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Nudging Eyeglass Use Among Children: Evidence from a Randomized Controlled Trial in Vietnam

Cuong Viet Nguyen^a Quynh Thien Thi Pham^b Tung Duc Phung^c

Abstract

In this study, we examine whether a nudging intervention increases eyeglass use among primary and lower-secondary students in Vietnam through a randomized controlled trial. Students with refractive errors in 34 schools in one province were provided with free eyeglasses. Half of the schools were randomly selected, allowing students in these schools to choose from 10 available eyeglass frames. Six months after receiving their eyeglasses, we assessed the impact of frame choice. We find no significant effect of frame choice on students' eyeglass-wearing behavior.

Keywords: Education, Health, Randomized Control Trial, Nudge, Vietnam.

JEL classifications: I12; I20; C93.

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1. Introduction

From the moment of birth through adulthood, vision is the most dominant of the five human senses, playing a vital role in shaping how individuals perceive, interact with, and navigate the world around them. Yet, around 2.6 billion people of all ages suffer from myopia (in 2020) and 1.8 billion experience presbyopia (in 2015) (WHO, 2019). A global meta-analysis by Hashemi et al. (2018) estimates the prevalence of myopia, hyperopia, and astigmatism in children at 11.7%, 4.6%, and 14.9%, respectively.

Despite the high prevalence of refractive errors, a significant number of children remain uncorrected, with low-income and minority children disproportionately affected (Dudovitz et al., 2020; Glewwe et al., 2018; Ma et al., 2014). Uncorrected refractive errors can impair academic performance (Krumholtz, 2000; Williams et al., 2005) and may lead to visual impairment later in life (Anh et al., 2021; Ma et al., 2014). As a result, wearing eyeglasses has been found to improve reading and math performance (Anne-Catherine et al., 2008; Ma et al., 2014; Glewwe et al., 2016, 2018), as well as language arts (Dudovitz et al., 2020).

Vietnam is a country with high rates of refractive errors with approximately 20% of the children, with the majority are uncorrected (Anh et al., 2021). In this study, we examine whether allowing students to choose eyeglass frame can increase the glass wearing among students with refractive errors in a province in Vietnam using a Randomized Controlled Trial (RCT) conducted during the 2017–2018 period. Students with refractive errors are provided with free eyeglass but half of them are offered to select one among 10 different eyeglass frame styles.

This study contributes to two strands of literature. First, it adds to the limited research on using nudges to encourage eyeglass wearing among children. For example, Yi et al. (2015) found that teacher incentives improved in-class spectacle use in urban China, while Morjaria et al. (2017) in India found no difference in usage between ready-made and custom-made spectacles. Second, this study also contributes to evidence on the academic impact of eyeglass provision. Dudovitz et al. (2020) reported gains in language arts and math among low-performing students in Los Angeles. Glewwe et al. (2018) found improved test scores in Florida after providing free eye care, though effects faded over time. In China, Glewwe et al. (2016) and Ma et al. (2014) found that free eyeglasses significantly boosted test scores and usage, especially among lower-performing students.

The remainder of the article is structured as follows: Section 2 provides background information and details on the study design; Section 3 outlines the estimation methodology; Section 4 presents the empirical findings; and Section 5 concludes.

2. The study design

The Fred Hollows Foundation implemented a School Eye Health project in the three provinces of Hai Duong, Da Nang, and Tien Giang in Vietnam during the 2016–2019 period. The project aimed to improve students' knowledge, attitudes, and practices related to child eye care. To evaluate the program's impact, a randomized controlled trial (RCT) was conducted in 2017–2018 in three districts of Tien Giang province: Cai Lay, Chau Thanh, and Cho Gao. A total of 45 schools were selected from these districts and randomly assigned to three groups:

- (i) 15 schools in which students with refractive errors received free eyeglasses;
- (ii) 15 schools in which students with refractive errors received free eyeglasses and could choose from 10 different frame styles;
- (iii) 15 schools in which students are not provided with free eyeglasses.

The project targeted students in grades 3, 4, 6, and 7 who had refractive errors at the time of the baseline survey. The baseline and endline surveys were conducted by the Mekong Development Research Institute in Vietnam, in May 2017 and March 2018, respectively. Students received free eyeglasses in August 2017.

One problem in this study is that parents and schools in the control group strongly requested eyeglasses for their children. The project ultimately provided free eyeglasses to most students in the control group. This makes it impossible to estimate the effect of eyeglass provision itself. Therefore, we exclude the original control group from the analysis and instead focus on estimating the effect of allowing students to choose their eyeglass frames on their wearing behavior.

