

Impact of spectacles wear on uncorrected visual acuity among urban migrant primary school children in China: a cluster-randomised clinical trial

Xinwu Zhang ,¹ Ming Zhou ,¹ Xiaochen Ma,² Hongmei Yi,³ Haiqing Zhang,⁴ Xiuqin Wang,⁵ Ling Jin,⁶ Kovin Naidoo,^{7,8,9} Hasan Minto,⁸ Haidong Zou,¹⁰ Scott Rozelle,¹¹ Nathan Congdon ,^{6,12} Yue Ma ¹¹

For numbered affiliations see end of article.

Correspondence to

Yue Ma, Rural Education Action Program, Freeman Spogli Institute for International Studies, Stanford University, Palo Alto, CA, USA; yma3@stanford.edu

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ABSTRACT

Objective To estimate the effect of providing free spectacles on uncorrected visual acuity (VA) among urban migrant Chinese school children.

Design Exploratory analysis from a parallel cluster-randomised clinical trial.

Methods After baseline survey and VA screening, eligible children were randomised by school to receive one of the two interventions: free glasses and a teacher incentive (tablet computer if $\geq 80\%$ of children given glasses were wearing them on un-announced examination) (treatment group) or glasses prescription and letter to parents (control group). The primary outcome was uncorrected logarithm of the minimal angle of resolution (LogMAR) VA at study closeout, adjusted for baseline uncorrected VA.

Results Among 4376 randomly selected children, 728 (16.6%, mean age 10.9 years, 51.0% boys) at 94 schools failed VA screening and met eligibility criteria. Of these, 358 children (49.2%) at 47 schools were randomised to treatment and 370 children (50.8%) at 47 schools to control. Among these, 679 children (93.3%) completed follow-up and underwent analysis. Spectacle wear in the treatment and control groups was 68.3% and 29.3% ($p < 0.001$), respectively. Uncorrected final VA for eyes of treatment children was significantly better than control children, adjusting only for baseline VA (difference of 0.039 LogMAR units, 95% CI: 0.008, 0.070, equivalent to 0.39 lines, $p = 0.014$) or baseline VA and other baseline factors (0.040 LogMAR units, 95% CI 0.007 to 0.074, equivalent to 0.40 lines, $p = 0.020$).

Conclusion We found no evidence that spectacles wear worsens children's uncorrected VA among urban migrant Chinese school children.

INTRODUCTION

Chinese children have among the world's highest rates of refractive error,^{1 2} and half of the global total of 13 million children visually impaired from uncorrected refractive error live in China.³ Uncorrected refractive error can lead to a variety of problems for school-age children, including negative effects on quality of life⁴ and visual function.⁵

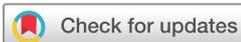
Spectacles provide an inexpensive and highly effective treatment to address these problems, with published evidence suggesting that distribution programmes can improve visual function⁶ and educational performance.⁷⁻⁹ Despite this, in rural western

China and urban migrant areas in the east, only 15–20% of children needing glasses own and wear them.^{7 10} In addition, poor compliance (ranging from 13% to 41%) with free spectacles has been reported in China and other low and middle-income countries.^{7 11 12}

Reasons for poor compliance reported by studies in a variety of settings include discomfort, inconvenience, concerns over being teased and lack of perceived need.^{11 13 14} Surveys in China point to a particular concern in this setting among children, parents and teachers that glasses wear harms children's uncorrected vision.^{14 15} While it is well known that wearing glasses improves best-corrected vision in the presence of refractive error, the concern in China is that use of glasses will 'weaken' children's eyes by worsening uncorrected vision, presumably by increasing myopic refractive power, potentially increasing dependency on glasses for useful vision.

