Impact of Free Glasses and a Teacher Incentive on Children's Use of Eyeglasses: A Cluster-Randomized Controlled Trial

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• PURPOSE: To study the effect of free glasses combined with teacher incentives on in-school glasses wear among Chinese urban migrant children.

• DESIGN: Cluster-randomized controlled trial.

• METHODS: Children with visual acuity (VA) ≤6/12 in either eye owing to refractive error in 94 randomly chosen primary schools underwent randomization by school to receive free glasses, education on their use, and a teacher incentive (Intervention), or glasses prescriptions only (Control). Intervention group teachers received a tablet computer if ≥80% of children given glasses wore them during unannounced visits 6 weeks and 6 months (main outcome) after intervention.

• RESULTS: Among 4376 children, 728 (16.7%, mean age 10.9 years, 51.0% boys) met enrollment criteria and were randomly allocated, 358 (49.2%, 47 schools) to Intervention and 370 (50.8%, 47 schools) to Control. Among these, 693 children (95.2%) completed the study and underwent analysis. Spectacle wear was significantly higher at 6 months among Intervention children (Observed [main outcome]: 68.3% vs 23.9%, adjusted odds ratio [OR] = 11.5, 95% confidence interval [CI] 5.91–22.5, *P* < .001; Self-reported: 90.6% vs 32.1%, OR = 43.7, 95% CI = 21.7–88.5, *P* < .001). Other predictors of observed wear at 6 months included baseline spectacle wear (*P* < .001), uncorrected VA <6/18 (*P* = .01), and parental spectacle wear (*P* = .02). The 6-month observed wear rate was only 41% among similar-aged children provided free glasses in our previous trial without teacher incentives.

• CONCLUSIONS: Free spectacles and teacher incentives maintain classroom wear in the large majority of children needing glasses over a school year. Low wear among Control children demonstrates the need for interventions. **(Am J Ophthalmol 2015;160(5): 889–896.**

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UNCORRECTED REFRACTIVE ERROR IS THE LEADING cause of visual disability among children worldwide, affecting nearly 13 million under the age of 16 years, among whom nearly half live in China.[1] If not treated, refractive error is associated with loss of visual function[2] and reduced educational performance in children.[3] Though refractive error can be safely[4] and inexpensively managed with glasses, as few as 1 in 6 children needing spectacles have them in rural parts of the developing world.[3]

Spectacle distribution programs for children can lead to normalization of visual function[5] and trial-proven, significant improvements in educational outcomes.[3] However, programs in China,[3] Mexico,[6] and Africa [7] have reported poor compliance with free spectacles, with rates of observed, short-term wear at unannounced visits ranging from 13% to 41%. Factors limiting wear of glasses include discomfort or inconvenience,[6,8] concerns over being teased,[6,9] parental opposition,[6,10,11] lack of perceived need,[6,8–10] and fear of damage to the eyes[8–11] (though a trial[4] has now demonstrated that spectacle wear is in fact protective against age-related declines in uncorrected visual acuity among children). Previous randomized trials of specially designed educational interventions promoting spectacle wear aimed at children, teachers, and parents have demonstrated very modest[3] or no[12] impact on observed use of glasses among children at unannounced follow-up visits.

We carried out a cluster-randomized controlled trial among children at predominantly migrant schools in urban eastern China, to determine whether providing free glasses combined with education on their use and a teacher incentive could lead to improvements in observed spectacle wear among children at unannounced visits over the course of a

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school year. Comparison is also made in the current report to rates of observed wear over similar time periods among similar-aged children receiving free spectacles under an identical protocol in a previous published trial,[3] without the use of teacher incentives. Our hypothesis was that the combination of free spectacles and teacher incentives would maintain compliance with classroom spectacle wear, where impact on educational attainment is presumably greatest, in the majority of Incentive group children over the course of a school year.

METHODS

THE PROTOCOL FOR THIS CLUSTER-RANDOMIZED TRIAL was prospectively approved in full by institutional review boards at Stanford University (Palo Alto, California, USA) and the Zhongshan Ophthalmic Center (Guangzhou, China). Permission was received from local boards of education in each setting, and from the principals of all schools, and at least 1 parent provided written informed consent for the participation of each child. The principles of the Declaration of Helsinki were followed throughout. This trial was registered at http://isrctn.org, under the registration number ISRCTN16720066.