In the remainder of the paper, we define the treatment group as students who received eyeglasses and were allowed to choose their frames, and the control group as students who received eyeglasses with pre-assigned frames (i.e., they were not allowed to choose). At baseline, the treatment and control groups included 254 and 184 students, respectively. At endline, these numbers were 251 and 177. Attrition in the study is minimal: 3 students (1%) in the treatment group and 7 students (4%) in the control group did not participate in the endline survey. It should be noted that, although both the treatment and control groups each include 15 schools, the number of students in the treatment group is significantly higher than in the control group. This is because the treatment group includes one large school with 88 students.

3. Estimation method

We conduct a balance test at baseline using the sample of students who participated in the endline survey. Appendix Table A.1 also presents the balance of all explanatory variables (student gender, age, and urban residence) and all outcome variables at baseline.

We use OLS regression to estimate the treatment impact on students' outcomes:

$$Y_{i,s} = \alpha + \beta Treatment_s + X_{i,s}\gamma + \varepsilon_{i,s}$$
(1)

where $Y_{i,s}$ is an outcome variable of student *i* in school *s* in the endline survey. *Treatment*_s is a dummy variable indicating school *c* received the intervention, that is students in the school can choose eyeglass frames. $X_{i,s}$ denotes exogenous control variables including gender, age, urban residence, and the dependent variable at the baseline. We control for baseline outcome variables to enhance statistical power (McKenzie, 2012). The unobserved variables are denoted by ε_{ic} . Standard errors are clustered at the school level, following Abadie et al. (2023).

4. Empirical results

The main outcomes are students' eyeglass-wearing behaviors. Students were asked how frequently they wore glasses during the past week. We compute three measures: the proportion of students who wore glasses at least once during the past week, the proportion who wore glasses often or always, and the proportion who always wore glasses. Figure 1 shows that the proportion of students wearing glasses, and those wearing glasses often or always, increased significantly in both the treatment and control groups. The increase in the proportion of students who always wore glasses was relatively small, likely because this group had more severe refractive errors and already wore glasses consistently, even before receiving the free glasses from the project.



Figure 1: The proportion of children wearing eyeglass (%)

Note: The percentage of control and treatment students wearing eyeglass and the 95% confidence interval in the baseline and endline surveys.

Table 1 reports the regression results based on Equation (1). Consistent with Morjaria et al. (2017), who reported no significant difference in eyeglass use between recipients of ready-made and custom-made spectacles in India, we find no statistically significant effect of permitting students to select their own eyeglass frames on subsequent wearing behavior. The estimated coefficients of the treatment are very small. We also examine the impact of the treatment on educational performance, measured by students' first-semester grades in the 2017–2018 school year and their scores on a mathematics test conducted during the survey. We find no statistically significant effects of the treatment on these educational outcomes. This is consistent with the absence of treatment effects on students' eyeglass-wearing behavior.

			Depende	ent variables		
Explanatory variables	Wearing eyeglass	Often or always wearing eyeglass	Always wearing eyeglass	Had excellent academic performance in first semester	Had good academic performanc e in first semester	Math score
Treatment	0.015	-0.017	-0.002	0.047	-0.013	-0.368
	(0.035)	(0.039)	(0.025)	(0.071)	(0.041)	(0.444)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.968***	0.170	0.054	0.450	0.869***	4.144**
	(0.137)	(0.152)	(0.105)	(0.301)	(0.245)	(1.974)
Observations	428	428	428	370	370	425
R-squared	0.116	0.180	0.086	0.360	0.198	0.494

Table 1: Impacts	of the treatment	on wearing	eyeglass and	l education
r		0	-) - 8	

Note: Control variables include age, student gender, urban residence, and the dependent variable at baseline. Robust standard errors in parentheses (clustered at the school level). *** p<0.01, ** p<0.05, * p<0.1.

In this study, students are asked about their knowledge of different refractive errors and eye care. Table 2 presents regressions of these variables. There are no significant effects of the treatment on these variables.¹ This is reasonable, given the null effect of the treatment on eyeglass-wearing behavior.

