

# Vision examinations for all children entering public school—the new Kentucky law

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**Background:** Kentucky was the first state in the United States to pass a law requiring an eye examination by an optometrist or ophthalmologist for each child entering public school, public preschool, or Head Start program for the first time. The law became effective on July 15, 2000.

**Method:** Forty-three of 334 Kentucky Optometric Association members were surveyed by the Kentucky Optometric Association. They practiced in 37 of 120 counties throughout Kentucky. Eye examinations for 5,316 children entering the Kentucky school system for the first time were reviewed. The children were divided into groups of 3-year-olds, 4-year-olds, 5-year-olds, and 6-year-olds and older. The survey summarized data collected during the period of July 15, 2000 through April 1, 2001.

**Results:** Based on the survey of the clinical assessments of 5,316 eye examinations, a total of 740 children were prescribed spectacle lenses, 181 were diagnosed with amblyopia, 123 children were diagnosed with strabismus, and 44 were diagnosed with other eye diseases. Children in the 6-years-old and above age group were statistically prescribed more spectacle prescriptions than were children ages 3, 4, or 5 years of age. The number of spectacle lens prescriptions, strabismus, amblyopia, and eye diseases diagnosed was independent of county income levels.

**Conclusion:** This survey of children entering the Kentucky public school system for the first time showed that 13.92% of the children were prescribed spectacle lenses, 3.40% were diagnosed with amblyopia, and 2.31% were diagnosed with strabismus.

**Key Words:** Amblyopia, children, children's vision, education, Kentucky, Kentucky Law House Bill 706, learning, preschool, required eye examinations, strabismus, vision screening

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On July 15, 2000, Kentucky became the first state in the United States to require children to have a vision examination before entering the public school system. Kentucky House Bill 706, the Early Childhood Development Initiative, included the following requirements for a vision examination:

“A vision examination by an optometrist or ophthalmologist shall be required by the Kentucky Board of Education. The administrative regulations shall require evidence that a vision examination that meets the criteria prescribed by the Kentucky Board of Education has been performed. This evidence shall be submitted to the school no later than January 1 of the first year that the child is enrolled in public school, public preschool, or Head Start programs.”<sup>1</sup> (See Appendix for a review of HB 706.)

The purpose of this study is to review a sample of the first year's results of the mandatory eye examinations.

## Kentucky demographics

The population of Kentucky was 4,041,769 in 2000, and, according to data, the median household income was \$31,730 in 1997.<sup>2</sup> Approximately 52,000 children are born in Kentucky each year.<sup>3</sup>

## Children's vision, eye health, and education

Public opinion data show that the American public continues to be interested in health care policy.<sup>4</sup> In a 2001 National Omnibus survey conducted by International Communications Research Division, 84% of Americans strongly agreed that a child's vision and eye health are an important part of the child's overall health.<sup>5</sup> In the same study, 98% of those surveyed agreed that good vision is necessary for success in school.

The National Parent Teacher Association reports that more than 10 million children experience vision problems.<sup>6</sup> The Prevent Blindness America organization states that vision problems affect one in four school-aged children.<sup>7</sup> Vision disorders have been considered the fourth most common disability in the United States, and they are one of the most prevalent handicapping conditions in childhood.<sup>8</sup> Amblyopia is considered the most common childhood vision disability.<sup>9</sup> The importance of vision and its relationship to childhood development and the educational environment has been noted in both the education and vision care literature.<sup>10-15</sup> A significant number of undetected vision problems have been found in specific groups of at-risk school children.<sup>16-22</sup>

**Vision screenings and vision examinations**

In an effort to address these vision-related issues, vision screenings have been recommended for all school students for years.<sup>8,23-27</sup> There are varying types of vision-screening protocols.<sup>28</sup> Vision screenings can detect certain vision problems, but they do not provide a diagnosis of vision disorders. In Kentucky—prior to the passage of House Bill 706—the only vision screening required before entering the public school system was performed by the students’ physicians, as part of the school entrance physical.

