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I. Purpose

The purpose of this report is to promote the prevention, early detection, and treatment of eye and vision disorders in children through evidence-based approaches to optimum vision and eye health. It provides a snapshot of the current science, where we are as a state, identify gaps, and suggest next steps. Specific goals include the following:

1. Analyze results from the annual vision screenings of Indiana school children and develop an epidemiological database and policy recommendations on vision and learning.

2. Assess the eye and vision health outcomes under the Indiana Medicaid and Children’s Health Insurance Programs.

3. Assemble information and evidenced-based rationales to guide and support policy development and legislation for improving the ocular and visual health of Indiana school children.

4. Consider the relative merits of legislatively mandated vision screenings and comprehensive eye examinations as a public health requirement for entrance into kindergarten or first grade of the Indiana public school corporations.
II. The Issues

The health of a nation is largely a reflection of the past and present health of its children. [Forrest, Riley, 2004]

The Importance of Eye Care for Children

Good health is an essential step along the pathway to social, educational, and economic independence and success, and good vision and eye health are important attributes of general health and well-being. The health of the eye can reflect the health of the body, but too frequently eye health is overlooked as a measure of general health and undervalued as a marker of undiagnosed disease. Poor vision and eye health interfere with a child’s ability to learn, a parent’s ability to work, a senior citizen’s ability to maintain independence and a society’s ability to experience quality of life. According to Prevent Blindness America (PBA) and the National Association of Chronic Disease Directors (NACDD), “there is substantial evidence that vision and eye health initiatives are both necessary and cost effective for all life stages.” [National Association of Chronic Disease Directors, 2005] Findings from a national telephone survey indicate that “more than 7 in 10 adults reported loss of eyesight as the worst thing that could happen to them.”[Scarborough, 2006]

Approximately 85 million people in the United States have potentially blinding eye disease, low vision, or blindness that create significant economic burdens for individuals and society. [U.S. Department of Health and Human Services, 2005] Retinopathy (or fluctuating vision or an associated blurring) may represent the first clinically observed sign (or symptom) of systemic illness, as in uncontrolled and previously undiagnosed cases of diabetes. Although visual impairment and blindness from conditions like diabetic eye disease and glaucoma are mostly avoidable through early intervention, these and other diseases frequently go undetected and untreated in underserved and vulnerable populations. [Higginbotham, Gordon, Beiser, et al, 2004; Varma, Ying-Lai, Klein, et al, 2004] Findings based on the 1999-2002 National Health and Nutrition Examination Survey (NHANES) and reported in the May, 2006, issue of the *Journal of the American Medical Association* indicate that the prevalence of visual impairment is higher among African Americans, Hispanics, the poor, the less educated, and those without private health insurance. [Vitale, Cotch, Sperduto, 2006] Recent findings place the monetary impact of vision problems in the U.S. adult population at $51.4 billion, drawing attention to the economic burden that vision problems place on society. [Rein DB, Zhang P, Wirth KE, et al., 2006; Frick KD, Gower EW, Kempen
THROUGH OUR CHILDREN’S EYES – THE VISION STATUS OF INDIANA SCHOOL CHILDREN

However, the monetary costs of care and rehabilitation are compounded by the increased probability of a lowered quality of life associated with restricted activities of daily living, lost years of potential employment and productivity, lost mobility and independence, increased risk for accidents and decreased levels of social functioning and interaction.

The Institute of Medicine (IOM) states that high quality health care should be safe, effective, patient-centered, timely, efficient and equitable. [Institute of Medicine, 2001] High quality primary care then becomes the “the central focus for addressing the health care needs of all children,” and “access to [high quality primary] care becomes more important as the efficacy of what [primary] health care has to offer expands.” [Wise, 2004] However, such environmental factors as values, preferences, politics, cost, feasibility and readiness for change can help increase the “translational gap” between scientific knowledge, clinical practice and public action, and possibly hinder public access to scientifically scrutinized and recommended clinical interventions. [Simpson, 2004]

The Committee on Evaluation of Children’s Health, formed by the National Research Council and the Institute of Medicine, states that “children’s health should be defined as the extent to which individual children or groups of children are able or enabled to a) develop and realize their potential, b) satisfy their needs, and c) develop the capacities that allow them to interact successfully with their biological, physical, and social environments.” [National Research Council and Institute of Medicine, 2004] The Committee identifies three related domains of health: “health conditions, which capture disorders or illnesses of body systems; functioning, which focuses on the manifestation of health on an individual’s daily life; and health potential, which captures the development of assets and positive aspects of health, such as competence, capacity, and developmental potential.” Considering the Committee’s definition and domains of children’s health, vision and ocular health must be considered as integral to realizing potential, satisfying needs and developing capacities of children to allow them to interact successfully within their environments.

It has been estimated that “one-quarter to three-quarters of children do not receive the health care that is scientifically proven and/or that experts recommend to prevent disease, reduce disease complications, and achieve optimal health development.” [Leatherman, McCarthy, 2004] According to a 2004 University of Chicago survey, 59% of the population do not believe that the needs of children are being met,
and 84% agree or strongly agree that the government should ensure funding for health care for all children regardless of income (90% agree or strongly agree that the government should ensure funding for health care of low-income children). [Berk, Schur, Chang, Knight, Kleinman, 2004]

Healthy People 2010 – the nation’s health agenda and road map for improving the health of all Americans during the first decade of the 21st century – identifies vision as “an essential part of everyday life, depended on constantly by people at all ages,” and an attribute of well-being that “affects development, learning, communicating, working, health, and quality of life.” [U.S. Department of Health and Human Services, 2000] Essentially, it acknowledges the significant role of vision in the overall health of the nation. As part of its strategic guidelines for improving the nation’s health, Healthy People 2010 sets forth 10 objectives related to vision, four of which are specific to the vision and eye health of children [U.S. Department of Health and Human Services, 2006]:

- **Objective 28-2** – Increase the proportion of preschool children aged 5 years and under who receive vision screening from baseline of 36% (2002) to 52% (2010).
- **Objective 28-3** – Reduce uncorrected visual impairment due to refractive errors from baseline of 110.7 per 1,000 (1999-2000) to 92.9 per 1,000 (2010).
- **Objective 28-4** – Reduce blindness and visual impairment in children and adolescents aged 17 years and under from baseline of 24.0 per 1,000 (1997) to 18.0 per 1,000 (2010).
- **Objective 28-9a** – Increase the use of personal protective eyewear in recreational activities and hazardous situations around the home among children 6-17 years from baseline of 15% (2002) to 20% (2010).

The rationale for the four vision objectives is founded on the premise that “many infants and young children are at high risk for vision problems because of hereditary, prenatal, or perinatal factors” and that “these individuals need to be identified and tested early and annually to make sure their eyes and visual system are functioning normally.” [U.S. Department of Health and Human Services, 2000] Objectives 28-3 and 28-4 are particularly challenging for those living in poverty, with respective baseline metrics of 169.0 per 1,000 and 34.0 per 1,000. The U.S. Department of Health and Human Services realizes that early vision problems that can lead to significant visual impairment in children – such as uncorrected refractive errors, amblyopia, strabismus and ocular...
disease – can be prevented or treated with early detection and appropriate intervention. To increase public awareness of the importance of vision disorders and facilitate strategic action towards achieving the targets in the vision-related objectives of Healthy People 2010, the American Optometric Association (AOA) and the U.S. Department of Health and Human Services (DHHS) in 2002 entered into a Memorandum of Understanding (MOU). The MOU created a public-private partnership between the AOA and DHHS focused on improving the visual health of all Americans.

Childhood is a very critical phase in the human life span, and “unique environmental interactions . . . can have profound effects on future health.” [Forrest, Riley, 2004] Visual impairment is “the most prevalent handicapping condition in childhood” and an important contributor to developmental disability in children; if undetected or untreated, it can produce long-term adversities and quality of life effects on the lives of children, family members and other caregivers and unduly stress public health resources. [Ciner, Schmidt, Orel-Bixler, et al, 1998; Centers for Disease Control and Prevention, 2005; Ryskulova, Klein, 2006] The Centers for Disease Control and Prevention (CDC) reports that, “visual cues are important to how a child learns to understand and function in the world,” and “impaired vision can affect a child’s cognitive, emotional, neurologic and physical development by potentially limiting the range of experiences and the kinds of information to which the child is exposed.” [Centers for Disease Control and Prevention, 2005] According to the Project Universal Preschool Vision Screening (PUPVS), children with impaired vision may have difficulty learning, trouble participating in sports and recreational activities, limited employment options, increased morbidity or mortality due to accidents, and difficulty with psychosocial development. [Maternal and Child Health Bureau and American Academy of Pediatrics, 2006]

Visual impairment in children has “an early sensitive period when interventions lead to better outcomes,” such that timely diagnosis and intervention become essential to preventing the possibility of irreversible vision defects and improving the vision health of visually impaired children. [U.S. Preventive Services Task Force, 2004; National Eye Institute, 2006; U.S. Department of Health and Human Services, 2006(b)] Although the “critical period” for visual development in humans is thought to end around age 7 years, recent research indicates that children up to age 17 years may benefit from the treatment of amblyopia, and that children age 6-17 years are almost three and a half times more likely to have visual impairment compared to children under age 6 years. [Pediatric Eye Disease Investigator Group, 2005; Ryskulova, Klein, 2006] However, Dr. Ned Calonge, Chair of the U.S. Preventive Services Task Force and Chief Medical Officer and State Epidemiologist for the Colorado Department of Public Health and Environment, states that “early
testing for vision problems is key to preventing learning disabilities or in some cases, significant visual impairment in children.” [Agency for Healthcare Research and Quality, 2006]

The lack of preventive eye and vision care for children “represents missed opportunity for prevention, early detection, and treatment of health and developmental problems,” particularly for children most at risk visually, educationally, and socially. [Leatherman, McCarthy, 2004] Undetected and uncorrected oculomotor, binocular, accommodative, and perceptual problems that interfere with the development of the visual system during early childhood, when the visual system is most susceptible, represent risk factors to serious lifelong visual impairment and potential precursors to poor academic performance, academic drop out, and involvement with the juvenile court system. [Maples, 2001; American Optometric Association, 2002; American Academy of Pediatrics, American Association of Certified Orthoptists, American Association for Pediatric Ophthalmology and Strabismus, American Academy of Ophthalmology, 2003; Vaughn, Maples, Hoenes, 2006]

The New Jersey Commission on Business Efficiency of the Public Schools concluded that “children with reading difficulties who do not receive intervention services are much more likely to be classified as requiring special education than those students with reading difficulties who receive such services,” and that children with reading problems fall basically within two groups: 1) children who have problems mastering basic reading skills and 2) children with undiagnosed and/or untreated visual problems which prevent them from acquiring reading skills. [New Jersey Commission on Business Efficiency of the Public Schools, 2006] An analysis of vision data, standardized test scores, and teacher grades in a low socioeconomic, urban elementary school eye clinic from 1993 to 1999 found that the majority of vision problems were related to near vision and were associated with lower average test scores. [Orfield, 2001] The study also found that the interventions of reading glasses and vision therapy correlated with improvements in teacher grades, percentiles, and grade equivalents on standardized tests in reading and mathematics for a school-age population where 85% of the children qualified for free breakfast and lunch. Noting an inverse correlation between visual symptoms and academic performance among third, fifth and seventh grade public school students, researchers observed that visual factors are better predictors of academic success than race and/or socioeconomic status, even though a majority of academically at-risk students are from low socioeconomic backgrounds. [Vaughn, Maples, Hoenes, 2006]
The unfortunate dynamic of low socioeconomic status and increased prevalence of undiagnosed and uncorrected vision problems among inner city children helps perpetuate the closed loop of poverty and ill health, exacerbates the negative influence of the social determinants (e.g., education, income, socialization, etc.) on the health of children and adults, and burdens the community with societal diseconomies and reduced productivity. The risk for poor academic performance, social maladjustment and their consequences is compounded by low socioeconomic status, such that “children from poor socioeconomic backgrounds are plagued by academic underachievement, grade retention and special education placement” and they are “three times as likely to drop out of high school as middle-class children.” [Oberg, Bryant, Bach, 1994] Consequently, vision problems are more common and often more limiting among poor children compared to non-poor children. [Currie, Lin, 2007]

Studies suggest that refractive, accommodative and binocular vision anomalies (e.g., hyperopia, heterophoria, fixation disparity, convergence and accommodative insufficiency, aniseikonia, anisometropia) in school-age children can interfere with binocular near point functioning (e.g., reading), hinder school performance and impede academic success. [Grisham, Simons, 1986; Simons, Grisham, 1987; Simons, Gassler, 1988; Simons, 1993] Along with learning difficulties, studies also document the important relationship between uncorrected vision problems in children with “delinquency, illiteracy and social and emotional problems.” [Zaba, 2001] The Eye Care Council’s SEE TO LEARN® Program reports that more than 20% of kindergarten children have vision problems that potentially can affect academic performance as well as other attributes of personal development. [Eye Care Council, 2007]

Amblyopia is a leading cause of visual impairment in children. However, it is estimated that only 20% of preschool children are screened for amblyopia and amblyogenic risk factors – factors that can lead to amblyopia (e.g., strabismus, anisometropia, cataract, ptosis) – at the age when treatment is most successful. [Donahue, Johnson, Leonard-Martin, 2000] Although 47% of parents have the opinion that “poor academic performance is the most important consequence of untreated vision problems;” 48% of parents reported that they have not taken their child age 12 years or under to an optometrist or ophthalmologist – mostly because there were “no problems evident in their child.” [Vision Service Plan, 2002] A study of Americans’ Attitudes and Perceptions about Vision Care, conducted by Harris Interactive on behalf of The Vision Care
Institute™ of Johnson & Johnson Vision Care, Inc., indicated that 35% of respondents reported that their child has never seen an eye care provider, and that parents who have not been diagnosed with a vision problem are significantly more likely (49%) than parents who have been diagnosed with a vision problem (30%) to report that their child has never seen an eye care provider. [The Vision Care Institute, 2006] Other estimates indicate that, in spite of existing state laws and guidelines, only 21% of preschool children are screened for vision problems and even fewer (14%) have received a comprehensive eye examination. [Ciner, Schmidt, Orel-Bixler, et al, 1998] The 2006 American Eye-Q™ Report Card released by the American Optometric Association gives American adults grades of “F” in knowing the “signs that may indicate a child has vision problems” and “when a child’s first eye exam should occur.” [American Optometric Association, 2006] These findings indicate the unfortunate likelihood that many children are entering school without the benefit of a comprehensive eye and vision screening or examination and with uncorrected vision problems.

The prevalence of undetected vision problems in preschool children is estimated to be 5% to 10%. [U.S. Preventive Services Task Force, 1996] A 1998 published review of the literature found the following prevalence of vision disorders in children: amblyopia, 2%-3%; strabismus, 3%-4%; refractive errors, 15%-30%; ocular disease, less than 1%; and color vision defects, 8%-10% of males. [Ciner, Schmidt, Orel-Bixler, et al, 1998] However, higher prevalences may be found in certain select populations. A study of Head Start children found that over 29% had one or more targeted vision disorders (i.e., amblyopia, 6.3%; strabismus, 4.3%; significant refractive error, 20.8%; and reduced visual acuity, 9.5%). [The Vision in Preschoolers Study Group, 2004] Other studies of childhood populations have found similar results for preschool (i.e., amblyopia, 7.9%; strabismus, 21.0%; hyperopia, 33.0%; myopia, 9.4%; and astigmatism, 22.5%) and school-age children (i.e., amblyopia, 6.8%; strabismus, 10.0%; hyperopia, 23.0%; myopia, 20.2%; and astigmatism, 22.5%). [Scheiman, Gallaway, Coulter, et al, 1996]

From its analysis of the 2002 National Health Interview Survey (NHIS), the Centers for Disease Control and Prevention (CDC) found the prevalence of

Children from families living above the FPL
- More likely to see an eye care provider
- Less likely to be visually impaired

Children from families living at or below the FPL
- Less likely to see an eye care provider
- Twice as likely to be visually impaired

[Centers for Disease Control and Prevention, 2005]
visual impairment (i.e., trouble seeing, even when wearing glasses or contact lenses) and use of eye care services (i.e., seen or talked to an optometrist, ophthalmologist, or eye doctor [someone who prescribes glasses] during past 12 months) to be significantly higher among children over 6 years, compared to younger children, and variable by race/ethnicity and family income: [Centers for Disease Control and Prevention, 2005; Ryskulova, Klein, 2006]

• Prevalence of reported visual impairment and blindness among children under 18 years was 2.5% – significantly lower for children under 6 years (1.0%) than for children aged 6 to 17 years (3.3%).

• Among children younger than 6 years, only 36.3% were reported to have ever had their vision tested (below the national health objective target of 52%), and 7.4% had visited an eye care provider during the preceding year.

• Among all children under 18 years, only 20.7% had visited an eye care provider during the preceding year.

• Children whose families were below the Federal Poverty Level (FPL) were nearly twice as likely to be visually impaired as children from families whose income was equal to or greater than 200% of the poverty level.

• Children from families with incomes equal to or more than 200% of the FPL were more likely to see an eye care provider during the preceding 12 months than children from families with incomes below the poverty level (22.7% vs. 17.0%).

• Hispanic children had a significantly higher prevalence of reported visual impairment and blindness (3.6%) than non-Hispanic white children (2.3%).

• Asian, non-Hispanic black, and Hispanic children (15.0%, 19.1%, and 15.5%, respectively) were significantly less likely to have visited an eye care provider during the preceding 12 months than non-Hispanic white children (22.8%).

• The proportion of teenagers with a reported visit to an eye care provider during the preceding year was significantly higher than the proportion of the youngest age group: 30.6% of adolescents age 15 to 17 years and 30.1% of those 12 to 14 years, compared to 7.4% in children under 6 years.

CDC concluded that the prevalence of visual impairment and blindness in 2002 (25 per 1,000 children) was nearly the same as in 1997 (24 per 1,000 children) – indicating little movement toward the Healthy People 2010 goal of 20 per 1,000 children – and that children from poorer
families were at greater risk for visual impairment and less likely to visit an eye care provider than children from higher-income families.

The Collaborative Longitudinal Evaluation of Ethnicity and Refractive Error (CLEERE) Study – a multi-center, longitudinal, observational study of refractive error in 2,523 African American, Asian, Hispanic, and white children age 5-17 years (grades 1 through 8) – found that the prevalence of refractive error is a function of race and ethnicity. [Kleinestein, Jones, Hullett, et al, 2003] The prevalence of myopia was found to be the highest among Asian children (18.5%) and lowest among white children (4.4%), with Hispanic (13.2%) and African American (6.6%) in between. Hyperopia was most prevalent in white (19.3%) and Hispanic (12.7%) children and least prevalent in African American (6.4%) and Asian (6.3%) children. However, astigmatism was the most prevalent of the refractive errors, showing up in 28.4% of children (Hispanic, 36.9%; Asian, 33.6%; white, 26.4%, and African American, 20.0%). Using data from the 1998 Medical Expenditure Panel Survey (MEPS), researchers from the University of Michigan estimated that 25.4% of the U.S. population of 6 to 18 year old children have corrective lenses, but that the use of corrective lenses varies by gender, race/ethnicity, family income, and health insurance status. [Kemper, Bruckman, Freed, 2004] Finding that the proportion of elementary school-age children with corrective lenses (15.8%) was less than the proportion of middle school-age children (30.8%) and high school-age children (36.0%) with corrective lenses, that Hispanic children (20.9%) and black children (20.5%) were less likely than non-black/non-Hispanic children (27.5%) to have corrective lenses, and that children from families with incomes less than 200% of the Federal Poverty Level (19.3%) were less likely than children from families with incomes equal to or greater than 200% of the poverty level (29.0%) to have corrective lenses, the researchers concluded that their findings suggest that “visual impairment is the most common treatable chronic condition of childhood.” Commenting on the study’s findings and implications, the study’s lead author, Dr. Alex Kemper of the University of Michigan Health System’s Child Health Evaluation and Research Unit, further concluded that, “if early detection of visual impairment is important for long-term educational performance, which we think it may be, then it’s possible that disparities in eye care and corrective lens use may lead to an ‘educational gap’ by gender, race, ethnicity, income and insurance status.” [Gavin, 2006]

Access to Eye and Vision Care

Health insurance is a significant and important vehicle for acquiring health care services, including preventive health care. A lack of insurance may cause appropriate levels of curative care and preventive care to be unaffordable and inaccessible, creating a discontinuity of primary
care services. Furthermore, the absence of insurance increases the risk for the delivery of untimely, more costly, and possibly less productive care later. The “working poor” – those above the poverty threshold, but with incomes insufficient to cover the cost of health insurance – are the ones most susceptible to a lack of continuous health insurance. [Kogan, Alexander, Teitelbaum, et al, 1995] Affordability and expense of health insurance, or other insurance-related problems (e.g., “insurance company wouldn’t approve, cover, or pay for care,” “insurance required a referral but couldn’t get one”), are the main reasons frequently cited for not having coverage or receiving care. [Newacheck, Stoddard, Hughes, Pearl, 1998; Weigers, Weinick, Cohen, 1998; Weinick, Weigers, Cohen, 1998]

For children, health insurance increases access to appropriate, timely and affordable health care, as well as the opportunity to grow up healthy and to live healthy adult lives. [Mitchell, Riley, 1998; Weigers, Weinick, Cohen, 1998] Illinois is the first state, under its “All Kids” plan, to provide comprehensive health care (including vision care) coverage to all children in the state, regardless of income. Although America’s Health Insurance Plans (AHIP) has proposed a plan to extend health insurance coverage to all children nationwide and WellPoint has called for the expansion of state health care programs to cover children in families with incomes up to 300% of the FPL, insurance coverage of children generally varies according to age, race/ethnicity, parents’ education and employment status, and geographical residence. Older children, Hispanic children, children of parents with less than 12 years of education, children with one employed parent, children who live in non-metropolitan statistical areas, and children who live in the South are more likely to be uninsured. [Weigers, Weinick, Cohen, 1998; Weinick, Weigers, Cohen, 1998; Kogan MD, Alexander GR, Teitelbaum MA, et al, 1995] Families USA estimates that minority children are at greatest risk, with 22.4% of Hispanic children and 12.9% of African American children – compared to 7.5% of white children – being uninsured. [Families USA, 2006]

Out of approximately 77.5 million children nationwide, approximately 9 million children (11.6%) were without health insurance in 2005, and 88.3% of uninsured children were in families where at least one parent works. [Families USA, 2006] Kogan et al. found that 22.6% of preschoolers were without health insurance for at least one month and that 60% of those without insurance were without it for more than 6 months. [Kogan, Alexander, Teitelbaum, et al, 1995] Compared to insured children, uninsured children are less likely to have a usual source of health care or receive care (e.g., vision care) when indicated and more likely to receive inadequate preventive care (e.g., vision screenings) or face financial and other provider access barriers to needed care (e.g., 40.6% of children under 18 years of age who have a usual source of care receive it from a provider who does not have evening or weekend office hours). [Newacheck,
Stoddard, Hughes, Pearl, 1998; Weigers, Weinick, Cohen, 1998; Weinick, Weigers, Cohen, 1998] Families USA and the Campaign for Children’s Health Care reported that “more than half of children who were uninsured for a year or more had not had a well-child visit [which includes vision screening] in the past year compared to only about one-quarter of children who were insured for a year or more.” [Families USA, 2006] Weigers et al. reported that 11.6% of U.S. families either experience difficulty or delay in obtaining care or do not receive needed health care services. [Weigers, Weinick, Cohen, 1998] Based on a sample of 50,000 children from the 1993-1994 National Health Interview Survey (NHIS), 22.2% of uninsured children compared to 6.1% of insured children are unable to obtain access to at least one needed health care service and that uninsured children are 3.5 times as likely to go without needed medications, eyeglasses or mental health care. [Newacheck, Stoddard, Hughes, Pearl, 1998] The insurance effect persisted even after controlling for age, race, income, health status, and other potential confounding factors.