We conduct several robustness checks to assess the sensitivity of our estimates to different model specifications. Specifically, we estimate models without control variables, models that control for baseline refractive errors, and panel-data models with student fixed effects. We also exclude the treatment school with the largest sample size (88 students) and re-estimate the treatment effects on all outcomes. The results, presented in Appendix Tables A.4 to A.11, are very similar to those in Tables 2 and 3. We find no statistically significant effect of the treatment on any outcome.

¹ Tables 1 and 2 only present the coefficient of the treatment variables. The full regression results are reported in Appendix Tables A.2 and A.3.

					Dependent	variables				
Explanatory variables	Having heard of the term 'eye refractive errors'	Having heard of the term 'short- sightedness'	Having heard of the term 'long- sightedness'	Having heard of the term 'astigmatism'	Knowing 'short- sightedness requires wearing glasses'	Knowing 'Correct posture while learning'	knowing 'After 45 minutes of screen use, rest eyes for 5-10 minutes'	Knowing 'Reduce the time spent on TV and electronic devices'	Knowing 'Get enough lighting while learning or working'	Knowing 'Get enough and balanced nutrients'
Treatment	0.029	-0.003	0.006	-0.017	-0.027	0.045	0.024	-0.051	-0.072	0.011
	(0.062)	(0.011)	(0.040)	(0.041)	(0.038)	(0.056)	(0.058)	(0.045)	(0.053)	(0.030)
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.467**	0.573***	-0.216	0.352	0.493***	-0.098	0.010	0.937***	-0.492**	-0.028
	(0.216)	(0.078)	(0.235)	(0.262)	(0.143)	(0.260)	(0.230)	(0.145)	(0.203)	(0.115)
Observations	428	428	428	428	428	428	428	428	428	428
R-squared	0.275	0.185	0.145	0.118	0.039	0.064	0.029	0.037	0.167	0.072

Table 2: Impacts of the treatment on knowledge of eye health

Note: Control variables include age, student gender, urban residence, and the dependent variable at baseline. Robust standard errors in parentheses (clustered at the school level). *** p<0.01, ** p<0.05, * p<0.1.

5. Conclusion

We evaluate the impact of allowing students to choose their eyeglass frames on eyeglasswearing behavior, educational outcomes, and knowledge of eye care, using a randomized controlled trial conducted in Vietnam. The underlying hypothesis is that giving students the autonomy to select their frames would increase their likelihood of wearing the glasses, as they may find them more appealing or personally suited. However, our findings show no statistically significant effects of this intervention on any of the outcomes measured. These results suggest that simply allowing students to choose their eyeglass frames is not an effective strategy to promote regular eyeglass use. This finding indicates a caution for future studies seeking to increase eyeglass wear through similar nudging interventions. From a policy perspective, this also implies that resources might be better allocated to interventions that directly address other barriers to wearing glasses, such as improving awareness of the importance of vision correction, reducing stigma associated with wearing glasses, or enhancing parental and teacher engagement.

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Appendix

Veriables	Variable	Treatment	Control	Difference:
variables	type	(T)	(C)	T - C
Control variables				
Gender of students (boy=1, girl=0)	Binary	0.466	0.435	0.031
		(0.037)	(0.039)	(0.057)
Age of students	Discrete	11.940	11.316	0.624
		(0.296)	(0.338)	(0.586)
Urban areas (urban=1, rural=0)	Binary	0.100	0.062	0.037
		(0.071)	(0.034)	(0.110)
Outcome variables				
Wearing eyeglass (yes=1, no=0)	Binary	0.606	0.520	0.086
		(0.052)	(0.062)	(0.089)
Often or always wearing eyeglass (yes=1, no=0)	Binary	0.175	0.113	0.062
		(0.024)	(0.026)	(0.039)
Always wearing eyeglass (yes=1, no=0)	Binary	0.056	0.034	0.022
		(0.020)	(0.015)	(0.022)
Had excellent academic performance in first	Binary	0.458	0.467	-0.010
semester (yes=1, no=0)		(0.049)	(0.035)	(0.053)
Had excellent or good academic performance in	Binary	0.720	0.793	-0.073
first semester (yes=1, no=0)		(0.038)	(0.029)	(0.052)
Math score of students	Continuous	16.861	16.955	-0.094
		(0.663)	(0.447)	(0.834)
Having heard of the term 'eye refractive errors'	Binary	0.315	0.203	0.111
(yes=1, no=0)		(0.063)	(0.044)	(0.101)
Having heard of the term 'short-sightedness'	Binary	0.968	0.972	-0.004
(yes=1, no=0)		(0.020)	(0.016)	(0.031)
Having heard of the term 'long-sightedness'	Binary	0.554	0.463	0.091
(yes=1, no=0)		(0.086)	(0.061)	(0.131)
Having heard of the term 'astigmatism' (yes=1,	Binary	0.606	0.576	0.029
no=0)		(0.068)	(0.059)	(0.110)
Knowing 'short-sightedness requires wearing	Binary	0.821	0.791	0.030
glasses' (yes=1, no=0)		(0.031)	(0.043)	(0.056)
Knowing 'Correct posture while learning'	Binary	0.307	0.316	-0.010
(yes=1, no=0)		(0.037)	(0.036)	(0.061)
knowing 'After 45 minutes of screen use, rest	Binary	0.235	0.237	-0.002
eyes for 5-10 minutes' (yes=1, no=0)		(0.050)	(0.034)	(0.074)
Knowing 'Reduce the time spent on TV and	Binary	0.661	0.689	-0.028
electronic devices' (yes=1, no=0)		(0.037)	(0.036)	(0.057)
Knowing 'Get enough lighting while learning or	Binary	0.398	0.282	0.116
working' (yes=1, no=0)		(0.056)	(0.037)	(0.081)
Knowing 'Get enough and balanced nutrients'	Binary	0.116	0.068	0.048
(yes=1, no=0)		(0.030)	(0.020)	(0.042)

