Original Investigation

Population Prevalence of Need for Spectacles and Spectacle Ownership Among Urban Migrant Children in Eastern China

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IMPORTANCE The number of urban migrants in China is 300 million and is increasing rapidly in response to government policies. Urban migrants have poor access to health care, but little is known about rates of correction of refractive error among migrant children. This is of particular significance in light of recent evidence demonstrating the educational impact of providing children with spectacles.

OBJECTIVE To measure prevalence of spectacle need and ownership among Chinese migrant children.

DESIGN, SETTING, AND PARTICIPANTS Population-based, cross-sectional study among children who failed vision testing (uncorrected visual acuity ≤6/12 in either eye) between September 15 and 30, 2013, at 94 randomly selected primary schools in predominantly migrant communities in Shanghai, Suzhou, and Wuxi, China.

MAIN OUTCOMES AND MEASURES Refractive error by cycloplegic refraction; spectacle ownership, defined as producing glasses at school, having been told to bring them; and needing glasses, defined as uncorrected visual acuity of 6/12 or less correctable to greater than 6/12 in either eye, with myopia of −0.5 diopters (D) or less, hyperopia of +2.0 D or greater, or astigmatism of 0.75 D or greater in both eyes.

RESULTS Among 4409 children, 4376 (99.3%) completed vision screening (mean [SD] age, 11.0 [0.81] years; 55.3% boys; 4225 [96.5%] migrant and 151 [3.5%] local). Among 1204 children failing vision testing (total, 27.5%; 1147 migrant children [27.1%] vs 57 local children [37.7%]; $P = .003$), 850 (70.6%) completed refraction. Spectacle ownership in migrant children needing glasses (147 of 640 children [23.0%]) was less than among local children (12 of 34 children [35.3%]) (odds ratio = 0.55; 95% CI, 0.32-0.95; $P = .03$). Having uncorrected visual acuity less than 6/18 in both eyes was associated positively with baseline spectacle ownership (odds ratio = 5.73; 95% CI, 3.81-8.62; $P < .001$), but parental education and family wealth were not.

CONCLUSIONS AND RELEVANCE Among urban migrant children, there was a high prevalence of need for spectacles and a very low rate of spectacle ownership. Spectacle distribution programs are needed specifically targeting migrant children.

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Invited Commentary

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Among nearly 13 million children worldwide with visual disability from uncorrected refractive error, half live in China.[1] Refractive error can be safely treated with glasses,[2] leading to improvements in visual function[3] and trial-proven enhancement of educational outcomes.[4] However, in rural areas in China, as few as 1 in 6 children needing glasses owns them.[4]

In addition to China's rural population, urban migrants are another group known to have poor access to health care facilities.[5,6] In 2013, 35.3 million rural laborers, or 21% of the total, brought their families to their destination cities.[7] The number of urban migrant children younger than 17 years increased 80% in a decade, from 19.8 million in 2000 to 35.8 million in 2010.[8] Owing to China's strict *hukou* (local residence) household registration system,[9] migrants have limited access to public services, including health care and education, resulting in poorer educational and health care outcomes than their local counterparts.[10-12] Compared with other Chinese urban dwellers, migrants bear a higher burden of hepatitis,[13] sexually transmitted diseases,[14] occupational injuries,[15] and inadequate women's,[16] children's[17] and prenatal[18] health care. However, few studies[19] have assessed the burden of visual impairment and rates of spectacle wear among China's urban migrant children.

We carried out a randomized trial of incentives to increase spectacle use[20] among children attending predominantly migrant primary schools in 3 large eastern Chinese cities. In the current article, we report the baseline prevalence of need for spectacles and spectacle ownership among such children screened for our trial.

At a Glance

- Although a quarter of migrant children needed spectacles, only 15% of these owned them.
- This figure is comparable to that for similar children in rural western China measured using an identical protocol.
- It is substantially lower than previously reported for similar-aged children at conventional Chinese urban schools (66%).