Children who are uninsured for only part of the year may still experience delayed care (20.2%), unmet medical care (13.4%) and unfilled prescriptions (9.9%), such that the lack of continuous health insurance coverage may “preclude the receipt of preventive care, hearing, vision, and developmental screening, and early intervention.” [Kogan MD, Alexander GR, Teitelbaum MA, et al, 1995; Olson, Tang, Newacheck, 2005] One study of preschool-aged children concluded that, “gaps in health insurance, which decrease the likelihood of continuous utilization of preventive and curative health care, may further establish patterns of not having a regular source of care that could continue into adulthood.” [Kogan MD, Alexander GR, Teitelbaum, et al, 1995] Delayed or discontinuous care and the resulting unmet needs place uninsured children at increased jeopardy for not succeeding in school, the workforce, and in life. [Families USA, 2006]

A national survey reported in the Journal of the American Optometric Association found that 5.3% of the population in 1994 had an unmet need for eyeglasses. [Hodges, Berk, 1999] The highest levels of unmet needs were experienced by those in poor health, African Americans, those with incomes less than 150% of the Federal Poverty Level, and the unemployed. Eighty percent of those surveyed attributed their unmet need to financial reasons (i.e., could not afford it, no insurance), and over 25% assessed their underlying vision problem as very serious. Visual impairment from uncorrected refractive errors (functional blindness) is a significant public health problem, and the finding that a sizable majority of 82% thought that they would have been better
off if they would have received glasses earlier indicates a significant need for community-based programs targeted at the uninsured and underinsured working poor populations.

An examination of the impact of two western Pennsylvania children’s insurance programs (the Children’s Health Insurance Program of Pennsylvania and the Highmark Blue Cross Blue Shield Caring Program) revealed that nearly 1 in 5 uninsured children had an unmet vision need, delayed vision care or both at the time of enrollment, and that prior to enrollment “many parents reported that their children had headaches and difficulties seeing in school, which had an impact on their grades.” [Lave et al., 1998; Lave et al., 1998(b)] Families USA found that uninsured children (23.3%) are five times more likely than insured children (4.6%) to have an unmet vision care need – 1.43 million uninsured children had an unmet vision care need in 2005 – and that children in the lowest three health status categories (good, fair, and poor as reported by a parent or guardian on the National Health Interview Survey) are more than four times as likely (30.1% compared to 7.3%) than insured children to have an unmet vision care need. [Families USA, 2006]

A cross-sectional analysis of data from the National Survey of Children with Special Health Care Needs found that 5.8% of U.S. children with special health care needs (CSHCN) had unmet needs for vision care, placing them “at great risk of long-term delays in their educational and social development.” [Heslin, Casey, Shaheen, Cardenas, Baker, 2006] The analysis also found that African American, Latino, and multiracial CSHCN children were at 2 to 3 times greater risk than white CSHCN children for unmet need.

Findings from the 2002 National Health Interview Survey indicate that the absence of health insurance and low family income are associated with an underutilization of eye care services, and that families without health insurance have more than a three times greater odds of not being able to purchase eyeglasses compared to families with health insurance. [Ryskulova, Klein, 2006] Limited access to vision and eye care services contributes to the prevalence of quality of life threatening health conditions and adversely impacts the educational and economic potential of underserved populations. According to a policy statement released jointly by the American Academy of Pediatrics, the American Association of Certified Orthoptists, the American Association for Pediatric Ophthalmology and Strabismus, and the American Academy of Ophthalmology, “eye examination and vision assessment are vital for the detection of conditions
that result in blindness, signify serious systemic disease, lead to problems with school performance, or worse, threaten the child’s life.” [American Academy of Pediatrics, American Association of Certified Orthoptists, American Association for Pediatric Ophthalmology and Strabismus, American Academy of Ophthalmology, 2003] Therefore, reducing or removing economic, social and cultural barriers that hinder access to eye care services could help reduce the prevalence of avoidable visual impairment and blindness, their related ocular, systemic and psycho-social manifestations and associated costs.

Medicaid, the Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) Program, and the State Children’s Health Insurance Program (SCHIP) provide low income children with avenues of access to needed health care services. Medicaid was enacted in 1965 as Title XIX of the Social Security Act to provide coverage of health care services for blind and disabled persons and economically indigent families with dependent children. In 1967, EPSDT coverage was added as a mandated benefit under Medicaid to provide screening and medically necessary health care services – including vision services (i.e., diagnosis, treatment, eyeglasses) – for all Medicaid-eligible and enrolled children under 21 years of age. Expansions in Medicaid eligibility between 1987 and 1996 helped increase Medicaid coverage from 12.4% to 20.0% of eligible children. [Weigers, Weinick, Cohen, 1998] Despite the increases in the percent of children covered, a large number of children remained uninsured and without affordable access to health care.

Under Subtitle J of the Balanced Budget Act (BBA) of 1997, Congress amended the Social Security Act to add Title XXI – the State Children’s Health Insurance Program (SCHIP). [P.L. 105-33, 1997] SCHIP represents the most significant health legislation for children since the enactment of Medicaid and, in conjunction with Medicaid, has helped reduce the number of uninsured low-income children under the age of 19 years. It expanded the capability for extending public health insurance eligibility thresholds up to and beyond 200% of the Federal Poverty Level for uninsured children of low-income, working families whose income exceeds the Medicaid income threshold, but not enough to afford private insurance. SCHIP eligibility criteria exclude children eligible for Medicaid or covered with other forms of health insurance. The Congressional Budget Office (CBO) estimated that 2.8 million uninsured children would be covered under SCHIP. [Rosenbaum, Johnson, Sonosky, Markus, DeGraw, 1998] Other estimates predicted that SCHIP would extend health insurance coverage to 3.4 million previously uninsured children. [Mitchell, Riley, 1998] In addition to the uninsured children that would be covered directly under SCHIP, program participation requires that outreach and enrollment activities be employed to identify and enroll Medicaid-eligible children in the state’s Medicaid program. CBO estimated that 660,000 eligible, but uninsured, children would be enrolled in Medicaid as a result
of SCHIP outreach and enrollment. [Rosenbaum, Johnson, Sonosky, Markus, DeGraw, 1998] In Indiana, between 55,000 and 61,000 children were found to be eligible for Medicaid, but unenrolled. [Indiana Children’s Health Insurance Program, 1998] Current estimates report that SCHIP provides health insurance coverage for 4 million low-income children nationally who otherwise would be uninsured. [The Kaiser Commission on Medicaid and the Uninsured, 2006(b)] However, an additional 1.7 million uninsured children, over and above the 4.4 million uninsured Medicaid eligible children, are eligible for SCHIP enrollment. [Dubay, Guyer, Mann, Odeh, 2007] Senate Enrolled Act 19 (1998) established the Indiana Children’s Health Insurance Program and extended health care coverage to an estimated 131,000 low-income children in working-poor families without insurance and Medicaid eligibility.

The SCHIP legislation requires each participating state to cover certain basic services: inpatient and outpatient hospital services, physicians’ surgical and medical services, laboratory and x-ray services, and well-baby and well-child care. Each state has the option of expanding coverage by including additional services, such as prescription drugs, mental health services, hearing services and vision services. The SCHIP definition of “child health assistance” encompasses all benefits recognized under Medicaid, including payment for part or all of the cost of eyeglasses for targeted low-income children if specified under the state plan. [H.R. 2015, 1997] However, the legislation’s listing of vision services under the “Categories of Additional Services,” does not guarantee the inclusion of vision services in a state plan, nor does it guarantee that plan coverage will be consistent across all participating states. The Indiana General Assembly opted to include the same array of vision service benefits in SCHIP as included in the Indiana Medicaid program.

The State Children’s Health Insurance Program was created not as an entitlement program, but as a ten-year block grant program for states. The program is up for reauthorization in 2007 and, although it should be a top priority on the 2007 Congressional agenda, it is at-risk of legislative restructuring and/or reduced funding. The potentiality of budgetary shortfalls make state-supported programs like SCHIP a constant target for benefit cuts, greater eligibility restrictions, and other programmatic adjustments. Any cuts in federal funding, reductions in programmatic content, and/or increased eligibility requirements would adversely affect the program’s ability to provide necessary health care services to current and future beneficiaries. Additional eligibility and enrollment barriers – such as the lack of parental awareness of a child’s eligibility, complex application procedures, fear and mistrust of providers or government, health illiteracy, and limited language proficiency – impact enrollment success and subsequent access to services. [Zambrana, Carter-Pokras, 2004]
Coverage through public programs like SCHIP is critical to health insurance protection for children with health problems. [Weigers, Weinick, Cohen, 1998] Vision services must be viewed as being basic to the health of every child in every state and, since children unable to see the blackboard often fall behind in school, the Children’s Defense Fund states that vision services and eyeglasses “are essential in any program for children.” [Children’s Defense Fund, undated] Preliminary data on the impact of public programs from BlueCHIP in western Pennsylvania indicated that “unmet vision care” among eligible children decreased from 18% at enrollment to 3% 12 months after enrollment. [Lave et al., 1998; Western Pennsylvania Caring Foundation for Children, unpublished] Eye care providers have a professional responsibility to help educate policy makers, child advocacy groups, other health care providers, and the general public about the importance of comprehensive vision care services to the health and welfare of all children and the necessity of including such services in insurance plans and programs designed to increase access and improve children’s health. [Solan, Mozlin, 1997; Solan, Mozlin, 1997(b)] As states grapple with the dilemma of benefit cost versus extent of coverage, the message must be clear that the incremental cost of including eye and vision care is considerably less than the increased potential for personal development, beneficiary satisfaction and reduced societal costs accrued through improved access to eye and vision care services.

Vision Screening versus Eye Examination

Vision screenings have a long history of use as a diagnostic tool for identifying vision problems in children, with the first state-supported school vision screening program being implemented in Connecticut in 1899. [Appelboom, 1985] Vision screenings are justified in the presence of the following conditions: 1) vision problems are highly prevalent and affect well-being; 2) vision problems can be easily identified through valid, reliable, and acceptable tests; 2) vision problems are correctable with available therapy at reasonable cost; and 3) therapy will improve the quality of life of those screened. [Appelboom, 1985] According to Dr. Henry Peters, one of the authors of The Orinda Study, the objectives of vision screening programs are two-fold: [Peters, 1963]

The two main objectives of a vision-screening program for school children are: (1) to detect those children who have vision problems or potential vision problems that may affect the physiological or perceptive processes of vision; and (2) to find those children who have vision problems that interfere with performance in school. Although these two objectives overlap, they are not identical. Some vision problems may not directly affect school performance, and some may affect school performance but not affect visual health. Children with both types of problems must be
detected by the vision-screening program. In other words, it should detect those children who, because of their visual mechanisms, have performance handicaps; detect those children who have visual anomalies that may become performance handicaps at some future time; and detect those children with eye-health problems who should be under professional observation or treatment.

Today, screening children for vision problems represents “one of the most widely accepted screening procedures . . . incorporated in routine child health assessment activities, school health programs, and most preventive efforts,” including the EPSDT Program, Head Start, and Maternal and Child Health Crippled Children’s Programs. [Ciner, Dobson, Schmidt, et al., 1999; Leske, Rosenthal, Soroka, 1981] However, different opinions exist with regard to the clinical areas and functions to be assessed, the most appropriate tests, the ages of children to screen, screening frequency, referral criteria and the qualifications of screening personnel. [Ciner, Dobson, Schmidt, et al., 1999] Controversy also exists with regard to the validity and effectiveness (e.g., sensitivity, specificity) of vision screening versus comprehensive eye and vision examination when applied to preschool and school-age children. For vision screening to be effective, it must be coupled with appropriate referral and comprehensive follow-up of children identified to be in need of further attention.

Vision screening by pediatricians, other primary care physicians, and lay screeners can be problematic, particularly for infants, toddlers and preschoolers. Under-screening, screening inaccuracy (e.g., high false negative rate), and difficulties with post-screening referral and follow-up (e.g., ineffective communication with parents, lack of written reports) can lead to untimely intervention, delayed diagnoses and less than optimal outcomes. [Campbell, Charney, 1991; Wasserman, Croft, Brotherton, 1992] Similarly, failure to screen all children – as well as failure to refer for comprehensive follow-up eye examinations – can lead to the late detection of vision disorders. [American Optometric Association, 2002] A study from the Department of Pediatric Medicine of the Children’s National Medical Center in Washington, DC and the Department of Pediatrics at the University of Massachusetts Medical School found that 35% of children with good access to health care who were diagnosed with amblyopia after entering school had actually received a vision screening prior to age 5, suggesting that “there are deficiencies in the vision screening of preschool children in pediatric practices.” [Campbell, Charney, 1991] Despite the screening recommendations promoted by the American Academy of Pediatrics, it has been suggested that “as many as 60% of primary care [physician] providers do not perform preschool vision screening.” [Hered, Rothstein, 2003] A survey of Illinois pediatricians found that only 60% tested the visual acuity of children aged 5 years and older, and that only half of them tested children aged 2-4 years of age. [Marcinak, Yount, 1995] The reported reasons for not testing visual
acuity were inadequate time (42%), children too young (18%), or screening done at school (18%).

A cross-sectional study of vision screening of 8,417 children aged 3 to 5 years in 102 pediatric practices in 23 states and Puerto Rico found that 34% of children overall – 62% of 3 year old children – were not screened for the stated reasons of not routine (44%), child too young (40%), screening already done (17%), and screening will be done elsewhere (9%). [Wasserman, Croft, Brotherton, 1992] The findings that younger children and Hispanic children were less likely to be screened than older children and children of any other ethnic group, and that half of the parents of children who failed the screening claimed to have been unaware of the results were reported as “a missed opportunity for prevention.”

A Vision Service Plan (VSP) study found that, of parents who have taken their child to an eye care specialist, only 10% reported that they did so upon recommendation by the school. [Vision Service Plan, 2002] Conversely, the same study found that parents who have not taken their child to an eye care specialist did not do so because their child is checked by the doctor or pediatrician (28%), examined in school (25%), or too young (18%). A review of kindergarten health assessment forms for students enrolled in North Carolina’s Guilford County Public Schools during the 1999-2000 school year indicated that 14.2% of the 3,413 children who received vision screening failed the screening, but only 38% of those who failed were recommended for follow-up. [Clemens, Doolittle, Hoyle, 2002] Other studies have found that 40% to 67% of children who fail a vision screening are noncompliant with recommended follow-up care. [Preslan, Novak, 1998; Donahue, Johnson, Leonard-Martin, 2000] When follow-up does occur, the mean lag time between referral and follow-up has been estimated to be 1.8 years for ophthalmologic care and 2.4 years for optometric care – for a 5 or 6 year old the mean time from first referral to first eye care professional visit is 4.1 years. [Yawn, Lydick, Epstein, Jacobsen, 1996] Justifications for parental non-compliance with recommended follow-up instructions include lack of awareness of the failed screening, lack of time and lack of financial resources, with lower income families being considerably less likely than higher income families (29% compared to 66%) to comply with follow-up examination recommendations. [Mark, Mark, 1999]

A review of the literature indicates that “deficient distance acuity would not be expected to affect the reading skills of children unless substantial reading instruction takes place on the chalk board . . . deficient near point acuity seems a more likely candidate to influence reading performance.” [Grisham, Simons, 1986] Therefore, because of their limitations and reliance on the
single measure of distance visual acuity, many vision screening protocols may fail to detect important learning-related problems (e.g., hyperopia) that do not affect distance acuity, allowing for the potential misinterpretation and misunderstanding by teachers, nurses, and parents of the screening’s value as a predictor of academic readiness.

The Vision in Preschoolers (VIP) Study is a National Eye Institute (NEI) funded, three phased, multi-center clinical study designed to evaluate the effectiveness of vision screening tests used to identify preschool-aged children in need of further evaluation for vision disorders. [The Vision in Preschoolers Study Group, 2004; The Vision in Preschoolers Study Group, 2005] In Phase I, the VIP Study Group evaluated the performance of selected vision screening tests when conducted by licensed eye care professionals (i.e., optometrists and ophthalmologists). With the specificity set at 0.90, the sensitivity of the evaluated tests ranged from a high of 0.64 for noncycloplegic retinoscopy to a low of 0.16 for the cover-uncover test in the identification of one or more visual conditions important to detect in preschool children. [The Vision in Preschoolers Study Group, 2004] However, some tests were found to be more sensitive for certain conditions than for others – the SureSight Vision Screener (0.89), Retinomax Autorefractor (0.85), and the Power Refractor II (0.80) were found to be most sensitive in detecting amblyopia; the Lea symbols visual acuity test (0.58), Retinomax Autorefractor (0.50), and the HOTV visual acuity test (0.48) were most sensitive for reduced visual acuity; the Retinomax Autorefractor (0.69), the Stereo Smile II (0.68), the MTI Photoscreener (0.65), and the HOTV visual acuity test (0.65) were most sensitive for strabismus; and the Retinomax Autorefractor (0.78), SureSight Vision Screener (0.75), and Lea symbols visual acuity test (0.70) were the most sensitive tests for detecting refractive error. [The Vision in Preschoolers Study Group, 2004]

Phase II of the VIP Study was designed to compare the performance of pediatric nurse screeners with the performance of lay screeners in administering the three best-performing, commonly used preschool vision screening tests from Phase I (Retinomax Autorefractor, SureSight Vision Screener, and Lea symbols distance visual acuity test) and one of the most effective Phase I tests for detecting children with strabismus (Stereo Smile II stereoacuity test). Although the overall conclusion was that the two best-performing vision screening tests for preschool children (Retinomax Autorefractor and SureSight Vision Screener) are as effective when used by nurse screeners and lay screeners as they are when used by optometrists and ophthalmologists and that most nurse-lay screener differences were small and statistically insignificant, published findings from Phase II indicate that the sensitivities of screening tests vary from a high of 0.68 for the Retinomax Autorefractor (best-performing test) when administered by a nurse screener to a low of 0.37 for the Lea symbols visual acuity test at 10 feet.
when administered by a lay screener (specificity set at 0.90). [The Vision in Preschoolers Study Group, 2005] Therefore, only 68% of preschool children with vision problems in need of correction are being identified by the best-performing vision screening test of the VIP protocol when administered by a pediatric nurse. Stated differently, the best-performing VIP assessed screening test will miss more than 30% of common childhood eye conditions such as refractive error, amblyopia and strabismus. The “worse of the best” vision screening tests will miss more than 60% of potentially impairing conditions when administered by a lay screener. In final analysis, depending on the screening tests used and the administrator of the tests, vision screenings can miss as many as 60% of children with vision problems in need of correction.

### Table 1 – Vision screening tests by selected health care personnel

<table>
<thead>
<tr>
<th>Optometrist</th>
<th>Ophthalmologist</th>
<th>Pediatrician</th>
<th>Optometric Technician</th>
<th>School Nurse</th>
<th>Trained Lay Person</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Visual Acuity (Distance)</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Binocularity (Cover Test)</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Refraction (Retinoscopy)</strong></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ocular Health (Ophthalmoscopy)</strong></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Visual Acuity (Near)</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Stereoacuity (Random Dot E)</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Fusion (Worth Dot)</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Color Vision</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Machine Screener (Telebinocular)</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

It has been reported that “vision screening using tests of visual acuity and ocular alignment alone does not achieve a sensitivity or specificity above 95%,” and that “only with a battery of tests approaching that of the Modified Clinical Technique can the validity attain 95%.” [Robinson, Bobier, Martin, Bryant, 1999] In general, a battery of tests done in parallel will produce a higher sensitivity than a single test done in isolation. The Modified Clinical Technique (MCT) – often referred to as the “Gold Standard” for vision screening – represents a battery of tests that include an assessment of distance visual acuity, distance and near muscle imbalance, refractive error and ocular health. The full battery of MCT tests requires the training of a licensed eye care professional to conduct the cover test (muscle balance), retinoscopy (refractive error) and ophthalmoscopy (ocular health). However, other health care providers and trained lay screeners can conduct various components of the battery, as well as many of the adjunctive tests that complement the MCT (Table 1).

