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What Can Children Learn from a Free Trial of Eyeglasses Use? Evidence from a Cluster-Randomized Controlled Trial in Rural China

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Abstract

Free trial is a widely used business strategy that takes advantage of information asymmetry. However, evidence on what we can learn and how rapidly we can learn from a free trial of health care is limited. This study evaluates the effect of a free trial of eyeglasses on children's 8 items of perception related to eyeglasses use. An evaluation was conducted alongside a cluster-randomized controlled trial involved 832 myopic children from northwest rural China. A total of 428 myopic children from 42 schools were randomized to receive free eyeglasses, and 404 myopic children from 42 schools were randomized as control group. We find that the perceived costs and benefits of eyeglasses use and the perceived timing of wearing eyeglasses at the appropriate time can be learned from a free trial of eyeglasses. Compared with the control group in the long run, 5.6 percentage points more children in treatment group agreed that wearing eyeglasses was attractive, 16.5 percentage points more children agreed that wearing eyeglasses is helpful to academic performance, and 7.9 percentage points more children agreed that children with vision problems should wear eyeglasses. Due to the effects of a free product and the time to learning from experience, the magnitude of the impact of a free trial changed over time. We also find that the indirect experience, such as a vision protection course, cannot change children' perceptions about the cost or benefits of eyeglasses use. The findings imply that children can learn significantly from the experience of a free trial of eyeglasses. A free trial is an effective strategy to solve the information asymmetry problem for health care. The first pair of eyeglasses of children can be one-off subsidized to trigger demand for eyeglasses use.

Keywords

free trail, information asymmetry, experience attributes, eyeglasses use, rural China

What do we already know about this topic?

Free trial is a widely used business strategy that takes advantage of information asymmetry. However, evidence on what we can learn and how rapidly we can learn from a free trial of health care is limited.

How does your research contribute to the field?

Children can learn significantly from the experience of a free trial of eyeglasses. Due to the effects of a free product and the time to learning from experience, the magnitude of the impact of a free trial will change over time.

What are your research's implications toward theory, practice, or policy?

A free trial is an effective and cost-effective strategy to solve the information asymmetry problem for health care. The first pair of eyeglasses of children can be one-off subsidized to trigger demand for eyeglasses use. Besides, it is important to choose the appropriate timing to assess charges for the product.

Introduction

Due to economic disparities and gaps in infrastructure, the quality of public health care in China is worse among children in rural regions than in urban regions.[1,2] Access to high quality public health care is crucial not only for optimal child health and development, but also for academic performance and future economic participation. However, in rural China, especially in the impoverished regions, public health care is still widely inaccessible. For example, one study in 2011 found that 38% of elementary children in western China have anemia—a condition that is easily treated with iron supplements but consequential if left untreated. Alarmingly, this same study found that few of those children took the supplements.[1]

Vision problems, mainly myopia, is also a compelling example of the underutilization of public health care. Over one-quarter of the world's estimated 285 million visually impaired individuals live in China, and uncorrected refractive error is the leading cause of visual impairment in the world.[2,3] Previous studies have also shown that about 25% of elementary children and 50% of middle school children have vision problems, which can be easily corrected with proper eyeglasses. However, among children who have myopia, less than 20% of elementary children and less than 30% of middle school children wear proper eyeglasses.[4,5]

While issues regarding myopia treatment and eyeglass compliance are multifaceted, information asymmetry remains one of the most important reasons why children with myopia do not wear eyeglasses. Studies have shown that children and parents are unaware of the importance of wearing eyeglasses when they have vision problems, as well as its benefits in improving academic performance.[5-7] Moreover, misconceptions about eyeglasses among children in rural China are prevalent. For instance, our study found that 75% of children believed that wearing eyeglasses can harm their eyesight, despite research proving otherwise.