Methods

The protocol for this study has been described elsewhere in detail[20] and was approved in full by the institutional review boards at Stanford University and the Zhongshan Ophthalmic Center. Permission was received from local boards of education in each setting, and the principals of all schools and at least 1 parent of each child provided written informed consent for participation. The principles of the Declaration of Helsinki were followed throughout.

Setting

The study was carried out in Shanghai (the world's largest city proper, with a total population of 24.2 million in 2012,[21] including 9.6 million migrants[22]) as well as Suzhou and Wuxi (in Jiangsu Province, a pair of cities located near Shanghai with a combined prefectural population of 17.0 million in 2014,[23,24] more than half estimated to be migrants[25]) between September 15 and 30, 2013. These cities were selected for having among China's largest populations of migrants, defined herein as children and families who reported not having a local primary residence (*hukou*). Substantial rural and suburban areas exist within the borders of these 3 cities, and migrant populations tend to be clustered in these rural and suburban zones. In 2010, migrants accounted for 46.2% of all children living in Shanghai and 24.7% in Jiangsu. As the number of migrant children has increased, their education has become one of the greatest challenges facing the Chinese education system. Given that migrant children in cities still retain their rural *hukou*, they are allowed to enroll in urban public schools only if space is available. As a result, migrant children in these communities mostly attend schools that are private and unregulated, with little support from the government.[12]

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). All 28 schools on the lists for Suzhou and Wuxi were chosen. In the principal migrant districts of Shanghai (Fengxian, Jinshan, Qingpu, and Pudong), 70 of 107 schools were selected at random based on the population size of each district. During implementation, 4 of the Shanghai schools (5.7%) withdrew from participation.

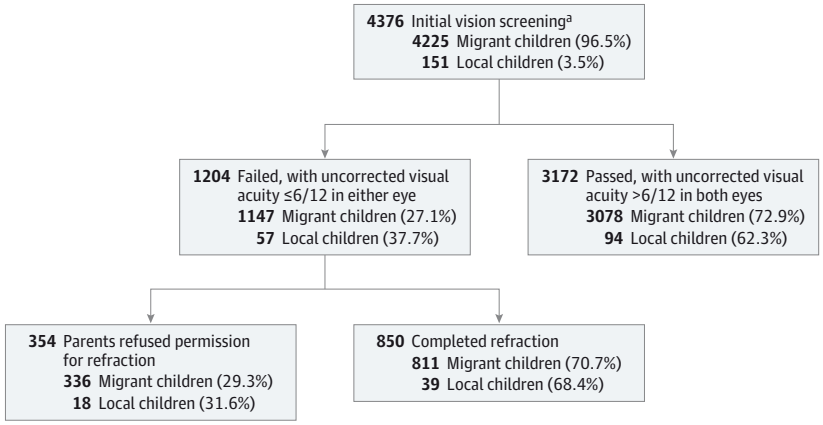
One fifth-grade class (children usually aged 10-12 years) was selected at random in each school, questionnaires were administered, and visual acuity (VA) testing and refraction were carried out. All children in the selected classes meeting the following criteria were considered eligible to receive glasses in the parent trial and as needing glasses in the current study: uncorrected VA of 6/12 or less in either eye; refractive error showing myopia of −0. 5 diopters (D) or less in both eyes, hyperopia of +2.0 D or greater in both eyes, or astigmatism (nonspherical refractive error) of 0.75 D or greater in both eyes; and VA correctable to greater than 6/12 in either eye with glasses.

Our definition of needing glasses was based on having VA at the level used in the Refractive Error Study in Children to define vision impairment,[26] together with refractive error cutoffs validated in our previous work[27] as being associated with greater improvement in VA when corrected. Finally, improvement in VA to 6/12 in either eye with glasses was required, to eliminate children whose poor vision was due predominantly to amblyopia or other nonrefractive causes.