The Orinda Vision Study, which was conducted in Orinda, California during the years of 1954 to 1956, validated the MCT as the “most effective screening method” for the assessment of visual performance in children. The purpose of The Orinda Study was to design “the least expensive, least technical and most effective screening program for finding essentially all elementary-school children with vision problems.” [Blum, Peters, Bettman, 1959] The study found the MCT to be most diagnostically accurate method among those evaluated (i.e., Parent Questionnaire, Teacher Observation, Nurse Observation, California State Recommended Procedure, Massachusetts Vision Kit, Modified Clinical Technique, Telebinocular), with a sensitivity of 0.96 (i.e., 96% of children with vision problems identified as having vision problems), a specificity of 0.98 (i.e., 98% of children without vision problems are correctly identified as not having vision problems), a positive predictive value of 0.90 (i.e., 90% of children referred will have vision problems), and a negative predictive value of 0.99 (i.e., 99% of children not referred will not have vision problems) when administered to school children (Table 2). [Blum, Peters, Bettman, 1959; Peters, Blum, Bettman, Johnson, Fellows, 1959] The accuracy of the MCT reportedly decreases, however, to sensitivities of 0.65 to 0.50 and specificities of 0.93 to 0.79 when used in preschool populations. [Ciner, Schmidt, Orel-Bixler, et al, 1998]

Based on data from The Orinda Vision Study, and except for nurse observation, the sensitivity of the nurse-administered Snellen test appears to be among the lowest of the screening techniques at 0.27 (Table 2). The sensitivities of the other procedures vary according to who
administers the procedure (i.e., licensed eye care professional, nurse screener, or lay screener) and/or the set level of specificity (i.e., 0.90 or 0.94). [The Vision in Preschoolers Study Group, 2004; The Vision in Preschoolers Study Group, 2005; The Vision in Preschoolers Study Group, 2005(b)] Balancing the “necessary community cost” of correct referrals against the “unnecessary community cost” of over-referrals, and in addition to finding the MCT as the most effective vision screening procedure, The Orinda Study judged the MCT also as “the most efficient and economical screening procedure tested.” [Blum, Peters, Bettman, 1959; Peters, Blum, Bettman, Johnson, Fellows, 1959] However, even the “Gold Standard” does not correctly identify all children with vision problems. Consequently, the American Optometric Association adopted a 2001 resolution on the importance of informing parents that a vision screening does not replace a comprehensive examination of vision and ocular health. [American Optometric Association, 2001]

<table>
<thead>
<tr>
<th>SCREENING METHOD</th>
<th>EFFECTIVENESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sensitivity</td>
</tr>
<tr>
<td>Modified Clinical Technique*,+,‡‡</td>
<td>0.96</td>
</tr>
<tr>
<td>Telebinocular*,+,‡‡</td>
<td>0.76</td>
</tr>
<tr>
<td>NYSOA Vision Screening Battery‡</td>
<td>0.72</td>
</tr>
<tr>
<td>Retinomax Autorefractor†,‡,±±</td>
<td>0.63&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.52&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>SureSight Vision Screener†,‡,±±</td>
<td>0.63&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.51&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Massachusetts Vision Kit*,+,‡‡</td>
<td>0.62</td>
</tr>
<tr>
<td>Lea Symbols Visual Acuity†,‡,±±</td>
<td>0.61&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.49&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Power Refractor II†,±±</td>
<td>0.54&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>0.36&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Test Type</td>
<td>Value 1</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>HOTV Visual Acuity†,±±</td>
<td>0.54a</td>
</tr>
<tr>
<td></td>
<td>0.36a</td>
</tr>
<tr>
<td>Stereo Smile II†,±,±±</td>
<td>0.44a</td>
</tr>
<tr>
<td></td>
<td>0.45b</td>
</tr>
<tr>
<td></td>
<td>0.40c</td>
</tr>
<tr>
<td></td>
<td>0.33a</td>
</tr>
<tr>
<td>Random Dot E Stereoacuity†,±,±±</td>
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<tr>
<td>Teacher Observation*,+,‡‡</td>
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<td>Parent Questionnaire*,+,‡‡</td>
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<tr>
<td>iScreen Photoscreener†,±,±±</td>
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<td>MTI Photoscreener†,±,±±</td>
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<tr>
<td>Snellen E Chart*,+,‡‡</td>
<td>0.27</td>
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<tr>
<td>Nurse Observation*,+,‡‡</td>
<td>0.18</td>
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Source:

††Values calculated from available data.
††Values can not be calculated from available data.
aConducted by licensed eye care professional.
bConducted by nurse screener.
cConducted by lay screener.
Prevent Blindness America (PBA) and the National Association of Chronic Disease Directors (NACDD), in cooperation with the Centers for Disease Control and Prevention (CDC), are collaborating to establish vision as a state public health priority and have released a report titled *A Plan for the Development of State Based Vision Preservation Programs*. [National Association of Chronic Disease Directors, 2005] The report states that “the greatest challenge in meeting the needs related to children’s vision is ensuring that they receive optimum vision screening with essential follow-up or comprehensive eye examinations within the first five years of life when serious eye problems are easiest to correct.” The report also states that “efforts should include a more concerted focus on screening ‘program’ development, consisting of optimally defined procedures for early detection based on sensitivity, specificity and positive predictive value, and well coordinated follow-up evaluations for individuals with positive test results.”

According to a report from the Vision Council of America (VCA), 19 states do not require children to have any preventive vision care (eye examination or vision screening) before starting school or during the school years, thus contributing to the CDC finding that 2 in 3 children do not receive a vision test prior to entering school (Figure 1). [Centers for Disease Control and Prevention, 2005; Vision Council of America, 2005] Since the 2005 publication of VCA’s *Making the Grade? An Analysis of State and Federal Children’s Vision Care Policy*, Rhode Island and

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### Figure 1 – State preventive vision care requirements for children, United States, 2007

![Map showing state requirements for children's preventive vision care](image)

<table>
<thead>
<tr>
<th>State</th>
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Oklahoma, two of the 19 states that were reported to not require an eye examination or vision screening subsequently enacted legislation to require all children to receive a vision screening or comprehensive eye examination before starting elementary school. Rhode Island and Oklahoma also require all children who fail the screening to receive a follow-up examination from an optometrist or ophthalmologist. VCA reports that 31 states (33 with the addition of Rhode Island and Oklahoma plus the District of Columbia) require a vision screening prior to school. However, 28 of the now 33 states (85%) do not require children who fail the screening to have a follow-up eye examination by an eye doctor. Only Arkansas, Massachusetts, North Carolina, Oklahoma and Rhode Island require a comprehensive follow-up examination by an optometrist or ophthalmologist upon failing the vision screening.

With estimates as high as 80% of children who fail a vision screening not visiting the eye doctor for a recommended follow-up eye examination, the absence of provisions requiring follow-up care for those who fail the vision screening seriously weakens the impact of the state’s screening requirement. [Vision Council of America, 2005] Therefore, it is reasonable to conclude that “children who receive comprehensive eye exams are likely to have their vision problems identified and treated earlier than if they had a vision screening,” and are at least ensured of initial follow-up care by the examining eye care professional. [White, 2004]

Although Massachusetts and Ohio require eye examinations for all special needs students, only two states, Kentucky in 2000 and North Carolina in 2005, have enacted legislation requiring a comprehensive eye examination by an optometrist or ophthalmologist for all children prior to entering public school. However, the North Carolina law was repealed in 2006 in the face of opposition from school officials, pediatricians and ophthalmologists who claimed the examinations were an unnecessary burden for most families. [Bonner, 2006] North Carolina now requires all children entering kindergarten to have a vision screening and a comprehensive follow-up vision examination if they fail the screening. In 2006 Puerto Rico amended the Children and Adolescents Health Conservation Act of 2000 to require vision examinations by an optometrist or ophthalmologist for children in all public and private schools, including day care centers and Head Start centers. The pre-amended 2000 law only required visual acuity testing.

Awaiting the Governor’s signature in Missouri is Senate Bill No. 16, which requires that “beginning July 1, 2008, every child enrolling in kindergarten or first grade in a public elementary school [in Missouri] shall receive one comprehensive vision examination performed by a state licensed optometrist or physician” and that “beginning July 1, 2008, and continuing through the 2010-2011 school year unless extended by act of the general assembly, all public school districts shall conduct an eye screening for each student once before the completion of first
grade and again before the completion of third grade.” [Senate Bill No. 16] At a minimum, the comprehensive vision examination shall include a complete case history, aided and unaided visual acuity, external and internal ophthalmoscopic examination and subjective refraction to best visual acuity. According to the proposed regulation, the vision screening method “shall be one approved by the children’s vision commission and shall be performed by an appropriately trained school nurse or other trained and qualified employee of the school district.” Senate Bill No. 16 also establishes a Children’s Vision Commission to: 1) analyze and adopt one or more standardized eye screening and eye examination tests to be used in all schools; 2) develop a standardized reporting form which shall be used by all school districts; 3) design and coordinate appropriate training programs for school district staff who conduct the screening exams; 4) conduct a pilot project to track the results of the eye screenings and eye examinations based on the reports submitted by school districts; 5) develop guidelines outlining the benefits and ongoing eye care for children and summarizing the signs and symptoms of vision disorders for the Missouri Optometric Association and the Missouri Society of Eye Physicians and Surgeons websites; and 6) submit a report by December 31, 2011 to the general assembly on the results and findings of the pilot project, including the total number of eye screenings and eye examinations, the number of students who received a follow-up examination, and the results of those examinations to determine the relative effectiveness of eye examinations and eye screenings.

During the first year of the newly enacted Kentucky vision examination law, 3.4% of the examined children were diagnosed with amblyopia, 2.3% with strabismus and 13.9% were prescribed spectacle lenses. [Zaba, Johnson, Reynolds, 2003; Zaba, Moslin, Reynolds, 2003] In assessing the impact of the law – that is, estimating the number of children that would have entered school with an undiagnosed vision problem in the absence of the new law – it was determined that 80% to 86% of children diagnosed with vision problems (86% of the amblyopes, 80% of the strabismics, and 84% of those requiring a lens prescription) had visited a pediatrician or family physician within the past year and prior to receiving the required eye examination. [Zaba, Moslin, Reynolds, 2003] However, only 18% to 26% of those subsequently diagnosed with vision problems (20% of the amblyopes, 26% of the strabismics, and 18% of those requiring a lens prescription) were referred by the pediatrician or family physician to an eye care provider for an eye examination.

New Jersey is considering a three-year pilot program requiring mandatory eye examinations for second grade students. [American Optometric Association, 2007] The purpose of the pilot is to assess the ability of a comprehensive eye examination – defined as history, external and internal ophthalmoscopic examination, visual acuity, ocular alignment and motility, refraction and
assessment of accommodation and binocular vision by an optometrist or ophthalmologist – to eliminate inappropriate referrals of students with undiagnosed and untreated vision problems to special education programs. Finding the current requirement for vision screening of public school children for acuity only to be inadequate, the New Jersey Commission on Business Efficiency of the Public Schools recommended that the New Jersey Legislature require three, four, five, or six year old children to present a vision examination certificate – signed by an optometrist, ophthalmologist, or qualified physician – with the results of a vision examination performed six months prior to enrollment in public school, public preschool, or Head Start. [New Jersey Commission on Business Efficiency of the Public Schools, 2006] The Commission estimated that the state could save $200 million a year in special education costs if early intervention reading programs with universal screening and follow-up were available to all of New Jersey’s public school children.

In an analysis prepared for the Vision Council of America, Abt Associates concluded that universal preschool comprehensive eye examinations would be more cost effective in diagnosing and treating cases of amblyopia in children and produce a greater return on investment than a universal vision screening program or usual patterns of care (e.g., care initiated by a concerned parent or on referral by a pediatrician). [White, 2004] The study reported a trend of decreasing amblyopia detection rates for comprehensive examinations (95%), vision screening (65%), and usual eye care (24%), along with decreasing amblyopia treatment rates for children who have a comprehensive examination (76%), those with a vision screening (31%), and those under usual eye care (19%). The study also concluded that the higher costs of comprehensive examinations, compared to vision screenings, are offset by gains in quality-adjusted life years (QALYs), which consider the increase in both the quantity and the quality of life produced by comprehensive examinations and subsequent treatment compared to vision screenings and usual eye care. The incremental cost and cost per QALY for comprehensive examinations were determined to be $71.98 and $18,390, respectively, for vision screenings, and $88.44 and $12,985 for usual eye care – well below the $50,000 per QALY threshold used to determine the reasonableness of the intervention’s expenditure and below the $20,000 threshold for assessing the intervention as highly cost-effective (e.g., the cost per QALY for use of driver-side air bags is $30,000). Dr. Susan Taub, ophthalmologist and professor at Northwestern University, commented that “this
study proves that eye exams are not only better at saving sight, but one of the most cost-effective interventions available.” [Vision Council of America, 2006]

Recognizing that “eye and visual problems which are not detected during childhood can lead to serious illness” and that “these conditions if not treated properly can lead to poor performance in school,” the American Public Health Association (APHA) called upon Congress to “assure that every child has access to a comprehensive benefit package . . .” to “help ensure that all children receive preventive care, routine eye examinations . . .” [American Public Health Association, 1997] APHA also supports the inclusion of comprehensive eye care services in proposed legislation to develop school-based health clinics that would provide comprehensive health services to underinsured and at-risk children. APHA’s recognition of the importance of proper vision care supports the premise that early and periodic intervention can help diagnose and correct undetected vision problems before the onset of serious and sometimes irreversible consequences. In a 2001 policy statement, the American Public Health Association, noting that “visual development from birth through school age has sensitive and critical periods where abnormalities can lead to permanent impairments,” furthered its support of improving early childhood eye care by encouraging “a regular comprehensive eye examination schedule as opposed to just screening . . . so that all children have exams performed at approximately age 6 months, 2 years, and 4 years.” [American Public Health Association, 2002] The U.S. Preventive Services Task Force also recommends screening to detect amblyopia, strabismus, and defects in visual acuity (refractive error) in children younger than age 5 years. [U.S. Preventive Services Task Force, 2004]

Believing that 80% of all learning during a child’s first 12 years comes through vision, the American Optometric Association (AOA) recognizes that “good eye and visual health is essential for the optimal development of every child” and encourages “doctors of optometry, as a matter of professional responsibility, to garner appropriate private and public support to assure that every child receives eye and vision care services essential for his or her optimal development.” [American Optometric Association, 1997] The AOA also “believes that an eye/vision assessment conducted as part of a preschool or school physical or a vision screening in public or private schools cannot substitute for regular professional care” and that “a professional vision examination is essential for the diagnosis and treatment of eye and vision problems prior to entry into school.” [American Optometric Association, 2006(b)] Consequently, the AOA concluded that “all children
should receive a comprehensive eye and vision examination assessing and treating any deficiencies in ocular health, visual acuity, refractive status, oculomotility and binocular vision prior to entering school.” The AOA Optometric Clinical Practice Guideline recommends a schedule of pediatric eye examinations for asymptomatic and risk free children at 6 months of age, at 3 years of age, before first grade, and every two years thereafter. [American Optometric Association, 2002] However, more frequent care may be necessary for children at significant risk for visual impairment, including those with the following factors:

- prematurity, low birth weight, oxygen at birth, grade III or IV intraventricular hemorrhage;
- family history of retinoblastoma, congenital cataracts, or metabolic or genetic disease;
- infection of mother during pregnancy (e.g., rubella, toxoplasmosis, venereal disease, herpes, cytomegalovirus, or human immunodeficiency virus);
- difficult or assisted labor, which may be associated with fetal distress or low Apgar scores;
- high refractive error;
- strabismus;
- anisometropia;
- known or suspected central nervous system dysfunction evidenced by developmental delay, cerebral palsy, dysmorphic features, seizures, or hydrocephalus.

The National Parent Teacher Association (PTA) position statement on Elements of Comprehensive Health Programs also supports the early diagnosis and treatment of vision problems in children through comprehensive examinations, stating that: [National Parent Teacher Association, 2006]

- early diagnosis and treatment of children’s vision problems is a necessary component to school readiness and academic learning;
- vision screening is not a substitute for a complete eye and vision evaluation by an eye doctor; and
- comprehensive eye and vision examinations by an optometrist or ophthalmologist are important for all children first entering school and regularly throughout their school-aged
years to ensure healthy eyes and adequate vision skills essential for successful academic achievement.

The Illinois PTA adopted a 2004 resolution to “support legislation to require a comprehensive eye and vision examination, by an optometrist or ophthalmologist, for all children entering kindergarten (or first grade) as a necessary prerequisite to academic learning.” [Illinois PTA, 2006]

With support from the American Optometric Association, the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus, Prevent Blindness America and the Vision Council of America, the Vision Care for Kids Act of 2007 (H.R. 507/S. 1117) is being considered by Congress as a legislative vehicle to address undiagnosed and untreated vision problems in school-age children. If enacted, the legislation would establish a federal grant program to assist states in providing timely and comprehensive eye examinations, treatment, and follow-up care to correct vision problems in at-risk, uninsured children who have trouble accessing vision care services. The legislation complements the Children’s Vision Improvement and Learning Readiness Act, a bill introduced in the House in 2005 and endorsed by the AOA and the National Head Start Association (NHSA) as a grant process to provide states with the necessary funds to increase the number of children that visit an eye care provider.

In 2005, the American Optometric Association launched its landmark public health program, InfantSEE™, as a way of enhancing infant wellness care and improving a child’s quality of life by providing the first assessment of an infant’s vision at no cost to the family and without billing governmental or private health insurance (as long as child is assessed within the first 12 months of life). In partnership with the Vision Care Institute™ of Johnson & Johnson Vision Care, Inc., InfantSEE™ stresses the critical importance of early detection, management, and treatment of ocular conditions and diseases. Its primary objectives are to identify and treat risk factors that may adversely affect ocular and visual health, reduce the impact of amblyopia and other conditions that may affect child development, earlier detection of retinoblastoma, and education of parents about the importance of eye care for children. Nearly 50,000 infants were assessed under the program during its first year. [InfantSEE™, 2007] As a public health measure, the InfantSEE™ initiative can help increase the breadth and depth of awareness and knowledge about the importance of early examination and intervention of potentially harmful vision and ocular conditions in young children. Former Surgeon General Richard Carmona, MD commended AOA optometrists for their efforts to improve the health and well-being of all Americans, and welcomed the partnership with the AOA to advance his healthy child agenda. [American Optometric Association, 2005]
The United Health Foundation’s America’s Health Rankings for 2006, based on key measures of wellness, ranks Indiana 33rd behind first rated Minnesota and 32 other states in relative overall healthiness as a state. [United Health Foundation, 2006] The 2006 ranking continues Indiana’s downward trend (down from 32nd in 2005 and 25th in 1990) and reflects the increasingly demanding need of the state to strategically address its absolute and relative unhealthiness. According to the U.S. Census Bureau, 26.1% of the Indiana population in 2005 was under 18 years of age. [U.S. Census Bureau, 2006] The 2004 Kids Count data, released by The Annie E. Casey Foundation, ranks Indiana 32nd in its overall assessment of child well-being, and it has been noted that “patterns of child health are always rooted in patterns of social well-being.” [Wise, 2004; The Annie E. Casey Foundation, 2006]

Indiana ranked 27th among all states, and below the national average, in both median family income and median household income at $54,077 per family and $43,993 per household in 2005 inflation-adjusted dollars. [U.S. Census Bureau, 2006] However, at 16.7% in 2005, Indiana ranked 28th...
among all states and below the national average (18.5%) in the percent of children between the ages of 0-17 years living in poverty (i.e., at or below 100% of the Federal Poverty Level) – that is, Indiana has fewer children on average living in poverty than the country as a whole. [U.S. Census Bureau, 2006] Among Indiana’s 92 counties, 25 have child poverty rates equal to 15% or higher of the county’s child population (Figure 2). The counties with the highest percentage of children living in poverty are Crawford (18.9%), Vigo (18.7%), Lake (18.5%), Knox (18.4%), Grant (18.3%), Marion (18.3%), and Daviess (18.1%). For the 2005-2006 school year, 28.1% of public elementary school children in Indiana were eligible for the free lunch program, indicating a family income of equal to or less than 130% of the Federal Poverty Level. [Indiana Department of Education, 2006; Indiana Department of Education, 2006(b)]

In terms of educational achievement, 17.9% of adults age 25 years and older have less than a high school education with 34 Indiana counties reporting percentages over 20% (Figure 3). [Indiana Business Research Center, 2006] Compared to other states, Indiana ranks the worst (50th out of 50 states) in the percent of teenagers who are high school dropouts. In 2004, 13% of Indiana’s teenagers were high school dropouts compared to an average of 8% for all states. [The Annie E. Casey Foundation, 2006] Based on its “Chance-for-Success Index” of 13 indicators (family income, parent education, parental employment, linguistic integration, preschool enrollment, kindergarten enrollment, elementary reading, middle school mathematics, high school graduation, postsecondary participation, adult educational attainment, annual income and steady employment), Education Week’s Quality Counts 2007 report ranks Indiana 30th in terms of the probability of students achieving academic success. [Education Week, 2007] However, Indiana’s averages of 36.4% for preschool enrollment and 30.3% for elementary reading suggest that there

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**Figure 3 – Percentage of adults, age 25 years and older, with less than 12 years of education, Indiana, 2000**

is considerable room for improvement in providing its children with opportunities for academic and economic success.