Table A.1: Balance test of baseline

Note: This table reports the means and mean differences of characteristics between the treatment and control groups at baseline (2017). The last column shows that the differences in the characteristics between the treatment and control groups are not statistically significant at the 10% level.

Standard errors (clustered at the school level) are reported in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

			Depend	ent variables		
Explanatory variables	Wearing eyeglass	Often or always wearing eyeglass	Always wearing eyeglass	Had excellent academic performance in first semester	Had good academic performance in first semester	Math score
Treatment	0.015	-0.017	-0.002	0.047	-0.013	-0.368
	(0.035)	(0.039)	(0.025)	(0.071)	(0.041)	(0.444)
Gender of students (boy=1, girl=0)	-0.048**	-0.002	0.010	-0.135***	-0.143***	-1.048***
	(0.019)	(0.031)	(0.023)	(0.036)	(0.041)	(0.349)
Age of students	-0.012	0.006	-0.002	-0.020	-0.028	-0.047
	(0.011)	(0.012)	(0.008)	(0.025)	(0.016)	(0.133)
Urban areas (urban=1, rural=0)	0.001	0.052	0.019	-0.019	0.001	1.686***
	(0.037)	(0.034)	(0.026)	(0.081)	(0.042)	(0.344)
Baseline dependent variable	0.184***	0.561***	0.311**	0.556***	0.387***	0.623***
	(0.038)	(0.049)	(0.117)	(0.045)	(0.064)	(0.026)
Constant	0.968***	0.170	0.054	0.450	0.869***	4.144**
	(0.137)	(0.152)	(0.105)	(0.301)	(0.245)	(1.974)
Observations	428	428	428	370	370	425
Dequered	0.116	0.180	0.086	0.360	0.198	0.494