Questionnaires

At baseline (September 2013, beginning of the school year), enumerators administered questionnaires to children concerning their age, sex, urban vs rural residence, local primary residence (to identify migrant status), glasses wear, time spent in near work and outdoor activities, family migrant status, and parental glasses wear and education. Children were asked about the family's ownership of 13 items as an indication of family

Figure. Flowchart for Enrollment of Children in the Study



[a] The total number of baseline observations was 4409. Among these, 15 children with missing baseline screening data and 18 children with unknown residential status (a total of 33 [0.75%]) were excluded.

wealth: car, camera, washing machine, motorcycle or electric bicycle, air conditioner, water heater, gas or liquefied petroleum gas stove, computer, range hood, Internet access, refrigerator or freezer, television, and flush toilet. Children's weekly pocket money[28] was also recorded as an alternative indicator of family financial status. 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 no teaching. Baseline spectacle use was defined as being able to produce glasses at school on the day of the examination, having been told previously to bring them.

VA Assessment

Children underwent baseline VA screening at school by a nurse and trained assistant. Visual acuity was tested separately for each eye without refraction at 4 m using an Early Treatment Diabetic Retinopathy Study[29] chart (Precision Vision) 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 m, the child was tested as described earlier at 1 m and the measured VA was divided by 4.

Refraction

Children with uncorrected VA of 6/12 or less in either eye underwent cycloplegia with up to 3 drops each of cyclopentolate hydrochloride, 1%, and proparacaine hydrochloride, 0.5%. Children then underwent automated refraction (Topcon KR 8900) with subjective refinement by a local optometrist previously trained by experienced optometrists from Zhongshan Ophthalmic Center.

Statistical Analysis

Refractive power was defined throughout as the subjective spherical equivalent, or spherical power plus half the cylindrical power. Family wealth was calculated by summing the value, as reported in the *Rural Household Survey Yearbook*,[30] of items reported as being owned by the family from a list of 13. Terciles of family wealth were used in analyses owing to nonnormal distribution of the data. Tercile levels for children failing to complete the list of 13 items (n = 518 [11.8%]) were imputed based on their tercile level of self-reported weekly pocket money.

All analyses were performed using Stata version 12.0 statistical software (StataCorp LP), calculating robust standard errors to adjust for clustering by school.[31] Other baseline variables were investigated using logistic regression as predictors of the main outcomes: need for spectacles among children failing VA screening, and ownership of spectacles among children who needed them. The multiple regression models included age, sex, migrant status, and all variables in the simple regression associated with the outcome at $P \leq .20$. In view of the high proportion (nearly 30%) of parents refusing permission for refraction, we performed an alternative analysis of spectacle ownership and its predictors among all children failing VA screening to assess the potential effect of the loss of these children on our analyses.

Results

Among 4409 children in selected fifth grade classes in 94 randomly chosen schools, 4376 (99.3%; mean [SD] age, 11.0 [0.81] years, 55.3% boys) completed vision screening. Of these 4376 children, 4225 (96.5%) self-identified as migrant and 151 (3.5%) as local (**Figure**). Migrant children were more likely than local children to report rural residence (89.3% vs 59.6%, respectively; $P < .001$), to have additional siblings in the family rather than being an only child (only child, 15.8% vs 40.4%, respectively; $P = .007$), and to have parents who were less educated (≥1 parent with ≥12 years of education, 7.7% vs 24.7%, respectively; $P < .001$); were less likely to have parents who wore glasses (12.3% vs 30.1%, respectively; $P < .001$); and had less family wealth ($P < .001$). However, standardized scores on a study-specific mathematics tests were higher among migrant children (0.07 vs −0.45 SDs, respectively; $P < .001$). Age, sex,

Table 1. Comparison of Baseline Characteristics Between Migrant and Local Children, Both Attending Majority-Migrant Schools