In Indiana a total of 872,920 nonelderly individuals are uninsured, of which 161,260 (18.5%) are children. [The Kaiser Family Foundation, 2007] Hoosier Healthwise (Indiana’s Medicaid Program) has an age-stepped eligibility up to 150% of the FPL. However, with a family income threshold of 200% of the Federal Poverty Level ($40,000 for a family of four in 2006), many Indiana children who fall through the Medicaid safety net benefit from SCHIP with insurance coverage and improved access to health care services. Although children in Indiana are more likely than children in other states to be covered by private health insurance, over 535,000 Indiana children are insured by one of two public programs – Hoosier Healthwise (Medicaid) or SCHIP – with enrollment densities for Hoosier Healthwise and SCHIP being highest in urban counties and rural counties respectively (Figure 4). [EP&P Consulting, Inc, 2006; The Kaiser Commission on Medicaid and the Uninsured, 2006; The Kaiser Commission on Medicaid and the Uninsured, 2006(b)] In spite of private and public coverage, 9.7% of Indiana children were uninsured in 2005 – less than the national uninsured children average of 11.6% – and 92.2% of uninsured Indiana children lived with a working parent. [Families USA, 2006] More importantly, 63.8% of uninsured Indiana children lived in families with incomes at or below 200% of the Federal Poverty Level, making them eligible for coverage under Indiana Medicaid or SCHIP (Figure 5). [Families USA, 2006]

As of June 2006, 69,787 children were enrolled in the Indiana SCHIP. [The Kaiser Family Foundation, 2007] However, enrollment in Medicaid or SCHIP does not necessarily translate into enrollee utilization; it only can be assumed that enrolled children are properly utilizing their benefits and receiving appropriate eye and vision care services in a timely manner. The 2003
National Survey of Children’s Health revealed that only 51% of Indiana children had “a personal doctor or nurse from whom they receive family-centered, accessible, comprehensive, culturally sensitive and coordinated health care” and that slightly over 77% had “a preventive medical care visit in the past year.” [Child and Adolescent Health Measurement Initiative, 2006]

Based on the 2005 population estimates Indiana has 430,439 preschool (0 to 4 years) children and 1,172,408 school age (5 to 17 years) children. [U.S. Census, 2006(b)] Using an estimated prevalence of 10%, approximately 43,000 preschool and 117,200 school-age children in Indiana are at risk for undetected and untreated vision problems and their consequences, including the increased probability of a low level of academic readiness due to uncorrected vision problems (Figure 6). Approximately 12,913 preschoolers and 35,172 school children (3%) are at risk for amblyopia, 17,218 and 46,896 (4%) are respectively at risk for strabismus, and 129,132 preschool and 351,722 school children (30%) are at risk for refractive error.

Vision Service Plan (VSP) is the nation’s largest provider of eye care coverage. In 2002 VSP partnered with the Indiana Optometric Association, the Indiana University School of Optometry, and the

**Figure 6 – Indiana’s children at risk**

**Preschool Children (0-4 years)**
- Undetected Vision Problems . . . 43,000 (10%)
- Amblyopia . . . . . . . . . . . . . . . 12,913 (3%)
- Strabismus . . . . . . . . . . . . . . . 17,218 (4%)
- Refractive Error . . . . 129,132 (30%)

**School Children (5-17 years)**
- Undetected Vision Problems . . . 117,200 (10%)
- Amblyopia . . . . . . . . . . . . . . . 35,172 (3%)
- Strabismus . . . . . . . . . . . . . . . 46,896 (4%)
- Refractive Error . . . . 351,722 (30%)
Indianapolis Indians minor league baseball team to conduct one of its seven city-specific “Kids Get Focused” campaign events of the summer. The campaign included the vision screening of local school children with the goal of educating parents about the need for regular eye examinations and the role good vision plays in academic and athletic performance. Of the seven cities in which the campaign was conducted (Birmingham, AL, Columbus, OH, Grand Rapids, MI, Indianapolis, IN, Memphis, TN, Portland, OR, Sacramento, CA), Indianapolis had the third highest percentage (30%) of children to fail the screening. [Vision Service Plan, 2002(b)] The percentages of failure ranged from a high of 34% in Columbus to a low of 15% in Sacramento.

A major concern regarding a legislative mandate requiring a comprehensive vision screening or examination for children prior to entry into school is the availability of professional personnel (e.g., optometrists) to carry out the expectations of the mandate. The Trust for America’s Health reports that, as of September, 2005, there were 75 Primary Care Health Professions Shortage Areas (PC-HPSAs) in Indiana. [Trust for America’s Health, 2006] However, findings in the study on the Workforce, Specialty Distribution and Capacity of Optometrists in the State of Indiana indicate that Indiana optometrists – as primary providers of eye and vision care – are available and distributed with practitioner to population ratios that make them readily and directly accessible to 99 percent of the state’s population. [Marshall, 1997; Marshall, 2000] Therefore, Indiana optometrists have the geographic accessibility to provide effective primary eye and vision care services to the children of Indiana.
IV. THE INDIANA VISION SCREENING PROGRAM

Legislation

Early in the 1980s the State of Indiana recognized that good vision was essential to the educational success of its children. The Indiana Superintendent of Public Instruction further recognized that any program that would reduce the academic failure rate in Indiana schools would save the state money. In 1986 the Indiana General Assembly enacted P.L. 140-1986 (S.B. 201) to require – as a public health intervention – the annual vision screening with the Modified Clinical Technique (MCT) of all children upon their enrollment in either kindergarten or the first grade, and the annual screening of visual acuity of all children enrolled in the third and eighth grades, and all other school children suspected of having a visual defect. [P.L. 140-1986] Chapters 20-8.1-7-16 and 20-8.1-7-16.5 of the Indiana Code gave the Indiana State Department of Health (ISDH) and the Indiana Department of Education (IDOE) joint authority for developing guidelines for the administration of the mandated vision screenings. [IC 20-8.1-7-16; IC 20-8.1-7-16.5]:

IC 20-8.1-7-16 – Section 16. (a) The governing body of each school corporation shall conduct: (1) an annual vision test, using the modified clinical technique described in subsection (c), of all children upon their enrollment in either kindergarten or the first grade; and (2) an annual screening test of the visual acuity of all children enrolled in or transferred to the third and eighth grades and of all other school children suspected of having a visual defect. (b) Records of all tests shall be made and continuously maintained in order to provide information useful in protecting, promoting, and maintaining the health of school children. The state department of health and the Indiana state board of education shall adopt joint rules concerning vision testing equipment, qualifications of vision testing personnel, visual screening procedures, and criteria for failure and referral in the screening tests based upon accepted medical practice and standards. (c) For purposes of this section, "modified clinical technique" means a battery of vision tests that includes: (1) a visual acuity test to determine an individual's ability to see at various distances; (2) a refractive error test to determine the focusing power of the eye; (3) an ocular health test to determine any external or internal abnormalities of the eye; and (4) a binocular coordination test to determine if the eyes are working together properly.

However, under Chapter 20-8.1-7-16.5, if a school corporation could not find qualified screeners to conduct the MCT vision screening, the school corporation could apply to the Superintendent of Public Instruction for a waiver to conduct only a Snellen chart screening of visual acuity at 20 feet.
IC 20-8.1-7-16.5 – Section 16.5 (a) If a school corporation is unable to comply with section 16(a)(1) of this chapter, the governing body of the school corporation may, before November 1 of a school year, request from the state superintendent of public instruction a waiver of the requirements of section 16(a)(1) of this chapter. (b) The waiver request under subsection (a) must: (1) be in writing; (2) include the reason or reasons that necessitated the waiver request; and (3) indicate the extent to which the governing body of the school corporation attempted to comply with the requirements under section 16(a)(1) of this chapter. (c) The state superintendent of public instruction shall take action on the waiver request no later than thirty (30) days after receiving the waiver request. (d) The state superintendent of public instruction may: (1) approve the waiver request; (2) deny the waiver request; or (3) provide whatever relief that may be available to enable the school corporation to comply with the requirements under section 16(a)(1) of this chapter. (e) If the state superintendent of public instruction approves the waiver request, the governing body of the school corporation shall conduct an annual screening test of the visual acuity of all children upon their enrollment in or transfer to the first grade.

In 2005, House Enrolled Act 1288 (P.L. 1-2005) recodified Title 20 – concerning elementary and secondary education – of the Indiana Code to reorganize and restate the law without substantive change. [P.L. 1-2005]. The recodification replaced Chapter 20-8.1-7-16 with Chapter 20-34-3-12 and replaced Chapter 20-8.1-7-16.5 with Chapter 20-34-3-13:

IC 20-34-3-12 Vision tests – Section 12. (a) For purposes of this section, "modified clinical technique" means a battery of vision tests that includes: (1) a visual acuity test to determine an individual's ability to see at various distances; (2) a refractive error test to determine the focusing power of the eye; (3) an ocular health test to determine any external or internal abnormalities of the eye; and (4) a binocular coordination test to determine if the eyes are working together properly. (b) The governing body of each school corporation shall conduct: (1) an annual vision test, using the modified clinical technique, of each student upon the student’s enrollment in either kindergarten or grade 1; and (2) an annual screening test of the visual acuity of each student enrolled in or transferred to grade 3 and grade 8 and of all other students suspected of having a visual defect. (c) Records of all tests shall be made and continuously maintained by the school corporation to provide information useful in protecting, promoting, and maintaining the health of students. The state department of health and the state board shall adopt joint rules concerning vision testing equipment, qualifications of vision testing personnel, visual screening procedures, and criteria for failure and referral in the screening tests based upon accepted medical practice and standards.

IC 20-34-3-13 School corporation waiver of vision tests – Section 13 (a) If a school corporation is unable to comply with section 12(b)(1) of this chapter, the governing body may, before November 1 of a school year, request from the state superintendent a waiver of the requirements of section
12(b)(1) of this chapter. (b) The waiver request under subsection (a) must: (1) be in writing; (2) include the reason or reasons that necessitated the waiver request; and (3) indicate the extent to which the governing body attempted to comply with the requirements under section 12(b)(1) of this chapter. (c) The state superintendent shall take action on the waiver request not later than thirty (30) days after receiving the waiver request. (d) The state superintendent may: (1) approve the waiver request; (2) deny the waiver request; or (3) provide whatever relief that may be available to enable the school corporation to comply with the requirements under section 12(b)(1) of this chapter. (e) If the state superintendent approves the waiver request, the governing body shall conduct an annual screening test of the visual acuity of each student upon the student’s enrollment in or transfer to grade 1.

**Rules**

The rules governing the implementation of *IC 20-34-3-12 (IC 20-8.1-7-16)* were promulgated jointly by the Indiana State Department of Health and the Indiana State Board of Education and are provided under Article 3 (Maternal and Child Health) of Title 410 (Indiana State Department of Health) and Article 4 (Pupil Personnel Services; Student Health Testing; Food and Nutrition Programs; Extended Services) of Title 511 (Indiana State Board of Education) of the *Indiana Administrative Code*.


*410 IAC 3-1-1 Testing* – Section 1. (a) All school corporations shall conduct an annual screening test of the visual acuity of all children enrolled in or transferred to grades 3 and 8 and all other school children suspected of having a visual defect. (b) Equipment for testing visual acuity shall consist of the following: (1) The minimum equipment to be used shall be a Snellen Chart illuminated by two (2) sixty (60) watt bulbs. (2) The Snellen E Chart shall be used for grade 3. (3) The Snellen Alphabetical Chart shall be used for grade 8. (4) The use of testing equipment equivalent to or more elaborate than the Snellen test is at the discretion of the local school system and shall be based on the recommendations of the school's professional health advisory sources.

*410 IAC 3-1-2 Testing procedures; standards* – Section 2. Procedures for vision testing are as follows: (1) Equipment shall be used as follows: (A) The Snellen Chart (E or Alphabetical) shall be used at a distance of twenty (20) feet. (B) The lamps used to illuminate the chart shall be placed one (1) foot from the chart. (2) The following standards apply: (A) Children in grade 3 who are unable to read with each eye the 20/30 line of the Snellen Chart shall be recommended for further examination based upon the recommendations of the professional advisors of a school's
eye screening program. (B) Children in grade 8 who are unable to read with each eye the 20/20 line of the Snellen Chart shall be recommended for further examination. (C) Parents of children with corrective lenses or other ocular devices shall be informed of the eye screening program but these children need not be referred for further examination.

410 IAC 3-1-3 Qualification of testers – Section 3. The school administrator shall assign the best qualified person in the school system or school health service to supervise eye screening tests.

410 IAC 3-1-4 Reports – Section 4. Reporting of School Testing Program. (1) Each school corporation shall submit an annual report of its vision testing program to the Indiana State Board of Health. (2) The report shall include the following: (A) the number of children in each grade tested; (B) the number of children in each grade requiring further examination; (C) the number of children receiving further professional attention; (D) the type of screening test used; (E) the person or department supervising the testing program. (3) The school's testing program shall be subject to review and approval by the state board of education and the state board of health.


410 IAC 3-1.1-1 Annual vision test – Section 1. Every school corporation shall conduct an annual visual test, using the modified clinical technique, of children when they enroll in either kindergarten or grade 1 unless an eye care professional requests, in writing, that the child not be tested. The modified clinical technique consists of testing for vision acuity, refractive error, ocular health, and binocular coordination. The school corporation shall use the suggested equipment unless the professional health personnel of the school recommend other equivalent or superior equipment.

410 IAC 3-1.1-2 Visual acuity – Section 2. To test for visual acuity, the school corporation shall use the Snellen Alphabetical, Stycar (HOTV) Chart or equivalent test. The chart shall be calibrated at ten (10) to twenty (20) feet for distance vision and fourteen (14) inches for near vision. For testing distance vision, the chart shall be illuminated by two (2) sixty (60) watt bulbs and for near vision, by one (1) sixty (60) watt bulb. The chart shall be located at a distance of ten (10) to twenty (20) feet from the student and calibrated accordingly. Lamps shall be placed one (1) foot from the chart. The school shall recommend for further examination those students who: (1) are unable to read the 20/40 line with either eye; (2) with one (1) eye can read a line that is two (2) or more lines higher or lower on the chart than the line that can be read with the other eye; or (3) are unable to read the 20/30 line at 14 inches using both eyes.

410 IAC 3-1.1-3 Refractive error – Section 3. To test for refractive error, a retinoscope with loose lenses or a lens bar shall be used. The child shall focus on an object at twenty (20) feet for distance vision of 3/4 meter (29.53 inches) for near vision. A school corporation shall recommend for
further examination a student who has: (1) refraction of + 2.00D or greater; (2) refraction of - 1.00D or greater; (3) astigmatism of 1.00D or greater; (4) anisometropia of 1.00D or greater.

410 IAC 3-1.1-4 External health of eye – Section 4. To determine the external health of the eyes, the ocular adnexa, conjunctiva and cornea of the eyes shall be observed in a room with normal illumination and the illumination from a pen light.

410 IAC 3-1.1-5 Internal health of eye – Section 5. To determine the internal health of the eyes, the anterior chamber, iris, posterior chamber, lens, vitreous, optic nerve head, and retina shall be observed with a direct ophthalmoscope with rheostat, variable aperture and variable plus and minus lenses.

410 IAC 3-1.1-6 Binocularity – Section 6. Binocularity shall be tested respectively at twenty (20) feet (distance) and fourteen (14) inches (near). To test the binocularity of the eyes, any of the following equipment may be used: (1) A paddle occuluder [sic.] to alternately cover the eyes while the opposite eye fixates on a target. (2) Plastic or glass prisms loose or in a bar or rotary pedestal to measure manifest or latent deviation. (3) Stereopsis targets with appropriate testing spectacles. Disparity shall be recorded in seconds of arc.

410 IAC 3-1.1-7 Further examination – Section 7. The school corporation shall recommend for further examination those students who demonstrate: (1) a manifest deviation of any size; (2) a latent deviation of 10 prism diopters of exodeviation; (3) a latent deviation of 8 prism diopters of esodeviation; or (4) a lack of stereocuity.

410 IAC 3-1.1-8 Eye health care professional; qualifications – Section 8. Qualification of testers: (1) The school administrator shall be responsible for assigning the best qualified person(s) in the school system or school health service for conducting, supervising, and assisting in eye screening. (2) The school administration shall be responsible for obtaining the services of a licensed eye health care professional to conduct testing using the modified clinical technique (internal and external diseases of the eye, testing of refraction and binocularity using paddle occlusion test with prism measurement) for students upon first entrance into the school.

Title 511. Article 4. Pupil Personnel Services; Student Health Testing; Food and Nutrition Programs; Extended Services. Rule 2. Student Health Testing

511 IAC 4-2-1 Visual acuity testing; equipment and procedures; reports – Section 1. (a) All school corporations shall conduct an annual screening test of the visual acuity of all children enrolled in or transferred to grades 3 and 8 and all other school children suspected of having a visual defect. (b) Equipment for testing visual acuity [sic.] shall consist of the following: (1) The minimum equipment to be used shall be a Snellen Chart illuminated by two (2) sixty (60) watt bulbs. (2) The Snellen E Chart shall be used for grade 3. (3) The Snellen Alphabetical Chart shall be used for grade 8. (4) The use of testing equipment equivalent to or more elaborate than the
Snellen test is at the discretion of the local school system and should be based on the recommendations of the school's professional health advisory sources. (c) Procedures for vision testing are as follows: (1) Equipment shall be used as follows: (A) The Snellen Chart (E or Alphabetical) shall be used at a distance of twenty (20) feet. (B) The lamps used to illuminate the chart shall be placed one (1) foot from the chart. (2) The following standards apply: (A) Children in grade 3 who are unable to read with each eye the 20/30 line of the Snellen Chart shall be recommended for further examination based upon the recommendations of the professional advisors of a school's eye screening program. (B) Children in grade 8 who are unable to read with each eye the 20/20 line of the Snellen Chart shall be recommended for further examination. (C) Parents of children with corrective lenses or other ocular devices shall be informed of the eye screening program but these children need not be referred for further examination. (d) The school administrator shall assign the best qualified person in the school system or school health service to supervise eye screening tests. (e) Each school corporation shall submit an annual report of its vision testing program under this section and 511 IAC 4-2-1.1 to the Indiana state board of health. The report shall include the following: (1) The number of children in each grade tested. (2) The number of children in each grade requiring further examination. (3) The number of children receiving further professional attention. (4) The type of screening test used. (5) The person or department supervising the testing program. The school's testing program is subject to review and approval by the state board of education and the state board of health.

511 IAC 4-2-1.1 Visual acuity testing; modified clinical technique – Section 1.1. (a) Every school corporation shall conduct an annual visual test, using the modified clinical technique, of children when they enroll in either kindergarten or grade 1 unless an eye care professional requests, in writing, that the child not be tested. The modified clinical technique consists of testing for vision acuity, refractive error, ocular health, and binocular coordination. The school corporation shall use the suggested equipment unless the professional health personnel of the school recommend other equivalent or superior equipment. (b) To test for visual acuity, the school corporation shall use the Snellen Alphabetical, Stycar (HOTV) Chart or equivalent test. The chart shall be calibrated at ten (10) to twenty (20) feet for distance vision and fourteen (14) inches for near vision. For testing distance vision, the chart shall be illuminated by two (2) sixty (60) watt bulbs and for near vision, by one (1) sixty (60) watt bulb. The chart shall be located at a distance of ten (10) to twenty (20) feet from the student and calibrated accordingly. Lamps shall be placed one (1) foot from the chart. The school shall recommend for further examination those students who: (1) are unable to read the 20/40 line with either eye; (2) with one (1) eye can read a line that is two (2) or more lines higher or lower on the chart than the line that can be read with the other eye; or (3) are unable to read the 20/30 line at 14 inches using both eyes. (c) To test for refractive error, a retinoscope with loose lenses or a lens bar shall be used. The child shall focus on an object at twenty (20) feet for distance vision of [sic.] 3/4 meter (29.53 inches) for near vision. A school
corporation shall recommend for further examination a student who has: (1) refraction of $+2.00 \text{ D}$ or greater; (2) refraction of $-1.00$ or greater; (3) astigmatism of $1.00 \text{ D}$ or greater; (4) anisometropia of $1.00 \text{ D}$ or greater. (d) To determine the external health of the eyes, the ocular adnexa, conjunctiva and cornea of the eyes shall be observed in a room with normal illumination and the illumination from a pen light. (e) To determine the internal health of the eyes, the anterior chamber, iris, posterior chamber, lens, vitreous, optic nerve head, and retina shall be observed with a direct ophthalmoscope with rheostat, variable aperture and variable plus and minus lenses. (f) Binocularity shall be tested respectively at twenty (20) feet (distance) and fourteen (14) inches (near). To test the binocularity of the eyes, any of the following equipment may be used: (1) A paddle occluder \textit{sic.} to alternately cover the eyes while the opposite eye fixates on a target. (2) Plastic or glass prisms loose or in a bar or rotary pedestal to measure manifest or latent deviation. (3) Stereopsis targets with appropriate testing spectacles. Disparity shall be recorded in seconds of arc. (g) The school corporation shall recommend for further examination those students who demonstrate: (1) a manifest deviation of any size; (2) a latent deviation of 10 prism diopters of exodeviation; (3) a latent deviation of 8 prism diopters of esodeviation; or (4) a lack of stereoacuity. (h)(1) The school administrator shall be responsible for assigning the best qualified person(s) in the school system or school health service for conducting, supervising, and assisting in eye screening. (2) The school administration shall be responsible for obtaining the services of a licensed eye health care professional to conduct testing using the modified clinical technique (internal and external diseases of the eye, testing of refraction and binocularity using paddle occlusion test with prism measurement) for students upon first entrance into the school.

\textit{Application of the Law}

Under Chapter 20-1-1.2-7 of the \textit{Indiana Code}, compliance with the “health and safety requirements,” which include vision screening, is one of the “legal standards” of the Indiana Department of Education’s Performance-Based Accreditation System. [IC 20-1-1.2-7; 511 IAC 6.1-2-4 (b)] As specified in the legislation (in the absence of an approved waiver from the State Superintendent of Public Instruction or a written request from an eye care provider that a child not be tested), the Modified Clinical Technique is to be used each year as the screening method for children enrolled in either kindergarten or the first grade. The Snellen chart, as a test of distance visual acuity only, is to be used for children enrolled in grades 3 and 8. However, the local school system has the discretion to use, on the recommendation of its professional health advisors, testing equipment that is equivalent to or more elaborate than the Snellen chart.

A licensed eye care professional (i.e., optometrist or ophthalmologist) is required to conduct the professionally administered components of the MCT (assessment of external and internal ocular health, refractive status and binocularity) and to make recommendations regarding the
need for further assessment based on the vision screening referral criteria (Table 1, Table 3). It is the responsibility of the school administration to secure the services of local eye care providers to assist with the annual MCT screening; that is, “to conduct testing using the modified clinical technique (internal and external diseases of the eye, testing of refraction and binocularity using paddle occlusion test with prism measurement).” [see 410 IAC 3-1.1-8 above]

Each public school corporation is required to submit an annual report – the School Corporation Vision Screening Report (State Form 5888) – of the results of the annual vision testing to the Local Liaison Office of the Indiana Department of Health by June 1 of each year (Figure 7, Figure 8). Starting in 2007 the annual reports will be submitted to the Indiana Department of Education. Each annual report is to include the total number of children screened in grades K, 1, 3, and 8 along with the actions taken as a result of the screening (i.e., number referred from positive findings, number receiving professional treatment, number who saw a doctor but treatment was not needed, number of referrals not yet completed and number of referrals completed from the previous year). The report also must indicate the screening method, and whether a waiver was received if the MCT was not used. To increase the efficiency of the reporting process and starting with the 2000-2001 school year, school nurses could access and submit the School Corporation Vision Screening Report electronically via the Indiana State Department of Health web page. It was hoped that the ability to access and submit the form electronically would facilitate the timely and optimal reporting of the statewide data (Figure 9).