A free trial is one of the best ways to solve this information asymmetry problem. Information can be attained by direct and indirect experience, implying 2 kinds of methods to solve the problem. First, information can be attained through indirect experience, such as vision protection courses that help children better understand myopia. However, gaining knowledge through indirect experience has been shown to be not as effective in changing perceptions and behavior.[6] Second, information can be gained through direct experience, such as the use of the product, which has been used particularly in marketing strategies. Nelson et al. introduced the concept of learning from product use experience, which may lead to the participants purchasing the product.[8] A free trial is one of the most popular marketing strategies and has been found to significantly increase demand for products.[9,10]

While many studies have focused on the effects of a free trial on commercial goods, few studies have rigorously examined how a free trial may be applied to increase use of health care. Previous studies have argued that since health care is considerably different from traditional commercial products, the quality of health care cannot be accurately assessed by patients. Therefore, a free trial may not be effective for health care.[8,11] However, the demand for health care is affected not just by its quality but also by other perceptions about product use. For instance, although consumers may not know whether their eyeglasses prescriptions are correct, they can perceive whether the eyeglasses are helpful to their daily activities, which can also impact their decision on whether or not to wear eyeglasses. A few studies had documented the effectiveness of a free trial on the adoption of health care or new health technology.[9,16] However, no study focused on how this change happen, in other words, what did the children learn from the free trial that lead the change of adoption?

The Search, Experience, and Credence Attributes (SEC) framework show that only the experience attributes of the product can be learned from a free trial experience. Nelson and Darby and Karni extended Stigler's economics of information theory by considering how different types of information or claims interact with consumers' search and trial.[8,12] Information or claims of product can be classified by 3 different attributes: Search, Experience, and Credence Attributes, also known as the SEC framework.[8,12] The Search attribute is defined as information or claims that can be verified prior to purchase or use through direct inspection, prior knowledge, or a readily available source. For instance, the colors of candies can be directly observed prior to consumers' purchase or consumption. The Experience attribute is information or claims that can be verified only after purchasing or using the product for a certain period of time, which is relatively short in comparison to the product's life. For example, the tastes of candies can only be known after consumers taste them. The Credence attribute is one that cannot be verified even after the product is used because of the consumer's lack of technical expertize or because the cost of obtaining sufficient accurate information to check the veracity of the claims is higher than its expected value. However,

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such information or claims can be verified by experts. For instance, the claim that "candies can be used to destroy oral bacteria" can only be verified through professional or technical knowledge, rather than direct inspection. If a commercial product contains mainly one type of attribute, they can be called certain type of product. For example, movies have relatively more experience attributes, then movies are called experience products.

Another important question is how rapidly the participants can learn from the free trial experience and how long can the perception last. On the one hand, the perceptions need time. Participants require time to verify the information as well as to change their perceptions. On the other hand, a free product involves no financial risk, therefore, it will elicit a more positive affective response,[13] which means that consumers could have more positive perceptions of the free product in the short run. However, few studies clarify whether the positive perception will sustain in the long run.

To bridge this literature gap, the main goal of this study is to conduct a randomized controlled trial among children in rural China to determine whether a free trial of eyeglasses could change children' perceptions about eyeglasses. The remainder of the paper is organized as follows. Section II describes the research design, data collection and our statistical approach. In Section III, we report our findings. And Section IV presents our discussion.

Methods

Sampling

This study's data were drawn from an eyeglasses experiment which was implemented in Gansu and Shaanxi provinces during the fall semester of the 2012 to 2013 academic year. Tianshui prefecture is a deprived area in one of China's lowest resource provinces, Gansu. Yulin prefecture is a relatively affluent area, in the middle-income Shaanxi province.

To choose our sample of schools and children, we followed a 5-step process. First, we obtained a list of all schools in 2 prefectures: Tianshui Prefecture in Gansu Province and Yulin Prefecture in Shaanxi Province. Second, we included all counties of these 2 prefectures, except for 1 county in Yulin (Wubu county is excluded from the project because of its small population size.). In total, 18 counties were included in the sampling: 7 counties in Tianshui and 11 counties in Yulin. After selecting the counties, in the third step, we obtained a list of all primary schools from each county's bureau of education. In total, the list included 435 schools. Using the list as a guide, we proceeded to the fourth step and randomly selected 1 school from each township in all of the 18 counties in the sample. We limited our choice of schools to only those schools that had between 50 and 150 children in grades 4 and 5 together. Finally, within each school, only 1 class was included in each grade. If there was more than 1 class in either grade, we randomly selected 1 class only.

