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ON THE ISSUE OF REQUIRED PRESCHOOL VISION EXAMS

By

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A thesis submitted to the faculty of the
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Abstract

Several states have passed legislation – and others are currently under consideration – requiring comprehensive preschool vision examinations. Such action has stemmed from data showing the prevalence of vision problems in this age group and the potential impact on undetected visual dysfunction could have upon learning. This movement has surfaced as a public health issue, however there has been some debate among the health professions, specifically optometry, ophthalmology, and pediatrics on the merits of such a requirement. There seems general agreement that learning disabilities are a common condition in the pediatric population. The core disagreement is whether a visual dysfunction can give rise to a learning disability, and if so, whether a simple screening test is adequate in detecting such problems. The possible sources of disagreement and the various views and on this issue are examined and a review of literature, current practice guidelines, and current legislation for children’s vision is presented.

Key Words:
School vision, vision screening, required pre-school vision examinations, optometry, ophthalmology, learning disabilities
I. Introduction:

A. Prevalence/Importance

As Leonardo da Vinci once said, “All our knowledge has its origins in our perceptions.” It is not surprising that as children, 80% of our learning takes place through our visual perception.\(^1\) With this said, the conclusion that vision problems in our nation’s children can have a deleterious effect on learning is one of common sense. So the question arises, do visual inadequacies cause significant problems and risks for our children and with what frequency? How many of our children suffer from a less than sufficient visual system and what might we as healthcare providers do to prevent this occurrence? More and more of our state legislatures are studying these same questions.

Currently in the United States there are approximately 60 million children younger than 15 years who make up 20% of the total population.\(^2\) Vision problems (including amblyopia, strabismus, significant refractive error, ocular disease, and color vision deficits) are a common occurrence in these children.\(^2\)-\(^6\) Studies show nearly 25% of school-aged children have vision disorders.\(^7\)-\(^9\) It has been found that these disorders are the most common disability in the United States and the leading cause of handicapping conditions in childhood.\(^10\) The public has shown continued interest in this area as seen in results of a 2001 National Omnibus survey conducted by the International Communications Research Division. These results say 84% of Americans strongly agree that a child’s vision and eye health are an important part of the child’s overall health.\(^11\) Of those surveyed in the same study, 98% agreed that good vision is necessary for success in school.
Refractive error (including nearsightedness or myopia, farsightedness or hyperopia, and astigmatism) is the most common cause of decreased vision in children and adults alike. But the positive aspect is that refractive error may be corrected simply using prescriptive lenses. Amblyopia, on the other hand is a decrease in vision not corrected with lenses and in the absence of any ocular disease condition. It is responsible for more vision loss than trauma and ocular disease combined in those under forty-five. The movement toward preventive health is especially poignant in the case of amblyopia as there are approximately 6 million Americans who are amblyopic in one or both eyes. It is estimated that 75,000 three year olds develop this condition each year - all of which, theoretically, may be prevented.

Optometrists and ophthalmologists alike (as well as many other healthcare professionals) have researched the prevalence of vision disorders in children and their impact on academic performance. There is agreement among professionals that a need exists for early assessment and diagnosis of vision anomalies to prevent unnecessary loss of vision in children. This need is also recognized in several of the 10 vision objectives stated in “Healthy People 2010.” Three of these vision objectives apply to this discussion: Objective 28-2 aims to increase the proportion of preschool children aged 5 and under who receive vision screening, 28-3 aims to reduce uncorrected visual impairment due to refractive errors, and 28-4 to reduce blindness and visual impairment in children and adolescents aged 17 and under.

It is clear that the necessity of preventing vision problems in our children has received national awareness. So wherein does the debate lie? It appears to encompass a disagreement about the best and most cost-effective approach for prevention. Basically,
it comes down to the issue of vision screening versus a comprehensive exam. Though vision problems may only be officially diagnosed by an eye care professional in a comprehensive vision exam, only 14% of children under 6 years of age receive this level of care. And although screening laws exist, only 21% of preschool children receive vision screenings. Some groups still support a screening as the best, most cost-effective means of preventing vision loss in children while others feel a comprehensive visual examination (CVE) of children at an early age is the only fool-proof method and have shown it to be feasible in cost considerations as well.

**Impact on Learning/Quality of Life/Career:**

The world continues moving into a technological-information age in which full participation in education, science, business, industry, and the professions requires ever increasing levels of literacy. It is obvious even to the most casual observer that normal reading begins with an active visual process. However, this simple association has been lost on many educators, psychologists, and, most disappointingly of all, many eye care practitioners and pediatricians. Vision problems can decrease a child’s ability to progress sufficiently in the early years of their education, specifically in reading, which sets the stage for later learning. Without a sufficient ability to read, excellence in high school and beyond is unattainable.

The relationship between vision and learning has been a topic of hot debate as well and remains an undercurrent for disagreement in the issue of requiring preschool CVE’s. The research is vast in this area and there have been many meta-analyses and literature reviews to attempt to reach a solid conclusion on the question: “Does a problem
with vision/visual perception correlate to reading and/or learning disabilities?” Typically, the answer is yes that vision does have an effect on the ability of children to read and learn.\(^{25-35}\) In the words of George E. Park, M.D. “A definite relationship seems to be present so that abnormal peripheral ocular variations are invariable concomitants in direct ratio to abnormal reading skill or efficiency and are quite constant through the various grade levels.”\(^ {27}\) And as concluded in a literature analysis by Grisham and Simons, “The complex process of learning to read can be adversely affected by many factors, with IQ and teaching skill being among the most important, but certain visual disorders also have an influence and need to be properly managed if reading progress is to be maintained.”\(^ {31}\) Some studies, however, have shown no support for this relationship or, in other words, support the view of the Committee on Children with Disabilities which has stated a belief that “there is no known visual cause for learning disabilities and no known effective visual treatment.”\(^ {37}\)

The most recent policy statements from the American Academy of Pediatrics, American Academy of Ophthalmology, and American Academy of Pediatrics Ophthalmology and Strabismus say that there is no support for a relationship between vision and learning problems.\(^ {37}\) (See Appendix A) This is in contrast to the ophthalmic literature. There are several studies done by noted ophthalmologists (Most notably George E Park and Thomas H. Eames) that are in support of the idea of inefficient vision being a detriment to the young child in learning.\(^ {25-29}\)

If one only looks at the sheer amount of quality research on the topic from all areas including optometry, ophthalmology, and education there stands support for what seems common sense. Learning and reading are highly complex processes that require
all systems to be functioning properly. The factors that interact and ultimately put a child at risk for a problem are vast and extremely difficult to separate. In fact, it seems arrival at a causal relationship is impossible in processes this complex. As stated by Hoffman, "The complexities of both vision and reading processes make the study of each difficult, and an evaluation of the relationship between the two perplexing." Many sources in the literature, using solid evidence, have shown that vision problems (specifically hyperopia and unstable binocularity) should be considered as some of the many possible risk factors for learning problems. And correction of these problems, though they clearly may not have any impact on underlying perceptual problems such as dyslexia, do support the notion that basic binocular skills are needed to be an effective reader. Good visual skills can only serve to benefit the child and put one more "ball in their court," as they say.