Table A.2: Regression of wearing eyeglass and education

					Dependent	variables				
	Having	Having	Having	Having heard	Knowing	Knowing	knowing	Knowing	Knowing	Knowing
	heard of the	heard of the	heard of the	of the term	'short-	'Correct	'After 45	'Reduce the	'Get enough	'Get enough
Explanatory variables	term 'eye	term 'short-	term 'long-	'astigmatism'	sightedness	posture	minutes of	time spent	lighting	and
	refractive	sightedness	sightedness		requires	while	screen use,	on TV and	while	balanced
	errors				wearing	learning	rest eyes for	devices'	learning or	nutrients
					glasses		minutes'	devices	working	
Treatment	0.029	-0.003	0.006	-0.017	-0.027	0.045	0.024	-0.051	-0.072	0.011
	(0.062)	(0.011)	(0.040)	(0.041)	(0.038)	(0.056)	(0.058)	(0.045)	(0.053)	(0.030)
Gender of students	-0.105**	-0.017	-0.028	-0.038	-0.038	-0.101*	-0.002	0.017	-0.089**	-0.079***
(boy=1, girl=0)	(0.049)	(0.013)	(0.057)	(0.037)	(0.030)	(0.051)	(0.045)	(0.040)	(0.041)	(0.021)
Age of students	0.068***	0.005	0.068***	0.023	0.030**	0.040*	0.016	-0.024*	0.075***	0.010
	(0.019)	(0.005)	(0.017)	(0.019)	(0.013)	(0.020)	(0.018)	(0.012)	(0.018)	(0.009)
Urban areas (urban=1,	0.252***	0.012	0.095**	0.087	0.042	-0.123***	-0.177***	-0.018	0.015	0.025
rural=0)	(0.090)	(0.007)	(0.041)	(0.071)	(0.042)	(0.031)	(0.029)	(0.050)	(0.071)	(0.044)
Baseline dependent	0.435***	0.359***	0.201***	0.264***	0.062	0.165**	0.105*	0.154***	0.303***	0.189*
variable	(0.055)	(0.084)	(0.048)	(0.046)	(0.052)	(0.080)	(0.053)	(0.038)	(0.064)	(0.102)
Constant	-0.467**	0.573***	-0.216	0.352	0.493***	-0.098	0.010	0.937***	-0.492**	-0.028
	(0.216)	(0.078)	(0.235)	(0.262)	(0.143)	(0.260)	(0.230)	(0.145)	(0.203)	(0.115)
Observations	428	428	428	428	428	428	428	428	428	428
R-squared	0.275	0.185	0.145	0.118	0.039	0.064	0.029	0.037	0.167	0.072

Table A.3: Regression of knowledge of eye health

Note: Robust standard errors in parentheses (clustered at the school level). *** p<0.01, ** p<0.05, * p<0.1.

	Dependent variables								
Explanatory variables	Wearing eyeglass	Often or always wearing eyeglass	Always wearing eyeglass	Had excellent academic performance in first semester	Had good academic performance in first semester	Math score			
Treatment	0.022	0.024	0.005	0.020	-0.069	-0.411			
	(0.028)	(0.046)	(0.026)	(0.066)	(0.053)	(0.730)			
Constant	0.898***	0.311***	0.051**	0.405***	0.779***	13.774***			
	(0.023)	(0.037)	(0.024)	(0.044)	(0.036)	(0.459)			
Observations	428	428	428	370	370	425			
R-squared	0.001	0.001	0.000	0.000	0.006	0.002			

Table A.4: Regression of wearing eyeglass and education without control variables

Note: Control variables include age, student gender, urban residence, and the dependent variable at baseline. Robust standard errors in parentheses (clustered at the school level). *** p<0.01, ** p<0.05, * p<0.1

					Dependent	variables				
Explanatory variables	Having heard of the term 'eye refractive errors'	Having heard of the term 'short- sightedness'	Having heard of the term 'long- sightedness'	Having heard of the term 'astigmatism'	Knowing 'short- sightedness requires wearing glasses'	Knowing 'Correct posture while learning'	knowing 'After 45 minutes of screen use, rest eyes for 5-10 minutes'	Knowing 'Reduce the time spent on TV and electronic devices'	Knowing 'Get enough lighting while learning or working'	Knowing 'Get enough and balanced nutrients'
Treatment	0.127	-0.001	0.069	0.007	-0.006	0.060	0.027	-0.070	0.007	0.024
	(0.102)	(0.018)	(0.061)	(0.060)	(0.046)	(0.072)	(0.061)	(0.047)	(0.083)	(0.034)
Constant	0.435***	0.977***	0.712***	0.774***	0.898***	0.390***	0.220***	0.751***	0.475***	0.079***
	(0.049)	(0.012)	(0.039)	(0.051)	(0.036)	(0.035)	(0.045)	(0.031)	(0.068)	(0.016)
Observations	428	428	428	428	428	428	428	428	428	428
R-squared	0.016	0.000	0.006	0.000	0.000	0.004	0.001	0.006	0.000	0.002

Table A.5: Regression of knowledge of eye health without control variables

 Note: Robust standard errors in parentheses (clustered at the school level).