Randomization and Intervention

After vision examinations were finished, all schools were divided into 42 strata according to 3 variables, the information on which was collected during the baseline survey and screening. The data collected included the total number of children in grades 4 and 5, and the number of children failing vision screening in grades 4 and 5. There were 6 schools in each stratum which were randomly divided into 6 different groups. They were: control group, free eyeglasses (providing free eyeglasses to the children with vision problems) group, and 4 different types of interventions. This study only focuses on the intervention of eyeglasses and therefore, only focuses on the free eyeglasses group (42 schools) and the control group (42 schools). All the schools were randomized into different treatment groups, ensuring that the free eyeglasses treatment group was similar to the control group. Balance tests, which are described below, validate this similarity.

(a) Control group: Based on refraction results, children in the control group were provided with prescriptions, which were included in a letter to the parents. After the interventions and evaluations were finished, free eyeglasses were provided to children in this group.
(b) Treatment group (free eyeglasses group): free eyeglasses were distributed to the students found to require eyeglasses after refraction, regardless of whether they already had eyeglasses. The process of filling the prescriptions and manufacturing eyeglasses followed the standard process for the local optical shop.

Only the students without eyeglasses at baseline from the free eyeglasses group and control group were included in this analysis. Considering that the objective of our research is to evaluate the impact of free trial of eyeglasses, the children included in this analysis should not have prior experience of wearing eyeglasses.

Children's Perception about Eyeglasses Use

In order to measure the change of children perception because of free trial, 3 types of information on eyeglass use are selected in this study: perceived characteristics of vision problems, perceived costs and benefits of eyeglass use, and perceived timing of wearing eyeglasses. The criteria used to choose the information is the importance on children that lead them to purchase or use eyeglasses according to previous studies (Table 2).

(a) Perceived characteristics of vision problems. Lack of knowledge about vision problems is one of the main reasons for the low rate of eyeglasses use.[4] Therefore, the definition of myopia (myopia is when one cannot see things that are far away clearly) and the cause of myopia (myopia is caused by a change in the shape of

the eyeball) are included. In addition, "children should have vision exams regularly" is also included.

(b) Perceived costs and benefits of eyeglasses use. Dupas found that the underestimation of the benefits or the overestimation of the costs of products contributed to their low adoption.[9] In order to measure the perceived cost of eyeglasses use of children, we select the top 2 self-reported concerns of children who are unwilling to wear eyeglasses[4,5]: wearing eyeglasses negatively impacts appearance and wearing eyeglasses worsens vision. The information that wearing eyeglasses is helpful to children' academic performance is included in this study. This information is selected to measure the perceived benefit of eyeglass for 2 reasons. Firstly, academic performance is crucial for elementary children. Secondly, dozens of studies have shown that wearing eyeglasses can significantly improve the academic performance of children who have vision problems.[5-7]

(c) Perceived timing of wearing eyeglasses. Elementary children with vision problems may want to delay wearing eyeglasses instead of completely refusing to wear eyeglasses.[4,14] The perceived timing of wearing eyeglasses implies the necessity of the children to wear eyeglasses immediately. Therefore, 2 information about the perceived timing of wearing eyeglasses are selected: elementary children should not wear eyeglasses, and it is unnecessary to wear eyeglasses when myopia is mild.

Considering our objective, 2 things should be noted. Firstly, we focus on the children's perception instead of the objective factors for eyeglasses purchase. For example, the price of eyeglasses and the distance to eyeglasses shop are not included in our analysis though they are obviously important for eyeglasses purchase. Second, the perception of the information which can be easily obtained prior to the experience is also not included in the analysis. For example, the perception of the price of eyeglasses is not included as one item of the perceived cost.

Data Collection

Our data were collected through a baseline survey and school-based visual acuity (VA) assessment, followed by 2 follow-up surveys to assess the short-run and long-run impacts of the intervention.