Vision problems have been shown to be associated with learning deficits (including reading dysfunctions), juvenile delinquency, and hyperactivity. These connections arise because a child who does not have comfortable, clear vision will be less likely to develop normal fine and gross motor, language, and social skills in the first years of life. Prescriptive lenses that allow a child to attain comfort in near tasks can make the difference between success and failure in a preschool setting. The benefits of proper optical correction and vision therapy include normal binocular vision, enhanced stereopsis (or depth perception), clear peripheral images, equal accommodative (focusing) stimulus and significant reduction of the prevalence of amblyopia. This reduction can also lead to a decrease in the vision rehabilitation and health care costs that accompany amblyopia.
B. Problem (issue of public debate)

Currently, in the field of vision care, legally requiring comprehensive pre-school exams is one of the most hotly debated topics. Despite the clear agreement in the policy statements of various health care professions that a need exists for early vision assessment in our children, the mechanisms proposed to meet this need vary widely between the different groups. Recently optometry, with the backing of the American Optometric Association, the American Academy of Optometry, and the American Public Health Association has been pushing forward the proposal of required preschool vision exams. In direct opposition are the American Academy of Ophthalmology, the American Academy of Pediatrics (AAP), American Academy of Family Physicians (AAFP), and the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) who feel that “proper eye screening” techniques (meaning ocular health/red reflex testing at birth and 6 months to one year and assessment of vision and alignment ideally between 3 to 3.5 years and definitely before the age of 5) are adequate to detect vision ailments in their early stages and prevent permanent vision loss.

How and why does this common goal exist with such strong (and many times unpleasant or accusatory) disagreement on the most efficient means to accomplishing it? To address this issue from all sides it may be easiest to examine where we are now in terms of the current standards to prevent vision loss in children and how they are measuring up. From that point, a discussion of the various educational backgrounds and views of the professions taking part in this debate will be outlined as well as the cost effectiveness of the options proposed.
C. The Status Quo

The current laws in most states require some amount of vision screening in the public schools. Most require only a visual acuity test at distance and even with these laws in place only 21% of our preschool children are screened as cited above. Also, as mentioned above, the problems of amblyopia and strabismus occur most commonly before the age of five. Some recommend vision care as a preventive measure is most feasible before the age of 3 because half of all cases of strabismus occur by this age and the earlier we diagnose the condition the fewer sensory adaptations have developed and the easier it is to treat.38

Aside from the issue of timing, the value, as well as the risks of screenings must be discussed. Several studies have been done, and more are currently underway, to arrive at the best method for screening. The goal of any screening is to detect everyone with the problem in question while not misdiagnosing those without the problem. Of course, it is well known that all screenings have some false positives and false negatives. As stated in the Orinda Study in 1959, screening successes are the correct-referrals and non-referrals, and screening errors are over-referrals and under-referrals.39

One study on kindergarten vision screenings published by König et al stated that the main purpose of preschool vision screening is the prevention of amblyopia.40 In this study the concern about the lack of scientific data on the effectiveness of such programs was reiterated. They go on to say that in Germany general practitioners and pediatricians perform vision assessment as part of general preventive care examinations but the effectiveness of these exams in detecting amblyopia is considered to be poor because
GP's and pediatricians lack the necessary experience for ophthalmic testing in this age group.

Another main issue of screenings is the lack of public understanding surrounding the procedure. It has long been a concern that vision screening can often give a false sense of confidence. Many parents do not know exactly what is meant when told that their child has passed a vision screening. Where screenings are used and a child is given a “Pass” should it not come with a warning? The group performing the screening should be responsible for clarifying that a vision screening is not a means to diagnose vision disorders but only to detect whether further examination may be necessary. It also does not rule out the possibility of an undetected vision problem. This is the nature of a screening, a cost effective, quickly administered, battery of tests to find a prevalent problem in a large population.

As far as studies done to evaluate screening methods, the Orinda Study was one of the most thorough. Its results showed that the Modified Clinical Technique was the most efficient method of screening and surpassed the next best method considerably. It referred the greatest number of correct-referrals (90 percent) and the fewest over-referrals (4 percent). The second best method as stated in the same study was the CSRP (California State Recommended Procedure) which identified less than half those needing attention though it had few over-referrals.

The Maternal and Child Health Bureau and National Eye Institute conducted a more recent task force on preschool vision screening. A report was compiled in order to determine “useful screens to efficiently detect amblyopia risk factors and other significant problems” as well as “to provide and evaluate the practicality and
effectiveness of ocular screening services for young children, including photoscreening technology.\textsuperscript{41} This task force uncovered an urgent need for large-scale studies aimed at answering questions about the reliability and validity of commonly used screening methods and newer technologies such as photoscreening. They also concluded that although a variety of recommendations have been published by several organizations, they are inconsistent and therefore confusing. Different tests are recommended by different agencies with little guidance for selection or implementation. Finally, the panel put together some interim recommendations that are more explicit but are not backed by adequate studies for validation as such data are not available at this time. This task force was unique in the wide array of professions represented and more interesting was the general agreement as to the importance of vision screening in young children and the need for continued work in this area.\textsuperscript{41}

Another noteworthy publication is the survey of vision screening policy of preschool children in the United States done by Ciner et al.\textsuperscript{42} In this article they state that 34 states recommend or require vision screening of preschool children but despite these laws only 21\% as mentioned above are actually screened for vision problems. The authors feel this topic to be of particular importance as examining vision in 3-year olds allows intervention at a time when the problems are highly amenable to treatment. After evaluation of both old and new screening techniques they concluded that there is no validated, highly effective, efficient battery of tests for screening preschool children that is comparable to the MCT for school-aged children. They state that as yet, no large scale, scientifically controlled study has been done to compare screening methods conducted by lay persons with the results of comprehensive vision examinations. Furthermore research
is also needed to identify risk factors for vision problems in 3-year-olds as well as
determine what visual skills need assessment.

So despite the many laws currently in place in our states, the number of preschool
children screened remains inadequate. In addition, the screening methods being used are
not backed by scientific studies and may not actually be catching the visual problems
they are intended to prevent.

D. Legislation

Many states have been moving toward legislation that will require some form of
comprehensive vision examination (CVE) before children enter elementary school. As of
now, Kentucky and Wisconsin are the only states that have passed laws requiring
comprehensive vision exams for public schools (including preschools). Studies are being
conducted to summarize the results of these laws and what data is being found. Although
Kentucky and Wisconsin are the only states with laws requiring CVE’s, several others
have proposed such legislation. Sixteen states as of May 2003 have vision bills
pertaining to preschool examinations either enacted or in the legislation process (See
Table 1). This is twice the number of states compared to March of 2002. Along with the
momentum at the state level, the America Public Health Association passed a resolution
addressing this very issue at their 129th annual meeting in Atlanta in October of 2001
(See Appendix B).
E. Chronology of Legislation/Existence of children’s vision programs

On July 15, 2000 Kentucky became the first state to require comprehensive vision exams as a prerequisite for children entering into public schools. In a whirlwind of legislative efforts since that time, several states have passed bills pertaining to this issue. Wisconsin passed a similar bill in 2001 requiring children to have their eyes examined by an optometrist or ophthalmologist by December of their kindergarten year. Kansas passed an amendment to a current law to include a section of children’s vision that, among other things, requires screenings every two years, they also encourage children struggling with reading, writing, or mathematics to seek out services of either an ophthalmologist or optometrist.