A number of small studies¹⁶⁻²² have been inconclusive about the effect of glasses wear on refractive power. These reports have not compared wear of glasses with non-wear, or reported direct effects on visual acuity (VA). To our knowledge, only one previous trial has assessed causal effects of providing glasses on uncorrected VA.²³ Our study in rural western China reported no worsening of final uncorrected VA in a large cohort of children assigned at random to receive glasses, when compared with controls. There was in fact a small but statistically significant trend towards better final uncorrected VA in the children randomised to glasses delivery compared with controls at 9 months after the intervention.²³ Given the importance of this finding and persistent unwillingness among parents and even providers to facilitate glasses wear in young children, we sought to replicate the results of our prior analysis in a different cohort.

We carried out a parallel clustered-randomised trial among migrant schools in urban eastern China demonstrating that free glasses and a teacher incentive significantly improved observed classroom wear of spectacles at an un-announced examination 9 months later.²⁴ We now report an exploratory analysis on the impact of the above intervention on children's uncorrected VA over the course of a school year. An advantage of the current study over our previous report on the safety of glasses for children's vision²³ is the much higher rates of spectacle wear in the current cohort



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(68%²⁴ vs 42%²³) Our hypothesis is that change in uncorrected VA of children in the treatment group will not be worse than that of controls.

METHODS

The methods of the study have been described elsewhere in detail,²⁴ and are summarised here for reference. The protocol for this study was approved in full prior to recruitment by Institutional Review Boards at Stanford University (Palo Alto, California, USA) and the Zhongshan Ophthalmic Center, Sun Yat-sen University (ZOC, Guangzhou, China). Permission was received from local education bureaux in each area and from the principals of all participating schools, and at least one parent provided written informed consent for each child's participation. The principles of the Declaration of Helsinki were complied with throughout. The original trial was registered at URL: <http://isrctn.org>, under registration number ISRCTN16720066.

Setting

The study was conducted in Shanghai and Suzhou/Wuxi ('twin cities' located near Shanghai). These cities were selected not only for their large populations (Shanghai's population was 24.2 million in 2012; Suzhou/Wuxi had a combined population of 17.0 million in 2014),^{25 26} but also their large concentration of migrants without local residence documents (*hukou*): 9.6 million in Shanghai in 2012 and approximately 8.5 million in Suzhou/Wuxi 2014.^{25 26} A lack of *hukou* means that migrants have reduced access to local public health and education resources. Migrant communities tend to be clustered, and migrant children generally only have the option to attend private, unregulated schools with minimal government support.²⁷

Sampling and eligibility criteria

Local Bureaux of Education provided a list of schools with a majority of migrant students, and 94 schools were randomly selected (66 in Shanghai and 28 in Suzhou/Wuxi) from the total of 135 migrant schools. In each school, one fifth grade class (children aged 11–12 years) was selected randomly, to receive questionnaires, VA testing and refraction. Students in the selected classes at chosen schools were eligible for the trial if they had the following: uncorrected VA $\leq 6/12$ in either eye; spherical equivalent refractive error of myopia ≤ -0.75 diopters (D), hyperopia $\geq +2.00$ D, or astigmatism ≥ 1.00 D, and VA could be improved to $\geq 6/7.5$ in both eyes with glasses.

Questionnaires

At the time of the baseline examination (September 2013, beginning of the school year), enumerators administered questionnaires to children and their parents. Children were asked about their age,^{1 2 28 29} sex,^{1 2 28 29} rural vs urban residence,¹ number of siblings,³⁰ self-reported glasses wear, beliefs about whether wearing glasses harms vision,^{15 29} parental glasses wear,²⁴ parental education,²⁸ and total time participating in outdoor activities throughout the day (min/day).³¹ Children's parents were also asked to state ownership of 14 selected items to create an index of family wealth. Potential participating children were told to bring their glasses on the day of baseline VA testing, and ownership of glasses at baseline was defined as being able to produce glasses at school. At endline, children were asked whether they were satisfied with the style of their glasses frames, the thickness of the lenses, and the ease in which glasses could be cleaned.

