

Receiving Eyeglasses Benefits Grades and Attendance among Elementary Students in a Low-Income District: A Four-Year Longitudinal Study

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Abstract

Uncorrected visual problems undermine children's academic performance. The impact of these problems is exacerbated among children living in poverty. The present study examined the impact of providing eyeglasses to poor children diagnosed with refractive errors. We obtained archival data for all 3rd through 6th graders in one low-income school district in the southern U.S. for a five-year period. During the second study year, a non-profit organization (Kids Vision for Life) screened all students in this district and provided free eyeglasses to children in need. We found that prior to receiving eyeglasses, children with refractive errors performed significantly more poorly than peers on state-mandated tests of Reading and Math. In the third and fourth years, children who had received glasses caught up to or exceeded their peers in test scores and school attendance. These findings suggest that eyeglasses had a positive impact on the elementary school students who received them.

Keywords: refractive errors, corrective lenses, academic achievement

1. Introduction

Approximately one in five America children enter school with refractive errors or other visual deficits (Webb, 2011). Uncorrected refractive errors can undermine student health by creating short-term problems such as headaches and eyestrain, as well as more enduring conditions such as amblyopia (Chandler & Box, 2012; Dirani, M., Zhang, X., Goh, et al., 2010; Ethan, Basch, Platt et al., 2010). Students with visual deficits also tend to have poorer school attendance, lower grades, and a higher incidence of repeating grades as compared to students with normal vision (Basch, 2011; Krumholtz, 2000; Kulp, 1999; Stewart-Brown, Haslum, & Butler, 1985; Toledo et al., 2010). Moreover, when a visual problem is undetected, a child may exhibit undesirable behaviors that cause him or her to be misdiagnosed with an attentional or behavioral disorder (Vaughn, Maples, & Hoenes, 2006). These findings illustrate the importance of identifying and correcting refractive errors in school children.

The problems described here are exacerbated for children living in poverty. The rate of refractive errors is as much as twice as high in low-income schools as in middle-income schools (Webb, 2011; Basch, 2011; Ethan & Basch, 2008; Gould & Gould, 2003). When a vision screening indicates the need for further intervention, poor children are less likely to receive such interventions owing in part to the cost of vision examinations and glasses (Ethan, Basch, Platt et al., 2010; Kimel, 2006; Mark & Mark, 1999). As a result of such considerations, many non-profit organizations focus on providing screening and related services to students in poor school districts. The present study focuses on the impact of one such program, Kids Vision for Life of Greater Dallas (KVFL).

KVFL provides students in northeast Texas with eye screenings, eye examinations (if indicated by the results of the screenings) and eyeglasses (if indicated by the results of the examinations). The focus of our study was on the impact of the KVFL program in Everman Independent School District (EISD), a low-income district in the Fort Worth area. We used a longitudinal panel design to analyze archival data provided by EISD for academic years 2009-2010 through 2013-2014. Data was obtained for all students who were in 3rd through 6th grade during the initial study year.

For all students we obtained information on state test scores in Reading and Math each year, and on attendance (total numbers of unexcused absences per year). Grades were not analyzed, in light of differences among teachers in grading standards, differences in grading scales across grades (K through 5), and a general tendency for teachers to grade older students more rigorously than younger ones.

During academic year 2010-2011, all EISD students received vision screening through KVFL. In this report we present comparisons between EISD students who received eyeglasses in 2010-2011 (intervention group) versus the rest of the EISD students (control group). In sum, we obtained baseline data for one academic year (2009-2010), followed by four years of longitudinal data on the achievement test scores and attendance of each group.

2. Methods

2.1 Participants

Everman Independent School District (EISD) serves roughly 5,000 students in Everman, Forest Hill, Burleson, and parts of Fort Worth, Texas. The demographic composition of the district in 2014 was 56.2% Hispanic, 37.2% African American, 4% White, and 2.6% Multiracial or Other. The median household income for the district at that time was \$41,235, and the median per capita income was \$15,185. 79% of the students in the district are classified as economically disadvantaged (i.e., these students qualify for free or reduced-price lunch).

In 2015 we were contacted by KVFL and the superintendent of EISD with a request to quantitatively evaluate the impact of vision screenings and eyeglasses that KVFL provided to EISD beginning in academic year 2010-2011, as the superintendent reported anecdotal evidence of a positive impact. As noted, we obtained archival data for all students enrolled in 3rd through 6th grade during the initial study year (2009-2010). These grades were chosen in order to make use of state-mandated achievement test scores, which begin in 3rd grade. For convenience, we refer to academic year 2009-2010 as the "Baseline Year", academic year 2010-2011 as "Year 1", and so on through "Year 4" (academic year 2013-2014). During Year 1, all EISD students received free vision screening through KVFL, and, if deemed necessary based on screening results, free examinations. Students whose examination results indicated refractive errors were provided with free eyeglasses. Data was not available on eyeglass use, but anecdotal evidence suggested that teachers closely monitored use and encouraged students who received glasses to wear them.

The exact sample size varied according to year, grade of student, and variable being analyzed but never fell below 90% of students enrolled in EISD for a particular grade and year. Details on sample size can be seen in Table 1. Attrition rates, as evident in Table 1, were moderate.

Table 1: Sample size, by group and year.