• **SETTING:** The study was carried out in Shanghai (the world's largest city, with a total municipal population of 24.2 million in 2012, including 9.6 million migrants)[13] and Suzhou/Wuxi ("twin cities" located near Shanghai, with a combined prefectural population of 17.0 million in 2014, half estimated to be migrants).[14] These cities were selected for having among China's largest populations of migrants, a term defined in this study as including families who did not have a local primary residence (*hukou*), implying reduced access to local public health care and schools. Substantial rural and suburban areas exist within the borders of all of these cities, and migrant populations tend to be clustered in these rural/suburban zones. In these communities migrant children mostly attend schools that are private and unregulated, with little support from the government.[15]

• **SAMPLING AND ELIGIBILITY CRITERIA:** All elementary schools in these cities identified by the local Bureaus of Education as having a primarily migrant population were enumerated and 94 schools were selected at random (66 in Shanghai and 28 in Suzhou/Wuxi). One fifth grade class (children aged 10–12 years) was selected at random in each school, and questionnaires (see below) were administered and visual acuity testing and refraction (see below) carried out. All children in the selected classes meeting both the following visual and refractive criteria were eligible: uncorrected visual acuity ≤6/12 in either eye; refractive error meeting cutoffs shown to be associated with significantly greater improvement in visual acuity when corrected[16]: myopia ≤−0.75 diopters (D), hyperopia ≥+2.00 D, or astigmatism (nonspherical refractive error) ≥1.00 D.

• **QUESTIONNAIRES:** At baseline (September 2013, beginning of the school year), enumerators administered questionnaires to children concerning their age, their sex, urban vs rural residence, whether they were an only child, glasses wear, belief that wearing glasses harms vision (a common misapprehension in China),[8,10] family migrant status, and parental glasses wear, education, and place of residence/work (local vs elsewhere). A study-specific mathematics test was administered as an index of academic achievement. Teachers were asked to state whether the blackboard (potentially not clearly seen by myopic children and so a possible driver of glasses use) was used for all, most, about half, little, or none of teaching. A parental questionnaire asked about ownership of 14 selected items as an index of family wealth. Children were told to bring their spectacles on the day of the baseline examination, and baseline spectacle use was defined as being able to produce glasses at school.

• **VISUAL ACUITY ASSESSMENT:** Children underwent baseline visual acuity screening at school by a nurse and trained assistant. Visual acuity was tested separately for each eye without refraction at 4 meters using an Early Treatment Diabetic Retinopathy Study[17] chart (Precision Vision, La Salle, Illinois, USA) in a well-lighted, indoor area. If the orientation of at least 4 of 5 optotypes on the 6/60 line was correctly identified, children were examined on the 6/30 line, on the 6/15 line, and then line by line to 6/3. Visual acuity for an eye was defined as the lowest line on which 4 of 5 optotypes were read correctly. If the top line could not be read at 4 meters, the subject was tested as above at 1 meter, and the measured visual acuity was divided by 4.

• **REFRACTION:** Children with uncorrected visual acuity ≤6/12 in either eye underwent cycloplegia with up to 3 drops each of cyclopentolate 1% and proparacaine hydrochloride 0.5%. Children then underwent automated refraction (Topcon KR 8900; Topcon, Tokyo, Japan) with subjective refinement by a local optometrist, previously trained by experienced optometrists from Zhongshan Ophthalmic Center.

• **RANDOMIZATION AND INTERVENTIONS:** This was a cluster-randomized, controlled trial, with schools as the clusters (Figure). The trial was originally designed to include 150 schools and to include 3 treatment arms (control, free glasses, and free glasses combined with teacher incentive). However, in view of lower-than-expected enrollment and our having recently completed a large trial[3] providing glasses only to similar-aged children, the glasses-only arm was dropped. In October 2013, after the baseline