Characteristic	All (N = 4376)	Migrant (n = 4225)	Local (n = 151)	*P* Value for Migrant vs Local[a]
Age, y				
No. (%)				
≤9	81 (1.9)	79 (1.9)	2 (1.3)	.38
10	1203 (27.5)	1154 (27.4)	49 (32.5)	
11	1779 (40.7)	1713 (40.6)	66 (43.7)	
≥12	1305 (29.9)	1271 (30.1)	34 (22.5)	
Data missing	8 (0.2)	8 (0.2)	0	
Mean (SD)	11.0 (0.81)	10.9 (0.77)	11.0 (0.81)	
Male, No. (%)	2421 (55.3)	2344 (55.5)	77 (51.0)	.15
Children needing glasses, No./children with uncorrected VA ≤6/12 in either eye, No. (%)[b]	675/850 (79.4)	641/811 (79.0)	34/39 (87.2)	.15
Data missing, No. (%)[c]	354 (29.4)	336 (29.3)	18 (31.6)	
Rural residence, No. (%)	3757 (88.3)	3667 (89.3)	90 (59.6)	<.001
Data missing, No. (%)	120 (2.74)	120 (2.84)	0 (0.00)	
Only child in family, No. (%)	726 (16.6)	665 (15.8)	61 (40.4)	.007
Data missing, No. (%)	4 (0.1)	4 (0.1)	0	
Standardized mathematics score, mean (SD)	0.05 (1.01)	0.07 (1.00)	−0.45 (0.96)	<.001
Data missing, No. (%)	3 (0.1)	3 (0.1)	0	
≥1 Parent with >12 y of education, No. (%)	360 (8.3)	323 (7.7)	37 (24.7)	<.001
Data missing, No. (%)	39 (0.9)	38 (0.9)	1 (0.7)	
Both parents working in the area, No. (%)	3743 (86.7)	3617 (86.7)	126 (85.1)	.55
Data missing, No. (%)	57 (1.3)	54 (1.3)	3 (2.0)	
≥1 Parent wears glasses, No. (%)	549 (12.9)	505 (12.3)	44 (30.1)	<.001
Data missing, No. (%)	133 (3.0)	128 (3.0)	5 (3.3)	
Family wealth tercile, No. (%)				
Top	1428 (32.8)	1346 (32.0)	82 (54.7)	<.001
Middle	1469 (33.8)	1430 (34.0)	39 (26.0)	
Bottom	1455 (33.4)	1426 (33.9)	18 (13.6)	
Data missing	24 (0.6)	23 (0.5)	1 (0.7)	
Near work, mean (SD), h/wk[d]	7.62 (4.02)	7.62 (4.00)	7.61 (4.54)	.99
Data missing, No. (%)	20 (0.5)	18 (0.4)	2 (1.3)	
Time spent outdoors, mean (SD), h/wk	6.63 (4.74)	6.66 (4.72)	5.93 (5.15)	.10
Data missing, No. (%)	77 (1.8)	71 (1.7)	6 (4.0)	

Abbreviation: VA, visual acuity.

[a] Cluster effects within school were adjusted for in all comparisons. Linear regression was used for age, mathematics score, time of near work, and time spent outdoors. Ordinal logistic regression was used for pocket money. Logistic regression was used for other variables.

[b] Myopia of −0.5 diopters (D) or less, hyperopia of +2.0 D or higher, or astigmatism of 0.75 D or higher in both eyes, and uncorrected VA of 6/12 or less, correctable to greater than 6/12, in either eye.

[c] A total of 354 children's parents refused permission for cycloplegic refraction.

[d] Near-work activity includes all activities occurring at a working distance less than 50 cm.

and the perception that wearing glasses harms children's eyes did not differ between migrant and local children (**Table 1**).

A total of 1204 children (27.5%) failed vision screening on the basis of having uncorrected VA of 6/12 or less in either eye (1147 migrant children [27.1%] vs 57 local children [37.7%]; *P* = .003). Parental permission was granted for cycloplegic refraction among 850 children (70.6%) failing vision screening (811 migrant children [70.7%] and 39 local children [68.4%]) (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 it.