Some states such as Arkansas are in the stages of studying the needs of school children to determine; 1) if vision screenings are effective, 2) if children are receiving adequate eye and vision care and correction of vision problems, 3) the effects of inadequate vision on academic performance, and 4) how to develop a plan to ensure adequate vision care of school age children. The Arkansas report is due back November of 2004 with similar studies having been conducted in Ohio, Pennsylvania, Virginia, and West Virginia and pending recommendation/legislation. Georgia also has a committee in the process of studying the issue of requiring eye, ear, and dental examination that was passed in 2002. Tennessee (2001) and Delaware (2002) both passed laws simply to inform parents of the health benefits of eye (and dental in Tennessee) care and encourage parents to have their children examined by an eyecare professional to prepare them for success in the classroom.
F. Results of current laws (Findings)

The first study on the results of requiring children to have comprehensive vision exams is that of Zaba, Johnson, and Reynolds. This study was done by surveying 43 of 334 members of the Kentucky Optometric Association and reviewing their clinical assessment of 5,316 children seen from July 15, 2000 to April 1, 2001 in 37 of 120 counties in Kentucky. This study reinforced the prevalence of eye and vision disorders mentioned above. Specifically, out of the data for 5,316 children given eye examinations, 13.92% were given spectacle lenses, 2.31% were diagnosed with strabismus, 3.40% were diagnosed with amblyopia, and 0.83% were diagnosed with ocular pathology.

It was concluded, that had Kentucky House Bill 706 not been enacted that these vision problems may have gone untreated and if so, these children would have been lacking the optimum vision required to perform well in the classroom. Another interesting conclusion of this study was that required examinations should not be restricted to children in any specific financial bracket as the number of spectacles prescribed, amblyopia, strabismus, and eye diseases diagnosed were independent of county income levels (found by comparing the five counties with highest average income versus the five counties with lowest average income).

Much more research may be conducted on the estimated 50,000 children who will be examined each year in Kentucky as a result of this new law as well as other laws being passed in several other states. In the mean time, this study alone gives ample evidence of the need and justification for laws of this nature.
II. Opposing Views:

As mentioned above several groups, including the American Academy of Ophthalmology and the American Academy of Pediatrics, have met the momentum toward required CVEs with strong opposition. Cicero once said, "there is no more sure tie between friends than when they are united in their objects and wishes." With the common public health objective of preventing unnecessary vision loss in children why the opposing views among us on this issue? After perusing the literature, the curriculum and training of the various professions, etc. there may be a difference in views resulting from background and also a discrepancy between the literature and the political statements of certain organizations.

A. Educational Backgrounds

The question that needs most to be answered is how can several groups have the exact same goal with such different views on the best way to accomplish it? The surest means to understand this discrepancy is to look at the education received by each group of professionals. Each type of doctor obviously receives a specialized training that allows them to serve their patients to the fullest of their ability. The three main professions of interest in this discussion are ophthalmology, pediatrics, and optometry.

Ophthalmology and Pediatrics obviously share the four-year medical school curriculum and the broad base of knowledge that accompanies it. Each of these fields requires a 3 year residency following the post graduate clinical year where the resident has been exposed to patient care in fields such as internal medicine, neurology, pediatrics, surgery, family practice, and emergency medicine.\textsuperscript{52}
Pediatric residents undergo rigorous requirements in their three years of training but in the area of sight and visual function the only requirement is that pediatric residents should be provided with “exposure” to vision screening (as stated in the American Medical Association’s Graduate Medical Education Directory or “Green Book”). This is the only place in the curricular requirements of a pediatric resident that the eyes or vision is mentioned and it is not an area residents are required to be proficient in or to have been trained.

Ophthalmology residents obviously have much more exposure to all components of the eyes and visual system than their pediatrician peers. Specifically, the American Board of Ophthalmology requires they be familiar with the anatomy, embryology, physiology, and pathology of abnormalities and diseases of all ocular and surrounding structures. It is also required that they be skilled in differential diagnosis and management of such conditions including surgical management and its accompanying risks. The ophthalmology board exams concentrate on developmental, dystrophic, degenerative, inflammatory, infectious, toxic, traumatic, neoplastic, and vascular diseases affecting the eye and surrounding structures.

Optometric education is more focused on the total visual system. While systemic disease, pharmacology, neurology, and ocular disease make up a large part of required curriculum the National Board of examiners in Optometry require knowledge of perceptual conditions, sensory integrative conditions, and problems with accommodation and vergence as well.

As usual, the disagreement on children’s vision legislation appears to stem from a logical source. Professionals are educated to perform to the highest standard of their
particular medical specialty. Whereas a pediatrician is responsible for the physical, emotional, and social health of children from birth to young adulthood which may encompass a vastly wide array of responsibilities, the training is aimed at such a large skill set that the eyes and vision do not gain much mention in the curriculum. An ophthalmologist begins their in depth training of the orbital structures and management of visual conditions “on the job” in a hospital setting during their 3 year residency most of which is very focused on numerous abnormalities and disease processes as well as mastering the surgical skills required to treat cataract, strabismus, cornea, glaucoma, retina/vitreous, oculoplastic, and trauma (including laser surgery). It is reasonable that they turn out very skilled disease/surgery minded clinicians. The difference presented by optometric education is the didactic curriculum, including labs, that students attend the first 3 years. These lectures include education on more functional vision problems such as accommodative or vergence type dysfunctions as well as the importance of perception and the interaction of the senses.

Doctors study very diligently to learn what they are expected to and practice healthcare the way in which they are trained. It is only reasonable that the training of an ophthalmologist is different from that of an optometrist or pediatrician. The disagreement of how best to detect and prevent vision loss in children follows from this difference in training and what each doctor is taught to believe is important with respect to children’s vision. Whereas optometry regards the functional aspect of vision (comfortable, efficient vision) of high importance and its studies have shown it to be linked with reading skill and school performance, ophthalmology and pediatricians are not trained to believe this area is of importance and thus feel screenings are ideal to detect
ametropias and ocular health problems. Following are the various recommendations that arise from these several different areas of medicine.

B. Ophthalmology

The American Academy of Ophthalmology and American Association for Pediatric Ophthalmology and Strabismus (AAPOS) joint policy (which is also supported by the American Academy of Pediatrics and American Academy of Family Physicians) recommends screening for potentially vision-threatening conditions at specific times in a child’s life, and referral to an ophthalmologist for further evaluation for the few who show signs of serious problems. (See Appendix C) Specifically, in their Vision Screening for Infants and children policy statement, the AAO and AAPOS state that by using an acuity chart (the statement did not specify as to whether it referred to distance or near acuity chart) conditions including reduced vision in one or both eyes from amblyopia, uncorrected refractive errors or other eye defects and, in most cases, misalignment of the eyes (strabismus) can be detected. Their recommendations for screening include a newborn eye examination for general eye health including a red reflex test, an ocular health screening for infants 6-12 months including a red reflex test, vision screening between 3 and 3 ½ years of age to assess vision and alignment, and further screening at routine school checks or upon appearance of symptoms. They further state that CVE’s of normal asymptomatic children has no proven medical benefit and that there is not adequate scientific evidence to suggest that defective eye teaming and accommodative disorders are common causes of educational impairment and do not recommend screening for these conditions be done. The Academy and others are working to frame policy at the federal and state levels that would increase both the
number and effectiveness of screening programs. In reference to the legislation for
required CVE’s, Academy Executive Vice President H. Dunbar Hoskins Jr., M.D. said
"While these compulsory exams may seem appealing on the surface, a closer look
demonstrates that they are a poor use of scarce health care dollars – and with fewer
children getting the care they need.” The American Academy of Ophthalmology says
they will continue the fight to ensure “appropriate” eye care for children. This is where
the disagreement lies: What exactly is appropriate eye care for children?