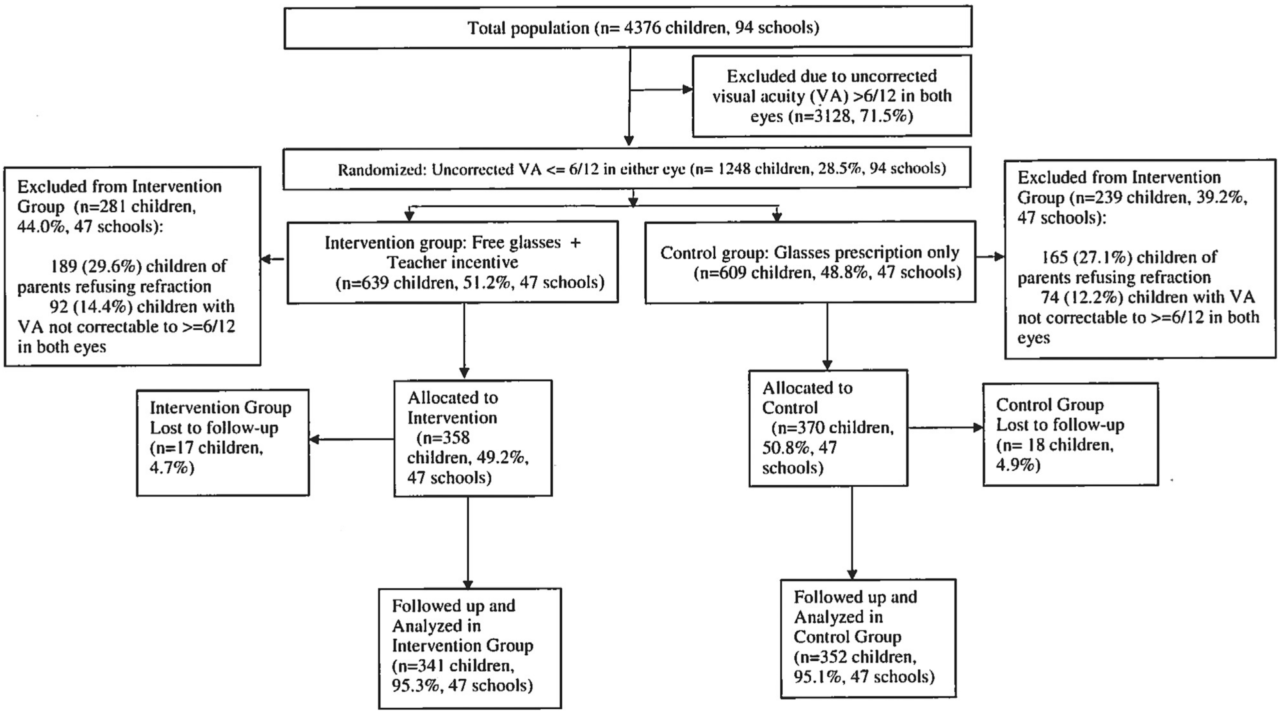

FIGURE. Flowchart for enrollment and allocation of children with refractive error in a randomized trial of free glasses and teacher incentives to promote spectacle wear.

survey and vision screening but prior to refraction, eligible children were randomized by school to receive 1 of 2 interventions:

- Free spectacles based on the child's measured refractive power dispensed at school by the study optometrist. A letter informing the parents about the free glasses program and including the child's prescription was sent to parents, and a previously described[3] educational intervention directed at teachers and children and promoting spectacle wear was carried out. Additionally, teachers (but not children) in eligible classes were informed that if ≥80% of children given glasses were wearing them at the time of 2 unannounced class visits, the teacher would receive a tablet computer (approximate value US$350; approximate monthly teacher income US$450). This offer was made to Chinese, mathematics, and English teachers (the main academic subjects in Chinese primary schools) (Intervention group, 47 schools); or
- A glasses prescription and letter to the parents informing them of the refractive status of their child, with free glasses provided only at the conclusion of the trial, though this was not previously announced. No teacher incentive was offered. (Control group, 47 schools).

Randomization was carried out at a central location (Stanford University, Stanford, California, USA) using R software (R Foundation for Statistical Computing, Vienna, Austria). Participants (students, parents, and teachers) and enumerators were not informed of either the overall design of the study or the explicit treatment arm assignment.

• **EDUCATIONAL INTERVENTION:** The educational intervention has been described elsewhere in detail.[3] Children at Intervention group schools watched a video and were given cartoon-based pamphlets and a classroom presentation showing children experiencing the benefits of glasses and teachers explaining that glasses do not harm vision. Teachers viewed a presentation at school on the safety and benefits of glasses, accompanied by a brochure with similar information, and posters with similar content were hung in classrooms.