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
Intervention group	208	190	165	124	96
Control group	2349	2162	1981	1755	1603

2.2 Instrumentation

For all students we obtained information on state test scores in Reading and Math, operationally defined in terms of percentages of Texas Assessment of Knowledge and Skills (TAKS) or State of Texas Assessment of Academic Readiness (STAAR) test items correctly answered. (Data analysis focused on percentages of correct answers since the state of Texas changed the content and format of its required achievement tests from TAKS to STAAR in 2012.) Attendance was operationally defined as numbers of unexcused absences per year.

Data analysis

Statistical analyses focused on only those students for whom data was available for the Baseline Year and at least two subsequent years. Independent-samples t-tests were used to compare the intervention and control groups for each study year. Focusing on year-by-year analyses allowed us to determine whether the groups were comparable at baseline, and then to determine the trajectory of changes, if any, from year to year.

3. Results

Table 2 shows the mean percentages of correct answers on the state Reading and Math tests for the intervention and control groups across each year of the study. Table 3 provides the same information for mean numbers of unexcused absences.

Table 2: Mean percentages of correct scores on state achievement tests by group, variable, and year*.

	Baseline 2009-2010	Year 1 2010-2011	Year 2 2011-2012	Year 3 2012-2013	Year 4 2013-2014
Intervention group - Reading	75.6% ** (126)	79.0% (112)	76.4% (102)	79.5% ** (86)	77.5% ** (70)
Control group - Reading	80.3% (2007)	80.4% (1969)	73.6% (1895)	73.2% (1873)	69.6% (1801)
Intervention group - Math	73.4% ** (125)	75.8% (112)	69.7% ** (100)	73.1% ** (85)	74.8% ** (68)
Control group - Math	77.5% (2002)	73.1% (1967)	62.5% (1889)	61.0% (1875)	64.3% (1816)

*Sizes of sample available for each analysis are given in parentheses at the bottom of each cell.

**Significantly different than corresponding mean for control group ($p < .05$).

Table 3: Mean numbers of absences by group and year.

	Baseline 2009-2010	Year 1 2010-2011	Year 2 2011-2012	Year 3 2012-2013	Year 4 2013-2014
Intervention group	3.84 (208)	2.98 (190)	2.61 (165)	2.43** (124)	3.55** (96)
Control group	3.41 (2349)	3.22 (2162)	2.98 (1981)	3.53 (1755)	5.27 (1603)

*Sizes of sample available for each analysis are given in parentheses at the bottom of each cell.

**Significantly different than corresponding mean for control group ($p < .05$).

For the Baseline Year, independent sample t-tests were used to determine whether the intervention and control groups differed significantly for any of the dependent variables. These analyses showed that the Reading scores and the Math scores were significantly higher for the control group than for the intervention group. No differences between the groups were found for absences during the Baseline Year.

For Year 1, independent samples t-tests showed that the intervention and control groups no longer differed significantly in mean Reading and Math scores, nor were there group differences in absences. Group differences for Reading and absences were not observed in Year 2 either. However, in Year 2, the intervention group obtained significantly higher Math scores than the control group did.

For Years 3 and 4, independent samples t-tests showed that each year, the intervention group obtained significantly higher Reading and Math scores, and exhibited significantly fewer absences, than the control group did.

Finally, analyses of variance (ANOVA) procedures using group and gender as independent variables revealed no main effects or interactions involving gender.

4. Discussion

During the Baseline Year (2009-2010), 3rd through 6th grade students who would be diagnosed with a refractive error and receive eyeglasses during Year 1 performed significantly more poorly than their peers on state achievement tests of Reading and Math. The groups did not differ in absences at baseline. During Years 3 and 4, students who had received eyeglasses during Year 1 now showed significantly higher performance in Reading and Math, and significantly fewer absences. These findings suggest that eyeglasses had a positive impact on the students who received them. According to this interpretation, at least some students who were identified in Year 1 as needing eyeglasses had a refractive problem that was already present during the Baseline Year, resulting in these students having lower achievement test scores on average. However, by Years 3 and 4, the students who had received eyeglasses caught up to - and even surpassed their peers - in test scores as well as attendance owing to the impact of corrected vision. The findings are consistent with prior work in the literature, and highlight the need for early intervention to assist children with uncorrective refractive errors (Basch, 2011; Dirani et al., 2010; Zaba, 2011).

4.1. Limitations

Although the results suggest that receiving eyeglasses benefited students, causality cannot be definitively established given that the study design was not experimental (Springer, 2010). Moreover, it is unclear from the data what percentage of the intervention group had already developed a refractive problem during the Baseline Year, and what percentage of these students wore their glasses regularly following Year 1 (although anecdotal reports suggest that teachers encouraged students to wear their glasses and that student compliance was good). The archival data provided to us did not include additional variables besides gender that might have moderated the impact of wearing glasses. A final concern is that students in the intervention group not only caught up to, but surpassed their peers in academic performance during Years 3 and 4. Although the absolute values of the difference are small (see Table 1), this finding does not seem credible without further qualification, as it is hard to imagine that receiving corrective lenses causes students to academically outperform peers with normal or corrected vision. The slightly higher performance among the intervention group may reflect a statistical anomaly and/or the possibility that some control group students had or developed undetected visual problems. In any event, the results bode well for students with refractive errors who received corrective lenses.

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