Visual acuity assessment

A nurse and trained enumerator conducted VA testing in each eye separately for all eligible children without refraction at 4 m using an Early Treatment Diabetic Retinopathy Study³² chart (Precision Vision, La Salle, Illinois, USA). VA testing was administered in an illuminated, indoor area at school. Testing began with the top (6/60) line, and VA for an eye was defined as the lowest line on which 4 of 5 optotypes were read correctly. If a child could not read the top line at 4 m, the nurse tested the child's VA as above at 1 m, and the measured VA was divided by 4.

Refraction

Children with uncorrected VA $\leq 6/12$ in either eye received cycloplegia with up to 3 drops of cyclopentolate 1%. Automated refraction (Topcon KR 8900; Tokyo, Japan) with subjective refinement was performed by a refractionist, previously trained by experienced pediatric optometrists from ZOC.

Randomisation and interventions

In this cluster-randomised clinical trial, schools served as the clusters (figure 1). In October 2013, after the baseline survey and VA screening, but before refraction, eligible children were randomised by school to receive one of the two interventions (figure 1):

- ▶ Control: a glasses prescription and letter were sent to parents informing them of the refractive status of their child. Free glasses were provided to the children at study closeout, although this was not previously announced. No teacher incentive was provided.
- ▶ Treatment: free glasses were distributed at school by an optometrist based on the measurement of children's refractive power as above. A letter about the free glasses programme was sent to the parents with the child's prescription, and to promote glasses wear, a previously described educational intervention⁷ aimed at teachers and children was conducted. Additionally, teachers of Mathematics, English and Chinese in the selected classes were briefed by the research team on the safety and benefits of glasses, and were told that if $\geq 80\%$ of the children they taught who were given glasses were wearing them at the time of two unannounced class visits, a tablet computer (approximate value US\$350) would be awarded to the teacher (approximate monthly teacher income was US\$450). These teachers, according to protocol, then explained to their students that glasses do not harm vision, and asked students to wear glasses in class. They would also remind those students not wearing glasses to put them on.

Randomisation was conducted at Stanford University (Palo Alto, California, USA) using R software (R Foundation for Statistical Computing, Vienna, Austria). Participating children, their parents, teachers and enumerators were either masked (in the case of study personnel) or unaware of the overall design of the study and the explicit treatment arm assignment.

Outcome assessment

At the conclusion of the trial, the protocol and vision chart described above were used to assess VA. The main outcome of the current analysis was uncorrected logarithm of the minimal angle of resolution (LogMAR) VA at study closeout 9 months after glasses distribution, adjusted for baseline uncorrected VA. The LogMAR system has a constant increment of 0.1 log units across its range; each increment indicates approximately one line of VA loss on the ETDRS chart, and thus higher LogMAR values indicate poorer vision.