In September 2012, we conducted baseline survey for children, families, and school administrators. The student questionnaire collected data regarding demographic and household information, school boarding status, vision acuity, perceived characteristics of vision problems, perceived costs and benefits of eyeglasses use, and perceived timing of wearing eyeglasses. The family questionnaire collected information on family economic conditions, household members, employment, parents' education level, and whether parents out-migrated for work. School questionnaires collect information about classroom arrangements and whether the school offered educational modules related to vision health and protection.

After the baseline survey was completed, visual acuity (VA) was assessed for all children in their schools following 2 steps. First, visual acuity was tested separately for each eye without refraction (without eyeglasses) at 4 m using Early Treatment Diabetic Retinopathy Study (ETDRS) charts (Precision Vision, La Salle, IL, USA) in a well-lighted, indoor area. The chart has 14 rows of porotypes (represented by capital letter E) with 5 porotypes pointing (randomly) in different directions in each row. Based on these results, children who had an uncorrected VA lower than 6/12 in either eye were identified. Second, local optometrists trained at the Sun Yat-sen University ophthalmic center were recruited to confirm which of these identified children needed glasses. Children identified in the first step underwent cycloplegia and then automated refraction with subjective refinement by the optometrist. Children whose VA could be improved to greater than 6/12 in both eyes with refraction were identified as eligible for a free pair of eyeglasses.

The evaluation process included 2 rounds of surveys. The perception needs time. In order to examine the short run impact, surveys were conducted 3 weeks after the intervention in November 2012. Our baseline data shown that the average lifetime of eyeglasses for children is about 1 year. Hence, in order to examine the long run impact, a follow up survey was conducted 8 months after the intervention, in June 2013. The content of the evaluation survey was similar to the baseline survey.

Baseline Balance Check

Both the control and the treatment (the free eyeglasses group) groups had 42 schools, with 40 elementary schools in Gansu and 44 in Shaanxi. After rigorous vision examinations, 1037 children from those 84 schools were identified as needing eyeglasses. 205 children are excluded from the analysis because they already had eyeglasses at baseline. Therefore, 832 children are included in the analysis while 404 children are from the control group and 428 are from the treatment group (Table 1).

Generally, there is no significant differences at baseline between the control and treatment group regarding individual, family, and school characteristics of children (Table 1). Overall, the 2 groups are balanced on observables at baseline. Among the 9 variables tested, there is only one with a significant difference between treatment and control group, no more than would be expected by chance. An omnibus test confirms that the differences between the 2 groups across all variables are jointly insignificant ($P = .29$).

Table 1. Characteristics of Samples and Balance Checking.

Variables	(1) All samples (N = 832)	(2) Control group (N = 404)	(3) Treatment group (N = 428)	(4) Differences (3)–(2)
(1) Number of schools	84	42	42	——
(2) Number of children who need eyeglasses	832	404	428	——
Children' characteristics				
(3) Gender (1 = male)	0.496 (0.500)	0.520 (0.500)	0.474 (0.500)	−0.046 (0.036)
(4) Grade (1 = fifth grade)	0.599 (0.490)	0.601 (0.490)	0.596 (0.491)	−0.006 (0.037)
(5) Vision acuity (LogMAR)	0.467 (0.207)	0.450 (0.204)	0.483 (0.209)	0.033* (0.018)
(6) Whether children have known that they need to wear eyeglasses (1 = yes)	0.371 (0.483)	0.372 (0.484)	0.370 (0.483)	−0.002 (0.036)
Family characteristics				
(7) Both parents migrants (1 = yes)	0.098 (0.298)	0.105 (0.307)	0.092 (0.289)	−0.013 (0.022)
(8) One of the parents have high school education (1 = yes)	0.202 (0.402)	0.183 (0.387)	0.220 (0.414)	0.036 (0.033)
(9) Family wealth (indicator)	31767 (34650)	30032 (33572)	33376 (35586)	3344 (5100)
School characteristics				
(10) Vision acuity examination in school (1 = yes)	0.601 (0.490)	0.609 (0.489)	0.593 (0.492)	−0.015 (0.124)
(11) Vision protection course (1 = yes)	0.762 (0.426)	0.725 (0.447)	0.797 (0.403)	0.071 (0.088)

Note. Data are from the baseline survey.
Standard Deviation adjusted at school level.
*significant at 10% level.