Another point of interest, is that despite ophthalmology’s current views on vision and
learning, this has not always been the case. Perusal of the ophthalmological literature
reveals several MD’s who researched the effect of vision problems on learning and
school achievement and concluded that the two are linked. Eames in fact did several
studies beginning in the 1940’s and found that convergent strabismus and fusion
deficiency were both more frequent among the poor readers\(^25\) and concluded that, “the
general impression that reading failures should have complete eye examinations to
disclose possible eye handicaps is supported.”\(^26\)

B. Pediatrics

The American Academy of Pediatrics (AAP) Section on Ophthalmology has said that
the legislation that has been proposed to require school children to receive comprehensive
vision exams prior to school entry differs significantly from AAP guidelines on vision
screening. In their policy statement, “Eye Examination and Vision Screening in Infants,
Children, and Young Adults” (Appendix D), they state that vision screening and eye

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examination are vital for the detection of conditions that distort or suppress the normal visual image, which may lead to inadequate school performance, or at worst, blindness in children. Conditions that interfere with vision are of extreme importance, because visual stimuli are critical to the development of normal vision. Normal visual development requires the brain to receive equally clear, focused images from both eyes simultaneously for visual pathways to develop properly. As far as timing of examination and screening they say children should have age-appropriate assessments for eye problems in the newborn period at all subsequent health supervision visits and all infants should be examined by 6 months of age to evaluate fixation, preference, ocular alignment, and the presence of any eye disease. They state that infants should be checked until 3 or 4 years of age when visual acuity in children can be evaluated more easily and formal vision screenings should begin at 3 years of age.

The elements of eye evaluation listed are: 1) Eyelids and orbits, 2) External examination, 3) Motility, 4) Eye muscle balance, 5) Pupils, 6) Red reflex, 7) Vision testing starting at 3 years of age, and 8) Ophthalmoscopy with very cooperative 4 year olds. They also state that vision screening is one of the most sensitive techniques for the detection of eye abnormalities in children. There is no mention in the AAP policy statement of refractive problems as this is typically outside the scope of practice for pediatricians.

C. Optometry

The American Optometric Association believes that an eye/vision assessment conducted as part of a physical or screening in schools cannot substitute for regular
professional care. Optometry, as a whole, feels vision screening is a limited process of surveying certain aspects of vision problem areas and that a vision examination by an eyecare professional is essential for the diagnosis and treatment of eye and vision problems prior to entry into school. Vision screenings are not diagnostic nor do they lead to treatment, but rather only indicate a potential need for further care. In a very real sense, screenings give a false sense of security to parents and teachers who get the impression that the child who passes the screening has no vision problem.

The American Optometric Association recommends children have examinations by 6 months of age, at 3 years of age, before first grade, and every two years thereafter. The scope of the examination recommended even at the infant to toddler ages includes patient history, visual acuity, refraction (utilizing retinoscopy or photorefractive screening), ocular motility/binocular vision, ocular health and systemic health screening. It is very clinically possible to complete a full vision exam on a 6 month old utilizing age appropriate techniques and mainly objective data.

As stated in the practice guideline for pediatric eye and vision examination, the AOA feels studies have shown screenings are less accurate for preschool children than for older children and full eye examination at 3 years of age continues to be the most effective approach to prevention or early detection of eye and vision problems in the preschool child.

D. Public Health

At its 129th Annual Meeting, the American Public Health Association (APHA) passed a resolution and Public Policy Statement entitled “Improving Early Childhood Eyecare”
in an attempt to improve early childhood eye care. This resolution states the prevalence of strabismus as 6.7% in children under five, anisometropia as 1%, and clinically significant farsightedness as 3-6%. Clinically significant hyperopia causes almost half of all cases of esotropia and over 90% of cases of anisometropia, and these and strabismus are responsible for nearly all amblyopia, the leading visual impairment in children with a prevalence of up to 4.5%. The resolution stated that the majority of eye and vision conditions in infancy and preschool ages are not obvious on gross examination and go undetected until children can read standard letter acuity charts around age five. The resolution also notes that decreased binocular vision and depth perception can lead to problems in gross motor and fine motor development, and that uncorrected hyperopia is associated with deficits in visual perceptual skills, reading readiness, intelligence quotient, and reading achievement, and correction of hyperopia by age 4 improves the expected reading achievement later in school. The APHA believes infant and early childhood eyecare is a neglected area in public health and medicine as less than half of pediatricians routinely perform vision screenings. Moreover, pediatric screening when performed is usually limited to a light reflex test which will not detect most strabismus, hyperopia, or anisometropia. In addition to this, they note that vision screening programs in existence have low sensitivity and specificity for the above conditions. The resolution makes an interesting point: Several organizations including the American Academy of Pediatrics, the American Academy of Ophthalmology, The American Association for Pediatric Ophthalmology and Strabismus, the American Optometric Association, the U.S. Public Health Service, and Prevent Blindness America all agree that screening is not
successful in children under age 3 but there is ample evidence that amblyogenic conditions should be detected and treated as early as possible.

The APHA resolution encourages: 1) CVE’s performed at approximately 6 months, 2 years, and 4 years, 2) health insurers to educate parents on the importance of these vision exams, 3) pediatricians to recommend all children receive exams and refer all children at high risk, and 4) children’s health programs require monitoring in their quality assurance programs to ensure eye and vision needs are met.

In addition to passing the Early Childhood Eyecare resolution, there has been a proposal for a joint collaborative project for the AOA and APHA for a Task Force to produce a national plan to reduce uncorrected vision impairments of infants and children using all available resources.

E. Education

In the education arena, the National Parent Teachers Association (PTA) adopted a resolution in June of 1999 entitled, “Learning Related Vision Problems Education and Evaluation”. (See Appendix E) The resolution stated that it has been estimated that more than 10 million children (ages 0 to 10) suffer from vision problems and as visual skills are necessary for successful learning in our modern classrooms deficiencies may lead to poor school achievement. They also stated that typical vision screenings that only test a subset of visual functions leave most visual skill deficiencies undiagnosed. Also mentioned is the fact that learning related vision problems, when accurately diagnosed, are treated very successfully and permanently. Finally the resolution states students,
parents, teachers, administrators, and public health officials are not widely aware of the relationship of poorly developed visual skills and poor academic performance.