• **OUTCOME ASSESSMENT: GLASSES WEAR:** Trained assessment teams consisting of 2 persons each returned unannounced to each school at 6 weeks and 6 months after distribution of glasses and prescriptions. At these visits, spectacle wear was assessed through unannounced direct examination. The main study outcome was observed wear (that is, glasses actually present on the child's face) at 6 months, and the secondary outcome was self-reported wear at 6 months, assessed on the same occasion. After completing the unannounced direct examination, enumerators also asked sampled children in each school to describe their own spectacle wear (secondary outcome) as "always," "only for studying," or "usually not worn." These study personnel were masked to children's group assignment.

• **SAMPLE SIZE:** Power calculations were performed using Optimal Design software (http://sitemaker.umich.edu/group-based/optimal_design_software) for cluster-randomization and binary outcome (wear vs non-wear). Based on our earlier trials in similar-aged children,[3] we assumed an estimated rate of wear of 30% in the Control and 70% in the Intervention group, and a 20% prevalence of myopia. We determined that 90 schools (45 per group) with 1 class per school (an average of 50 children, with 10 expected to have myopia) would provide 90% power to detect the expected difference between groups with an alpha error of 0.05, intraclass correlation of 0.15.

• **STATISTICAL METHODS:** We standardized baseline math score to give a mean of 0 and standard deviation (SD) of 1. Baseline wear of glasses was defined as being able to produce glasses at school, having been told the day before to bring them, whereas a positive self-report of wear at follow-up was defined as wearing glasses "Always" or "Only for studying." We calculated family wealth by summing the value, as reported in the China Rural Household Survey Yearbook (Department of Rural Surveys, National Bureau of Statistics of China, 2013), of items on the list of 14 owned by the family. Refractive power was defined throughout as the spherical equivalent, spherical power plus half the cylindrical power.

Subsequent to randomization, a number of children either could not undergo refraction owing to parental refusal of cycloplegia or did not meet our refractive and visual criteria to receive glasses (see above). Thus, our analyses were performed in per-protocol fashion using the vce (cluster) command in Stata 12.0 (StataCorp, College Station, Texas, USA), calculating robust standard errors to adjust for clustering by school.[18] Our analysis took 2 forms. In the primary analysis, we used logistic regression to examine the association between baseline variables and observed wear at unannounced visits 6 weeks and 6 months (main outcome) after provision of spectacles and prescriptions. Second, we used multiple logistic regression to determine whether membership in the Intervention group was associated with observed spectacle wear at 6 weeks and 6 months, adjusting for other baseline factors. These included variables associated with 6 week/6 month wear at $P \leq .20$ (baseline spectacle wear, baseline uncorrected VA, baseline math score, parental education, family migrant status, and parental glasses wear) and those we felt important to adjust for on a theoretical basis (age, sex, rural vs urban residence, status as an only child, belief that wearing glasses harms the vision, family wealth, and blackboard use).

• **MISSING DATA:** To reduce the inefficiency of estimation owing to missing values, we use multiple imputation in Stata to impute data for several data at baseline: rural residence (n = 17), beliefs about the potential harm of wearing glasses (n = 4), baseline glasses wear (n = 1), parental education (n = 10), having both parents working in the area (n = 5), and family wealth (n = 55). We used logistic regression for binary variables and ordered logistic regression for ordinal variables. The independent variables used for imputation included all nonmissing variables listed in Table 1. The multiple imputation approach created 20 copies of the data in which missing values were imputed by chained equations. Final results of multivariate analysis were obtained by averaging these 20 datasets using Rubin's rules,[19] which ensured that the standard errors for all regression coefficients took into account uncertainty in the imputations and in the estimation.

RESULTS

AMONG 4376 CHILDREN IN SELECTED FIFTH GRADE CLASSES in 94 randomly chosen schools, 3128 (71.5%) were excluded on the basis of having uncorrected visual acuity (VA) >6/12 in both eyes. At 94 schools, there were 1248 children (28.5%) with uncorrected VA ≤6/12 in either eye. A total of 47 schools (639 children, 51.2%) were randomized to the Intervention group (free glasses and the teacher incentive) and 47 schools (609 children, 48.8%) were randomized to the Control group (glasses prescriptions and a note to the parents only) (Figure).