Among the 832 children, 800 completed the follow-up survey. Sample attribution is relatively small (3.8%), and there were no significant differences in sample loss between control and treatment groups.

Statistical Approach

We estimate the treatment effects of free product trial on perception of children with ordinary least squares (OLS) regression. Only the children who were found to require eyeglasses and without eyeglasses at baseline are included in the analysis sample. To improve statistical power of the estimation, control variables and the fixed effects of random distribution strata are added into model. We estimate the following regression:

$$Y_{ij} = \alpha_1 + \alpha_2 Treat_i + \alpha_3 Y_{ij\_baseline} + \alpha_4 X_{ij} + \alpha_5 \psi_i + \varepsilon_{ij}$$

Where Y_{ij} indicates the outcome of number j student in number i school (The details are shown in Table 2). $Treat_i$ indicates whether school i received treatment, that is, whether a school received free eyeglasses; $Y_{ij\_baseline}$ indicates the baseline data. X_{ij} indicates the basic characteristics of a student, including children characteristics (gender, age, whether eyeglasses were worn before, vision acuity, and whether children are aware of their myopia), family characteristics (whether parents are immigrant workers, educational level of parents, and the family's economic conditions), and the school characteristics (whether schools have organized children to check their visions *and* whether schools had vision protection courses); and ψ_i indicates the fix effects of the randomly assigned strata.

Results

Summary Statistics

For the perceived characteristics of vision problems, the percentage of children' agreeing with that children should go to test their vision regularly is 62.5% at baseline (Table 2, row 1), which is the highest rate among the 8 items of perception. It implies that this information can be perceived prior to children's experience of eyeglasses use. The rate of children who agreed with the definition and cause of myopia (people with myopia cannot clearly see things far away and it is caused by the change in the eyeballs' shape) are quite low at baseline, 24.6% and 18.1%, respectively, indicating that they cannot be verified prior to a free trial of eyeglasses (rows 2 and 3).

In terms of perception of the cost/benefit of eyeglasses use, on the one hand, the children believe the costs of eyeglasses use were relatively high at baseline. Only 3.9% of the children agreed that wearing eyeglasses was attractive at baseline (Table 2, row 4). Moreover, 74.6% of children agreed that wearing eyeglasses worsen vision (row 5). On the other hand, they did not perceive the benefit of wearing eyeglasses. Less than half of the children agreed that wearing eyeglasses would be helpful for their academic performance (row 6). In terms of the perceived timing of wearing eyeglasses, only about one-third of children perceived that children with myopia should wear eyeglasses (row 7) and that

Table 2. Differences of Perception of Eyeglasses Attributes at Baseline Between Intervention and Control Group.

Variables	Definition	All (N = 832)	Control group (N = 404)	Treatment group (N = 428)	Difference (3)–(2)
Perceived characteristics of vision problem					
(1) Children should have regular vision exams	1 = Agree; 0 = Disagree	0.625	0.592	0.657	0.065
(2) People with myopia cannot clearly see things far away	1 = Agree; 0 = Disagree	0.246	0.240	0.252	0.012
(3) Myopia is caused by a change in eyeballs' shape	1 = Agree; 0 = Disagree	0.181	0.213	0.152	−0.061*
Perceived cost and benefit of eyeglasses use					
(4) Do you think wearing eyeglasses looks good?	1 = Yes; 0 = No	0.039	0.032	0.044	0.012
(5) Wearing eyeglasses will worsen vision acuity	1 = Disagree; 0 = Agree	0.254	0.248	0.259	0.012
(6) Wearing eyeglasses is helpful for academic performance	1 = Yes; 0 = No	0.466	0.443	0.488	0.045
Perceived timing of wearing eyeglasses					
(7) Elementary children should not wear eyeglasses	1 = Disagree; 0 = Agree	0.294	0.270	0.318	0.048
(8) Wearing eyeglasses is unnecessary when myopia is mild.	1 = Disagree; 0 = Agree	0.328	0.337	0.320	−0.017

*significant at 10% level.

wearing eyeglasses is unnecessary when the degree of myopia is mild (row 8) at baseline.