 *** p<0.01, ** p<0.05, * p<0.1.</td>

			Depende	nt variables		
Explanatory variables	Wearing eyeglass	Often or always wearing eyeglass	Always wearing eyeglass	Had excellent academic performance in first semester	Had good academic performance in first semester	Math score
Treatment	0.015	-0.016	-0.001	0.045	-0.012	-0.367
	(0.035)	(0.039)	(0.025)	(0.072)	(0.040)	(0.440)
Gender of students (boy=1, girl=0)	-0.047**	-0.004	0.010	-0.136***	-0.145***	-1.055***
	(0.019)	(0.030)	(0.023)	(0.036)	(0.043)	(0.333)
Age of students	-0.013	0.008	-0.004	-0.021	-0.025	-0.014
	(0.012)	(0.012)	(0.009)	(0.025)	(0.016)	(0.132)
Urban areas (urban=1, rural=0)	-0.004	0.039	0.016	-0.016	0.007	1.811***
	(0.038)	(0.032)	(0.023)	(0.085)	(0.040)	(0.350)
Baseline dependent variable	0.187***	0.593***	0.304**	0.546***	0.390***	0.623***
	(0.039)	(0.045)	(0.117)	(0.048)	(0.062)	(0.024)
The student has nearsightedness at baseline	-0.003	-0.097	0.034**	0.059	-0.006	-0.289
	(0.037)	(0.065)	(0.013)	(0.052)	(0.050)	(0.441)
The student has farsightedness at baseline	0.045	-0.255***	-0.016	-0.087	-0.272	0.810
	(0.036)	(0.052)	(0.016)	(0.088)	(0.258)	(0.887)
The student has astigmatism at baseline	-0.046	-0.083	-0.015	0.047	0.056	0.686
	(0.032)	(0.060)	(0.029)	(0.052)	(0.052)	(0.511)
The student has an eye problem at baseline	-0.009	0.136	-0.021*	0.028	-0.101	-0.805
	(0.120)	(0.128)	(0.012)	(0.096)	(0.151)	(1.015)
Constant	0.991***	0.214	0.060	0.417	0.844***	3.855*
	(0.145)	(0.135)	(0.114)	(0.311)	(0.246)	(1.973)
Observations	428	428	428	370	370	425
R-squared	0.119	0.202	0.093	0.363	0.206	0.498

Table A.6: Regression of wearing eyeglass and education with additional control variables

Note: Robust standard errors in parentheses (clustered at the school level). *** p<0.01, ** p<0.05, * p<0.1.

					Dependent	variables				
Explanatory variables	Having heard of the term 'eye refractive errors'	Having heard of the term 'short- sightedness'	Having heard of the term 'long- sightedness'	Having heard of the term 'astigmatism'	Knowing 'short- sightedness requires wearing glasses'	Knowing 'Correct posture while learning'	knowing 'After 45 minutes of screen use, rest eyes for 5-10 minutes'	Knowing 'Reduce the time spent on TV and electronic devices'	Knowing 'Get enough lighting while learning or working'	Knowing 'Get enough and balanced nutrients'
Treatment	0.031	-0.003	0.006	-0.017	-0.027	0.048	0.024	-0.053	-0.074	0.010
	(0.062)	(0.010)	(0.041)	(0.041)	(0.037)	(0.052)	(0.058)	(0.045)	(0.054)	(0.028)
Gender of students (boy=1,	-0.106**	-0.017	-0.032	-0.039	-0.038	-0.103**	-0.000	0.018	-0.091**	-0.079***
girl=0)	(0.049)	(0.012)	(0.059)	(0.037)	(0.030)	(0.049)	(0.046)	(0.041)	(0.041)	(0.020)
Age of students	0.071***	0.006	0.072***	0.026	0.030**	0.040**	0.013	-0.023*	0.077***	0.008
	(0.019)	(0.005)	(0.015)	(0.018)	(0.014)	(0.019)	(0.017)	(0.011)	(0.019)	(0.009)
Urban areas (urban=1,	0.263***	0.017*	0.106**	0.094	0.042	-0.121***	-0.189***	-0.007	0.029	0.025
rural=0)	(0.087)	(0.009)	(0.040)	(0.071)	(0.040)	(0.036)	(0.031)	(0.053)	(0.073)	(0.042)
Baseline dependent variable	0.426***	0.359***	0.180***	0.233***	0.061	0.152*	0.098*	0.152***	0.298***	0.183*
	(0.059)	(0.085)	(0.051)	(0.048)	(0.051)	(0.078)	(0.051)	(0.039)	(0.061)	(0.103)
Student has nearsightedness	0.020	0.002	0.052	0.051	0.016	0.068	0.005	0.022	0.033	0.061**
at baseline	(0.050)	(0.016)	(0.057)	(0.043)	(0.046)	(0.050)	(0.034)	(0.040)	(0.045)	(0.023)
Student has farsightedness	-0.079	0.057	0.011	-0.019	-0.011	-0.422***	0.073	0.166	0.107	-0.076*
at baseline	(0.153)	(0.057)	(0.139)	(0.133)	(0.110)	(0.068)	(0.148)	(0.148)	(0.142)	(0.042)
Student has astigmatism at	0.093	0.025*	0.116	0.104**	0.007	0.089*	-0.094***	0.051	0.102*	0.013
baseline	(0.077)	(0.014)	(0.095)	(0.041)	(0.035)	(0.047)	(0.033)	(0.075)	(0.058)	(0.029)
Student has an eye problem	-0.147	-0.055	-0.106	-0.162	0.009	-0.090	0.019	-0.049	-0.000	0.014
at baseline	(0.092)	(0.119)	(0.104)	(0.124)	(0.116)	(0.079)	(0.101)	(0.150)	(0.132)	(0.047)
Constant	-0.515**	0.561***	-0.293	0.288	0.487***	-0.142	0.056	0.906***	-0.556**	-0.044
	(0.224)	(0.068)	(0.194)	(0.250)	(0.134)	(0.236)	(0.226)	(0.140)	(0.220)	(0.110)
Observations	428	428	428	428	428	428	428	428	428	428
R-squared	0.284	0.197	0.158	0.135	0.040	0.086	0.034	0.041	0.173	0.083