A total of 281 children (parents refused refraction, 189/639 = 29.6%; VA not correctable to ≥6/12 in both eyes, 92/639 = 14.4%) were excluded from the Intervention group and 239 (parents refused refraction, 165/609 = 27.1%; VA not correctable to ≥6/12 in both eyes, 74/609 = 12.2%) from the Controls, leaving 358 children (49.2%) at 47 schools allocated to Intervention and 370 children (50.8%) at 47 schools allocated to Control (Figure). Children of families refusing refraction were more likely to be boys ($P = .003$) and had better uncorrected VA ($P = .003$) than children whose families accepted, but their age ($P = .25$) and rates of spectacle wear ($P = .71$) did not differ.

Among the 728 children allocated to the study (mean age [SD] 10.9 [0.9] years, 51.0% boys), children in the Intervention and Control groups did not differ significantly in any individual-level or cluster-level variables at baseline, including baseline glasses use (17.8% in the Control and 17.9% in the Intervention group, Table 1). Among those allocated in the study, 341 children (95.3%) and 352 children (95.1%) followed up at 6 months in the Intervention and Control arms, respectively, and underwent analysis (Figure).

Table 2 shows both directly observed and self-reported glasses use among the treatment groups at the 6-week and

TABLE 1. Baseline Characteristics of 728 Children With Correctable Refractive Error, by Group Assignment

Variable	Control Group (n = 370 at 47 Schools)	Intervention Group (n = 358 at 47 Schools)	*P* Value, Control vs Intervention	Missing Data, Number (%)
Age, y, Mean (SD)	11.0 (1.0)	10.9 (0.9)	.80	0 (0.0)
Male sex (n, %)	191 (51.6)	180 (50.3)	.71	0 (0.0)
Rural residence (n, %)	320 (88.2)	295 (84.8)	.26	17 (2.3)
Only child in family (n, %)	74 (20.0)	70 (19.6)	.91	0 (0.0)
Believes wearing glasses harms vision (n, %)	127 (34.5)	118 (33.1)	.72	4 (0.5)
Wearing glasses at baseline (n, %)[a]	66 (17.8)	64 (17.9)	.98	1 (0.1)
VA <6/18 both eyes (n, %)	164 (44.3)	142 (39.7)	.24	0 (0.0)
Math score, mean, SD	0.1 (1.0)	0.2 (1.0)	.83	0 (0.0)
At least 1 parent with >12 years education (n, %)	112 (30.7)	108 (30.6)	.98	10 (1.4)
Both parents working in the area (n, %)	323 (87.8)	299 (84.2)	.18	5 (0.8)
At least 1 parent wears glasses (n, %)	65 (17.6)	70 (19.6)	.56	1 (0.1)
Family wealth (n, %)			.14	55 (8.0)
Top tercile	101 (29.4)	114 (35.1)		
Middle tercile	120 (35.0)	110 (33.8)		
Bottom tercile	122 (35.6)	101 (31.1)		
Blackboard use (n, %)			.52	0 (0.0)
< Half of teaching	12 (25.5)	16 (34.0)		
Half of teaching	19 (40.4)	16 (34.0)		
> Half of teaching	16 (34.0)	15 (31.9)		

VA = visual acuity.
Values are mean (SD) unless stated otherwise.
[a]Defined as being able to produce glasses at school, having been told the day before to bring them.

TABLE 2. Glasses Use at 6-Week and 6-Month Follow-up in Each Group of Children With Refractive Error

	6-Week Follow-up (N = 715)	6-Month Follow-up (N = 693)
Directly observed glasses use (primary outcome)		
Control n (%)	60/363 (16.5)	84/352 (23.9)
Intervention n (%)	287/352 (81.5)	233/341 (68.3)
P value comparing Control and Intervention groups[a]	<.001	<.001
Self reported glasses use		
Control n (%)	97/361 (26.9)	106/330 (32.1)
Intervention n (%)	321/350 (91.7)	308/340 (90.6)
P value comparing Control and Intervention groups[a]	<.001	<.001

[a]2-sample *t* test.