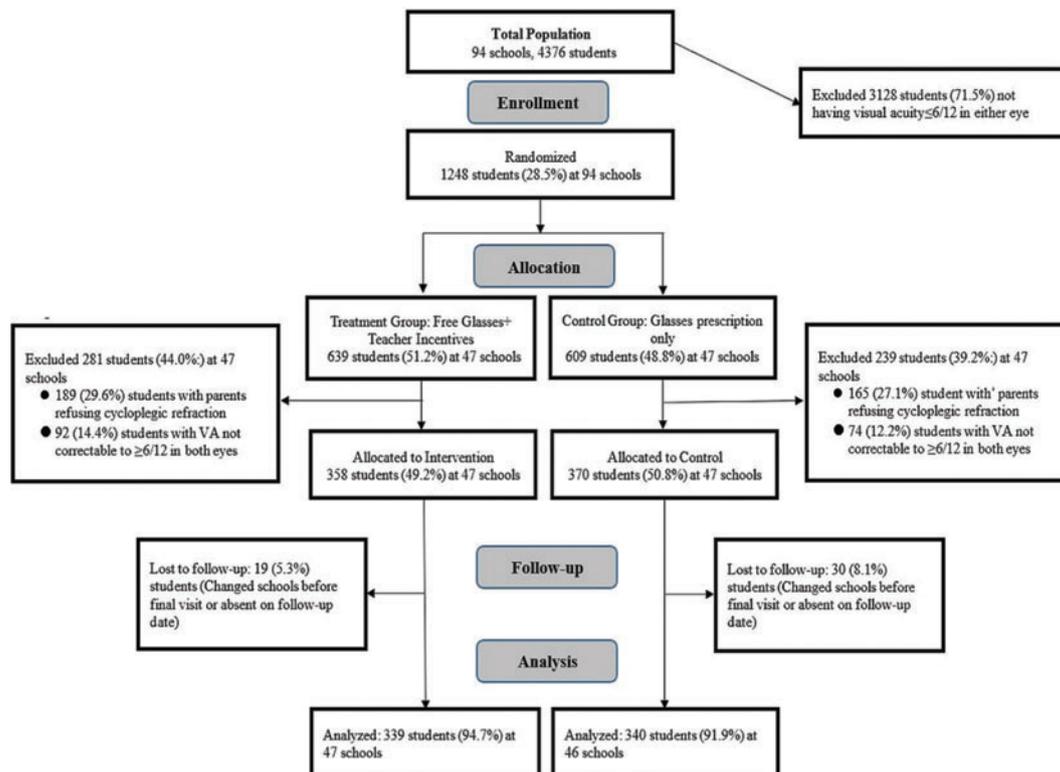


Figure 1 Flowchart for enrollment and allocation of students with refractive error in a randomised trial of free glasses and teacher incentives to promote spectacle wear.

We used two methods to assess participants' glasses wear, which was the exposure variable of interest in the current study and the main outcome in the parent trial. The primary measure was observed wear (glasses present on the child's face) at the time of an un-announced visit at 9 months after glasses distribution, by trained two-person assessment teams masked to the children's study group assignment. Additionally, children also described self-reported wear as 'always', 'only for studying' or 'usually not worn'. We defined positive self-reported wear as wearing glasses 'always' or 'only for studying'.

Statistical methods

According to the China Rural Household Survey Yearbook (Department of Rural Surveys, National Bureau of Statistics of China, 2013), we calculated family wealth by summing the value of 14 items owned by the family on a predefined list. Refractive power in an eye was the spherical equivalent, defined as the spherical power plus half the cylindrical power.

The control and treatment groups were compared by intention-to-treat (ITT) analysis using multiple linear regression, with end-line uncorrected VA (LogMAR) as the main outcome variable and intervention arms and baseline uncorrected VA as covariates. Other baseline variables were also investigated as predictors for final VA, with the final model including intervention arms and variables associated with baseline VA at $p \leq 0.20$ ^{7,23} Students and schools were included in a random intercept model to adjust for the correlation between eyes of a student, and between children in the same school. All analyses were performed using Stata 14.2 (StataCorp, College Station, Texas, USA) and SAS 9.3 (SAS Institute, Cary, North Carolina, USA), which calculated robust SEs to adjust for clustering by school.³³

Missing data: To reduce the inefficiency of estimation due to missing values, we use multiple imputation in Stata to impute data

for several variables at baseline,³⁴ including rural residence ($n=17$), believing that wearing glasses harms vision ($n=4$), baseline glasses wear ($n=1$), parental education ($n=10$), parental glasses wear ($n=1$), family wealth ($n=55$), refractive error ($n=1$) and total time participating in outdoor activities throughout the day ($n=1$).

RESULTS

Among 4376 students screened at 94 selected schools, 1248 (28.5%) failed VA screening and were randomised (figure 1). A total of 47 schools (639 children, 51.2%) were randomised to the Intervention group (free glasses and the teacher incentive) and 47 schools (609 children, 48.8%) to the control group (glasses prescriptions and a note to the parents only). A total of 281 children (parents refused refraction, $189/639=29.6\%$; VA not correctable to $\geq 6/12$ in both eyes, $92/639=14.4\%$) were excluded from the treatment group and 239 (parents refused refraction, $165/609=27.1\%$; VA not correctable to $\geq 6/12$ in both eyes, $74/609=12.2\%$) from the controls, leaving 358 children (49.2%) at 47 schools allocated to treatment and 370 children (50.8%) at 47 schools allocated to control (figure 1).