A significant omission of the Indiana vision screening regulation is the absence of a strong follow-up provision. Rule 410 IAC 3-1.1-2 does state that “the school shall recommend for further examination those students who: (1) are unable to read the 20/40 line with either eye; (2) with one eye can read a line that is two or more lines higher or lower on the chart than the line that can be read with the other eye; or (3) are unable to read the 20/30 line at 14 inches using both eyes.” Also, under the heading of “Further Examination,” rule 410 IAC 3-1.1-7 states that “the school shall recommend for further examination those students who demonstrate: (1) a manifest deviation of any size; (2) a latent deviation of 10 prism diopters of exodeviation; (3) a latent deviation of 8 prism diopters of esodeviation; or (4) a lack of stereoaucuity.” Similarly, rule 511 IAC 4-2-1 states that “children in grade 3 who are unable to read with each eye the 20/30 line of the Snellen Chart shall be recommended for further examination based upon the recommendations of the We cannot afford to let any youngster go through the educational process with vision defects or problems undetected.

Dr. Suellen Reed
Indiana Superintendent of Public Instruction
[Indiana Optometric Association, 2000]
professional advisors of a school’s eye screening program,” and “children in grade 8 who are unable to read with each eye the 20/20 line of the Snellen Chart shall be recommended for further examination.” However, these rules only provide for the recommendation of further examination and not the requirement of further examination in response to a failed vision screening. Consequently, children who fail the vision screening may continue in school under the continuing burden of an uncorrected vision problem.

As stated in the *Indiana School Vision Screening Guidelines*, Indiana’s vision screening law “supports the concept of local participation and cooperation of . . . school nurses, teachers, parents and eye care professionals, as well as interested volunteers, service clubs and civic groups” for the improved eye care of Indiana’s children. [Indiana Optometric Association, 2000] While stating that “we cannot afford to let any youngster go through the educational process with vision defects or problems undetected,” Dr. Suellen Reed, Indiana Superintendent of Public Instruction, also realizes that vision screenings serve only as an “early warning system” and “should not be confused with more comprehensive full eye examinations, which take place in the office of any eye care professional.” [Indiana Optometric Association, 2000]

Although the Indiana legislation mandates the vision screening of children in kindergarten or first grade, third grade and eighth grade, there is no state funding to support either the vision screening or follow-up care, and many schools, consequently, “waive out” of the requirement due to a lack of resources. Private schools are not required by law to provide vision screenings or to submit an annual report to the Department of Health; however, some private schools do conduct annual vision screenings and report their results to the state.
<table>
<thead>
<tr>
<th></th>
<th><strong>INDIANA VISION SCREEN PROGRAM</strong></th>
<th><strong>AMERICAN OPTOMETRIC ASSOCIATION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kindergarten/Grade 1</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Grade 3</strong></td>
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<tr>
<td><strong>Grade 8</strong></td>
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<tr>
<td><strong>Visual Acuity</strong></td>
<td>Unable to read 20/40 @ distance</td>
<td>Unable to read 20/30 @ distance</td>
</tr>
<tr>
<td></td>
<td>with either eye</td>
<td>with either eye</td>
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<tr>
<td></td>
<td>Difference of 2 or more lines</td>
<td>Difference of 2 or more lines</td>
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<tr>
<td></td>
<td>Unable to read 20/30 @ 14 inches</td>
<td>Unable to read 20/20 @ distance with</td>
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<tr>
<td></td>
<td></td>
<td>either eye</td>
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<td></td>
<td></td>
<td>Unable to read 20/30 @ distance</td>
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<tr>
<td></td>
<td></td>
<td>with either eye</td>
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<td></td>
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<td>Difference of 2 or more lines</td>
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<td>Unable to read 20/40 @ 14 inches</td>
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<td><strong>Refractive Error</strong></td>
<td>≥ +2.00 D (hyperopia)</td>
<td>≥ +2.00 D (hyperopia)</td>
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<tr>
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<td>≥ −1.00 D (myopia)</td>
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<td></td>
<td>≥ 1.00 D (astigmatism)</td>
<td>≥ 1.00 D (astigmatism)</td>
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<tr>
<td></td>
<td>≥ 1.00 D (anisometropia)</td>
<td>≥ 1.00 D (anisometropia)</td>
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<td><strong>Binocular Coordination</strong></td>
<td>Manifest deviation</td>
<td>Manifest deviation</td>
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<tr>
<td></td>
<td>Latent deviation of 8^3 eso</td>
<td>Latent deviation of &gt; 5^3 eso</td>
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<td></td>
<td>Latent deviation of 10^3 eso</td>
<td>Latent deviation of &gt; 5^3 eso @</td>
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<td></td>
<td>Lack of stereoacuity</td>
<td>distance</td>
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<td></td>
<td></td>
<td>Latent deviation of &gt; 10^3 @ exo</td>
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<td></td>
<td>near</td>
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<td></td>
<td></td>
<td>Latent deviation of 2^3 vertical</td>
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<td></td>
<td></td>
<td>&lt; 120&quot; of arc of stereopsis</td>
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<tr>
<td><strong>Ocular Health Abnormality</strong></td>
<td>Any</td>
<td></td>
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</tbody>
</table>
Figure 7 – Notification of vision screening results

To: The Parent or Guardian of __________________________
From: Director of the School Screening Program
Date: __________
Re: Vision Screening Performed by the Indiana University School of Optometry

Your child has passed the vision screening.

This was a screening only and not a complete eye examination. The American Optometric Association recommends that ALL school age children have a complete eye examination each year. We support this recommendation, and encourage you to schedule yearly eye examinations with the optometrist or ophthalmologist of your choice.

Our clinics are open to the public. Among other services, we offer specialty care in the area of pediatrics.

----------------------------------------------------------------------------------------------------------------

To: The Parent or Guardian of __________________________
From: Director of the School Screening Program
Date: __________
Re: Vision Screening Performed by the Indiana University School of Optometry

Your child is being referred for a complete eye examination. Please report the results of the examination to your child's school nurse upon its completion.

This referral is generated based on the results of a recent vision screening, or if your child was absent the day the vision screening was performed at her/his school.

This was a screening only and not a complete eye examination. The American Optometric Association recommends that ALL school age children have a complete eye examination each year. We support this recommendation, and encourage you to schedule yearly eye examinations with the optometrist or ophthalmologist of your choice.

Our clinics are open to the public. Among other services, we offer specialty care in the area of pediatrics.
## Figure 8a – School Corporation Vision Screening Report form

<table>
<thead>
<tr>
<th>GRADE</th>
<th>TOTAL NUMBER SCREENED</th>
<th>POSITIVE FINDINGS</th>
<th>RECOMMENDATION TO DOCTOR</th>
<th>TREATMENT NOT NEEDED</th>
<th>REFERRALS COMPLETED FROM LAST YEAR</th>
<th>TOTALS</th>
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<tbody>
<tr>
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<td>OTHERS</td>
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<td>TOTALS</td>
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</tr>
</tbody>
</table>

- **Major reasons for incomplete estimate this year:**
  - Yes
  - No (circle one)

- **School year:** 20xx

**Please return this form no later than June 1**.
Figure 8b – Guidelines for completing the Vision Screening Report

<table>
<thead>
<tr>
<th>Column 1: Total Number Screened</th>
<th>Column 2: Positive Findings Referred</th>
<th>Column 3: Receiving Professional Treatment</th>
<th>Column 4: Saw Doctor, Treatment Not Needed</th>
<th>Column 5: Referrals Not Yet Completed</th>
<th>Column 6: Referral Completed From Last Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record the number of students screened in each category this year.</td>
<td>Record the number of students who have failed the screening test this year. This number includes referrals made to doctors by all professionals doing vision screening in the school corporation.</td>
<td>Record the number of students screened this year that were referred from Column 2 who are receiving treatment.</td>
<td></td>
<td>Record the number of students referred this year who were examined by a doctor and no treatment is necessary, or parents have not responded to referral request.</td>
<td>Record the number of students referred from previous school year who have seen a doctor to complete the referral this school year.</td>
</tr>
</tbody>
</table>

**PLEASE NOTE:** The law states that children enrolled in either Kindergarten or Grade 1, and Grades 3 and 8 must be screened. All other grades should be recorded under the “other” category.

**NOTE:** Column 2 = Column 3 + Column 4 + Column 5
Figure 9 – Letter from State Health Commissioner

Dear Screening Personnel:

In mutual recognition of the value of vision screenings in Indiana's elementary schools, the Indiana University School of Optometry and the Indiana State Department of Health (ISDH) have partnered this past year to benefit Hoosier school children. The goals of this partnership are: (1) making the reporting of vision screenings more efficient, and (2) utilizing the capabilities of the University in monitoring the eye health of Indiana's children through the timely analysis of the resulting screening data. It is a pleasure to announce these changes.

The School Corporation Vision Screening Report will be available on the Indiana State Department of Health Web page. Effective in the 2000-2001 school year, school nurses will be able to electronically access the reporting form. School personnel will have these options to report data.

1. Access http://www.state.in.us/isdh, click on Public Health Programs, then click on School Screening Forms and then on Vision Screening Form. Follow the directions to complete the form and electronically submit to ISDH.

2. Access http://www.state.in.us/isdh, click on Public Health Programs, then click on School Screening Forms and then on Vision Screening Form. Print the form, follow directions to complete and mail to Indiana State Department of Health, Local Liaison Office - 8-B, 2 North Meridian Street, Indianapolis, IN 46204 ATTN: School Health-8th Floor or fax to 317/233-7761.

3. Call 1-800-809-8460, ask for the School Health Reporting Form. The form will be mailed or faxed per your request. Return completed form by mail or fax back to ISDH.

Our hope is that ease of reporting on the part of local vision screening personnel will facilitate timely and optimal reporting for statewide vision health benefits. Our collective aspiration is that early screening, and appropriate follow-up treatment of problems so detected, will assure that all of Indiana's children are provided equal opportunities to enhance their academic performance.

We welcome suggestions/comments on how this new arrangement can be improved. Please share your ideas either with me or Edwin C. Marshall, O.D., M.S., M.P.H., Associate Dean for Academic Affairs, I.U. School of Optometry, 800 E. Atwater Avenue, Bloomington, IN 47405.

Sincerely,

PHIL D. FELDMAN, M.D.
STATE HEALTH COMMISSIONER
V. THE VISION READINESS OF INDIANA SCHOOL CHILDREN – A SELF STUDY

From 1987 to 1993 the Indiana State Department of Health (ISDH) collated the submitted statewide vision screening data and issued annual summary reports of the aggregated results. The last annual vision screening summary report published by ISDH was for the 1993-1994 school year. Since the publication of the 1993-1994 summary and in the interval prior to 2001, little oversight or attention had been given to the results and outcomes of the annual vision screenings.

In 2001 the Indiana State Department of Health partnered with the Health Policy Group of the Indiana University School of Optometry for the purpose of conducting an updated analysis of the statewide school screening data submitted by the Indiana public schools in compliance with IC 20-8.1-7-16 and IC 20-34-3-12. Dr. Richard Feldman, State Health Commissioner, declared the goals of the partnership to be: 1) making the reporting of vision screenings more efficient, and 2) utilizing the capabilities of the Indiana University School of Optometry in monitoring the eye health of Indiana’s children through the timely analysis of the resulting screening data.

The current analysis of the state vision screening data was approached with the following questions:

- Do any areas of the state show higher than average referral rates?
- Are there differences in the referral rates (disparities) between schools utilizing the MCT and schools utilizing the Snellen chart only?
- What are the referral rate differences (disparities) between schools using different screening techniques?
- What are the referral rate differences (disparities) between different socioeconomic (SES) groups?
- What are the reasons for the existence of any differences (disparities)?
- Are there any factors that could be identified as indicators of greater need?
- What is the impact of any differences (disparities) on the education and productive future of affected students?
- What can be concluded about the screening program’s success and areas of unmet need?
Sample

Data were extracted from the Indiana State Department of Health School Corporation Vision Screening Report forms – annual cross-sectional records of Indiana schoolchildren enrolled in kindergarten, Grade 1, Grade 3 and Grade 8 within Indiana’s public school corporations. Data from private school corporations were not included in the analysis. The study protocol was reviewed and approved by the Indiana University Human Subjects Committee.

Five years of data (2000-2001 to 2004-2005 school years) were made available for analysis. However, four of the five annual data sets (2001-2002 to 2004-2005) represented a less than 20% response rate for each of the reporting years, and were excluded from analysis due to the low representation of school corporations. Although submission of the report forms is a state requirement, only the 2000-2001 school year had a response rate greater than 40% (45.6%), the level identified for good survey analysis.

The report forms were collected by the Indiana State Department of Health and represent vision screenings conducted by personnel from 136 of the 294 Indiana public school corporations during the 2000-2001 school year. School corporations that submitted incomplete reports or referred zero children to an eye care provider were excluded from the study. Three school corporations that did not submit School Corporation Vision Screening Report forms to the ISDH were included in the data set. Data for the additional three school corporations were obtained from the Indiana University School of Optometry and added to the sample because of their validity and accuracy. Data from a total of 139 (47.3%) of the 294 Indiana school corporations submitted for the 2000-2001 school year were included in the analysis.

All of the data were extracted from the Grade 1 sample of students because it contained about twice as many children (n = 36,967) as the kindergarten sample (n = 18,516). School personnel are required to conduct a vision test using the Modified Clinical Technique at either age; however, Indiana school corporations are more likely to conduct the test at the Grade 1 level because students are more responsive, have more mature behavior, and are enrolled in school full-time. The 36,967 Grade 1 children in the study sample represented 41% of the state’s first grade student enrollment in 2000-2001. Grades 3 and 8, for which only distance visual acuity is required, were excluded from the study sample.

If a school corporation is unable to perform the Modified Clinical Technique, the school may petition the Indiana State Department of Health to conduct a simple visual acuity (Snellen chart)
screening. Waivers are commonly granted to larger school corporations or corporations that do not have the resources to conduct the Modified Clinical Technique screening (i.e., unable to identify or support the services of a local eye care provider). Schools approved to waive the Modified Clinical Technique were included as part of the study’s analysis.

The sample of children included in the 2000-2001 Grade 1 cohort was the same sample of children included in the 2002-2003 Grade 3 cohort.

**Measures**

**Technique.** A primary goal of the study is to determine if the percentage of children referred to an eye care professional is impacted by the screening technique – that is, do different screening techniques yield different percentages of positive reactors – and, if so, do these differences create or exacerbate disparities in performance outcomes that can adversely affect academic progress.

The Indiana School Corporation Vision Screening Report form requires school personnel to specify the screening technique used. Although the Modified Clinical Technique is required by law for kindergarten and Grade 1 public school students, school corporations can obtain waivers to exempt them from the necessity of using the MCT. A total of 139 public school corporations were coded as either conducting the Modified Clinical Technique (1 = MCT) or not conducting the Modified Clinical Technique (2 = non-MCT). As expected, most school corporations that reported vision screening data perform the Modified Clinical Technique (n = 125). Differences in percentages of Grade 1 children referred to an eye care provider were tested within each technique group using one-way analysis of variance (ANOVA).
**Socioeconomic Status.** To be consistent with the 2000-2001 school year data set, socioeconomic status (SES) was measured by the median family income declared on the 2000 U.S. Decennial Census (Figure 10). Using these census data, the Indiana Department of Education makes public the median family income of each school corporation. SES can be assessed on several variables, including income, occupation and education. [Krieger, Williams, Moss, 1997] Despite difficulties in collecting accurate data, income was selected because previous studies have shown strong associations between family income and a range of health outcomes. [Starfield, Shapiro, Weiss, et al, 1991; Adler, Boyce, Chesney, et al, 1994] Studies demonstrate that small differences in income are associated with much greater changes in health status among the poor as compared to affluent families. [Backlund, Sorlie, Johnson, 1996] Given the state of Indiana’s broad demographic base, which ranges from metropolitan to extremely rural, median family income was selected as the most appropriate socioeconomic variable.

A total of 139 public school corporations were coded into 1 of 4 categories based on the 2006 United States Department of Health and Human Services Poverty Guidelines: 1 = <$40,000; 2 = $40,000-$59,999; 3 = $60,000-$79,999; and 4 = ≥$80,000. [U.S. Department of Health and Human Services, 2006(c)] The average median family income for the four-group sample of 139 school corporations was $50,521. Specifically, 9 school corporations fell within the <$40,000 category; 111 school corporations fell within the $40,000-$59,999 category; 18 school corporations fell within the $60,000-$79,999 category; and 1 school corporation fell within the ≥$80,000 category (Figure 11). The one school corporation that reported a median family income greater than $80,000 was considered an outlier and excluded from the SES sample to avoid the impact of including a value that would be extreme or unrealistic compared to the rest of the sample corporations. Median family income for the resulting three-group sample was normally distributed among the 138 school corporations with a slight skewing to the left.
around a sample mean of $50,428 (Figure 12). Sample referral rates (percent of children referred out of the total number of children screened) and mean referral rates (the average of all corporations’ individual referral rates) were calculated for each analysis. Differences in the percentages of Grade 1 children referred to an eye care professional were analyzed between groups 1, 2 and 3 using one-way ANOVA.

The study also sought to identify a median family income value at which differences no longer existed in the percentage of children referred for an eye examination. In other words, what level of median family income is required to eliminate the effect of economic-related differences on the rate of referral for an eye examination? School corporations were coded as either below the testing income threshold (1 = below threshold) or above the testing income threshold (2 = above threshold). When the final threshold level was identified, 44 school corporations were coded as below the income threshold and 94 school corporations were coded as above the income threshold. T-tests were conducted on 138 school corporations to establish the median family income threshold.

**ISTEP+ Performance.** Standardized examinations are among the most objective and comprehensive methods to measure student progress. [American Educational Research Association, American Psychological Association, and National Council on Measurement in Education Standards for Educational and Psychological Testing, 1999] Examination results are used for many purposes, including: 1) comparing minority and non-minority academic achievement; 2) determining academic areas of improvement; and 3) comparing academic performance between schools within a corporation. [U.S. Department of Education, 2006] Often, results are used by state and federal governments to allocate funds for school districts for academic development and improvement. [U.S. Department of Education, 2006]
For this study, a school corporation’s performance on the Indiana Statewide Testing for Educational Progress Plus (ISTEP+) exam was used as the measure of academic achievement. According to the Indiana Department of Education, the ISTEP+ scores provide a focus for examining factors that affect the achievement levels of Indiana students and the necessity to make careful and deliberate decisions about how to leverage resources to address achievement gaps. [Indiana Department of Education, 2006(c)] Indiana school children take the ISTEP+ exam each year beginning in Grade 3 and continuing through Grade 10. The test includes an assessment of English/Language Arts and Mathematics in grades 3 through 10 and an assessment of Science in grades 5 and 7. The ISTEP+ results identify three categories of individual student achievement: Pass-Plus, Pass and Did Not Pass. The combination of the Pass-Plus and Pass percentages equals the total percent of students passing for a given year. For each year’s administration, the Indiana Department of Education publicly releases the statewide, corporation and school ISTEP+ results.

The school corporations’ results for Grade 3 are reported as: percent passing ISTEP+; percent above both English/Language Arts and Mathematics; percent above English/Language Arts; and percent above Mathematics.

Academic achievement data, derived from the yearly ISTEP+ testing, was obtained from the published data on the Indiana Department of Education web site (www.doe.state.in.us/istep/). The percent of Grade 3 public school students above on both the English/Language Arts and Mathematics components of the 2002-2003 exams was selected as the specific testing variable for this study because it identifies students passing both major components of the exam. The 2002-2003 exam results also represent the same population cohort of students initially receiving vision testing in 2000-2001.

A total of 139 public school corporations were coded as having results that were either below the state average (1 = below average) or above the state average (2 = above average). The average percent of Grade 3 students passing both English/Language Arts and Mathematics components of the ISTEP+ exam was 58.7%. A total of 65 school corporations were coded as 1 and 74 school corporations were coded as 2. The sample referral rates and mean referral rates were calculated for each analysis. Differences in percentages of Grade 1 children referred to an eye care provider in 2000-2001 were analyzed between the two groups using analysis of variance.

Similar techniques were used to compare school corporations conducting the Modified Clinical Technique and school corporations not conducting the Modified Clinical Technique. Among the 125 school corporations conducting the Modified Clinical Technique, 58 were coded as having below average ISTEP+ percentages and 67 were coded as having above average ISTEP+ percentages. In contrast, 14 school corporations did not conduct the Modified Clinical
Technique. Of those school corporations, 7 were coded as having above average ISTEP+ percentages while 7 were coded as having below average ISTEP+ percentages. Differences in the MCT and non-MCT group percentages of Grade 1 children referred to an eye care provider were analyzed within the two categories of above average and below average ISTEP+ performance using analysis of variance.