Vision screenings are not always performed on young children in pediatricians’ offices. Consequently, there are many preschool children who have never had a vision screening.<sup>8</sup> One study estimated that vision screenings were attempted on just 66% of children 3 to 5 years of age in a group of 102 pediatric practices covering 23 states.<sup>29</sup>

A significant number of children do not see an eye care professional before entering school. It has been estimated that only 5% to 14% of children receive an eye examination by an eye care practitioner before entering school.<sup>8,30</sup>

The importance of early diagnosis of vision disorders, through a complete eye examination, was one of the factors that led the Kentucky legisla-

**Table 1. Overall diagnostic results of the Kentucky Visual School Entrance Exam Survey\* (total number of children = 5,316 [100%])**

Diagnosis	No.	%
<b>Lens prescription</b>	740	13.92%
<b>Amblyopia</b>	181	3.40%
<b>Strabismus</b>	123	2.31%
<b>Pathology</b>	44	0.83%

\* Three-year-olds, 4-year-olds, 5-year-olds, and 6-year-olds and older.

ture to the conclusion that the time had come for children to have eye examinations—before they entered the public school system.

**Methods**

This study reviewed the results of 5,316 school entrance eye examinations performed under the newly enacted House Bill 706. In this study, 43 of 334 optometrists from the Kentucky Optometric Association performed these eye examinations. Thirty-seven of 120 Kentucky counties were represented. The examinations were performed during the period from July 15, 2000 through April 1, 2001.

The optometrists who participated in this study responded to a Kentucky Optometric Association survey of selected counties, trying to achieve an accurate geographical and economic representation of the state. Counties selected ranged in population from 7,752 to 693,604, with median income ranging from \$18,321 to \$48,999.

All eye examinations included ocular history, medical history, family ocular and medical history, unaided acuity, best-corrected acuity, external ocular examination, internal ocular examination, pupillary responses, binocular function, accommodation and convergence, color vision, diagnosis, and recommendations.

Each child entering the public school system for the first time, regardless of grade, was required to have a “Kentucky Eye Examination Form for School Entry” completed by an optometrist or ophthalmologist. Children who were already in the school system were not required to have this examination. Therefore, this survey only includes those students entering public school for the first time.

**Table 2. Diagnostic results by age group of the Kentucky Visual School Entrance Exam Survey**

	Ages of children (in yrs.)			
	3	4	5	6 or older
<b>No. of examinations</b>	632	1,504	2,071	1,109
<b>Lenses prescribed</b>	68 (10.76%)	173 (11.50%)	274 (13.23%)	225 (20.29%)
<b>Amblyopia</b>	13 (2.06%)	50 (3.32%)	69 (3.33%)	49 (4.42%)
<b>Strabismus</b>	20 (3.16%)	40 (2.66%)	38 (1.83%)	25 (2.25%)
<b>Pathology</b>	7 (1.11%)	9 (0.60%)	15 (0.72%)	13 (1.17%)

**Table 3. Diagnostic results of the Kentucky Visual School Entrance Exam Study Survey\* by income: five lowest income counties vs. five highest income counties**

Children	Five lowest income		Five highest income	
	No.	%	No.	%
<b>No. of examinations</b>	725		641	
<b>Lenses prescribed</b>	92	12.69%	87	13.57%
<b>Amblyopia</b>	10	1.38%	13	2.03%
<b>Strabismus</b>	18	2.48%	9	1.40%
<b>Pathology</b>	3	0.41%	1	0.16%

\* Three-year-olds, 4-year olds, 5-year-olds, and 6-year-olds and older.

The participating optometrists were asked to compile results from the "Kentucky Eye Examination Form for School Entry" and return their totals to the Kentucky Optometric Association. The results from these forms were divided into the number of examinations performed, the number of lenses prescribed, the number of children diagnosed with strabismus, the number diagnosed with amblyopia, and the number of specific medical diagnoses other than strabismus and amblyopia. This last diagnosis category was noted under the general heading of "pathology." The results were divided into four age groups: 3 years, 4 years, 5 years, and 6 years and older. A chi-square statistical analysis was performed to determine whether the number of spectacle lens prescriptions, strabismus, amblyopia, and ocular pathology were dependent on the age groups of the children tested.

Data from this study were also reviewed in relationship to estimated household income. Some doctors who participated in the study practiced in multiple locations, and their responses were not specific about the county in which individual patients had been seen. Therefore, they were excluded from the economic part of the study. The results from the remaining 27 doctors practicing

in 22 counties were compiled in reference to average household income by county.

The counties in which the participating doctors practiced were broken down according to the median household income. The counties were ranked from the highest to the lowest by average income. The average household income of the five lowest median income counties was \$19,240, and the average of the five highest median income counties was \$40,914. The counties with the five highest average incomes were compared with the counties with the five lowest average incomes. All the children examined in the five highest income counties were compared with all the children examined in the five lowest income counties with regard to the number of spectacle lenses prescribed and presence of strabismus, amblyopia, and ocular pathology. A chi-square analysis was performed to determine whether the number of lenses prescribed or cases of strabismus, amblyopia, and ocular pathology were significantly related to family income level.