Table A.7: Regressio	on of knowledg	e of eve he	alth with	additional	control	variables
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Note: Robust standard errors in parentheses (clustered at the school level). *** p<0.01, ** p<0.05, * p<0.1.

			Depende	nt variables		
Explanatory variables	Wearing eyeglass	Often or always wearing eyeglass	Always wearing eyeglass	Had excellent academic performance in first semester	Had good academic performance in first semester	Math score
Treatment	-0.064	-0.038	-0.017	0.029	0.009	-0.339
	(0.099)	(0.043)	(0.026)	(0.066)	(0.053)	(0.560)
Year 2018 dummy	0.379***	0.198***	0.017	-0.067	-0.018	-3.181***
-	(0.066)	(0.030)	(0.017)	(0.042)	(0.040)	(0.402)
Student fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.570***	0.150***	0.047***	0.465***	0.752***	16.906***
	(0.026)	(0.011)	(0.007)	(0.016)	(0.012)	(0.141)
Observations	856	856	856	775	775	853
Number of students	428	428	428	405	405	428
R-squared	0.335	0.132	0.002	0.014	0.001	0.382

Table A.8: Student fixed effect of regression of wearing eyeglass and education

Note: Robust standard errors in parentheses (clustered at the school level). *** p<0.01, ** p<0.05, * p<0.1.

	Dependent variables									
Explanatory variables	Having heard of the term 'eye refractive errors'	Having heard of the term 'short- sightedness'	Having heard of the term 'long- sightedness'	Having heard of the term 'astigmatism'	Knowing 'short- sightedness requires wearing glasses'	Knowing 'Correct posture while learning'	knowing 'After 45 minutes of screen use, rest eyes for 5-10 minutes'	Knowing 'Reduce the time spent on TV and electronic devices'	Knowing 'Get enough lighting while learning or working'	Knowing 'Get enough and balanced nutrients'
Treatment	0.015	0.002	-0.021	-0.022	-0.036	0.070	0.029	-0.042	-0.108	-0.023
	(0.061)	(0.020)	(0.106)	(0.079)	(0.043)	(0.067)	(0.094)	(0.064)	(0.074)	(0.044)
Year 2018 dummy	0.232***	0.006	0.249***	0.198***	0.107***	0.073	-0.017	0.062	0.192***	0.011
	(0.035)	(0.010)	(0.064)	(0.042)	(0.024)	(0.045)	(0.044)	(0.051)	(0.056)	(0.026)
Student fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.269***	0.970***	0.516***	0.593***	0.808***	0.311***	0.236***	0.673***	0.350***	0.096***
	(0.016)	(0.006)	(0.028)	(0.022)	(0.012)	(0.017)	(0.026)	(0.016)	(0.018)	(0.012)
Observations	856	856	856	856	856	856	856	856	856	856
Number of students	428	428	428	428	428	428	428	428	428	428
R-squared	0.189	0.002	0.154	0.108	0.034	0.037	0.001	0.005	0.058	0.001