According to the U.S. 2000 Decennial Census, the state of Indiana can be divided by county into six regions: Northwest IN (Benton, Carroll, Cass, Fulton, Jasper, La Porte, Lake, Marshall, Newton, Porter, Pulaski, St. Joseph, Starke, White), Northeast IN (Adams, Allen, Blackford, De Kalb, Elkhart, Grant, Huntington, Jay, Kosciusko, Lagrange, Miami, Noble, Steuben, Wabash, Wells, Whitley), East Central IN (Decatur, Delaware, Fayette, Franklin, Hamilton, Hancock, Henry, Howard, Johnson, Madison, Marion, Randolph, Rush, Shelby, Tipton, Union, Wayne), West Central IN (Boone, Clay, Clinton, Fountain, Hendricks, Montgomery, Morgan, Owen, Parke, Putnam, Tippecanoe, Vermillion, Vigo, Warren), Southwest IN (Crawford, Daviess, Dubois, Gibson, Greene, Knox, Lawrence, Martin, Monroe, Orange, Perry, Pike, Posey, Spencer, Sullivan, Vanderburgh, Warrick), and Southeast IN (Bartholomew, Brown, Clark, Dearborn, Floyd, Harrison, Jackson, Jefferson, Jennings, Ohio, Ripley, Scott, Switzerland, Washington) (Figure 13). Using the Census identified regional boundaries, the Indiana Business Research Center determined the school corporations that fall within each region. [Indiana Business Research Center, 2006]

The previously described statistical techniques were used to compare the percentages of children referred to an eye care provider to the ISTEP+ percentages within each region. Among the 36 Northwest IN school corporations reporting, 18 were coded as having ISTEP+ percentages below the state average and 18 were coded as having ISTEP+ percentages above the
state average. A total of 23 Northeast IN school corporations were analyzed, with 10 having ISTEP+ percentages below the state average and 13 having ISTEP+ percentages above the state average. Among the 31 East Central IN school corporations reporting, 17 were coded as having ISTEP+ percentages below the state average and 14 were coded as having ISTEP+ percentages above the state average. A total of 16 West Central IN school corporations were analyzed, with 6 having ISTEP+ percentages below the state average and 10 having ISTEP+ percentages above the state average. Among the 23 Southwest IN school corporations reporting, 9 were coded as having ISTEP+ percentages below the state average and 14 were coded as having ISTEP+ percentages above the state average. A total of 10 Southeast IN school corporations were analyzed, with 5 having ISTEP+ percentages below the state average and 5 having ISTEP+ percentages above the state average. Differences in percentages of Grade 1 children referred to an eye care provider were analyzed between groups within the six regional categories using analysis of variance.

The primary outcome measure was the percentage of Grade 1 children referred to an eye care provider. All statistical analyses were conducted using SPSS 13.0 for Windows software (SPSS Inc, Chicago IL). Descriptive statistics, including means and standard deviations, were computed for all outcome variables. Several series of analyses, including analysis of variance, t-tests and post-hoc testing of significant variables, were conducted to investigate relationships between outcomes variables.

Findings

Screening Technique.

During the 2000-2001 school year, 36,967 public school children were screened in 139 school corporations and, of those screened, 3,540 (9.6%) were referred for follow-up. The Modified Clinical Technique was used by 125 of the school corporations and some other technique was used by 14 school corporations.
corporations. Using analysis of variance, significant differences (p = 0.001) were seen when comparing the screening results (mean referral rates) of school corporations that conduct the Modified Clinical Technique (11.5%) against school corporations that do not conduct the Modified Clinical Technique (5.8%) (Table 4, Figure 14). From this observation it can be concluded that the MCT significantly referred more children for comprehensive eye examinations than alternative techniques (e.g., Snellen chart). Follow-up rates, when reported, were extremely low at only 9.3%.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Number School Corps</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCT</td>
<td>125</td>
<td>26,482</td>
<td>2,938</td>
<td>11.09</td>
<td>11.47</td>
<td>6.04</td>
<td>0.001</td>
</tr>
<tr>
<td>Non-MCT</td>
<td>14</td>
<td>10,485</td>
<td>602</td>
<td>5.74</td>
<td>5.77</td>
<td>4.28</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>139</td>
<td>36,967</td>
<td>3,540</td>
<td>9.58</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Socioeconomic Status.** The majority of school corporations (80.4%) were represented by median family incomes between $40,000 and $59,999. The percentages of children referred to an eye care provider were compared to their respective school corporation’s median family income for the three income classes of <$40,000 (14.6%), $40,000-$59,999 (11.0%), and $60,000-$79,999 (8.5%). The comparison yielded significant results (p = 0.050) in the rate of referral by income class with a graduated decrease in the rate of referral as the median family income increased from class 1 to class 3 (Table 5, Figure 15). To establish the threshold income level at which significant SES-specific differences in referral rates ceased to exist, referral rates were analyzed against the entire population of family incomes (all classes combined) at incremental income iterations of $500. Using one-way ANOVA, an income of $46,500 was identified as the level at which the difference
in referral rates was no longer significant (p = 0.074). To clarify, a significantly higher vision failure rate exists at family incomes of $46,000 and below.

Table 5 – MCT + other technique screening results by median family income

<table>
<thead>
<tr>
<th>Median Family Income (Class)</th>
<th>Number School Corps</th>
<th>Median Family Income</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$60,000-$79,999 (3)</td>
<td>18</td>
<td>$65,179</td>
<td>7,163</td>
<td>505</td>
<td>7.05</td>
<td>8.53</td>
<td>5.501</td>
<td></td>
</tr>
<tr>
<td>$40,000-$59,999 (2)</td>
<td>111</td>
<td>$48,732</td>
<td>27,215</td>
<td>2,742</td>
<td>10.08</td>
<td>11.02</td>
<td>6.133</td>
<td>0.050</td>
</tr>
<tr>
<td>&lt;$40,000 (1)</td>
<td>9</td>
<td>$38,142</td>
<td>1,575</td>
<td>226</td>
<td>14.35</td>
<td>14.56</td>
<td>5.917</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>138</td>
<td>$50,521</td>
<td>35,953</td>
<td>3,473</td>
<td>9.66</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ISTEP+ Performance. The 2002-2003 Grade 3 ISTEP+ scaled scores for English/Language Arts ranged from 100 to 690, with 10% of students achieving a “Pass-Plus” designation, 62% receiving a “Pass” designation and 27% receiving a “Did Not Pass” designation. For Mathematics, the scores ranged from 100 to 620, with 9% receiving a “Pass-Plus” designation, 57% receiving a “Pass” designation and 33% receiving a “Did Not Pass” designation. Overall, 72% of the 2002-2003 cohort of Grade 3 public school students passed English/Language Arts and 66% passed
Mathematics.

Within the study sample of the 139 public school corporations conducting either the MCT vision test or some other screening technique, the combined English/Language Arts and Mathematics pass rate results were normally distributed with a slight skewing to the left around a mean score of 59.9 (Figure 16). However, the results were found to be not significant (p = 0.116) when comparing the percentage of Grade 1 children referred to an eye care provider in 2000-2001 (10.1% with ISTEP+ scores above the state average and 11.8% with ISTEP+ scores below the state average) to the percent of a school corporation’s Grade 3 children passing both the English/Language Arts and Mathematics components of the 2002-2003 ISTEP+ exam (Table 6). Although the results were not significant statistically, they demonstrated that the greatest percentage of students referred for an eye examination came from the population of students with below average ISTEP+ results (Figure 17).

<table>
<thead>
<tr>
<th>Table 6 – 2000-2001 Grade 1 combined MCT + other technique screening results by 2002-2003 Grade 3 ISTEP+ performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Average</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Above</td>
</tr>
<tr>
<td>Below</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Within the sample of MCT school corporations the frequency of passing both the English/Language Arts and Mathematics components of the 2002-2003 ISTEP+ exam was normally distributed among the school corporations, with a slight skewing to the right around a mean passing frequency of 59.3 (Figure 18). That is, the most frequently reported rate of passing both the English/Language Arts and Mathematics components of the ISTEP+ among the MCT schools approximates 60%, suggesting that about 60% of students
within the “normal” school corporation would be expected to pass both the English/Language Arts and Mathematics components. However, results were found to be not significant \( p = 0.116 \) when comparing the percentages of Grade 1 children referred to an eye care provider in 2000-2001 to their respective school corporation’s 2002-2003 performance on the Grade 3 ISTEP+ exam (Table 7). Although the referral rate differences were not significant, there is evidence of a tendency for the referral rate of children with below average ISTEP+ percentages to be higher (12.4%) in comparison to the referral rate of children with above average ISTEP+ percentages (10.7%).

**Table 7 – 2000-2001 Grade 1 MCT screening results by 2002-2003 Grade 3 ISTEP+ performance**

<table>
<thead>
<tr>
<th>State Average</th>
<th>Number School Corps</th>
<th>Mean ISTEP+ Score (%)</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above</td>
<td>67</td>
<td>66.25</td>
<td>14,214</td>
<td>1,480</td>
<td>10.41</td>
<td>10.68</td>
<td>5.646</td>
<td>0.116</td>
</tr>
<tr>
<td>Below</td>
<td>58</td>
<td>52.50</td>
<td>12,268</td>
<td>1,458</td>
<td>11.89</td>
<td>12.38</td>
<td>6.397</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
<td>59.34</td>
<td>26,482</td>
<td>2,938</td>
<td>11.09</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Among school corporations not conducting the MCT vision test, results were found to be not significant \( p = 0.458 \) when comparing the percentage of Grade 1 children referred to an eye care provider in 2000-2001 to the school corporation’s 2002-2003 performance on the Grade 3 ISTEP+ exam (Table 8). As with the MCT conducting school corporations, the non-MCT conducting schools corporations also demonstrated a slight tendency toward a higher referral rate for children who performed below average on the ISTEP+ exam (6.7%) compared to children who performed above average (4.9%).

The mean referral rates were calculated as the average of all school corporations’ individual referral rates within the respective below state average and above state average samples for both
the MCT and non-MCT populations. The mean referral rates were found to be similar to the sample referral rates (i.e., the aggregated percentage of students referred among those screened within the below and above groups).

**Table 8 – 2000-2001 Grade 1 Non-MCT screening results by 2002-2003 Grade 3 ISTEP+ performance**

<table>
<thead>
<tr>
<th>State Average</th>
<th>Number School Corps</th>
<th>Mean ISTEP+ Score (%)</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above</td>
<td>7</td>
<td>68.13</td>
<td>3,801</td>
<td>157</td>
<td>4.13</td>
<td>4.88</td>
<td>4.279</td>
<td>0.458</td>
</tr>
<tr>
<td>Below</td>
<td>7</td>
<td>51.46</td>
<td>6,684</td>
<td>445</td>
<td>6.66</td>
<td>6.66</td>
<td>4.412</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>59.79</td>
<td>10,485</td>
<td>602</td>
<td>5.74</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ISTEP+ Performance by Region.** Among all regions of Indiana, results were found to be not significant (Northwest, IN:  \( p = 0.417 \); Northeast IN:  \( p = 0.177 \); East Central IN:  \( p = 0.437 \); West Central IN:  \( p = 0.114 \); Southwest IN:  \( p = 0.237 \); and Southeast IN:  \( p = 0.156 \)) when comparing the regional percentages of Grade 1 children referred to an eye care provider in 2000-2001 (Northwest, IN: 12.6%:10.7%; Northeast IN: 13.1%:9.3%; East Central IN: 8.3%:10.0%; West Central IN: 13.2%:9.6%; Southwest IN: 15.0%:12.1%; and Southeast IN: 10.6%:6.5%) by the 2002-2003 below average and above average Grade 3 ISTEP+ exam performance of the school corporations within the respective regions (Tables 9-14). The trend towards finding higher referral rates among children who performed below the state average on the ISTEP+ exam was also evident within each of the regions, except for the East Central region where the referral rate was slightly lower (8.3%) for children who performed below the state average compared to students who performed above the state average (10.0%). The overall sample referral rate varied from a low of 7.3% in the East Central region to a high of 11.3% in the Northwest region; whereas, the mean referral rate for students who performed below the state average on the ISTEP+ exam ranged from a low of 8.3% in the East Central region to a high of 15.0% in the Southwest region.

**Table 9 – 2000-2001 Grade 1 screening results by 2002-2003 Grade 3 ISTEP+ performance by region, Northwest Indiana**

<table>
<thead>
<tr>
<th>State Average</th>
<th>Number School Corps</th>
<th>Mean ISTEP+ Score (%)</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above</td>
<td>18</td>
<td>69.12</td>
<td>4,441</td>
<td>491</td>
<td>11.06</td>
<td>10.68</td>
<td>5.709</td>
<td>0.417</td>
</tr>
<tr>
<td>Below</td>
<td>18</td>
<td>52.52</td>
<td>4,436</td>
<td>513</td>
<td>11.56</td>
<td>12.56</td>
<td>7.888</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>60.82</td>
<td>8,877</td>
<td>1,004</td>
<td>11.31</td>
<td></td>
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</tr>
</tbody>
</table>
Table 10 – 2000-2001 Grade 1 screening results by 2002-2003 Grade 3 ISTEP+ performance by region, Northeast Indiana

<table>
<thead>
<tr>
<th>State Average</th>
<th>Number School Corps</th>
<th>Mean ISTEP+ Score (%)</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above</td>
<td>13</td>
<td>64.62</td>
<td>2,604</td>
<td>259</td>
<td>9.95</td>
<td>9.28</td>
<td>6.599</td>
<td>0.177</td>
</tr>
<tr>
<td>Below</td>
<td>10</td>
<td>51.95</td>
<td>4,101</td>
<td>439</td>
<td>10.71</td>
<td>13.10</td>
<td>6.357</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>59.11</td>
<td>6,705</td>
<td>698</td>
<td>10.41</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 11 – 2000-2001 Grade 1 screening results by 2002-2003 Grade 3 ISTEP+ performance by region, East Central Indiana

<table>
<thead>
<tr>
<th>State Average</th>
<th>Number School Corps</th>
<th>Mean ISTEP+ Score (%)</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above</td>
<td>14</td>
<td>64.37</td>
<td>4,750</td>
<td>351</td>
<td>7.39</td>
<td>9.97</td>
<td>6.705</td>
<td>0.437</td>
</tr>
<tr>
<td>Below</td>
<td>17</td>
<td>53.44</td>
<td>4,264</td>
<td>304</td>
<td>7.13</td>
<td>8.27</td>
<td>5.313</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>58.34</td>
<td>9,014</td>
<td>655</td>
<td>7.27</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 12 – 2000-2001 Grade 1 screening results by 2002-2003 Grade 3 ISTEP+ performance by region, West Central Indiana

<table>
<thead>
<tr>
<th>State Average</th>
<th>Number School Corps</th>
<th>Mean ISTEP+ Score (%)</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above</td>
<td>10</td>
<td>70.49</td>
<td>2,467</td>
<td>179</td>
<td>7.26</td>
<td>9.61</td>
<td>4.293</td>
<td>0.114</td>
</tr>
<tr>
<td>Below</td>
<td>6</td>
<td>51.10</td>
<td>1,143</td>
<td>151</td>
<td>13.21</td>
<td>13.15</td>
<td>3.604</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>63.22</td>
<td>3,610</td>
<td>330</td>
<td>9.14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 13 – 2000-2001 Grade 1 screening results by 2002-2003 Grade 3 ISTEP+ performance by region, Southwest Indiana

<table>
<thead>
<tr>
<th>State Average</th>
<th>Number School Corps</th>
<th>Mean ISTEP+ Score (%)</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above</td>
<td>14</td>
<td>64.31</td>
<td>3,105</td>
<td>316</td>
<td>10.18</td>
<td>12.05</td>
<td>5.602</td>
<td>0.237</td>
</tr>
<tr>
<td>Below</td>
<td>9</td>
<td>52.10</td>
<td>2,572</td>
<td>252</td>
<td>9.80</td>
<td>15.03</td>
<td>5.927</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>59.53</td>
<td>5,677</td>
<td>568</td>
<td>10.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 14 – 2000-2001 Grade 1 screening results by 2002-2003 Grade 3 ISTEP+ performance by region, Southeast Indiana

<table>
<thead>
<tr>
<th>State Average</th>
<th>Number School Corps</th>
<th>Mean ISTEP+ Score (%)</th>
<th>Number Screened</th>
<th>Number Referred</th>
<th>Sample Referral Rate (%)</th>
<th>Mean Referral Rate (%)</th>
<th>Standard Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above</td>
<td>5</td>
<td>65.04</td>
<td>648</td>
<td>41</td>
<td>6.33</td>
<td>6.46</td>
<td>3.713</td>
<td>0.156</td>
</tr>
<tr>
<td>Below</td>
<td>5</td>
<td>51.24</td>
<td>2,436</td>
<td>244</td>
<td>10.02</td>
<td>10.59</td>
<td>4.578</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>58.14</td>
<td>3,084</td>
<td>285</td>
<td>9.24</td>
<td></td>
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</tbody>
</table>

**Discussion**

Screening Technique. With mean referral rates of 11.5% for the MCT screening and 5.8% for the non-MCT screening, the results of this study demonstrate that the percentage of Grade 1 children referred to an eye care provider is significantly different (p = 0.001) between the two vision screening techniques. That is, school corporations conducting the Modified Clinical Technique identified more children in need of referral for comprehensive eye examinations than those school corporations that conducted an alternative vision screening technique (i.e., distance visual acuity). Based on the relatively high sensitivity (0.96) of the MCT battery of tests in comparison to the sensitivities of single measure vision screening techniques – Lea symbols visual acuity (0.61), HOTV visual acuity (0.54), and Snellen chart (0.27) – the results were expected and are consistent with previous vision screening research (Table 1). For example, The California Orinda Vision Study correctly referred 18.5% of all children who were tested with Modified Clinical Technique while vision screenings using only the Snellen chart correctly referred 7.2% of all children. [Blum, Peters, Bettman, 1959] Previous vision screenings with the MCT (1972 – 1986, 1991 – 1995) conducted by the Indiana University School of Optometry have yielded average referral rates between 11% and 12%; however, referral rates occasionally approached 30% for some of the more at-risk schools. [Indiana Optometric Association, 2000; Lyon, Meetz, 2001; Indiana University School of Optometry, unpublished data] Conversely, screenings of school children conducted between 2005 and 2006 by Prevent Blindness Indiana, using only the distance Snellen visual acuity chart, yielded an average referral rate of 8.5% [Prevent Blindness Indiana, 2006]. However, when Prevent Blindness Indiana used a more sensitive procedure – one closer to that of the Telebinocular (e.g., Optec Vision

These findings suggest that the Modified Clinical Technique will identify more children with visual defects than the Snellen chart, leading to earlier detection and correction of children’s vision problems.
Screener) – the yield was considerably higher with a referral rate of 25.1% among school-age children. These findings suggest that more sensitive techniques (e.g., Modified Clinical Technique) will correctly identify more children with visual defects than less sensitive screening techniques (e.g., Snellen chart) and contribute to the earlier detection and correction vision problems in children.

If the findings from the 2000-2001 cohort of first grade students are projected to the 2005-2006 cohort of 80,775 first grade students using the calculated sample referral rates, the Modified Clinical Technique would refer 8,966 (11.1%) children for comprehensive eye examinations, compared to the projected Snellen E chart referral of 4,604 (5.7%) children. The difference of 4,362 (5.4%) indicates the number of children who would not be referred by the Snellen E chart – children whose vision problems would go undetected as a result of the under-referral (Figure 19).

Although the MCT has been identified as the screening technique of choice for Indiana school children, the MCT screening requirement falls short of reaching all children at risk. The use of waivers by some of the school corporations allows them to circumvent the intent of the state’s MCT requirement and exposes students – frequently students who are most at-risk – to the improbable detection of vision problems by less sensitive means. The 1994-1995 report from the Indiana State Department of Health indicated that 23 public school corporations received waivers for that year, the last year of reported data. [Indiana State Department of Health, 1994-1995] Recent conversations with state personnel indicate that the number of waivers granted each year is somewhat constant, as are the school corporations that request them. Although the number of yearly waivers is relatively small at less than 10% of all public school corporations, many of the school corporations obtaining waivers include some of the larger schools. Waiver and screening data from the 1993-1994 school year indicate that the 93.2% of the state’s school corporations that reported using the state mandated MCT enrolled only 68% of the state’s children, suggesting a diminished reach of the vision screening mandate for 32% of the state’s children with the
implication that many of the larger school corporations do not use the MCT. [Indiana Optometric Association, 2000]

The finding that only 9.3% of the children who failed the state’s vision screening by whatever method actually had their eyes examined within the year in which the screening failure occurred is an equally important concern relative to the effectiveness of the vision screening mandate. This current finding represents a dramatic decrease from the 1994-1995 finding in which 55.1% of the 11.0% of public school children referred complied with the follow-up recommendations; 81.8% of those complying received treatment. [Indiana State Department of Health, 1994-1995] Although better than the current findings, the 1994-1995 follow-up data were far from optimal with a 45% noncompliance rate. An analysis of the state-wide public school screening data for the school years of 1991-1992 to 1994-1995 indicate that, out of a total of 1,369,699 Indiana kindergarten and first grade children screened over the four-year period, 150,989 children (11.0%) were referred for follow-up care. [Indiana State Department of Health, 1991-1992; Indiana State Department of Health, 1992-1993; Indiana State Department of Health, 1993-1994; Indiana State Department of Health, 1994-1995; Lyon, Meetz, 2001] However, 57,838 (38.3%) of the referred children over the four-year period did not visit an eye doctor for a comprehensive follow-up of the failed vision screening, indicating the existence of an on-going problem with the comprehensiveness of the vision screening/follow-up requirement. Since any screening program is only as good as its follow-up, the poor follow-up rate among failed children within the Indiana vision screening program is another factor that weakens the overall effectiveness of the program. School corporations, especially those with children from low income families, should endeavor to strengthen follow-up measures in compliance with vision screening referral recommendations.

**Socioeconomic Status.** The 1999 median family income of the 294 Indiana public school corporations ranged from a low of $31,778 to a high of $96,747. [The Annie E. Casey Foundation, 2006] The average median family income for the 138 school corporations in the study sample was $50,521, with 87.0% of the school corporations being comprised of students from families with median incomes of less than $59,999. This study’s analysis of family income versus referral rate confirms that the percentage of Grade 1 children referred to an eye care provider differs according to the socioeconomic level of the students being screened. Specifically, school corporations with a lower median family income had a greater percentage of children referred for a comprehensive eye examination – a result expected based on previous socioeconomic and
health status research. Earlier (1978-1979) data from the Indiana Division of Reading Effectiveness demonstrated a similar correlation between SES and referral rates among elementary grade students, with one of the lowest SES school corporations reporting one of the state’s highest vision referral rates (31%) and one of the lowest follow-up rates (40%). [Division of Reading Effectiveness, 1979]

Forty-four school corporations (31.9% of those reporting) had median family incomes below $46,500 – the income threshold for which SES remains a factor in the rate of referral. Since the income-specific SES effect on referral rate was found to wash out at incomes of $46,500 or higher, nearly one-third of the school corporations demonstrated referral rates that could be differentiated on the basis of family income. School corporations with median family incomes above $46,500 were less likely to demonstrate high referral rates in comparison to school corporations with median family incomes below $46,500.