Among the 1082 children, 728 children with consent for cycloplegia and 354 children without such consent did not differ significantly at baseline with regard to uncorrected VA, rural vs urban residence, status as an only child, believing that wearing glasses harms vision, parental glasses wear, parental education, family wealth and total time participating in outdoor activities (table 1). However, children without consent were older (11.0 vs 10.9 years, $p=0.018$), more likely to be male (61.0% vs 51.0%, $p=0.001$), less likely to be wearing glasses (14.1% vs 17.9%, $p=0.040$) and less likely to have VA $< 6/18$ in both eyes (28.0% vs 39.4%, $p<0.001$) (table 1).

Table 1 Baseline characteristics of 728 students with correctable myopia participating in a trial of spectacle provision and teacher incentives, by treatment group assignment

Variable	Lacked consent for cycloplegia		P value, comparison by consent	Control group		Treatment group		Missing data Number (%)
	(n=354*)	Had consent (n=728*)		(n=370* at 47 schools)	(n=358* at 47 schools)	P value, control vs treatment		
Age, years, mean (SD)	11.0 (1.00)	10.9 (0.92)	0.018	10.9 (0.97)	10.9 (0.87)	0.527	0 (0.0)	
Baseline uncorrected visual acuity (LogMAR)†	0.53 (0.28)	0.54 (0.21)	0.759	0.54 (0.21)	0.54 (0.21)	0.766	0 (0.0)	
Male sex (n, %)	216 (61.0)	371 (51.0)	0.001	191 (51.6)	180 (50.3)	0.645	0 (0.0)	
Rural residence (n, %)	292 (82.5)	632 (86.8)	0.108	320 (86.5)	295 (82.4)	0.253	17 (2.34)	
Only child in family (n, %)	84 (23.7)	144 (19.8)	0.361	74 (20.0)	70 (19.6)	0.735	0 (0.0)	
Believes wearing glasses harms vision (n, %)	104 (29.4)	245 (33.7)	0.115	127 (34.3)	118 (33.0)	0.853	4 (0.55)	
Wearing glasses at baseline (n, %) [‡]	50 (14.1)	130 (17.9)	0.040	66 (17.8)	64 (17.9)	0.834	1 (0.14)	
VA <6/18 both eyes (n, %)	99 (28.0)	287 (39.4)	<0.001	150 (40.5)	137 (38.3)	0.659	0 (0.0)	
At least 1 parent with >12 years education (n, %)	132 (37.3)	220 (30.2)	0.078	112 (30.3)	108 (30.2)	0.723	10 (1.37)	
One or both parents wearing glasses (n, %)	69 (19.5)	135 (18.5)	0.833	65 (17.6)	70 (19.6)	0.382	1 (0.14)	
Family wealth (n, %)			0.076			0.190	55 (7.55)	
Bottom tercile	126 (35.6)	258 (35.4)		121 (32.7)	103 (28.8)			
Middle tercile	129 (36.4)	243 (33.4)		114 (30.8)	108 (30.2)			
Top tercile	99 (28.0)	227 (31.2)		110 (29.7)	117 (32.7)			
Total time participating in outdoor activities (min/day) (n, %)			0.087			0.944	1 (0.14)	
0 min	101 (28.5)	165 (22.7)		91 (24.6)	74 (20.7)			
1–30 min	127 (35.9)	275 (37.8)		126 (34.1)	148 (41.3)			
31–60 min	59 (16.7)	126 (17.3)		68 (18.4)	58 (16.2)			
>60 min	67 (18.9)	162 (22.2)		85 (22.9)	77 (21.5)			
Mean (SD) refractive error (diopters)			–			0.329	1 (0.14)	
≤–2	–	–		112 (30.3)	103 (28.8)			
–2 to –0.5	–	–		210 (56.8)	208 (58.1)			
–0.5 to 0.5	–	–		19 (5.14)	13 (3.63)			
≥0.5	–	–		29 (7.84)	33 (9.22)			

*Data are presented as mean (SD) or number (%) unless otherwise stated.