Impact on Perceived Characteristic of Vision Problems

The provision of free eyeglasses in the treatment group, meaning they had the experience of a free trial, improved the usage of eyeglasses. Almost all the children in the treatment group tried the free eyeglasses after they acquired them. In the short run, 71% of the children said that they wore eyeglasses frequently, while in the long run, the rates slightly decreased to 64%.

Our findings show that the children's perceived characteristic of vision problem are changed in the short run. Specifically, 6 percentage points more children agreed with children should have vision exams regularly because of the experience of eyeglasses use in the short run (Table 3, row 1, column 1). Meanwhile, the perception of definition and cause of myopia increased by 5 percentage points and 6 percentage points, respectively (row 1, columns 2 and 3). However, the impact on those 3 items of perception decreased to almost zero in the long run. This findings indicate that the above information cannot be verified by or learn from the experience of a free trial of eyeglasses. For the children, free eyeglasses are like gifts or awards, which may inspire them to care and to learn more about vision problem in the short run, while those motivations will decrease in the long run.

For the perceived characteristic of vision problems, indirect experience such as vision protection course are more effective than direct experience in the long run. Specifically, there are more students agreed with "Children should have vision exams regularly" and "People with myopia cannot clearly see things far away" in the long run when they have vision protection course (row 2, columns 4 and 5).

Impact on Perceived Cost and Benefit of Eyeglasses Use

Generally, a free trial of eyeglasses reduced the perceived cost of eyeglasses use. In the short run, a free trial of eyeglasses increased the possibility of children agreeing that wearing eyeglasses was attractive by 9 percentage points (Table 4, row 1, column 1). In the long run, this rise decreased to 6 percentage points while it was still significant at 1% level (row 1, column 3). A free trial of eyeglasses did not decrease the agreement of children on eyeglasses harmfulness on vision in the long run. However, in the short run, the magnitude of the impact significantly increased by 10 percentage points (row 1; columns 2 and 4). Previous studies documented the safety of wearing eyeglasses. However, one study from China also showed that the vision acuity will decrease by 1 line on the ETDRS naturally in 8 months on average, regardless of whether eyeglasses were worn.[15] Although the effect was not significant in the long run, it is still good news that a free trial of eyeglasses did not reinforce this misunderstanding. In the short run (3 weeks), children vision acuity did not change significantly and children could see more clearly after wearing eyeglasses, which will evoke children to underestimate the cost of eyeglasses use.

Table 3. The Impact of Free Eyeglasses on the Perceived Characteristics of Vision Problems.

	Short run (3 weeks)			Long run (8 months)		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Children should have vision exams regularly (1 = Agree)	People with myopia cannot clearly see things far away (1 = Agree)	Myopia is caused by a change in eyeballs' shape (1 = Agree)	Children should have vision exams regularly (1 = Agree)	People with myopia cannot clearly see things far away (1 = Agree	Myopia is caused by a change in eyeballs' shape (1 = Agree)
(1) Treatment (1 = Yes)	0.061** (0.029)	0.048** (0.023)	0.064*** (0.024)	0.039 (0.029)	−0.008 (0.021)	−0.007 (0.032)
(2) Vision protection courses (1 = Yes)	0.023 (0.061)	0.034 (0.040)	−0.002 (0.043)	0.131** (0.054)	0.095** (0.040)	0.031 (0.054)
(3) R^2	0.174	0.108	0.190	0.162	0.106	0.113
(4) Observations	775	775	775	757	757	757

Note. All the regressions used the same control variables that are shown in the table.
Standard error was adjusted at the school level.
** and *** significant at 5% and 1% level.

Table 4. The Impact of Free Eyeglasses on the Perceived Costs and Benefits of Eyeglasses Use.