Table 2 shows spectacle ownership among migrant and local children meeting our trial criteria of needing glasses. Local children (12 of 34 [35.3%]) were more likely to own glasses than migrant children (147 of 640 [23.0%]) (odds ratio [OR] = 0.55; 95% CI, 0.32-0.95; *P* = .03). Among children with −2.5 to −3.5 D of myopia, only 40 of 92 migrant children (43.5%) owned glasses; among those with uncorrected VA less than 6/18, 106 of 263 migrant children (40.3%) and 10 of 14 local children (71.4%) owned glasses (OR = 0.27; 95% CI, 0.12-0.61; *P* = .002). The low prevalence of spectacle ownership among migrant children in this study is comparable to that among similar-aged children in poor areas of rural western China[4] using an identical protocol and definition of spectacle need: 463 of 3177 (14.6%). Ownership of glasses was far higher in a group of similar-aged children attending conventional urban schools in eastern China[32] using similar protocols and definitions: 640 of 971 (65.9%) (eTable in the Supplement).

Predictors of needing spectacles in multiple logistic regression models in this study included fewer weekly hours spent outdoors (OR = 0.96; 95% CI, 0.93-0.99; *P* = .02) and being an only child (OR = 2.78; 95% CI, 1.49-5.17; *P* = .001) (**Table 3**). An alternative analysis of spectacle wear among all children failing VA screening, to test the potential effect on our

Table 2. Association of Baseline Spectacle Ownership With Refractive Error and Uncorrected VA Among Migrant and Local Children Needing Glasses

Refractive Error Category[a]	Children Who Owned Glasses, No./Children Needing Glasses, No. (%)[b]		OR (95% CI)[c]	*P* Value[c]
	Migrant Children	Local Children		
All children needing glasses	147/640 (23.0)[d]	12/34 (35.3)	0.55 (0.32-0.95)	.03
Myopia in better-seeing eye, D[e]	137/601 (22.8)	12/32 (37.5)		
−0.5 to −1.5	15/250 (6.00)	1/10 (10.0)		
−1.5 to −2.5	31/191 (16.2)	4/14 (28.6)		
−2.5 to −3.5	40/92 (43.5)	2/2 (100.0)	0.49 (0.28-0.85)	.01
−3.5 to −4.5	34/49 (69.4)	4/5 (80.0)		
≤−4.5	17/19 (89.5)	1/1 (100.0)		
Hyperopia ≥+2.0 D in better-seeing eye[e]	9/20 (45.0)	1/1 (100.0)	…	…
Astigmatism ≥0.75 D in both eyes	31/87 (35.6)	2/4 (50.0)	0.55 (0.07-4.20)	.57
VA category for better-seeing eye[e]				
≤6/12 to ≥6/18	34/251 (13.6)	1/14 (7.1)	2.04 (0.25-16.4)	.50
≤6/19 to ≥6/48	106/263 (40.3)	10/14 (71.4)	0.27 (0.12-0.61)	.002

Abbreviations: D, diopters; OR, odds ratio; VA, visual acuity; ellipses, cannot be calculated.

[a] Myopia of −0.5 D or less, hyperopia of +2.0 D or higher, or astigmatism of 0.75 D or higher in both eyes, and uncorrected VA of 6/12 or less, correctable to greater than 6/12, in either eye.

[b] Children included as owning glasses are those who brought glasses to school after being told the previous day.

[c] Logistic regression was used with adjusting for the cluster effect within schools.

[d] One child with missing status of spectacle ownership was not included.

[e] Better-seeing eye was the eye with better uncorrected VA at baseline.

results of children whose families refused refraction, produced substantially similar results except that being a local child and being an only child in the family were now positively associated with spectacle use (data not shown). Having uncorrected VA less than 6/18 in both eyes was a predictor of higher baseline spectacle ownership (OR = 5.73; 95% CI, 3.81-8.62; $P < .001$), but parental education and family wealth were not (**Table 4**).