†0.1 change in LogMAR indicates 1 line change on the vision chart.

‡Defined as being able to produce glasses at school, having been told the day before to bring them.

LogMAR, logarithm of the minimal angle of resolution; VA, visual acuity.

Among the 728 children, those in the treatment and control groups did not differ significantly in any individual-level or cluster-level variables at baseline, including uncorrected VA (mean LogMAR value of 0.54, roughly equivalent to a Snellen fraction of 6/18, in both groups, [table 1](#)). A total of 339 treatment group children (94.7%) and 340 controls (91.9%) followed up at 9 months and underwent analysis ([figure 1](#)). End-line glasses wear was 68.3% (observed: 233/341) to 90.6% (self-reported: 308/340) in the treatment group; and 23.9% (observed: 84/352) to 32.1% (self-reported: 106/330) among controls. In the treatment group, over 80% of children were satisfied with the style of their frames (86.8%), thickness of the lenses (89.6%) and ease in which the glasses could be cleaned (87.7%).

End-line VA adjusted for baseline VA among treatment group children was significantly better than for control children (difference: 0.039 LogMAR units, 95% CI 0.008 to 0.070, 0.39 lines on the VA chart, $p=0.014$.) ([table 2](#)). In multiple linear regression models ([table 3](#)), better baseline VA (0.539 LogMAR units, 95% CI 0.422 to 0.657, $p<0.001$), membership in the treatment group (0.040 LogMAR units,

95% CI 0.007 to 0.074, $p=0.020$), lack of parental glasses wear (-0.039 LogMAR units, 95% CI: -0.072 , -0.005 , $p=0.026$) and lack of myopic refractive error (≤ -2 D (-0.251 LogMAR units, 95% CI: -0.339 , -0.164 , $p<0.001$) or -2 to -0.5 (-0.176 LogMAR units, 95% CI: -0.256 , -0.010 , $p<0.001$)) at baseline were all associated with better uncorrected end-line VA. Age, sex, rural residence, status as an only child, believing that wearing glasses harms vision, not wearing glasses at baseline, uncorrected VA <6/18 in both eyes, parental education, family wealth and total time participating in outdoor activities were not significantly associated with endline VA in multivariate models.

DISCUSSION

Results from ITT analysis in this randomised trial provide no evidence that provision of free glasses, in the face of relatively high rates of compliance thanks to a teacher intervention, was harmful to children's vision. In fact, there was a small but statistically significant trend towards better adjusted end-line VA

Table 2 Effect of treatment in a trial of spectacle provision and teacher incentives on final uncorrected visual acuity (LogMAR) of both eyes

Treatment group	N	Mean baseline uncorrected LogMAR visual acuity (SD)	Mean end-line uncorrected LogMAR visual acuity (SD)	Unadjusted change in LogMAR visual acuity (95% CI)	Difference between study groups in end-line uncorrected visual acuity adjusted for baseline acuity (95% CI) ^a
Total	679	0.538 (0.209)	0.643 (0.215)	-0.105 [†] (-0.120, -0.089)	-
Control	340	0.537 (0.210)	0.661 (0.212)	-0.124 [†] (-0.147, 0.101)	(Reference)
Treatment	339	0.540 (0.208)	0.625 (0.216)	-0.085 [†] (-0.106, -0.064)	0.039 ^a (0.008, 0.070)

*p<0.05.

LogMAR, logarithm of the minimum angle of resolution.

Though higher values on the LogMAR scale indicate worse vision, we have followed the convention in this table that negative change indicates worsening and positive change indicates improvement.