	Cost				Benefit	
	Short run (3 weeks)		Long run (8 months)		Short run (3 weeks)	Long run (8 months)
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Do you think wearing eyeglasses looks good? (1 = yes)	Wearing eyeglasses will worsen vision acuity (1 = Disagree)	Do you think wearing eyeglasses looks good? (1 = yes)	Wearing eyeglasses will worsen vision acuity (1 = Disagree)	Do you think wearing eyeglasses is helpful for academic performance? (1 = yes)	Do you think wearing eyeglasses is helpful for academic performance? (1 = yes)
(1) Treatment (1 = yes)	0.088*** (0.014)	0.098*** (0.022)	0.056*** (0.013)	0.012 (0.022)	0.216*** (0.035)	0.165*** (0.033)
(2) Vision protection courses (1 = yes)	0.050 (0.033)	0.034 (0.047)	−0.016 (0.025)	−0.053 (0.047)	0.103 (0.071)	−0.005 (0.076)
(3) R^2	0.141	0.120	0.060	0.100	0.139	0.148
(4) Observations	771	775	755	757	767	756

Note. All the regressions used the same control variables that are shown in the table.
Standard error was adjusted at the school level.
***significant at 1% level.

A free trial of eyeglasses also increased the perceived benefit of eyeglasses use. Compared with the control group, 21.6 percentage points more of children agreed that wearing eyeglasses was helpful to academic performance in the short run, while in the long run, the magnitude of the impact decreased to 16.5 percentage points (Table 4, row 1, columns 5 and 6). Even in the short run, a relative increase of 39% (42% in control group versus 58.5% in the treatment group, 16.5%/42% = 39%) was quite large.

The impact in the short run are greater than that in the long run for all the items of perception (Table 4, row 1). It reinforced the importance of the eyeglasses being free, which enticed children to take them as gifts or awards, thereby inspiring positive feelings. The perception of children will be more rational in the long run; hence the magnitude of the impact will decrease, while it is still significant.

We also found that the indirect experience, such as a vision protection course, cannot change children' perceptions about the cost or benefits of eyeglasses use. The coefficient for vision protection education courses was not significant, both in the short run and long run (Table 4, row 2), indicating that the perceived cost and benefit above can only be obtained from direct experience of eyeglasses use.

Impact on Perceived Timing of Eyeglasses Use

The perceived timing of wearing eyeglasses increased gradually as a result of lower perceived cost and higher perceived

Table 5. The Impact of Free Eyeglasses on Perceived Timing of Wearing Eyeglasses.

	Short run (3 weeks)		Long run (8 months)	
	(1)	(2)	(3)	(4)
Variables	Elementary children should not wear eyeglasses (1 = Disagree)	Wearing eyeglasses is unnecessary when myopia is mild (1 = Disagree)	Elementary children should not wear eyeglasses (1 = Disagree)	Wearing eyeglasses is unnecessary when myopia is mild (1 = Disagree)
(1) Treatment (1 = yes)	0.050* (0.028)	−0.018 (0.028)	0.079*** (0.030)	0.030 (0.029)
(2) Vision protection courses (1 = yes)	0.069 (0.067)	0.027 (0.044)	0.006 (0.057)	−0.013 (0.067)
(3) R^2	0.139	0.143	0.133	0.167
(4) Observations	776	776	757	757

Note. All the regressions used the same control variables that are shown in the Table 2. Standard error was adjusted at the school level.
* and *** significant at 10% and 1% level.

benefit of eyeglasses use. In the short run, 5 percentage points more children in treatment group agreed that children with vision problems should wear eyeglasses than that in the control group (Table 5, row 1, columns 1 to 2). In the long run, the magnitude of the impact increased to 8 percentage points, indicating a relative increase of 25% (=7.9%/31%). It is interesting that the impact of free trial on the perceived timing of wearing eyeglasses become larger rather smaller in the long run than that in the short run, which is different from the impact on other perception such as the perceived cost. It indicated that learning from experience may take some time and the perceived timing to wear eyeglasses need time to change.