Access to health care may account for the socioeconomic trends identified in this study. That is, increased referral rates among children living within lower income school corporations likely occurred because children may have decreased access to health care compared to children living in higher income school corporations. In Indiana, school corporations with lower median family incomes are located in either two locations: extremely rural or metropolitan. Studies have demonstrated that populations with great income disparity between the rich and poor have worse health status than populations with economic homogeneity and high SES. [Wilkinson, 1997] Health status can be a function of several factors, including income, parental education, parental employment, and health insurance. [Newacheck, Hughes, Stoddard, 1996; Shi, Starfield, Kennedy, Kawachi, 1999] The health status disparity function within Indiana is not implicit in the results of this study. However, research supports the premise that minority children whose families live in poverty and without health insurance must overcome greater barriers in access to health care than white children whose families live comfortably with health insurance. [Newacheck, Hughes, Stoddard, 1996] It can be assumed, therefore, that children living under these conditions need greater access to primary eye care.

It may be reasonable to suggest that families in higher income school corporations have greater access to health care, and that the children from such families receive adequate vision care
at a younger age compared to children in lower income school corporations. As a result, higher income school corporations have a reduced percentage of children referred for a comprehensive eye examination. Additionally, the changing financial condition of the school corporation and its impact on services may contribute to a child’s diminished health outcomes. Within the last five years, many Indiana school corporations have had to make budget reductions and, frequently, early reductions occur at the expense of the school health program. Larger school corporations have decreased the number of school nurses on staff, leaving fewer nurses with greater responsibilities. Some counties have only one nurse responsible for multiple school corporations and, because the nurse has more students to care for, she or he may be unable to comply with the state’s vision screening requirements or provide effective vision screenings for the children within the financially burdened school corporations.

**Education.** It has been commonly stated by the American Optometric Association and others that 80% of learning is processed through vision. Therefore, a properly functioning visual system would appear to be instrumental to the existence of a properly composed learning environment, and that the existence of uncorrected vision problems could lead to difficulties in learning and impact the necessary attributes associated with learning (e.g., reading). Previous research on the relationship between vision test performance and reading performance of kindergarten and first grade students reveal a significant association between MCT failure and decreased reading skill in five year old children. [Kulp, Schmidt, 1996] However, the results of this study indicate the existence of a non-significant relationship between the percent of Grade 1 children referred to an eye care provider in 2000-2001 and the percent of the same cohort, as Grade 3 children, subsequently passing both the English/Language Arts and Mathematics components of 2002-2003 ISTEP+ exam two years later. Irrespective of statistical significance, a relationship does
appear to exist between the vision screening referral rate and academic performance. A downward trend of poorer ISTEP+ performance in 2002-2003 is associated with students who were most likely to have been referred in 2000-2001 (Figure 20). This would indicate that students who fail the vision screening in Grade 1 tend to be more at-risk for poorer performance on the ISTEP+ exam in Grade 3. Comparing the combined English/Language Arts and Mathematics pass rate frequencies of the homogeneous MCT screening population with the heterogeneous total population (MCT and non-MCT populations), the frequency bars of the MCT population shift slightly to the right (towards a higher pass rate) from the left-skewed (lower pass rate) frequency bar alignment of the MCT and non-MCT population (Figure 21).

Within the populations of both the MCT and non-MCT school corporations and in every region of the state, except one (East Central), students whose performance was below average on the ISTEP+ exam had a higher rate of vision screening failure and referral for a comprehensive eye examination (Figures 22 - 26). Students enrolled in the East Central Indiana schools were found to have a higher vision screening referral rate among students with above average ISTEP+ results (Figure 27). However, these findings could imply that the East Central grade 1 students were more likely to have received the appropriate follow-up for their referral two years earlier and no longer manifested an uncorrected vision problem in Grade 3. The East Central region includes an economically diverse mixture of school corporations ranging from some with median family incomes of less that $40,000 to one with a median family income in excess of $90,000 (Figures 28 and 29). Approximately 58% of the East Central Indiana school corporations are comprised.
of students from families with median incomes of $50,000 or higher, well above the $46,500 income threshold for finding a referral rate difference by income. Therefore, the findings for the East Central Indiana schools also could imply that, because of their higher SES position relative to other regional schools, they have greater resources to ensure that the more diagnostically sensitive MCT test is conducted – potentially yielding higher rates of referral (true positives) than
the less sensitive Snellen chart and positioning students to be more academically ready through the early intervention of proper vision care.

The greatest intra-regional referral rate disparities between below average and above average ISTEP+ performance were found in the Southeast and Northeast Indiana school populations. The magnitude of the difference in the below average and above average mean referral rates was 4.1% for the Southeast regional schools and 3.8% for the Northeast regional schools (Figure 30). When compared to children who performed above average on the Grade 3 ISTEP+ exam, the regional findings indicate that children in the Southwest (15.0%), West Central (13.2%), and Northeast (13.1%) school corporations had the highest likelihood (although not to the level of statistical significance) of performing poorly on the ISTEP+ exam when failing the Grade 1 vision screening two years earlier. Nonetheless, the mean referral rates for students
performing below average were in the double digit range for all regions, except the East Central region (8.3%). As discussed earlier, students in the East Central Indiana schools demonstrated a higher vision screening referral rate for students with above average ISTEP+ results compared to students with below average ISTEP+ results (Figure 27). However, the East Central region also demonstrated the smallest intra-regional referral rate disparity (1.7%) between the below average and above average ISTEP+ performance populations (Figure 30).

These findings indicate that children who performed below the state average on the ISTEP+ exams were more likely to have failed the vision screening exam in Grade 1, placing increased emphasis on the importance of follow-up care for students who do not pass the vision screening.

It is the larger school corporations that often request waivers of exemption from the necessity of using the MCT. A comparison of the 2002-2003 Grade 3 ISTEP+ percentage pass rates of some of the larger school corporations that have appeared on the waiver list against the 2002-2003 state averages for English/Language Arts and Mathematics reveals lower than average pass rates for the larger “waiver list” corporations. Consequently, it could be argued that the use of the waiver provision reduces the public health impact of the vision screening requirement by limiting its ability to accurately assess the vision status of all academically at-risk children.

A review of the sample and mean referral rates for the schools in the Southwest region shows a contradiction in ISTEP+ exam performance with the sample referral rate (10.2%) being higher
for students with above average performance and the mean referral rate (15.0%) being higher for students with below average performance (Table 12). The contradiction may be due, at least partially, to the “weighting” effect on the small screening populations of primarily rural school districts when grouped with the screening populations of larger metropolitan school corporations. In addition to the sample size differences existent within the region, the difference also may be attributed to the use of less sensitive screening measures by the smaller schools.

Unfortunately, the data provided by the school corporations were not as complete and robust as desired. Consequently, the data set’s low reliability contributes to results that are of insufficient strength to conclude a significant association between referral rate and academic performance. Although school personnel are required to report on the Vision Screening Report Form the number of referrals completed and not completed, it is unknown if students initially referred for an eye examination actually received professional eye care services during the two year period between when the vision screening was held in Grade 1 and when the same student cohort took the ISTEP+ exam in Grade 3. Future efforts should investigate in greater detail the relationship between referral, follow-up examination, and academic performance on the ISTEP+. Students referred to an eye care provider should be followed administratively to ascertain the completion of a comprehensive follow-up eye examination, and the differences in ISTEP+ performance between students who received professional care against those students who did not receive professional care should be examined with greater understanding and accuracy of the facts.

Limitations

**ISTEP+ Performance.** Limitations to the present study include the methods by which the school corporations complete and report the School Corporation Vision Screening Report form to the Indiana State Department of Health. Specifically, the structure of the form requires school corporations to disclose if they did or did not conduct the Modified Clinical Technique. If they did not conduct the Modified Clinical Technique, then the school personnel must identify their preferred method of vision screening. Some school corporations declared conducting the Modified Clinical Technique, but also listed alternative vision screening methods, such the Titmus machine test or Snellen E chart. While these methods test individuals components of the Modified Clinical Technique, these methods alone do not constitute the Modified Clinical Technique. It cannot be determined if all of the school corporations who were included in the study actually conducted all components of the Modified Clinical Technique.
Indiana School Screening Law. A similar limitation involves the Indiana health and education regulations. IC 20-8.1-7-16 (IC 20-34-3-12) states that upon enrollment in kindergarten or first grade all children must receive an annual vision test using the Modified Clinical Technique. As previously described, the Modified Clinical Technique is the most comprehensive form of vision screening available and eye care providers must be present to conduct some of its components. It is unknown if the 125 school corporations that reported conducting the Modified Clinical Technique actually performed all five screening components or only selected screening components. It also is unknown if the school corporations actually conducted the Modified Clinical Technique or simply reported conducting it in order to give the appearance of complying with Indiana regulation. Although it cannot be determined if these school corporations performed the Modified Clinical Technique thoroughly, or at all, they nevertheless were included in the study because of their responses on the Vision Screening Report form.

Quality of Reported Data. Less than half (45.6%) of the state’s school corporation reports were available for analysis. Some forms were submitted electronically, not saved, lost or not submitted. The study did attempt to correlate academic achievement with vision screening referral rates; however, public data regarding screening results and academic performance were insufficient and significant conclusions, therefore, could not be drawn. Many of the data entries on the School Corporation Vision Screening Report form were incomplete or the entry did not reconcile with the school total. The most common data entry problem was the number of “Referrals Completed From Last Year,” with only 2% of the school corporations reporting any follow-up. On most forms, the entry was either blank or recorded with a “Zero” entry because the form was often completed immediately following the screening.
VI. RECOMMENDATIONS AND POLICY IMPLICATIONS

Vision can be considered a basic tool of learning, such that the unchecked prevalence of vision problems predisposes children to being ill-equipped with the requisite academic tools for learning and creates the potential for long-term “ripple effects” of “enormous social and economic impact.” [Zaba, 2001] The National Center for Health Statistics estimates that 20% to 25% of children enter school with significant vision problems that can affect their academic development and performance in school. Studies have shown that visual motor integration and hand-eye coordination are associated with academic performance. [Logan, Gilmartin, 2004] Over time, the child may fail to develop the skills necessary to become intellectually capable of succeeding in life. [Murphy, 1999] Consequently, if a child has an undetected visual defect, that child may not achieve his or her learning potential.

Relative to the Indiana vision screening law and the importance of assessing the vision readiness of children as a basic tool of learning, school corporations need to prioritize the well-being of the children when selecting and implementing a vision screening method for the detection of conditions that can deplete the academic tools necessary for learning. As a public policy, “when a state establishes vision screening procedures for its children, it implies that the selected procedures effectively identify those children who do and do not require further examination.” [Ciner, Dobson, Schmidt, et al., 1999] Indiana’s vision screening law requiring the use of the Modified Clinical Technique (MCT) in the annual vision screening of all children upon enrollment in either kindergarten or the first grade is designed to systematically identify early vision problems that could interfere with the learning process and adversely affect the vision readiness of children entering school for the first time.

The findings of the current analysis regarding the implementation of the Indiana school vision screening law carry important public health and policy implications that impact the continuation of and/or need for change in the regulations affecting the visual health and academic readiness of Indiana school children.

Recommendations

Given the significance of vision on learning and the relatively high prevalence of undetected vision problems in young children, it seems reasonable that all children should have a vision assessment prior to entry into kindergarten or first grade. Since children develop visual defects that are not restricted to distance visual acuity, the selected screening technique should be sufficiently comprehensive in its clinical scope and sufficiently valid to detect the more prevalent
vision problems of early childhood. The Modified Clinical Technique (MCT) was selected because of its comprehensive scope and high validity – its high sensitivity, high specificity, and high predictive values.

**Recommendation 1** – The Indiana State Department of Health and the Indiana Department of Education should reinforce with the school corporations the importance of the Modified Clinical Technique (MCT) as the screening technique of choice for children entering kindergarten or first grade.

The MCT requires the participation of a licensed eye care professional (i.e., optometrist or ophthalmologist) to perform some of its procedures (e.g., cover test, retinoscopy, ophthalmoscopy). Consequently, school corporations may find it difficult to use the MCT due to their inability to obtain the participation of a licensed eye care professional to conduct the entire MCT test battery. The use of trained lay personnel in combination with licensed eye care professionals might help spread the workload sufficiently to increase the likelihood of participation by licensed eye care professionals.

**Recommendation 2** – Prevent Blindness Indiana, as a statewide nonprofit organization that trains lay persons to conduct vision screenings throughout Indiana, should organize in conjunction with the Indiana Optometric Association and the Indiana Academy of Ophthalmology a procedure for partnering trained lay screeners and licensed eye care professionals with school corporations that currently do not use the Modified Clinical Technique (MCT).

The ability of school corporations to request and receive waivers that allow them to “substitute” another (less sensitive) technique that does not require participation by a licensed eye care professional may compromise the spirit of the law. Refractive errors, binocular problems, and ocular conditions, for example, may go undetected if schools rely only on a Snellen chart as the method of vision screening. Replacing the Modified Clinical Technique with the Snellen chart is less than sufficient – that is, assessing visual acuity does not necessarily constitute an assessment of other vision problems that could affect reading, learning, and academic progress. Findings of the current study indicate that the use of the Snellen chart as the primary screening method could result in a high rate of under-detection of vision problems among Grade 1 children. Current provisions (410 IAC 3-1-1 and 511 IAC 4-2-1) state that “the use of testing equipment
equivalent to or more elaborate than the Snellen test is at the discretion of the local school system and shall be based on the recommendations of the school’s professional health advisory sources.”

**Recommendation 3** – School corporations that request waivers of exemption from using the Modified Clinical Technique (MCT) should comply with a standardized vision screening protocol that requires the selection of a screening technique and/or equipment from a list of alternative techniques and equipment approved by the Indiana State Department of Health and the Indiana Department of Education.

Any screening technique, test battery, instrument or equipment designed to assess the vision readiness of children at the time of first entering kindergarten or Grade 1 should have the capability of meeting the intent of the Indiana vision screening regulations. The desired screening technique should be sufficiently comprehensive in scope to assess all of the visual skills necessary for learning. It also should be able to identify children who are visually at-risk for visual acuity and non-acuity related conditions. Specifically, the screening technique or battery should have the ability to assess, at a minimum, the following clinical areas and functions: visual acuity at distance and near; ocular alignment; and stereopsis (refractive error, internal and external ocular health and color perception are important and desirable adjuncts to the minimum list).

**Recommendation 4** – The Indiana State Department of Health and the Indiana Department of Education should assess, either directly or through delegation to an authorized entity, the comprehensiveness of alternative screening techniques and equipment, relative to the Modified Clinical Technique (MCT), as a basis for including them on the state approved list of alternative screening techniques and equipment.

**Recommendation 5** – The Indiana State Department of Health and the Indiana Department of Education should include on the state approved list of Modified Clinical Technique (MCT)-alternative screening techniques and equipment for kindergarten and Grade 1 children only those screening techniques or test batteries that are at least capable of assessing visual acuity at distance and near, ocular alignment and stereopsis.
Any screening technique, test battery, instrument or equipment designed to assess the vision readiness of children subsequent to the initial screening (i.e., at the time of first entering school) should have the ability to assess, at a minimum, visual acuity at distance and near and stereopsis.

**Recommendation 6** – The Indiana State Department of Health and the Indiana Department of Education should include on the state approved list of Modified Clinical Technique (MCT)-alternative screening techniques and equipment for Grade 2 and above children only those screening techniques or test batteries that are at least capable of assessing visual acuity at distance and near and stereopsis.

Since the validity (i.e., sensitivity, specificity, and predictive values) of the screening technique is extremely important to the ability of the technique to correctly identify children with vision problems in need of attention, school corporations that request waivers to exempt them from performing the MCT should attempt to identify and use a screening technique that produces the highest possible sensitivity when performed by the personnel charged with doing the screening. The Snellen chart should not be the default selection just because it may be the easiest to perform, economically appealing or legislatively permissible. Additionally, it has been suggested that the addition of a referral criterion for stereoacuity could improve the predictive value of the MCT for reading achievement and make the results more meaningful to educators. [Kulp, Schmidt, 1996]

**Recommendation 7** – The Indiana State Department of Health and the Indiana Department of Education should assess, either directly or through delegation to an authorized entity, the sensitivity, specificity, and predictive values of Modified Clinical Technique (MCT)-alternative screening techniques and equipment as a basis for including them on the state approved list of alternative screening techniques and equipment.

A major problem with vision screening programs conducted by lay personnel is the increased possibility of excessive unnecessary referrals, which can over-burden the school/health care system and erode the public’s confidence in the validity of the screening initiative. The variability of subjective responses among children can be mitigated by retesting all those who initially fail to enhance the consistency of subjective responses. Children who fail the retest should then be referred for further follow-up care.
Recommendation 8 – The Indiana State Department of Health and the Indiana Department of Education should adopt the test/retest format for any Modified Clinical Technique (MCT)-alternative screening techniques, test batteries, or equipment that require the screened children to make subjective responses in the absence of objective confirmation.

The Indiana vision screening law currently has no provisions for ensuring the follow-up of children who fail the vision screening. Consequently, children may be identified as having vision problems in need of follow-up care, but the current law falls short of directing a follow-up comprehensive examination or providing instructional language on the consequences of a failed screening or why a follow-up examination is important. Although the School Corporation Vision Screening Report form has columns to enter “Referrals Not Yet Completed” and “Referrals Completed From Last Year,” the law assumes that appropriate follow-up services will be provided in the normal course of business. As ineffective communication with parents and a lack of written vision screening reports have been cited as reasons for poor follow-up by parents or guardians, it is important to the validity of the vision screening program that the school corporations adequately communicate with parents or guardians on the importance of a follow-up comprehensive eye and vision examination by an optometrist or ophthalmologist for children who fail the vision screening.

Recommendation 9 – School corporations should advise, via clear and culturally competent communication (e.g., population-tested written parent notification forms), the parents or guardians of children who fail the vision screening on the need for follow-up services and the merits of an examination versus a screening, along with provisions, instructions, and a list of resources for acquiring follow-up services and a return notice acknowledging receipt of the parent notification.

Recommendation 10 – Parents or guardians of children who fail the vision screening should ensure that their child has a comprehensive follow-up eye and vision examination by an optometrist or ophthalmologist within sixty (60) days of receipt of the vision screening report identifying the need for follow-up services.
Recommendation 11 – Parents or guardians of children who fail the vision screening should present to the school corporation, as evidence of the completed follow-up examination, a doctor report form signed by an optometrist or ophthalmologist acknowledging completion of the follow-up examination.

Recommendation 12 – Children of parents or guardians who fail to present a doctor report form signed by an optometrist or ophthalmologist acknowledging completion of the follow-up examination shall be reported by the school corporation to the Indiana Department of Education.

Recommendation 13 – Children who have had a comprehensive eye and vision examination by an optometrist or ophthalmologist within six (6) months of a vision screening should not be required to have another eye and vision examination if the parent or guardian presents as evidence a doctor report form signed by an optometrist or ophthalmologist acknowledging the examination.

It is very important that school nurses and others who may be charged with performing vision screenings within the school corporations are familiar with the state vision screening regulations and procedures for completing the annual School Corporation Vision Screening Report. It is also very important that they be adequately trained on the proper use of the selected screening technique. Familiarity with regulations, standards, and procedures increases the opportunity for generating reliable and valid vision screening results. As the state agencies responsible for ensuring the successful implementation of the vision screening requirement, the Indiana State Department of Health and the Indiana Department of Education should ensure that all school nurses and lay screeners are properly certified in the appropriate screening techniques and reporting procedures.

Recommendation 14 – The Indiana State Department of Health and the Indiana Department of Education should continue to sponsor and organize, either directly or through delegation to an authorized entity, an annual vision screening conference for school nurses and other personnel charged with the vision screening of Indiana school children.
Recommendation 15 – The Indiana State Department of Health and the Indiana Department of Education should certify, either directly or through delegation to an authorized entity, the training of all lay personnel involved in the vision screening of Indiana school children through the implementation of a state approved vision screener training program.

Recommendation 16 – The Indiana State Department of Health and the Indiana Department of Education should provide, either directly or through delegation to an authorized entity, a venue, curriculum, and instructors for the state approved training for all lay personnel involved in the vision screening of Indiana school children.

The ability to assess outcomes is extremely vital to justifying the continuation of the state-mandated vision screening intervention. As a public health/education measure, the vision screening law should produce outcomes appropriate to the intent of the legislation. The under and untimely reporting of School Corporation Vision Screening Report forms, inaccurate and incomplete entries, and the misplacement of submitted forms create operational inefficiencies that undermine the state’s ability to properly monitor the interventional adequacy of the vision screening provision.

Recommendation 17 – The Indiana State Department of Health and the Indiana Department of Education should exercise accountability and enforcement of the provision that each public school corporation submit in electronic form an annual School Corporation Vision Screening Report to either the Indiana State Department of Health or the Indiana Department of Education by the June 1 deadline of each year.

Recommendation 18 – The Indiana State Department of Health and the Indiana Department of Education should continue to utilize the capabilities of the Indiana University School of Optometry to assist the monitoring the eye health of Indiana’s children through the timely analysis of the annually reported statewide vision screening data.

Better epidemiologic surveillance of vision problems and related health behavior of Indiana school children could facilitate the evaluation of the vision screening requirement and its success as an intervention in promoting enhanced vision readiness and academic performance of Indiana
school children. The CDC Behavioral Risk Factor Surveillance System (BRFSS) is conducted by the health department of each state as a procedure for tracking various health conditions and risk behaviors. The recently developed vision module of the BRFSS could be a useful tool in the state’s surveillance of conditions and behaviors that might impact the vision health of Indiana school children.

**Recommendation 19** – The Indiana State Department of Health should incorporate the BRFSS vision module into its annual administration of the CDC Behavioral Risk Factor Surveillance System (BRFSS).