Table 3 Linear regression model of potential predictors of final uncorrected LogMAR VA

Variables	Model adjusted only for baseline VA (n=679)		Full model [‡] (n=679)	
	Regression coefficient* [§] (95% CI)	P value	Regression coefficient [§] (95% CI)	P value
Age	0.005 (-0.011, 0.022)	0.522		
Baseline uncorrected VA (LogMAR)	0.433 (0.356, 0.511)	<0.001	0.539 (0.422, 0.657)	<0.001
Treatment group	0.035 (-0.005, 0.074)	0.084	0.040 (0.007, 0.074)	0.020
Male sex	0.011 (-0.014, 0.036)	0.382		
Rural residence	0.029 (-0.011, 0.070)	0.155	0.036 (-0.001, 0.072)	0.057
Only child in family	0.005 (-0.026, 0.036)	0.728		
Believes wearing glasses harms vision	-0.033 (-0.059, -0.007)	0.015	-0.018 (-0.042, 0.006)	0.138
Wearing glasses at baseline [†]	-0.050 (-0.091, -0.009)	0.017	-0.027 (-0.065, 0.011)	0.162
VA <6/18 both eyes	-0.027 (-0.059, 0.005)	0.099	0.023 (-0.011, 0.057)	0.180
At least 1 parent with >12 years education	-0.013 (-0.040, 0.014)	0.339		
One or both parents wearing glasses	-0.044 (-0.081, -0.007)	0.021	-0.039 (-0.072, -0.005)	0.026
Family wealth (bottom tercile as reference)				
Middle tercile	-0.008 (-0.031, 0.015)	0.506		
Top tercile	-0.011 (-0.041, 0.019)	0.509		
Total time participating in outdoor activities (min/day) (0 min as reference)				
1–30 min	-0.002 (-0.034, 0.030)	0.906		
31–60 min	-0.016 (-0.053, 0.021)	0.403		
>60 min	-0.022 (-0.061, 0.017)	0.272		
Mean (SD) refractive error (diopters) (-0.5 D to 0.5 D as reference)				
≤-2	-0.249 (-0.337, -0.160)	<0.001	-0.251 (-0.339, -0.164)	<0.001
-2 to -0.5	-0.172 (-0.256, -0.088)	<0.001	-0.176 (-0.256, -0.010)	<0.001
≥0.5	-0.061 (-0.151, 0.029)	0.180	-0.066 (-0.151, 0.019)	0.127

[†]Except for the regression coefficient for baseline VA (simple regression), coefficients for the different variables are for multiple models with end-line VA as dependent variable, adjusted for baseline VA.[‡]Including variables associated with VA p≤0.20 in the model only adjusted for baseline VA.[§]A negative regression coefficient indicates an association with worse end-line VA.

LogMAR, logarithm of the minimal angle of resolution; VA, visual acuity.

Though higher values on the LogMAR scale indicate worse vision, we have followed the convention in this table that negative change indicates improvement and positive change indicates worsening.

among treatment compared with control children. Both groups showed modest declines in uncorrected VA over 9 months, consistent with expected progression of myopia in this myopic cohort, but there is no evidence that glasses wear accelerated such progression. Concern over the potential for children's spectacle wear to accelerate myopia and worsen vision is widespread in China^{5 13 15} and acts as an important barrier to children's glasses use in China^{5 13} and elsewhere.^{35 36}

This result replicates the conclusion of our previous trial of glasses distribution in China,²³ and provides even stronger evidence for the visual safety of spectacle wear among Chinese children, given the higher rates of observed spectacle compliance

in the current study (68% vs 41% in our previous trial in rural western China.⁷) In view of the higher rate of glasses compliance observed in the current study, it is interesting to note that the point estimate for the modest improvement in vision was larger (0.040 LogMAR units) compared with that in our prior trial (0.023 LogMAR units, adjusting only for baseline VA in both cases), though the CIs overlap.