The PTA resolved to provide education about the above issues and through its constituent organizations to urge schools to perform vision screenings that will test for learning related visual skills that influence success in the classroom.22

III. Cost Effectiveness:

A. Cost of Implementation

Long-term benefits of the proposed laws would much outweigh the initial hurdle of cost. Actually, the states which have vision laws in place have found ways to generate money (such as tobacco settlement monies and voluntary one dollar donations on license renewal), Kentucky has not even needed much of the money they set aside for this purpose.

B. Cost to society of undetected problems

One may make a case that children who struggle in school may be more prone to juvenile delinquency. The Seattle Social Development Project found that a lack of success in elementary school was linked to later gang membership.44 And from another angle there is evidence that even in the midst of multiple other factors placing youth at high risk for delinquency, school success appears to be a protective factor against delinquency!45 The High/Scope Perry Preschool study found that increased school readiness results in positive reinforcement from teachers followed by enhanced academic performance in later grades and an overall stronger commitment to school.45 The same study revealed a strong association between school motivation in early grades and
literacy scores at age 19. School motivation was also highly correlated with the highest year of schooling completed which is in turn associated with higher monthly earnings in adulthood and fewer lifetime arrests.

The case has also been made that children who have certain vision problems will tend to do poorly in school. It is then with circular logic, that one may also finally conclude that having certain vision problems that may decrease school success can predispose a child to juvenile delinquency. A visual problem puts a child at risk for a reading problem, which puts a child at risk for a learning problem. This leads to school failure, which then sets the stage for anti-social behavior.

The price of juvenile delinquency and predelinquent behavior is high in both monetary and social terms. In 1987 the average cost of care for an incarcerated juvenile for one year was an estimated $40,000 and another $200 million is spent annually by taxpayers to repair schools that are vandalized. But putting money aside, there are many costs that are difficult to quantify, such as the creation of a poor learning environment for classmates, reduced quality of life for victims and those living in high crime areas, reduced earning potential for incarcerated juvenile, the danger that siblings will model delinquent behavior, and emotional stress on the family members of both victims and perpetrators.

Ziggler, Taussig, and Black state that the most effective early intervention projects have taken a multipronged approach to preventing school failure in at-risk populations. They included non-educational supports such as providing health care and involving parents in a program that offered them specific services. Depending on the needs of the children, early intervention must be viewed as a combination of preventive,
compensatory, and preparatory efforts. Birch and Gussow state that to recognize the present-day realities is to recognize that planning must provide for interventions to break the cycle of poverty, poor health, and educational failure. Juvenile delinquency may be one of the costs to society of undiagnosed vision deficits and while the complexity of juvenile delinquency requires multiple strategies that address the problem at various stages of development, early childhood intervention has been shown by several studies to be very protective.

C. Analysis of Benefit/Cost

One major benefit in such a cost/benefit analysis pertains to our country’s juvenile delinquents. A recent study says, “Twenty-five to 35 percent of adolescents will have committed a legal offense by the age of 19,” and it has been shown that a significantly high number of these juvenile delinquents have visual dysfunctions. Some studies even suggest that visual dysfunctions put youth at risk for deviant behavior. The proponents for pre-school vision exams aim to intercept these children at a young age, help them to achieve adequate vision, thereby preventing vision from acting as a risk factor for learning delays. Thus these children’s chance at excelling in the school environment and among their peers is much greater. They might not only avoid time in our school’s special education classes and our state detention facilities but also might be more able to contribute in a positive manner to our society as adults.

For a more comprehensive economic evaluation of CVE’s, further studies would need to analyze the costs and effectiveness of treatment, the cost of the disability caused by visual deficits, and the cost in health-related quality of life. Although not specifically
referring to vision, the High/Scope Perry Preschool study gives good insights into cost effectiveness of more generalized early intervention.45

IV. Conclusion:

Think of an infant learning the contours of its parents faces, learning its first color, then the alphabet, and finally putting those letters together to form their first word and ultimately learning to read. A fully functioning visual system is necessary for this process to occur. The laws that have been proposed/passed aim to detect vision-related conditions that might hinder the children throughout their academic years. We in the healthcare arena must take responsibility, as children typically are unable to verbally express that something is wrong with their vision even if they sense the problem. The goals of requiring comprehensive exams include greatly lowering the number of vision-related learning disabilities and increasing the possibilities that lie ahead of this country’s children.

The status quo, meaning screenings conducted by pediatricians, school nurses, teachers, and even eye care practitioners has been shown by many studies to be lacking in its ability to detect the visual problems that most commonly cause learning deficits (as mentioned above). The current recommendation of the American Optometric Association is that children have their first full examination at 6 months of age, the second at two to three years, and the third prior to first grade.20 As both the brain and vision develop at a very rapid rate in the first five years, assessment having maximum sensitivity and specificity is crucial to detect vision difficulties and minimize their negative impacts before children enter an atmosphere in which they may be labeled and risk a decrease in self-esteem which can have long-lasting effects into adulthood. After
all, many would agree with Erasmus, "The main hope of a nation lies in the proper
education of its youth."

The success of an individual in today’s society depends heavily on their ability to
take in information quickly and efficiently and learn in a highly visual environment. We
have the capabilities to screen for visual “road-blocks” that lie in the way of a fruitful
education, we can also create a protocol for a nationally required comprehensive vision
exam as a necessary step in our common goal to provide the patient with the best vision
care possible.

The ultimate goal of healthcare is to address the public’s needs. As professionals,
might we best achieve this goal by sharing our strengths and knowledge instead of
maintaining separate fronts? Ashley Montague said “The more cooperative the group,
the greater is the fitness for survival which extends to all of its members.”
References

45. Wilson, J. The High/Scope Perry Preschool Project. U.S. Department of Justice???
<table>
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<tr>
<th>State</th>
<th>CVE Law</th>
<th>Law to encourage CVE in schools/ to parents</th>
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Appendix A
Learning Disabilities, Dyslexia, and Vision: A Subject Review (RE9825)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Children With Disabilities, American Academy of Pediatrics (AAP) and American Academy of Ophthalmology (AAO), American Association for Pediatric Ophthalmology and Strabismus (AAPOS)

Learning disabilities are common conditions in pediatric patients. The etiology of these difficulties is multifactorial, reflecting genetic influences and abnormalities of brain structure and function. Early recognition and referral to qualified educational professionals is critical for the best possible outcome. Visual problems are rarely responsible for learning difficulties. No scientific evidence exists for the efficacy of eye exercises ("vision therapy") or the use of special tinted lenses in the remediation of these complex pediatric developmental and neurologic conditions.

BACKGROUND

Learning disabilities have become an increasing personal and public concern. Among the spectrum of issues of concern in learning disabilities, the inability to read and comprehend is a major obstacle to learning and may have long-term educational, social, and economic implications. Family concern for the welfare of children with dyslexia and learning disabilities has led to a proliferation of diagnostic and remedial treatment procedures, many of which are controversial or without clear scientific evidence of efficacy. Many educators, psychologists, and medical specialists concur that individuals who have learning disabilities should: 1) receive early comprehensive educational, psychological, and medical assessment; 2) receive educational remediation combined with appropriate psychological and medical treatment; and 3) avoid remedies involving eye exercises, filters, tinted lenses, or other optical devices that have no known scientific proof of efficacy.