In this survey, all diagnoses and recommendations were made based on clinical impressions of the participating doctors. The survey did not include

information on whether the children examined had received a previous eye examination or screening. Specific information on the types and degrees of refractive errors was not collected in this survey. The survey did not contain information on whether a cycloplegic or non-cycloplegic examination was performed.

## Results

Results of this survey are presented by spectacle lenses prescribed, strabismus, amblyopia, pathology, age groups, and income comparisons. The total number of children examined was 5,316 (see Table 1). Seven hundred forty spectacle lenses were prescribed for these children. One hundred eighty-one children were diagnosed with amblyopia. One hundred twenty-three children were diagnosed with strabismus. In addition, 44 were diagnosed with ocular pathology, which included conjunctivitis, blepharitis, foreign body, corneal scarring, ocular albinism, iris coloboma, retinal detachment, optic atrophy, iris nevus, and papilledema.

The results of the Kentucky Vision School Entrance Survey are divided into age groups in Table 2. These groups of children were divided into age groups of 3-year-olds, 4-year-olds, 5-year-olds, and 6-year-olds and older.

The survey indicated that the largest number of children examined by age group was the group of 5-year-olds (2,071), followed next by the 4-year-olds (1,504). The third largest number of children was in the group of 6-year-olds and above, regardless of their grade level in school (1,109). The smallest group was made up of 3-year-olds (632). Lenses were prescribed for 10.76% of the 3-year-olds, 11.50% of the 4-year-olds, 13.23% of the 5-year-olds, and 20.29% of the children ages 6 years and older.

Amblyopia was diagnosed in 2.06% of the 3-year-olds, 3.32% of the 4-year-olds, 3.33% of the 5-year-olds, and 4.42% of the children 6 years old and older. Strabismus was diagnosed in 3.16% of the 3-year-olds, 2.66% of the 4-year-olds, 1.83% of the 5-year-olds, and 2.25% of the children 6 years of age and older. Ocular pathology was diagnosed in 1.11% of the 3-year-olds, 0.60% of the 4-year-olds, 0.72% of the 5-year-olds, and 1.17% of the children 6 years old and older.

A chi-square analysis of the independence of categorical variables (age versus lenses prescribed) showed a resulting chi-square value of 51.23 that was significant at the 0.01 level of significance, with three degrees of freedom. This statistical analysis reveals a significant relationship between age group and the need for a lens prescription. That is, the need for a lens prescription was related to the child's age.

Based on these chi-square results, it appears that the number of lenses prescribed for children 6 years of age and older (20.29%)—compared to the number of lenses prescribed for children ages 3 years (10.76%), 4 years (11.50%), or 5 years (13.23%)—was significantly different. It also appears that the percentages of lenses prescribed for ages 3, 4, or 5 years were not statistically different.

In a chi-square analysis of the independence of the following categorical variables (age versus strabismus, age versus amblyopia, and age versus ocular pathology), all had nonsignificant values. Thus, in this study, a child's age was not related to the diagnoses of strabismus, amblyopia, or ocular pathology.

The results of the Kentucky Vision School Entrance Exam Survey by county income are presented in Table 3. Seven hundred twenty-five examinations were represented in the five lowest income counties. Six hundred forty-one examinations were represented in the five highest income counties. The total number of eye examinations for county economic comparisons was 1,366. The number of eye examinations that resulted in lenses prescribed and the diagnoses of strabismus, amblyopia, or ocular pathology are compared in Table 3.

A total of 12.69% of the children residing in the lowest income counties were prescribed lenses, and 13.57% of the children in the highest income counties were prescribed lenses. In the lowest income counties, 2.48% were diagnosed with strabismus, and in the highest income group, 1.40% were diagnosed with strabismus. Amblyopia was diagnosed in 1.38% of the children from the lowest income counties, and it was diagnosed in 2.03% of the children from the highest income counties. Ocular pathology was diagnosed in 0.41% of the children from the lowest income

counties, and in 0.16% of the children from the highest income counties.