We searched the PubMed database in February 2020 for articles describing randomised trials in any language published since 1970, using the terms 'correction', 'glasses', and 'spectacles' cross-indexed with 'refractive error' and 'myopia'; 'change', 'decline', 'effect' and 'impact'; and 'vision' and 'visual acuity'.

In addition to our previous trial noted above, two prior studies^{17 18} compared the effect on change in refractive power over 18–24 months of full correction of refractive error with glasses to provision of glasses with power lower by 0.50–0.75 D than needed for optimal distance VA. These studies were consistent with our results, in that they reported less progression of myopic refractive error in the full-power group, by 0.15 D.^{17 18} This effect was significant when the results were pooled in a subsequent Cochrane review.¹⁶ The total sample of the two trials was <200 students. Participants were not randomised to go without glasses in either trial, nor did either report on VA.

In China, myopia, much of it uncorrected, has both a high prevalent and early age of onset compared with most other settings, affecting children's physical^{1 2 5} and mental health.^{28 37} Recently, the Chinese government has come to attach great importance to the problem of children's myopia, as reflected most clearly in the August 2018 of a national anti-myopia programme, announced by none other than Chairman Xi Jinping.³⁸ In this setting, further evidence of the safety of glasses, the principal intervention against childhood myopia, is of practical significance to programme planners in a country where half the world's children visually impaired by refractive error dwell.³

The strengths of the current study include the randomised design, high follow-up rates, population-based sampling and the comparatively good spectacle compliance in the treatment group. Limitations must also be acknowledged. Power limitation did not permit us to include a third treatment group receiving free glasses without teacher incentive intervention, meaning that we could not directly assess the independent casual effect of the teacher incentive. However, fewer than half of similar-aged children receiving free spectacles without teacher incentives were wearing them at 6 months under a same observation protocol in our previous trial,⁷ carried out in an area with similar low rates of baseline wear. An additional limitation is the fact that these children were all recruited from predominantly migrant schools in two cities in urban eastern China, and thus application of these results to other settings must be made with caution.

CONCLUSIONS

Despite these limitations, this study provides further weight of evidence in favour of the safety of an intervention which has the potential to transform the educational prospects of millions of children in the world's most populous country.

Author affiliations

- ¹School of Public Administration, Northwest University, Xi'an, China
- ²China Center for Health Development Studies, Peking University, Beijing, China
- ³Center for Chinese Agricultural Policy, Peking University, Beijing, China
- ⁴College of Economics and Management, Shanghai Ocean University, Shanghai, China
- ⁵Affiliated Hospital of Guangdong Medical University, Zhanjiang, China
- ⁶Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou, China
- ⁷African Vision Research Institute, University of Kwazulu-Natal, Durban, South Africa
- ⁸Brien Holden Vision Institute, Sydney, Australia
- ⁹School of Optometry and Vision Science, University of New South Wales, Sydney, Australia
- ¹⁰Shanghai Eye Disease Prevention and Treatment Center, Shanghai, China
- ¹¹Rural Education Action Program, Freeman Spogli Institute for International Studies, Stanford University, CA, USA
- ¹²Centre for Public Health, School of Medicine, Dentistry, and Biomedical Sciences, Queen's University Belfast, Belfast, UK

Contributors Conceptualisation, YM and NC; Data curation, YM; formal analysis, XZ; investigation, YM; methodology, XM and HY; project administration, YM; supervision, MZ and SR; writing—original draft, XZ; writing—review & editing, YM, NC, HZ, XW, LJ, KN, HM and HZ; data analysis: XZ and YM.

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Competing interests NC is Director of Research for Orbis International, a non-governmental organisation which delivers children's refraction among other services in China and other countries.

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Data integrity statement All the authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

ORCID iDs

Xinwu Zhang <http://orcid.org/0000-0002-4574-536X>
 Ming Zhou <http://orcid.org/0000-0002-7033-954X>
 Nathan Congdon <http://orcid.org/0000-0001-9866-3416>
 Yue Ma <http://orcid.org/0000-0002-2802-574X>

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