Discussion

We observed a high prevalence of need for spectacles and very low rates of spectacle use among children needing them in this large cohort of urban migrant children. China's population of migrant children is currently estimated at more than 30 million, and government policies resettling rural dwellers to spe-

Table 3. Logistic Regression Model of Factors Potentially Associated With Needing Spectacles Among 1204 Migrant and Local Children With Uncorrected Visual Acuity of 6/12 or Less, Adjusting for Cluster Effects Within School

Variable	Simple Logistic Regression		Multiple Logistic Regression[a] (n = 821)	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Migrant status, migrant vs local	0.55 (0.25-1.25)	.15	0.67 (0.29-1.59)	.37
Age, y	0.79 (0.59-1.05)	.11	0.84 (0.62-1.13)	.24
Male	1.37 (1.01-1.86)	.04	1.32 (0.95-1.83)	.09
Near work, h/wk	0.96 (0.93-0.997)	.03	0.97 (0.94-1.01)	.09
Time spent outdoors, h/wk	0.97 (0.94-0.999)	.04	0.96 (0.93-0.99)	.02
≥1 Parent wears glasses	1.24 (0.80-1.93)	.34		
Both parents working in the area	1.46 (0.97-2.21)	.07	1.53 (0.98-2.38)	.06
Only child in family	2.69 (1.55-4.69)	.001	2.78 (1.49-5.17)	.001
Standardized mathematics score	1.10 (0.93-1.30)	.28		
≥1 Parent with >12 y of education	0.94 (0.54-1.63)	.83		
Rural residence	0.87 (0.53-1.42)	.58		
Family wealth, bottom tercile as reference				
Top tercile	1.37 (0.94-2.01)	.10	1.51 (0.98-2.32)	.06
Middle tercile	1.57 (1.04-2.36)	.03	1.35 (0.89-2.05)	.16
Blackboard use, less than half of teaching as reference				
Half of teaching	0.61 (0.40-0.94)	.04	0.71 (0.47-1.08)	.11
More than half of teaching	0.83 (0.51-1.35)	.44	0.97 (0.59-1.60)	.92

Abbreviation: OR, odds ratio.

[a] Age, sex, migrant status, and variables in the simple regression at $P \leq .20$ were included in the multiple regression.

Table 4. Logistic Regression Model of Factors Potentially Affecting Baseline Ownership of Spectacles Among 675 Migrant and Local Children Needing Them, Adjusting for Cluster Effects Within School

	Simple Logistic Regression		Multiple Logistic Regression[a] (n = 648)	
Variable	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Migrant status, migrant vs local	0.55 (0.32-0.95)	.03	0.61 (0.30-1.23)	.17
Age, y	0.81 (0.63-1.03)	.09	0.86 (0.67-1.11)	.25
Male	1.06 (0.75-1.49)	.76	1.19 (0.80-1.78)	.39
Uncorrected VA <6/18 in both eyes	5.97 (3.98-8.95)	<.001	5.73 (3.81-8.62)	<.001
≥1 Parent wears glasses	1.66 (1.08-2.56)	.02	1.35 (0.81-2.25)	.25
Both parents working in the area	0.97 (0.60-1.58)	.92		
Only child in family	1.52 (1.04-2.23)	.03	1.49 (0.96-2.31)	.07
Standardized mathematics score	0.97 (0.81-1.17)	.76		
≥1 Parent with >12 y of education	1.48 (0.92-2.38)	.11		
Rural residence	0.80 (0.48-1.32)	.38		
Family wealth, bottom tercile as reference				
Top tercile	1.03 (0.66-1.61)	.88		
Middle tercile	0.96 (0.63-1.47)	.86		
Blackboard use, less than half of teaching as reference				
Half of teaching	0.80 (0.49-1.31)	.37		
More than half of teaching	0.90 (0.57-1.41)	.64		

Abbreviations: OR, odds ratio; VA, visual acuity.

[a] Age, sex, migrant status, and variables in the simple regression at $P \leq .20$ were included in the multiple regression.

cially created urban areas are encouraging rapid expansion of this number. The results of this study add to existing data[19] suggesting that uncorrected refractive error among urban migrant children is a major health care problem for China. This has important implications for program planners, particularly in view of recent results demonstrating the significant effect of providing spectacles on children's educational outcomes in China.[4] Programs targeting migrant children and providing free or low-cost spectacles are needed; previous studies[4] have suggested that when glasses are provided for free, rates of use double compared with the use of even low-cost options.