A chi-square analysis of the independence of categorical variables (income versus vision conditions) showed that the number of lenses prescribed and diagnoses of strabismus, amblyopia, and ocular pathology were independent of income levels. That is to say, no significant differences were noted between the highest and lowest income counties for lenses prescribed and determination of strabismus, amblyopia, and ocular pathology.

## Discussion

For purposes of this discussion, the results of this study were divided into spectacle lens prescriptions, strabismus and amblyopia, age considerations, and ocular pathology.

### Spectacle lens prescriptions

In this study, 13.92% of the children were prescribed spectacle lenses. The figures in this study suggest that more than 10% of the children entering the Kentucky public school system were prescribed spectacle lenses. Such a percentage supports the need for eye examinations for children before they enter the public school system.<sup>21,22</sup> With regard to the number of prescribed spectacle lenses, no significant differences were found between the counties with the highest and lowest incomes.

Future research should quantify the type and degree of refractive errors, accommodative disorders, and convergence disorders that require a lens prescription. With regard to preschool children 3 to 6 years of age, additional research would be indicated to determine whether the clinical assessment of the refractive conditions required a static retinoscopy or a cycloplegic retinoscopy.

### Strabismus and amblyopia

The total number of cases of strabismus and amblyopia found in the children in this study is consistent with the research literature.<sup>31,32</sup> It is essential that both amblyopic and strabismic conditions be identified at an early age, so that appropriate intervention and treatment can be provided. It is well known that the earlier these vision conditions are diagnosed and treated, the

more successful the treatment outcome will be.<sup>9,31,32</sup>

The prevalence of amblyopia in preschool and school age children has been reported to range from 1.0% to 4.8%.<sup>9</sup> In this survey, the actual percentage of amblyopia in the high income group (2.03%) and the actual percentage of amblyopia in the low income group (1.38%) both fall within the prevalence range reported in the literature.<sup>9</sup>

### Ocular pathology

The total number of children diagnosed with ocular pathology amounted to less than one percent. In this study, the presence of ocular pathology does not appear to be related to family income. The most-common eye diseases diagnosed were conjunctivitis and blepharitis.

### Age considerations

The chi-square analysis suggests that children in the 6 years of age and older group had more lens prescriptions than did children in 3-year old, 4-year-old, or 5-year-old age groups. Although a chi-square test of independence is an appropriate statistical analysis to use as a means of determining whether or not two sets of frequency data (ages of children versus vision disorders and ocular pathology) are significantly related to one another, it has a limitation. The chi-square results are unable to determine which of the specific frequencies in the contingency Table 2 are significantly different from each other. Future research involving a multivariate statistical technique may add to our knowledge in this area.

Regarding age considerations, several factors may have contributed to these results. For example, it is possible that the children in the 6 years of age and older group experienced an age-related increase of myopia.<sup>33</sup> It may also be possible that the expected decrease in the amount of hyperopia in the children in the 6 years of age and older group did not occur.<sup>34,35</sup> Thus, they may have needed a lens prescription because of the significant amount of nearpoint work associated with the classroom environment.

### Future research, vision screenings, and eye examinations

Future research is indicated to determine the following: (1) what percentage of children who were diagnosed with strabismus or amblyopia received

a prior vision screening; (2) what percentage of children who were prescribed spectacle lenses received a prior vision screening; and (3) what percentage of children had a prior vision screening and had been referred for an eye examination, but then failed to follow through with the referral process?

Only an eye examination by an optometrist or ophthalmologist can diagnose and treat children's vision and ocular health disorders. Vision screenings can detect certain vision problems in children, but they cannot provide a diagnosis. The use of these two very good tools, eye examinations and vision screenings, allows us to effectively monitor children who are at risk for—or who already have—vision and ocular health disorders. However, absent the initial eye examination, we have no way of knowing who these children are, and their vision disorders may go undiagnosed and untreated. Eye examinations and vision screenings are not mutually exclusive. Rather, they are mutually inclusive and complementary.

## Conclusions

In this study, which included 5,316 children, 13.92% were prescribed spectacle lenses, 3.40% were diagnosed with amblyopia, 2.31% were diagnosed with strabismus, and 0.83% were diagnosed with ocular pathology. Also in this study, children 6 years of age and older were prescribed more spectacle lenses than were children in the 3-year-old, 4-year-old, and 5-year-old age groups.

When comparing the selected high income counties to the low income counties in this study, the number of lens prescriptions and determinations of strabismus, amblyopia, and ocular pathology were not related to family income. Therefore, it is important that we not limit the requirement of eye examinations to children in specific economic groups.