EVALUATION AND MANAGEMENT

Reading involves the integration of multiple factors related to an individual’s experience, ability, and neurologic functioning. Research has shown that the majority of children and adults with reading difficulties experience a variety of problems with language that stem from altered brain function and that such difficulties are not caused by altered visual function. In addition, a variety of secondary emotional and environmental factors may have a detrimental effect on the learning process in such children.

Sometimes children may also have treatable visual difficulty along with their primary reading or learning dysfunction. Routine vision screening examinations can identify most of those who have reduced visual acuity. Pediatricians and other primary care physicians whose pediatric patients cannot pass vision screening according to national standards should refer these patients to an ophthalmologist who has experience in the care of children.
Role of the Eyes
Decoding of retinal images occurs in the brain after visual signals are transmitted from the eye via the visual pathways. Some vision care practitioners incorrectly attribute reading difficulties to one or more subtle ocular or visual abnormalities. Although the eyes are obviously necessary for vision, the brain performs the complex function of interpreting visual images. Currently, no scientific evidence supports the view that correction of subtle visual defects can alter the brain's processing of visual stimuli. Statistically, children with dyslexia or related learning disabilities have the same ocular health as children without such conditions.10-12

Controversies
Eye defects, subtle or severe, do not cause the patient to experience reversal of letters, words, or numbers. No scientific evidence supports claims that the academic abilities of children with learning disabilities can be improved with treatments that are based on 1) visual training, including muscle exercises, ocular pursuit, tracking exercises, or "training" glasses (with or without bifocals or prisms),13-15 2) neurologic organizational training (laterality training, crawling, balance board, perceptual training),16-18 or 3) colored lenses.18-20 These more controversial methods of treatment may give parents and teachers a false sense of security that a child's reading difficulties are being addressed, which may delay proper instruction or remediation. The expense of these methods is unwarranted, and they cannot be substituted for appropriate educational measures. Claims of improved reading and learning after visual training, neurologic organization training, or use of colored lenses, are almost always based on poorly controlled studies that typically rely on anecdotal information. These methods are without scientific validation.21 Their reported benefits can be explained by the traditional educational remedial techniques with which they are usually combined.

Early Detection
Pediatricians, other primary care physicians, and educational specialists may use screening techniques to detect learning disabilities in preschool-aged children, but in many cases, the learning disability is discovered after the child experiences academic difficulties. Learning disabilities can include dyslexia, problems with memory and language, and difficulty with mathematic computation. These difficulties are often complicated by attention deficit disorders. A family history of learning disabilities is common in such conditions. Children who are considered to be at risk for or suspected of having these conditions by their physician should be evaluated for more detailed study by educational and/or psychological specialists.

Role of the Physician
Ocular defects in young children should be identified as early as possible, and when they are correctable, they should be managed by an ophthalmologist who is experienced in the care of children.22 Treatable ocular conditions among others include refractive errors, focusing deficiencies, eye muscle imbalances, and motor fusion deficiencies. When children have learning problems that are suspected to be associated with visual defects, the ophthalmologist may be consulted by the primary care pediatrician. If no ocular defect is found, the child needs no further vision care or treatment and should be referred...
for medical and appropriate special educational evaluation and services. Pediatricians have an important role in coordination of care between the family and other health care services provided by ophthalmologists, optometrists, and other health care professionals who may become involved in the treatment plan.

**Multidisciplinary Approach**
The management of a child who has learning disabilities requires a multidisciplinary approach for diagnosis and treatment that involves educators, psychologists, and physicians. Basic scientific and clinical research into the role of the brain's structure and function in learning disabilities has demonstrated a neural basis of dyslexia and other specific learning disabilities and not the result of an ocular disorder alone.4,6

**The Role of Education**
The teaching of children, adolescents, and adults with dyslexia and learning disabilities is a challenge for educators. Skilled educators use standardized educational diagnostic evaluations and professional judgment to design and monitor individualized remedial programs. Psychologists may help with educational diagnosis and classification. Physicians, including pediatricians, otolaryngologists, neurologists, ophthalmologists, mental health professionals and other appropriate medical specialists, may assist in treating the health problems of these patients. Because remediation may be more effective during the early years, prompt diagnosis is paramount.20,21 Educators with specialty training in learning disabilities play a key role in providing help for the learning disabled or dyslexic child or adult.

**RECOMMENDATIONS**

1. For all children, clinicians should perform vision screening according to national standards.8,9
2. Any child who cannot pass the recommended vision screening test should be referred to an ophthalmologist who has experience in the care of children.
3. Children with educational problems and normal vision screening should be referred for educational diagnostic evaluation and appropriate special educational evaluation and services.
4. Diagnostic and treatment approaches that lack objective, scientifically-established efficacy should not be used.

**SUMMARY**

Reading difficulties and learning disabilities are complex problems that have no simple solutions. The American Academy of Pediatrics and the American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus strongly support the need for early diagnosis and educational remediation. There is no known visual cause for these learning disabilities and no known effective visual treatment.23,24 Recommendations for multidisciplinary evaluation and management must be based on evidence of proven effectiveness demonstrated by objective scientific
It is important that any therapy for learning disabilities be scientifically established to be valid before it can be recommended for treatment.

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Appendix B
Appendix C
Policy Statement: Vision Screening for Infants and Children

Policy
The American Academy of Ophthalmology and the American Association for Pediatric Ophthalmology and Strabismus recommend timely screening for the early detection and treatment of eye and vision problems in America's children. This includes institution of rigorous vision screening during the preschool years. Early detection of treatable eye disease in infancy and childhood can have far reaching implications for vision and, in some cases, for general health.

Background
Good vision is essential for proper physical development and educational progress in growing children. The visual system in the young child is not fully mature. Equal input from both eyes is required for proper development of the visual centers in the brain. If a growing child's eye does not provide a clear focused image to the developing brain, then permanent irreversible loss of vision may result. Early detection provides the best opportunity for effective, inexpensive treatment. The American Association for Pediatric Ophthalmology and Strabismus, the American Academy of Ophthalmology, the American Academy of Pediatrics, the American Academy of Family Physicians and the American Association of Certified Orthoptists recommend early vision screening.

Vision screening programs should provide widespread, effective testing of preschool and early school-age children.

Many school systems have regular vision screening programs that are carried out by volunteer professionals, school nurses, and/or properly trained lay persons. Screening can be done quickly, accurately, and with minimum expense by one of these individuals. The screener should not have a vested interest in the screening outcome. As with all screening programs, vision screening should be performed in a fashion that maximizes the rate of problem detection while minimizing unnecessary referrals and cost. Beginning in the preschool years, those conditions which can be detected by vision screening using an acuity chart are: reduced vision in one or both eyes from amblyopia, uncorrected refractive errors or other eye defects and, in most cases, misalignment of the eyes (called strabismus).

**Amblyopia** is poor vision in an otherwise normal appearing eye, which occurs when the brain does not recognize the sight from that eye. Two common causes are strabismus (misaligned eyes) and a difference in the refractive error (need for glasses) between the two eyes. If untreated, amblyopia can cause irreversible visual loss. The best time for treatment is in the preschool years. Improvement of vision after the child is 8 or 9 years of age is rarely achieved.

