the group in which parents were not informed. Furthermore, the odds of students having refraction examination and spectacles ownership were higher in the group where parents were informed only by students than

in the group where parents were informed only by teachers. These additional opportunities may increase the likelihood that parents act to correct those vision problems.

There are two possible explanations for the positive association between TPC and vision care-seeking behaviours among students in this study. Teacher-to-parent communication provides an important channel for parents to learn about the vision problems in their children, which is a starting point and key aspect of vision care for students. Second, TPC reinforces the effects of students informing their parents. Compared with the group where parents were informed only by students, the rates of refraction examinations and spectacles ownership were nearly twofold greater in the group where parents were informed by both students and teachers. This was presumably because parents learned about vision problems in their children from two sources; the information from the students was reinforced by the information from the teacher.<sup>20</sup>

**Implications of promoting teacher-to-parent communication**

Small efforts by teachers may have great benefits

in terms of vision care for students. Compared with intervention programmes to increase the correction rate,<sup>7,21</sup> the results of present study indicate that TPC is both easy and cost-effective. Teachers should inform parents that their children cannot see the blackboard clearly. Studies of free spectacles distribution programmes have also shown that teachers can improve spectacles usage rates among students who have received spectacles.<sup>13,22</sup> Moreover, wearing spectacles can improve academic performance,<sup>7,21</sup> implying that TPC may both increase the correction rate and have a positive role in academic performance. Therefore, policymakers should carefully consider the role of teachers in protecting vision among students. Indeed, the Chinese Government has noted that multilateral cooperation (involving teachers, schools, parents, and society in general) should be encouraged to protect vision among students, in an effort to improve health status among young people by 2020.<sup>23</sup>

Unfortunately, the TPC ratio is very low. A recent study in China noted that approximately half of the parents and teachers communicate, in any form, during the course of an entire school year.<sup>24</sup> In our study, the proportion of parents who were informed by teachers was only approximately 36%, including parents informed only by teachers (20%) and parents informed by both teachers and students (16%). This is presumably because teachers do not know a particular student's vision status because it is not a vital consideration for most education work. Vision screening is the best method to detect vision problems.<sup>25</sup> The education bureau and the health bureau should conduct routine vision screenings and encourage teachers to engage in vision protection (eg, communicate with parents about vision problems in students).<sup>5,25</sup> If those stakeholders began to take action, more parents will learn about vision problems in their children and seek vision care services.

### Effects of students' informing on vision care-seeking behaviour

In the present study, the effects of students informing parents were greater than the effects of teachers informing parents when only one party informs the parents of vision problems. This finding implies that parents were more likely to act when they received information from students. However, students are often unaware of vision problems. Thus, teachers have an important effect; a previous survey reported that teachers were most likely to perceive visual impairment in children (70.6%), followed by the children's parents (18.9%) and by the children themselves (7.9%).<sup>26</sup> Therefore, careful attention is needed concerning the role of teachers in identifying vision problems, encouraging communication between students and their parents about such problems.

### Limitations

There were three important limitations in this study. First, the study could not investigate any causal link between TPC and vision care-seeking behaviour because of the cross-sectional design. However, the findings provide a foundation for follow-up analyses of causality. Second, this study only focused on whether teachers informed parents about vision problems in their children; it did not collect information concerning how parents were informed. Teacher-to-parent communication may happen in many ways, particularly in the internet era (eg, teachers communicate with parents via instant messenger). Additional research is needed to determine the types of TPC that are most effective in vision care for students. Third, the participants in this study were recruited from two provinces in rural north-western China, which limits the external validity of the findings. Despite this limitation, in the context of widespread uncorrected vision impairment among students,<sup>27</sup> our study still has important implications for improving the uptake rate of vision care services.

### Conclusions

Teacher-to-parent communication can significantly enhance the rates of refractive examinations and spectacles uptake through direct and indirect ways. Not only teacher informing provides a new channel for parents to learn about their students' vision problems, but also reinforce the information told by students. Teacher-to-parent communication is an easy and cost-effective way to improve the rate of vision care-seeking behaviour. Policymakers should encourage teachers to be more involved in students' vision protection, such as motivating teachers to communicate timely with parents about the students' vision status.

### Author contributions

Concept or design: K Du, J Huang.  
 Acquisition of data: H Guan, Y Shi.  
 Analysis or interpretation of data: All authors.  
 Drafting of the manuscript: K Du.  
 Critical revision of the manuscript for important intellectual content: All authors.

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

### Conflicts of interest

All authors have no conflicts of interest to disclose.

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### Ethics approval

This study was approved by Stanford University (No. ISRCTN03252665). Permission was received from local boards of education in each region and the principals of all schools. The presented data are anonymised, and the risk of identification is low. The principles of the Declaration of Helsinki were followed throughout.

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