In the absence of the eye examinations provided these children under Kentucky law (House Bill 706), it is possible these vision problems would have gone undiagnosed and untreated. If untreated, these children would have been lacking the optimum vision required to perform well in the classroom.

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## Appendix

## **A REVIEW OF KENTUCKY LAW HOUSE BILL 706**

Education reform has been a top priority in Kentucky since 1990. First, public school education was reformed, and later higher education. The last part of the reform occurred in 2000, with the passage of House Bill 706, the Early Childhood Development Initiative. The goal of this legislation was to make sure that Kentucky's young children begin life in an environment that provides the care necessary to ensure they will be successful learners when they enter school. Much of the impetus of the bill was based on brain development research and the understanding that there are certain developmental windows during a child's early life when interventions may be necessary to prevent lifelong disability.

A broad-based Task Force on Early Childhood Development studied the issue and made recommendations. The inability to see to read was identified as a major barrier to successful learning. Also, vision was recognized as one of the areas in which timing of problem identification and intervention was critical. Both Task Force members and legislators were aware of the AOA Guidelines for Pediatric Vision Care recommending eye examinations at 6 months, 3 years and 5 years.

The goal of the provision regarding vision was two-fold. The first was to identify children at as early an age as possible who are at risk for development of amblyopia or other eye health problems and get them treated. The other goal was to identify and correct vision problems that would hinder successful learning. It was recognized that under the existing system many children were in second, third, or even later grades before amblyopia or other vision problems were identified. By then a child has lost years of learning opportunities and, in some cases, experienced permanent vision loss.



The law requires that all children entering the public school system, including Headstart and public preschool, for the first time have proof of an eye examination by an optometrist or ophthalmologist. The Task Force found that referrals from screenings were not always followed up voluntarily. This provision ensures that—at least once in that child's life—the child must be checked for eye health as well as visual problems. By having the eye problem diagnosed by an optometrist or ophthalmologist, corrective actions can be taken immediately.

In addition, this broad piece of legislation mandated that Health Departments educate clients on the importance of eye examinations for young children. It also addressed a number of other health issues like immunizations and newborn hearing testing. A Healthy Babies Council was established and charged with educating Kentuckians on early childhood issues, including the importance of early eye exams. House Bill 706 passed both the House and the Senate of the Kentucky General Assembly without a single dissenting vote.

No changes were made in the existing school screening programs for older children.

In order to assist with the costs of the examination for families whose children were not eligible for Medicaid, KCHIP, or did not have insurance, the legislature appropriated \$150,000 per year. Insurance companies were not mandated to cover the examinations. Members of the Kentucky Optometric Association volunteered to see any needy children free through the Kentucky Vision Project (Kentucky's year-round VISION USA) if they did not qualify for any program. Other resources were also available, such as the Sight for Student (VSP) program and the Lion's Clubs.

The law was effective July 2000. Since then, the Kentucky General Assembly has met twice. A technical clarification was made in 2002, specifying that the law applied only to 3- to 6-year-olds entering school for the first time; not to older children transferring into schools.

During both the 2001 and 2002 session, no suggestion was made by any legislator or by those who testified that the basic tenet of the law—a comprehensive examination by an optometrist or ophthalmologist—be modified in any way. To the contrary, the Assistant Superintendent of Jefferson County Schools, the largest school system in the state, wrote to the Chairman of the Senate Education Committee that they would oppose any change in the requirement. Many parents have written to legislators thanking them for the law, after their children were found to have a previously undiagnosed problem.

The law has been strongly enforced. Parents have until January 1 of the year following school entrance to submit the proper papers. This grace period gives the schools an opportunity to help families learn about the provision and comply. According to the Governor's Office of Early Childhood Development, there have been adequate numbers of providers to meet the need for appointments by the January 1 deadline. The eye examination requirement is in the same section of the statute as the requirements for a preschool physical and immunizations. All the health mandates are to be enforced in the same way by school officials.

The concern over costs did not materialize. In spite of a great deal of publicity and the schools pushing the program, only 75 examinations were paid for in 2000 and 66 in 2001 from the \$150,000 program. Consequently, the 2002 General Assembly reduced the appropriation to \$50,000 per year. It was determined that adequate resources existed to take care of those in need.

The eye examination provision clearly supports the overall goal of House Bill 706, to ensure that all Kentucky children enter school prepared to learn to the best of their ability.