6-month follow-ups, all of which were significantly greater ($P < .001$, 2-sample *t* test) in the Intervention group. Observed wear (the primary outcome) was 68.3% (233/341) and 23.9% (84/352) among Intervention and Control children, respectively, at 6 months, while for self-reported wear at 6 months the figures were 90.6% (308/340) and 32.1% (106/330), respectively. A total of 19 of 47 (40.4%) Intervention group schools had spectacle wear rates ≥80% on both follow-up visits, and teachers at these schools received tablet computers. No Control group schools achieved this level of wear at either follow-up.

In regression models of factors potentially affecting observed spectacle wear at 6 months, membership in the Intervention group was highly associated with wear (odds ratio [OR] = 11.5, 95% confidence interval [CI] 5.91–22.5, $P < .001$) (Table 3). Other variables significantly associated with observed wear at 6 months in the multivariate model included baseline glasses wear (OR = 12.2, 95% CI 5.63–26.4, $P < .001$), uncorrected VA <6/18 in both eyes (OR = 1.70, 95% CI 1.14–2.53, $P = .01$), parental glasses wear (OR = 1.90, 95% CI 1.14–3.18, $P = .02$), and both parents working in the area (OR = 1.62, 95% CI 0.93–2.84, $P = .09$). Membership in the Intervention group was the strongest determinant of self-reported wear in logistic regression models at 6 months (OR = 43.7, 95% CI = 21.7–88.5, $P < .001$), with other variables generally consistent with the above results (data not shown).

TABLE 3. Logistic Regression Analysis of Factors Potentially Affecting Observed Wear of Spectacles at 6 Months (Main Study Outcome) Among Children With Refractive Error

	Univariate Analysis (N = 693)			Multivariate Analysis (N = 693)		
Variable	OR	95% Confidence Interval	*P* Value	OR	95% Confidence Interval	*P* Value
Intervention group	6.88[a]	4.09–11.6[a]	<.001[a]	11.5[a]	5.91–22.5[a]	<.001[a]
Age (y)	0.87	0.72–1.05	.16	0.95	0.77–1.18	.64
Male sex	1.04	0.75–1.43	.82	0.92	0.64–1.33	.67
Rural residence	0.67	0.42–1.07	.10	0.88	0.50–1.53	.65
Only child in family	1.36	0.92–2.00	.12	1.02	0.65–1.60	.92
Believes wearing glasses harms vision (n, %)	1.23	0.89–1.69	.21	1.17	0.79–1.73	.44
Wearing glasses at baseline	8.17[a]	4.50–14.9[a]	<.001[a]	12.2[a]	5.63–26.4[a]	<.001[a]
VA <6/18 both eyes	2.08[a]	1.49–2.89[a]	<.001[a]	1.70[a]	1.14–2.53[a]	.01[a]
Math score	1.13	0.92–1.40	.25	1.19	0.95–1.49	.12
At least 1 parent with >12 years education	1.44[a]	1.01–2.04[a]	.04[a]	1.31	0.85–2.00	.22
At least 1 parent wears glasses	1.78[a]	1.15–2.74[a]	<.001[a]	1.90[a]	1.14–3.18[a]	.02[a]
Both parents working in the area	1.16	0.77–1.75	.47	1.62	0.93–2.84	.09
Family wealth (bottom tercile as reference)						
Top tercile	1.15	0.81–1.63	.42	1.08	0.68–1.71	.76
Middle tercile	1.11	0.81–1.52	.53	1.15	0.75–1.77	.53
Blackboard use (less than half of teaching as reference)						
Half of teaching	0.89	0.49–1.62	.71	1.08	0.50–2.32	.85
> Half of teaching	0.95	0.48–1.91	.89	1.02	0.46–2.27	.96

VA = visual acuity.
[a]Variables with a statistically significant association with observed wear at 6 months.

DISCUSSION

WHEREAS PREVIOUS STUDIES OF PROGRAMS PROVIDING free glasses[3,6,7] and educational interventions to promote spectacle wear[3,12] have generally shown low uptake, the current report demonstrated that free glasses combined with education on their use and a teacher incentive maintained wear in between two-thirds and 90% of children needing them over the course of a school year. The impact of the intervention on spectacle wear at 6 months was greater than that of family wealth, parental spectacle wear, and children's uncorrected VA. Our main study outcome, observed wear at the time of an unannounced examination, might be expected to underestimate true daily use of spectacles somewhat. Self-reported wear ("Always" or "For studying") in the Treatment group at 6 months exceeded 90%, 3 times that among the Control group.