**Strabismus** is misalignment of the eyes in any direction. Amblyopia may develop when the eyes do not align. If early detection of amblyopia secondary to strabismus is followed by effective treatment, then excellent vision may be restored. The eyes can be aligned in some cases with glasses and in others with surgery. However, restoration of good
alignment does not assure elimination of amblyopia.

**Refractive errors** cause decreased vision, visual discomfort ("eye strain"), and/or amblyopia. The most common form, nearsightedness (poor distance vision) is usually seen in school-age children and is treated effectively, in most cases, with glasses. Farsightedness can cause problems with focusing at near and may be treated with glasses. Astigmatism (imperfect curvature of the front surfaces of the eye) also requires corrective lenses if it produces blurred vision or discomfort. Uncorrected refractive errors can cause amblyopia particularly if they are severe or are different between the two eyes.

In addition to detection of vision problems, effective screening programs should also place emphasis on a mechanism to inform parents of screening failures and attempt to ensure that proper follow-up care is received.

**Recommendations**
The American Academy of Ophthalmology and the American Association for Pediatric Ophthalmology and Strabismus recommend an ophthalmological examination be performed whenever questions arise about the health of the visual system of a child of any age. They recommend that infants and children be screened for vision problems as follows and any child who does not pass these screening tests have an ophthalmological examination.

1. A pediatrician, family physician, nurse practitioner, or physician assistant should examine a newborn’s eyes for general eye health including a red reflex test in the nursery. An ophthalmologist should be asked to examine all high risk infants, i.e., those at risk to develop retinopathy of prematurity (ROP), those with a family history of retinoblastoma, glaucoma, or cataracts in childhood, retinal dystrophy/degeneration or systemic diseases associated with eye problems, or when any opacity of the ocular media or nystagmus (purposeless rhythmic movement of the eyes) is seen. Infants with neuro-developmental delay should also be examined by an ophthalmologist.

2. All infants by six months to one year of age should be screened for ocular health including a red reflex test by a properly trained health care provider such as an ophthalmologist, pediatrician, family physician, nurse, or physician assistant during routine well-baby follow-up visits.

3. Vision screening should also be performed between 3 and 3 1/2 years of age. Vision and alignment should be assessed by a pediatrician, family practitioner, ophthalmologist, optometrist, orthoptist, or individual trained in vision assessment of preschool children. Emphasis should be placed on checking visual acuity as soon as a child is cooperative enough to complete the examination. Generally, this occurs between ages 2 1/2 to 3 1/2. It is essential that a formal
testing of visual acuity be performed by the age of 5 years.

4. Some evidence currently exists to suggest that photoscreening may be a valuable adjunct to the traditional screening process, particularly in pre-literate children.

5. Further screening examinations should be done at routine school checks or after the appearance of symptoms. Routine comprehensive professional eye examination of the normal asymptomatic child has no proven medical benefit.

6. School aged children who pass standard vision screening tests but who demonstrate difficulties learning to read, should be referred to reading specialists such as educational psychologists for evaluation for language processing disorders such as dyslexia. There is not adequate scientific evidence to suggest that "defective eye teaming", and "accommodative disorders" are common causes of educational impairment. Hence, routine screening for these conditions is not recommended.

Many serious ocular conditions, which can be found at screening are treatable, if identified in the preschool and early school-aged years. Many of these conditions are associated with a positive family history. Additional screening emphasis should, therefore, be directed to high risk infants and children with a low threshold for obtaining a comprehensive eye examination by an ophthalmologist.

Revised and Approved by American Association for Pediatric Ophthalmology and Strabismus, May 1991
American Academy of Ophthalmology, Board of Trustees, June 1991

Revised and Approved by American Association for Pediatric Ophthalmology and Strabismus, September 1996 & American Academy of Ophthalmology Board of Trustees, September 1996

Revised and Approved by American Association for Pediatric Ophthalmology and Strabismus, August 2001 & American Academy of Ophthalmology Board of Trustees, October 2001
Eye Examination in Infants, Children, and Young Adults by Pediatricians

AMERICAN ACADEMY OF PEDIATRICS

Committee on Practice and Ambulatory Medicine and Section on Ophthalmology

AMERICAN ASSOCIATION OF CERTIFIED ORTHOPTISTS

AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS

AMERICAN ACADEMY OF OPHTHALMOLOGY

Policy Statement

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

ABSTRACT. Early detection and prompt treatment of ocular disorders in children is important to avoid lifelong visual impairment. Examination of the eyes should be performed beginning in the newborn period and at all well-child visits. Newborns should be examined for ocular structural abnormalities, such as cataract, corneal opacity, and ptosis, which are known to result in visual problems. Vision assessment beginning at birth has been endorsed by the American Academy of Pediatrics, the American Association for Pediatric Ophthalmology and Strabismus, and the American Academy of Ophthalmology. All children who are found to have an ocular abnormality or who fail vision assessment should be referred to a pediatric ophthalmologist or an eye care specialist appropriately trained to treat pediatric patients.

INTRODUCTION

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 at worst, threaten the child's life. Through careful evaluation of the ocular system, retinal abnormalities, cataracts, glaucoma, retinoblastoma, strabismus, and neurologic disorders can be identified, and prompt treatment of these conditions can save a child's vision or even life. Examination of the eyes should be performed beginning in the newborn period and at all well-child visits. Visual acuity measurement should be performed at the earliest possible age that is practical (usually at approximately 3 years of age). Early detection and prompt treatment of ocular disorders in children is important to avoid lifelong permanent visual impairment.

TIMING OF EXAMINATION AND SCREENING

Children should have an assessment for eye problems in the newborn period and then at all subsequent routine health supervision visits. These should be age-appropriate evaluations as described in subsequent sections. Infants and children at high risk of eye problems should be referred for specialized eye examination by an ophthalmologist experienced in treating children. This includes children who are very
premature; those with family histories of congenital cataracts, retinoblastoma, and metabolic or genetic
diseases; those who have significant developmental delay or neurologic difficulties; and those with
systemic disease associated with eye abnormalities. Because children do not complain of visual difficulties,
visual acuity measurement (vision screening) is an important part of complete pediatric eye care and should
begin at 3 years of age. To achieve the most accurate testing possible, the most sophisticated test that the
child is capable of performing should be used (Table 1).1,2 The frequency of examinations recommended is
in accordance with the American Academy of Pediatrics "Recommendations for Preventive Pediatric
Health Care." Any child unable to be tested after 2 attempts or in whom an abnormality is suspected or
detected should be referred for an initial eye evaluation by an ophthalmologist experienced in the care of
children.

PROCEDURES FOR EYE EVALUATION

Eye evaluation in the physician's office should include the following:

**Birth to 3 Years of Age**

1. Ocular history
2. Vision assessment
3. External inspection of the eyes and lids
4. Ocular motility assessment
5. Pupil examination
6. Red reflex examination

**3 Years and Older**

1 through 6, plus:

7. Age-appropriate visual acuity measurement
8. Attempt at ophthalmoscopy

**Ocular History**

Parents' observations are valuable. Questions that can be asked include:

- Does your child seem to see well?
- Does your child hold objects close to his or her face when trying to focus?
- Do your child's eyes appear straight or do they seem to cross or drift or seem lazy?
- Do your child's eyes appear unusual?
- Do your child's eyelids droop or does 1 eyelid tend to close?
- Have your child's eye(s) ever been injured?