Our findings are consistent with other studies reporting suboptimal access to health care in migrant communities, resulting in a higher burden of infectious disease,[13,14] injury,[15] and maternal and child health problems.[16,18] In addition, He et al[19] have reported a high prevalence of uncorrected refractive error among children at predominantly migrant primary schools in Shanghai, similar to that observed in our study. In their report on children in elementary grades 1 to 5, 13% of children failed vision screening using a definition similar to ours, and only 15.5% of these owned and were wearing spectacles. The somewhat lower rate of failed vision screening is presumably due to the inclusion of younger children in the study by He and colleagues, whereas our study enrolled children in the fifth grade only.

Compared with the study by He and colleagues, our study included 3 municipalities with large migrant populations, as opposed to 1, and selected children from a much larger range of schools (94 in our study vs 11 in the study by He and colleagues), which is important in view of the strong tendency for clustering of visual impairment, spectacle use, and predictive factors within schools. The estimates provided in our study are thus expected to be more robust. Our study also provides information on important determinants of spectacle wear that were not provided in the article by He and colleagues. Finally, our study had a higher rate of participation than that by He and colleagues (70.7% vs 59.6%, respectively) and compared characteristics between children who did and did not participate.

Several factors may underlie the low rates of spectacle wear among urban migrant children. Compared with children self-reporting as local in this study, migrant families had lower parental education and parental rates of spectacle wear as well as poorer indicators of family wealth (Table 1). Among these, parental spectacle wear was a predictor of children's spectacle ownership in our univariate logistic models. Failing vision screening and needing spectacles were less common among migrant children as opposed to local children, and poor vision was also associated with spectacle wear, but glasses ownership rates remained lower among migrant children even when stratifying for both refractive error and VA (Table 2). In our models controlling for various determinants of spectacle wear (Table 4), the effect of migrant status disappeared.

Regarding the lower prevalence of need for spectacles among migrant children compared with local children, this appears to be explained by differences in factors such as urban vs rural residence and parental spectacle wear (presumably in this case acting as a proxy for genetic effects). In our models, when adjusting for these factors, migrant status was no longer associated with need for spectacles. Consistent with other studies among Chinese children,[33] myopia was the main cause of need for spectacles in our cohort, present in 169 of 181 such children (93.4%).

It should be remembered that the children self-reporting as local in this study were attending majority-migrant schools and thus likely differed from urban children studying at standard institutions. For example, spectacle wear among local chil-

dren who needed glasses in this study (35.3%) was only about half that reported previously[21] for urban children at standard schools (65.9%). Further, our sample of local children was also relatively small, comprising only 151 children, making inferences regarding them somewhat less reliable.

Strengths of this study include its population-based nature, having sampled randomly from among a large number of majority-migrant schools in 3 large eastern cities. Our protocols and definitions allowed direct comparison with spectacle ownership rates previously reported[4] among similar-aged children dwelling in poor, rural areas. Limitations must also be acknowledged. As noted earlier, the number of local children was small, and these children are unlikely to be representative of urban children attending typical public schools. Only children in the fifth grade are included, which means that our results can be applied only with caution to older and younger children. Additionally, we encountered relatively high rates of parental refusal of cycloplegia for their children (29.4%), as frequently observed in urban China. Our supplementary analyses of spectacle wear among all children failing vision screening attempt to take account of this effect. Finally, the fact that we performed refraction only for children failing vision screening means that we are unable to report prevalence rates of refractive error among all children.

Conclusions

This study is among the first, to our knowledge, to document both high prevalence of need for spectacles and very low rates of spectacle ownership among urban migrant children, a large and growing population in China. Together with information on similar low rates in rural western areas,[4] our study offers further evidence of the need for programs providing spectacles to China's millions of children affected by uncorrected refractive error.

ARTICLE INFORMATION

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