Previous trials in Africa[7] and China[3] have demonstrated a near doubling in rates of spectacle wear among children by providing free glasses rather than requiring that spectacles be purchased. However, the published literature suggests that there are important limits to children's compliance with free spectacles.

Studies on this subject have assessed spectacle use over periods of a month to a year, and relied on a variety of outcomes, including self-reported use;[20–22] estimates by parents, teachers, or health professionals;[18] and directly observed wear.[3,6,7,23–25] Observed rates of wear were low, ranging from 13% to 41%.[3,6,7,21,23,24] All of the few studies reporting higher rates (46% by Keay and associates in China,[25] 56% by Vincent and associates in Thai refugee camps,[22] and 58% by von-Bischhoffshaussen and associates in Chile[20]) relied on self-report and/or estimates of teachers or parents,[20,22] and had low (58%–76%) rates of follow-up[20,22] or assessment times as short as 1 month after spectacle distribution.[25]

It would appear that longer-term (over the course of a school year) compliance with free spectacles, as measured by objective indicators such as observed wear at unannounced examinations, is low among children without additional interventions. The highest rate of long-term (6 month) observed compliance identified in our review was 44% in our own previous trial,[3] among the subgroup of children receiving free glasses and an educational intervention promoting their wear (wear was 41% among all children receiving free glasses in the trial). The additional impact of this educational intervention appears to have been modest, however, as children not receiving it had only slightly lower observed wear rates of 37% at 6 months ($P = .04$). An earlier trial of educational interventions promoting spectacle wear in children found no effect.[12] The current trial is the only one of which we are aware in which a substantial majority of children provided free spectacles were observed to wear them over the course of a school year.

The importance of this study lies in the fact that recent trials have established a significant impact of providing spectacles on children's academic outcomes, even in the face of relatively low compliance with wear.[3] Given this, successful interventions to motivate regular use of spectacles in the classroom are of particular interest, and it is hoped that additional gains in children's educational outcomes may be realized with improved adherence. Further underscoring the significance of this work are the high reported prevalence of refractive error among Chinese children[26] and the very low rates of wear observed among Control children in the current study and in other large surveys among disadvantaged pediatric populations in China.[3]

Strengths of the current study include its randomized controlled design, high (>95%) rates of follow-up, and randomly selected cohort from among a social group at risk for both myopia and poor spectacle compliance. These tend to increase confidence in the significance of the results. Limitations must also be acknowledged. Over a quarter of parents (a proportion that did not differ between treatment groups) refused cycloplegic refraction on behalf of their children, a common situation in China when individual parental consent is sought for cycloplegia. Regarding potential impact on the main study outcome, baseline spectacle wear (the most important determinant of wear at 6 months) did not differ between children of families refusing and giving consent, though the former had better uncorrected VA, which was associated with lower rates of wear. Power limitations did not permit us to include a group receiving free spectacles but no teacher incentive, meaning that we could not directly assess the independent impact of the teacher incentive. However, fewer than half of similar-aged children who were provided free spectacles without teacher incentives were wearing them at 6 months under an identical direct observation protocol in our earlier trial,[3] conducted in an area with similar low rates of baseline wear.

All participating children attended majority-migrant schools drawn from 3 nearby eastern Chinese cities, and all of them were at the same grade level in school (fifth grade). The particular respect accorded teachers in Confucian cultures suggests that teacher incentives might be particularly well suited to such societies. For these reasons, application of these results to other settings and age groups must be made with caution. Still, an intervention is of potential value if it can improve spectacle wear in a country where half of the world's children visually disabled by refractive error reside.

For the provision of free glasses and teacher incentives to be a sustainable strategy in China, the government must likely play a substantial role. Our recent trials and the current study provide support for such government action in driving glasses programs, by demonstrating the educational impact[3] and safety[4] of glasses wear among children, together with a practical means to achieve high compliance. Pilot programs demonstrating scalable and sustainable school-based models of glasses distribution based on these trials are now under way with collaboration of local governments in Shaanxi, Gansu, Guangdong, and Yunnan provinces. In these studies, we are examining incentives based on teachers' evaluations, which can impact salary, as a more sustainable alternative to gifts. It is hoped that wider application of these models can reduce the burden of uncorrected refractive error among children in China's rural areas and large urban migrant populations.

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Biosketch

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