Table A.9: Student fixed effect regression of knowledge of eye health

Note: Robust standard errors in parentheses (clustered at the school level). *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables								
Explanatory variables	Wearing eyeglass	Often or always wearing eyeglass	Always wearing eyeglass	Had excellent academic performance in first semester	Had good academic performance in first semester	Math score		
Treatment	0.048	0.004	-0.007	0.092	-0.032	-0.702		
	(0.032)	(0.046)	(0.029)	(0.066)	(0.051)	(0.431)		
Gender of students (boy=1, girl=0)	-0.060***	0.004	0.025	-0.147***	-0.141**	-1.048**		
	(0.020)	(0.039)	(0.026)	(0.042)	(0.052)	(0.427)		
Age of students	-0.007	0.009	-0.003	-0.013	-0.032*	-0.047		
	(0.012)	(0.013)	(0.009)	(0.023)	(0.017)	(0.145)		
Urban areas (urban=1, rural=0)	-0.026	0.035	0.023	-0.053	0.009	1.936***		
	(0.026)	(0.037)	(0.028)	(0.083)	(0.054)	(0.348)		
Baseline dependent variable	0.159***	0.537***	0.253**	0.575***	0.363***	0.628***		
	(0.033)	(0.061)	(0.122)	(0.054)	(0.077)	(0.032)		
Constant	0.927***	0.132	0.067	0.361	0.946***	4.048*		
	(0.155)	(0.170)	(0.113)	(0.278)	(0.264)	(2.142)		
Observations	340	340	340	300	300	340		
R-squared	0.104	0.154	0.065	0.382	0.189	0.533		

Table A.10: Regression of wearing eyeglass and education, excluding the outlier school

Note: Control variables include age, student gender, urban residence, and the dependent variable at baseline.Robust standard errors in parentheses (clustered at the school level).*** p<0.01, ** p<0.05, * p<0.1</td>

	Dependent variables									
Explanatory variables	Having heard of the term 'eye refractive errors'	Having heard of the term 'short- sightedness'	Having heard of the term 'long- sightedness'	Having heard of the term 'astigmatism'	Knowing 'short- sightedness requires wearing glasses'	Knowing 'Correct posture while learning'	knowing 'After 45 minutes of screen use, rest eyes for 5-10 minutes'	Knowing 'Reduce the time spent on TV and electronic devices'	Knowing 'Get enough lighting while learning or working'	Knowing 'Get enough and balanced nutrients'
Treatment	-0.014	-0.008	0.007	-0.017	-0.045	-0.011	-0.002	-0.064	-0.061	-0.019
	(0.062)	(0.014)	(0.050)	(0.054)	(0.039)	(0.053)	(0.064)	(0.058)	(0.058)	(0.026)
Gender of students	-0.067	-0.020	-0.031	-0.042	-0.017	-0.088	-0.031	0.053	-0.086*	-0.066**
(boy=1, girl=0)	(0.047)	(0.016)	(0.070)	(0.045)	(0.032)	(0.064)	(0.045)	(0.036)	(0.049)	(0.025)
Age of students	0.059***	0.004	0.067***	0.021	0.024*	0.031	0.009	-0.024	0.075***	0.005
	(0.017)	(0.005)	(0.018)	(0.020)	(0.013)	(0.020)	(0.018)	(0.014)	(0.019)	(0.009)
Urban areas (urban=1,	0.292***	0.016	0.094*	0.081	0.054	-0.090*	-0.162***	-0.005	0.007	0.075**
rural=0)	(0.083)	(0.009)	(0.047)	(0.072)	(0.036)	(0.045)	(0.041)	(0.061)	(0.077)	(0.032)
Baseline dependent variable	0.458***	0.356***	0.197***	0.236***	0.090	0.077	0.142**	0.189***	0.358***	0.094
	(0.064)	(0.083)	(0.054)	(0.048)	(0.055)	(0.063)	(0.052)	(0.037)	(0.063)	(0.102)
Constant	-0.379*	0.587***	-0.192	0.396	0.530***	0.034	0.096	0.896***	-0.515**	0.041
	(0.203)	(0.075)	(0.251)	(0.276)	(0.141)	(0.257)	(0.229)	(0.168)	(0.213)	(0.102)
Observations	340	340	340	340	340	340	340	340	340	340
R-squared	0.246	0.182	0.131	0.094	0.042	0.029	0.041	0.052	0.200	0.048

Table A.11: Regression of knowledge of eye health, excluding the outlier school

 Note: Robust standard errors in parentheses (clustered at the school level).

 *** p<0.01, ** p<0.05, * p<0.1.</td>