The Indiana University School of Optometry, Prevent Blindness Indiana, Lions Club, and others conduct various types of vision screenings on Indiana children at different venues throughout the state. In 2006 Prevent Blindness Indiana staff and volunteers screened 21,159 children, with 4,219 of the screened children being referred for follow-up vision examinations. Screenings by such various entities frequently are conducted on an ad hoc basis, with little coordination of effort and subsequent diseconomies in the collective use of resources by the screening entities. The state’s vision screening entities and children would be better served through a comprehensively coordinated approach, leading to a more effective and efficient program of annual vision screening of Indiana school children.

**Recommendation 20** – The Indiana State Department of Health and the Indiana Department of Education should authorize Prevent Blindness Indiana, as a statewide nonprofit organization with a primary mission of preventing blindness and preserving sight for Indiana residents through screening, education, public awareness, and research, to serve as a central coordinating body for planning, scheduling, and oversight of vision screening activities and modalities for the Indiana school vision screening program.

Even with a sensitivity of 0.96, the Modified Clinical Technique can misidentify (i.e., under-refer) children with undiagnosed and uncorrected vision problems. Any vision screening technique or test battery, including the MCT, should not be considered a substitute for a comprehensive vision examination. A comprehensive eye and vision assessment and appropriate interventional care are critical to a child’s development. Therefore, ideally, all children should have a comprehensive eye examination by an optometrist or ophthalmologist prior to entry into kindergarten or first grade. The state should study the relative merits of mandating vision
screenings versus comprehensive eye examinations for children entering kindergarten or first grade.

**Recommendation 21** – The Indiana General Assembly in conjunction with the Indiana State Department of Health and the Indiana Department of Education should convene a study commission on children’s vision comprised of eye care providers, school nurses, educators and representatives of the general public to study within a maximum time frame of two years the desirability, feasibility, and benefit of requiring all children in Indiana to have a comprehensive eye and vision examination prior to entering kindergarten or first grade.

**Recommendation 22** – The state-convened study commission on children’s vision should report to the Indiana General Assembly recommendations based on its findings regarding the relative efficacy of mandating vision screenings and comprehensive eye examinations for children entering kindergarten or first grade.

**Policy Implications**

All public policies are subject to legislative and administrative oversight. Central to the administrative missions of the Indiana State Department of Health and the Indiana Department of Education regarding their respective concern for the health and welfare of Indiana children is the periodic review and assessment of the state’s mandated vision screening requirement for Indiana school children. As a strategy for review and to assist the state in its oversight responsibility for strengthening the process and outcomes of the state’s school screening program, a number of public health policy implications are provided in response to the findings of this study (Table 15).

<table>
<thead>
<tr>
<th>Questions</th>
<th>Findings</th>
<th>Public Health/Policy Implications</th>
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<tbody>
<tr>
<td>Do any areas of the state show higher than average referral rates?</td>
<td>School corporations with lower median family incomes – a SES referral factor – are located in either extremely rural or metropolitan areas.</td>
<td>Lower SES, rural, and inner city school corporations are more likely to be comprised of children who are at greatest risk of undetected vision problems and in greatest need for intervention services.</td>
</tr>
<tr>
<td>Question</td>
<td>MCT/non-MCT referral rate differences were statistically and clinically significant with a p value of 0.001.</td>
<td>MCT identifies (i.e., refers) more visually at-risk children through a relatively higher sensitivity, specificity, and predictive value, compared to other vision screening techniques. MCT should be the required method of vision screening, with the “waiver option” provided only as an option of last resort.</td>
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<td>Are there differences in the referral rates (disparities) between schools utilizing the MCT and schools utilizing the Snellen chart only?</td>
<td>MCT referral rate (11.1%) was twice the non-MCT referral rate (5.7%).</td>
<td>Schools that use the MCT have a higher probability of identifying visually at-risk children earlier than schools that do not use the MCT. Children develop visual problems that may go undetected by the low sensitivity of the non-MCT methods of vision screening.</td>
</tr>
<tr>
<td>What are the referral rate differences (disparities) between schools using different screening techniques?</td>
<td>Referral rate of students from low income school corporations (14.4%) was twice the referral rate of students from high income school corporations (7.1%). Differences in SES (median family income)-specific referral rates were significant with a p value of 0.050.</td>
<td>Efforts should be expanded to ensure that the MCT is universally administered by all school corporations. Policymakers should consider ways of increasing the number of Indiana school children who participate in MCT vision screenings with provisions for appropriate follow-up of referral recommendations.</td>
</tr>
<tr>
<td>What are the referral rate differences (disparities) between different socioeconomic (SES) groups?</td>
<td>Decreased access to health care may account for the SES disparity – 31.9% of the school corporations had median family incomes below the $46,500 income threshold for which SES remains a factor in the rate of referral.</td>
<td>Special emphasis on the use of the MCT should be extended to school corporations with large populations of visually at-risk students.</td>
</tr>
<tr>
<td>What are the reasons for the existence of any differences (disparities)?</td>
<td>SES – median family income less than $46,500.</td>
<td>Higher referral rates among low socioeconomic level schools indicate a need for greater preventive vision care within those schools. Special emphasis on the use of the MCT should be extended to school corporations with children from families with median family incomes of less than $46,500.</td>
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<tr>
<td>Are there any factors that could be identified as indicators of greater need?</td>
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<td>What is the impact of any differences (disparities) on the education and productive future of affected students?</td>
<td>Differences in the academic performance (ISTEP+ scores)-specific referral rates were not significant with a p value of 0.116 (MCT and non-MCT). Trend analysis supports the existence of a (non-significant) relationship between high referral rates and below average academic performance on the ISTEP+.</td>
<td>Further research using more robust academic performance and school screening follow-up data is required.</td>
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<tr>
<td>What can be concluded about the screening program’s success and areas of unmet need?</td>
<td>Less than optimal reporting compliance among school corporations. Only 68% of the state’s children were enrolled in school corporations that reportedly administered the MCT screening. Only 9.3% of children who failed the vision screening had their eyes examined within the year.</td>
<td>State efforts should be expanded to ensure the universal use of the MCT battery of vision screening tests, better reporting compliance by school corporations, and stronger follow-up measures for students who fail the vision screening.</td>
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</table>
VII. CONCLUSION

Vision is an important aspect of human life. It contributes to activities of daily living, the realization of personal potential and the pursuit of societal well-being. The failure to detect and correct vision problems, particularly in early childhood, can lead to a lifelong burden of vision impairment and its associated manifestations. Children are at particular risk for vision problems that can adversely affect their early development and readiness for academic engagement. According to the World Health Organization, “without appropriate optical correction, millions of children are losing educational opportunities . . . with severe economic and social consequences.” [World Health Organization, 2006]

Although uncorrected eye and vision problems – such as refractive errors, amblyopia, strabismus and ocular disease – can affect all children, they are believed to have a disproportionate effect upon children living in poverty and, as such, represent a major factor in an unbroken cycle of poverty, poor health, and academic underachievement. Prevention is the intervening factor in the early detection of vision problems, emphasizing an opportunity to preempt the potentially disadvantaging conditions that can impact academic readiness and educational achievement. It has been suggested that “investing in disadvantaged young children is a rare public policy initiative that promotes fairness and social justice and at the same time promotes productivity in the economy and in society at large.” [Iglehart, 2007] Public policies that promote the early and periodic intervention of vision services represent one such investment that can help break the poverty-academic failure cycle that devastates the fragile futures of impoverished youth. It is incumbent upon elected officials, health and education department leaders, health care professionals, teachers, parents and child advocacy groups to make certain that appropriate policies are in place to ensure that vision problems in children are identified and corrected prior to and throughout the school years.

In 1986 the Indiana General Assembly enacted legislation requiring the annual vision screening of all children upon their enrollment in either kindergarten or the first grade, all children enrolled in the third and eighth grades and all other school children suspected of having a visual defect. The legislation mandated, with a waiver option, the use of the Modified Clinical Technique (MCT) for the vision screening of kindergarten and first grade students. The use of the Snellen chart in screening visual acuity is required for all subsequent grades. School corporations are required to report to the state each year the results of the mandated vision screenings using the School Corporation Vision Screening Report form. In 2001 the Indiana
State Department of Health asked the Health Policy Group of the Indiana University School of Optometry to review the submitted forms and provide a report of its findings.

There are 294 public school corporations in Indiana, each required to submit an annual report of their vision screening results. With five years (2000-2001 to 2004-2005) of forms to review, it was determined that only one year (2000-2001) had a sufficient number (i.e., a greater than 40% response rate) of forms submitted for a significant analysis. Three school corporations that did not submit forms, but for which data were available from the Indiana University School of Optometry, were added to the 136 Indiana public school corporations that did submit forms for the 2000-2001 school year. The 139 (47.3%) school corporations generated a data sample of 36,967 Grade 1 children, representing 41% of the first grade enrollment in 2000-2001.

Data from the 139 school corporations were analyzed from several perspectives: the effect of differing vision screening techniques on referral rates; the effect of socioeconomic status (SES), using median family income, on referral rates; and the relationship between referral rates and academic performance, using the results of the 2002-2003 ISTEP+ exam on the same cohort of children two years later. Significant differences were found when analyzing the effect of the vision screening technique used (MCT versus non-MCT) on the rate of referral (p=0.001) and the effect of median family income (SES) on the rate of referral (p=0.050). The MCT identified more children in need of referral for follow-up eye and vision care, which also varied according to the median income of the children’s families. The family income or SES-effect washed out at median family incomes of $46,500, such that children from families with median incomes of $46,500 or more were less likely than children from families with median incomes of $46,000 or less to be referred for follow-up care. Although significant differences were not found when analyzing the relationship between referral rates and academic performance, evidence of an inverse relationship was detected between referral rate and performance on the ISTEP+ exam. Of the children referred for follow-up in 2000-2001, only 9.3% complied with the recommendation by having a follow-up eye examination within the year in which they were referred.

Based on the current analysis of Indiana school vision screening data from the 2000-2001 school year, several conclusions can be inferred to current and future vision screenings: 1) referral rates differ by screening method; referral rates differ by socioeconomic status; follow-up rates are extremely poor; and an inverse relationship appears to exist between referral rate and academic performance.

For the 2005-2006 school year, 75,500 children enrolled in kindergarten and another 80,775 enrolled in the first grade of Indiana’s public schools. [Indiana Department of Education, 2006(d)]
is unrealistic to expect or think that these children will be able to read effectively and efficiently under the burden of an impaired visual system. An extrapolation of the study’s findings to the 2005-2006 school year indicates that of the 80,775 children enrolled in the first grade during that year the MCT would identify 8,966 children in need of a follow-up eye and vision examination, almost twice as many as the 4,604 children who would be identified by the Snellen E chart. The 4,362 children who would not be identified by the Snellen E chart, in comparison to those who would be identified by the MCT, represent the children who would be under-referred on the basis of the single visual acuity measure. Consequently, the Snellen E chart would under-refer almost as many (5.4%) as it would refer (5.7%). This is particularly important since the single measure of visual acuity at distance is an extremely common mode of vision screening for children. [Ciner, Dobson, Schmidt, et al., 1999] Moreover, uncorrected hyperopia tends to be associated more with amblyopia, strabismus and lower school achievement than myopia and visual acuity at distance, which overlooks hyperopia and is reasoned to be a poor predictor of the visual abilities required for good learning. [Moore, Lyons, Walline, The Hyperopic Infants’ Study Group, 1999; Fulk, Goss, 2001; Hellerstein, Danner, Maples, et al., 2001] 

The early detection and treatment of vision problems should be a fundamental goal of any child health and academic readiness program. However, the lack of sufficient resources, the variable demands upon school personnel (e.g., school nurses) and the diversity of socioeconomic characteristics among families within and among school corporations make it difficult, if not impossible, for many school corporations to comply fully with the mandates of the Indiana school vision screening legislation.

Therefore, the **less than ultimate recommendation** of this report is that:

**All children have an age-appropriate, comprehensively sensitive vision screening by a certified vision screener using appropriate techniques and equipment prior to and throughout their school years, and that all children who fail the vision screening be referred for a comprehensive follow-up eye and vision examination by an optometrist or ophthalmologist.**

Vision screening programs are not diagnostic and typically do not assess all of the visual skills important to the learning process (e.g., distance and near visual acuity, accommodative facility, visual tracking, binocular fusion, convergence, uncorrected hyperopia, color vision, visual-motor integration). [Cohen, Lieberman, Stolzberg, Ritty, 1983]

To properly ensure the readiness of Indiana’s kindergarten and first grade children for the vision-related challenges of school, it is the **ultimate recommendation** of this report that:
All Indiana children have an age-appropriate, comprehensive eye and vision examination by an optometrist or ophthalmologist prior to and throughout their school years.

With realization of the policy process and the issues that impact legislative changes in state policy, an interim recommendation of this report is that:

The state should convene a study commission on the desirability, feasibility and benefit of requiring all children in Indiana to have a comprehensive eye and vision examination prior to entering kindergarten or first grade.
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>Accommodation</td>
<td>Change in the focus (intraocular lens power) of the eyes to attain clear vision at near (positive) or distance (negative).</td>
</tr>
<tr>
<td>Accommodative Facility</td>
<td>Ease of changing focus when viewing objects at different distances.</td>
</tr>
<tr>
<td>Accommodative Insufficiency</td>
<td>Insufficient accommodative ability to focus objects clearly at different distances.</td>
</tr>
<tr>
<td>Amblyopia</td>
<td>Reduced visual acuity usually in only one eye which is not correctable with eyeglasses or contact lenses and not attributable to obvious structural or pathological ocular anomalies.</td>
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<tr>
<td>Aniseikonia</td>
<td>Inter-ocular difference in sizes of visual images due to differences in the uncorrected refractive error between the two eyes.</td>
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<tr>
<td>Anisometropia</td>
<td>Condition in which the two eyes have clinically significant unequal refractive error.</td>
</tr>
<tr>
<td>Astigmatism</td>
<td>Refractive condition in which parallel rays of light entering the eye from a distant object do not come to a single point focus, but two point foci, producing five possible refractive errors: 1) both foci are in front of the retina; 2) both foci are behind the retina; 3) one focus is in front of the retina and one focus is behind the retina; 4) one focus is in front of the retina and one focus is on the retina; or 5) one focus is behind the retina and one focus is on the retina.</td>
</tr>
<tr>
<td>Behavioral Risk Factor Surveillance System (BRFSS)</td>
<td>Telephone-based health survey system conducted by state health departments to track state-specific health conditions and risk behaviors.</td>
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<tr>
<td>Binocularity (Binocular Fusion)</td>
<td>Condition in which both eyes fixate the viewed object and simultaneously perceive the fused images of the object on the retina (binocular vision).</td>
</tr>
<tr>
<td>Cataract</td>
<td>Loss of transparency or opacity of the intraocular lens.</td>
</tr>
<tr>
<td>Convergence</td>
<td>Inward turning of the lines of sight toward each other for fixating objects at near.</td>
</tr>
<tr>
<td>Cover Test</td>
<td>Clinical test in which either one eye is covered and then uncovered (unilateral) to determine the presence or absence of strabismus or in which both eyes are alternatively covered and uncovered (alternate) to determine the direction and magnitude of a tropia or phoria.</td>
</tr>
<tr>
<td><strong>Diopter (D)</strong></td>
<td>Unit of measure denoting the light-bending ability (power) of a spectacle lens (reciprocal of the focal length of the lens in meters).</td>
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<tr>
<td><strong>Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) Program</strong></td>
<td>Medicaid component that requires states to provide children and adolescents under the age of 21 years with access to comprehensive, periodic health and developmental evaluations, along vision services (diagnosis, treatment, and eyeglasses), dental services, hearing services, and services for other conditions discovered through screenings.</td>
</tr>
<tr>
<td><strong>Federal Poverty Level (FPL)</strong></td>
<td>Poverty threshold measure issued each year by the U.S. Department of Health and Human Services which may be used to determine financial eligibility of certain federal programs.</td>
</tr>
<tr>
<td><strong>Fixation Disparity</strong></td>
<td>Slight misalignment of the ocular images of the two eyes.</td>
</tr>
<tr>
<td><strong>Healthy People 2010</strong></td>
<td>Set of health objectives for the Nation to be achieved by the year 2010.</td>
</tr>
<tr>
<td><strong>Heterophoria (Esophoria)</strong></td>
<td>Binocular vision with a tendency of the eyes to turn inward.</td>
</tr>
<tr>
<td><strong>Heterophoria (Exophoria)</strong></td>
<td>Binocular vision with a tendency of the eyes to turn outward.</td>
</tr>
<tr>
<td><strong>Heterophoria (Hyperphoria)</strong></td>
<td>Binocular vision with a tendency of the eyes to turn upward.</td>
</tr>
<tr>
<td><strong>Hyperopia (Farsightedness)</strong></td>
<td>Refractive error in which the eyeball is too short from front to back or the refractive power of the eye too weak so that parallel rays of light entering the eye from a distant object come to a single point focus behind the retina.</td>
</tr>
<tr>
<td><strong>Incidence</strong></td>
<td>Rate of new cases of a condition or disease per unit population or person-years of observation identified in a defined period of time, usually one year.</td>
</tr>
<tr>
<td><strong>Indiana Statewide Testing for Educational Progress Plus (ISTEP+)</strong></td>
<td>Statewide, standardized testing of Indiana school children in English/language arts and mathematics in grades 3 through 10 and science in grades 5 and 7.</td>
</tr>
<tr>
<td><strong>Lens (Minus)</strong></td>
<td>Lens (concave) that diverges light and used to correct myopia (nearsightedness).</td>
</tr>
<tr>
<td><strong>Lens (Plus)</strong></td>
<td>Lens (convex) that converges light and used to correct hyperopia (farsightedness).</td>
</tr>
<tr>
<td><strong>Medicaid</strong></td>
<td>Enacted in 1965 as Title XIX of the Social Security Act to provide coverage of health care services for blind and disabled persons and economically indigent families with dependent children.</td>
</tr>
<tr>
<td><strong>Modified Clinical Technique (MCT)</strong></td>
<td>Battery of vision screening tests that include an assessment of distance visual acuity, distance and near muscle imbalance by objective cover test, refractive error, and ocular health.</td>
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<tr>
<td><strong>Myopia (Nearsightedness)</strong></td>
<td>Refractive error in which the eyeball is too long or the refractive power too strong so that parallel rays of light entering the eye from a distant object come to a single point focus in front of the retina.</td>
</tr>
<tr>
<td><strong>Ocular Motility</strong></td>
<td>Ability of the eyes to move freely and equally in all directions and to all points of gaze.</td>
</tr>
<tr>
<td><strong>Ophthalmoscopy</strong></td>
<td>Internal examination of the eyes with an ophthalmoscope for the purpose of detecting eye disease or ocular signs of systemic disease.</td>
</tr>
<tr>
<td><strong>Orinda Vision Study</strong></td>
<td>Longitudinal study conducted in Orinda, California from 1954 to 1956 for the purpose of designing an expensive and effective screening program for identifying elementary-school children with vision problems.</td>
</tr>
<tr>
<td><strong>Predictive Value (Negative)</strong></td>
<td>Rate of correct non-referrals (true negatives) per total negative reactors (true negatives plus false negatives); likelihood of not having a disorder if the screening result is negative.</td>
</tr>
<tr>
<td><strong>Predictive Value (Positive)</strong></td>
<td>Rate of correct referrals (true positives) per total positive reactors (true positives plus false positives); likelihood of having a disorder if the screening result is positive.</td>
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<tr>
<td><strong>Prevalence</strong></td>
<td>Rate of all cases of a condition or disease per unit population identified at a defined point or in a defined period of time.</td>
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<tr>
<td><strong>Ptosis</strong></td>
<td>Drooping of the eyelid.</td>
</tr>
<tr>
<td><strong>Referral Rate (Mean)</strong></td>
<td>Average of all child or school referral rates.</td>
</tr>
<tr>
<td><strong>Referral Rate (Sample)</strong></td>
<td>Rate of referrals per total number of children or schools screened.</td>
</tr>
<tr>
<td><strong>Refractive Error</strong></td>
<td>Parallel rays of light rays entering the eye from a distant object do not come to a single focus on the retina (e.g., hyperopia, myopia, astigmatism).</td>
</tr>
<tr>
<td><strong>Retinopathy</strong></td>
<td>Presenting retinal eye disease.</td>
</tr>
<tr>
<td><strong>Retinoscopy</strong></td>
<td>Objective measurement of the refractive state of the eye with a retinoscope.</td>
</tr>
<tr>
<td><strong>School Corporation Vision Screening Report</strong></td>
<td>Form used by Indiana public school corporations to report the results of the annual vision screening of school children (State Form 5888).</td>
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</tbody>
</table>
### Sensitivity
Rate of correct referrals (true positives) per total of true positives plus false negatives.

### Sign (Clinical)
Patient finding that can be viewed objectively by another person.

### Snellen chart
Chart of letters of decreasing size used to test visual acuity.

### Socioeconomic Status (SES)
Measure of social and economic status based on income, education, and occupation.

### Specificity
Rate of correct non-referrals (true negatives) per total of true negatives plus false positives.

### State Children’s Health Insurance Program (SCHIP)
Under Subtitle J of the Balanced Budget Act (BBA) of 1997, Congress Enacted in 1997 as Title XXI of the Social Security Act to extend public health insurance eligibility thresholds up to and beyond 200% of the Federal Poverty Level for uninsured children of low-income, working families whose income exceeds the Medicaid income threshold, but not enough to afford private insurance.

### Stereopsis
Binocular visual perception of three dimensional space based on retinal disparity and simultaneous perception of the viewed object (i.e., the ability to perceive depth).

### Strabismus
Monocular vision with a manifest inward (esotropia) or outward (exotropia) deviation of one (unilateral) or both (alternating) eyes.

### Symptom
Patient complaint that is subjectively experienced by the patient and not capable of being viewed objectively by another person.

### Tropia (Eso)
Monocular vision with a manifest inward deviation (turning) of one (unilateral) or both (alternating) eyes; type of strabismus.

### Tropia (Exo)
Monocular vision with a manifest outward deviation (turning) of one (unilateral) or both (alternating) eyes; type of strabismus.

### Visual Acuity
Minimum visual angle of an object that can be resolved when viewing the object at a specified distance, usually 6 meters (20 feet) or 40 centimeters (16 inches).
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