There was no significant impact on the perception of wearing eyeglasses timely either in short run or in the long run. This finding may be because children needed more information to verify the information of wearing eyeglasses timely than the information of wearing eyeglasses. Meanwhile, the vision protection courses did not correlate with the perception of those 2 items of perception, either in the short run or in the long run (row 2), indicating those 2 items of perception can only be learned from direct experience rather indirect experience.

Discussion

Our study reports results from a randomized controlled trial and evaluates the effects of a free trial of eyeglasses on 8 items of perception related to myopic children wearing eyeglasses in a poor region of western China. Children can learn significantly from the experience of a free trial of eyeglasses, though not all of the perception can be changed. Due to the experience of a free trial, the perceived costs of eyeglasses use of children are reduced and the perceived benefits are increased, meanwhile the perceived timing of eyeglasses use is increased. It implied that a free trial is an effective strategy to solve the information asymmetry problem for health care. Previous studies document that a free trial or one-off subsidy can increase the demand or the adoption of health care.[9,16] Our findings show how it happened. The perceived benefit, cost, and timing of the health care use are experience attributes, which can be learned from the experience of a free trial.

We also find that the impact of a free trial of eyeglasses is significantly stable in the long run, while that in short run will be different. The impact of a free trial on some items perception of some claims, for example, the perception on the appearance and helpfulness of eyeglasses use, will be larger in the short run than that in the long run. Conversely, the magnitude of the impact can also increase from the short run to the long run, because it takes time to learn from experience. In other words, the effect of a free trial on perception of eyeglasses use change over time. This finding implies that the timing to start charging for the originally free product is important. Considering our findings and the lifetime of 1 pair of eyelgasses, we can only subsidized or even freely provided the first pair of eyeglasses to myopic children while the eyeglasses can be charged from the second one. In other words, the government does not need to subsidize all subsequent eyeglasses, which minimizes the public expenditure.

The intervention should be relatively cost-effective when accounting for other potential benefits such as academic outcomes, as well as comparing with indirect experience such as information campaign. Besides perception learning from free trial, the academic performance measured by standardized math scores of children were also improved by 0.11 standard deviations after 8 months of intervention.[6] The cost of the intervention relative to the control group was approximately 376 yuan ($60) per child.[17] These costs imply a cost-effectiveness ratio of 269 yuan ($43) per 0.1 standard deviations increase in standardized math scores. Indirect experience such as information campaign are more widely used to solve the potential information asymmetry problem. Information campaign will be cheaper than a free trial, for example, a previous experimental study shown the cost of the information campaign was approximately 337 yuan ($53) per school. However, free trial is more effective than

information campaign, both on the term of eyeglasses use and academic performance.

Our findings also document that indirect experience, such as a vision protection course, and direct experience, such as a free trial, is complementary to solving the information asymmetry problem of health care. A free trial has a significant impact on the perception of experience attributes (such as the appearance and helpfulness of eyeglasses use, etc.), while a vision protection course did not. For some of the perception which can't learn from experience (for example, information about the definition of myopia), a vision protection course had a significant impact while a free trial did not. Therefore, those 2 approaches should be viewed as complementary with respect to public policy.

The results we present come with 2 main limitations. First, our study took place in 2 poor region of western China, and results may not apply to other settings. Second, the myopic children with mild vision problem, specifically, the uncorrected VA$<$6/9 but $>$6/12, were not included in our analysis. This group of children may also need eyeglasses. President Xi has called for a national effort to control myopia in China. All myopic children, not just children with visual impairment in our study, should be considered to be corrected. However, they may response to the free eyeglasses in a different way because their demand is less urgent.

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Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Jingchun Nie, Wei Nie, Ming Mu, Shuyi Song, Lanxi Peng, Lifang Zhang, Jie Yang, Hongyu Guan, Yiqi Zhu, Qiufeng Gao and Yaojiang Shi have no conflicts of interest that are directly relevant to the contents of this article.

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Ethical Approval

This study was approved by the institutional review boards at Stanford University (Palo Alto, USA) and the Zhongshan Ophthalmic Center (Guangzhou, China). Permission was received from local boards of education in each region and the principals of all schools. The presented data are anonymized and risk of identification is low. The principles of the Declaration of Helsinki were followed throughout.

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