Relevant family histories regarding eye disorders or preschool or early childhood use of glasses in parents
or siblings should be explored.

**Vision Assessment**

**Age 0 to 3 Years**

Vision assessment in children younger than 3 years or any nonverbal child is accomplished by evaluating
the child's ability to fix and follow objects.3,4 A standard assessment strategy is to determine whether each
eye can fixate on an object, maintain fixation, and then follow the object into various gaze positions.
Failure to perform these maneuvers indicates significant visual impairment. The assessment should be
performed binocularly and then monocularly. If poor fix and following is noted binocularly after 3 months
of age, a significant bilateral eye or brain abnormality is suspected, and referral for more formal vision assessment is advisable. It is important to ensure that the child is awake and alert, because disinterest or poor cooperation can mimic a poor vision response.

**Visual Acuity Measurement or Vision Screening (Older Than 3 Years)**

Various tests are available to the pediatrician for measuring visual acuity in older children. Different picture tests, such as LH symbols (LEA symbols) and Allen cards, can be used for children 2 to 4 years of age. Tests for children older than 4 years include wall charts containing Snellen letters, Snellen numbers, the tumbling E test, and the HOTV test (a letter-matching test involving these 4 letters). A study of 102 pediatric practices revealed that 53% use vision testing machines. Because testing with these machines can be difficult for younger children (3-4 years of age), pediatricians should have picture cards and wall charts available.

**Photoscreening**

Using this technique, a photograph is produced by a calibrated camera under prescribed lighting conditions, which shows a red reflex in both pupils. A trained observer can identify ocular abnormalities by recognizing characteristic changes in the photographed pupillary reflex. When performed properly, the technique is fast, efficient, reproducible, and highly reliable. Photoscreening is not a substitute for accurate visual acuity measurement but can provide significant information about the presence of sight-threatening conditions, such as strabismus, refractive errors, media opacities (cataract), and retinal abnormalities (retinoblastoma). Photoscreening techniques are still evolving. (For further information, see also the American Academy of Pediatrics policy statement, "Use of Photoscreening for Children's Vision Screening."

**External Examination (Lids/Orbit/Cornea/Iris)**

External examination of the eye consists of a penlight evaluation of the lids, conjunctiva, sclera, cornea, and iris. Persistent discharge or tearing may be attributable to ocular infection, allergy, or glaucoma, but the most common cause is lacrimal duct obstruction. It often manifests during the first 3 months as persistent purulent discharge out of 1 or both eyes. Topical or oral antibiotics should be given, and lacrimal sac massage should be attempted. Because these same findings are often seen in congenital glaucoma, failure to promptly resolve after treatment or the presence of cloudy or asymmetrically enlarged corneas should prompt ophthalmologic referral for additional evaluation.

Unilateral ptosis can cause amblyopia by inducing astigmatism, even if the pupil is not occluded. Patients with this condition require ophthalmic evaluation. Bilateral ptosis may be associated with significant neurologic disease, such as myasthenia. Additional investigation by a child neurologist and pediatric ophthalmologist is warranted.

**Ocular Motility**

The assessment of ocular alignment in the preschool and early school-aged child is of considerable importance. The development of strabismus in children may occur at any age and can represent serious orbital, intraocular, or intracranial disease. The corneal reflex test, cross cover test, and random dot E stereo test are useful in differentiating true strabismus from pseudostrabismus (see Appendix 1). The most common cause of pseudostrabismus is prominent epicanthal lid folds that cover the medial portion of the sclera on both eyes, giving the impression of crossed eyes (esotropia). Detection of an eye muscle imbalance or inability to differentiate strabismus from pseudostrabismus necessitates a referral.
Pupils

The pupils should be equal, round, and reactive to light in both eyes. Slow or poorly reactive pupils may indicate significant retinal or optic nerve dysfunction. Asymmetry of pupil size, with 1 pupil larger than the other, can be attributable to a sympathetic disorder (Horner syndrome) or a parasympathetic abnormality (third nerve palsy, Adie syndrome). Small differences can occur normally and should be noted in the chart for reference in case of subsequent head injury. Larger pupil asymmetries (>1 mm) can be attributable to serious neurologic disorders and need additional investigation.

Red Reflex Test (Monocular and Binocular, Bruckner Test)

The red reflex test can be used to detect opacities in the visual axis, such as a cataract or corneal abnormality, and abnormalities of the back of the eye, such as retinoblastoma or retinal detachment. When both eyes are viewed simultaneously, potentially amblyogenic conditions, such as asymmetric refractive errors and strabismus, also can be identified. The test should be performed in a darkened room (to maximize pupil dilation). The direct ophthalmoscope is focused on each pupil individually approximately 12 to 18 inches away from the eye, and then both eyes are viewed simultaneously at approximately 3 feet away. The red reflex seen in each eye individually should be bright reddish-yellow (or light gray in darkly pigmented, brown-eyed patients) and identical in both eyes. Dark spots in the red reflex, a blunted dull red reflex, lack of a red reflex, or presence of a white reflex are all indications for referral. After assessing each eye separately, the eyes are viewed together with the child focusing on the ophthalmoscope light (Bruckner test, see Appendix 1). As before, any asymmetry in color, brightness, or size is an indication for referral, because asymmetry may indicate an amblyogenic condition.

Visual Acuity Measurement (Vision Screening)

Visual acuity testing is recommended for all children starting at 3 years of age. In the event that the child is unable to cooperate for vision testing, a second attempt should be made 4 to 6 months later. For children 4 years and older, the second attempt should be made in 1 month. Children who cannot be tested after repeated attempts should be referred to an ophthalmologist experienced in the care of children for an eye evaluation. Appendix 1 provides a detailed explanation of the techniques available for visual acuity measurement in children.

Ophthalmoscopy

Ophthalmoscopy may be possible in very cooperative 3- to 4-year-olds who are willing to fixate on a toy while the ophthalmoscope is used to evaluate the optic nerve and retinal vasculature in the posterior pole of the eye.

RECOMMENDATIONS

1. All pediatricians and other providers of health care to children should be familiar with the joint eye examination guidelines of the American Association for Pediatric Ophthalmology and Strabismus, the American Academy of Ophthalmology, and the American Academy of Pediatrics.
2. Every effort should be made to ensure that eye examinations are performed using appropriate testing conditions, instruments, and techniques.
3. Newborns should be evaluated for ocular structural abnormalities, such as cataract, corneal opacities, and ptosis, which are known to result in vision problems, and all children should have their eyes examined on a regular basis.
4. The results of vision assessments, visual acuity measurements, and eye evaluations, along with instructions for follow-up care, should be clearly communicated to parents.
5. All children who are found to have an ocular abnormality or who fail vision screening should be referred to a pediatric ophthalmologist or an eye care specialist appropriately trained to treat pediatric patients.
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APPENDIX 1. TESTING PROCEDURES FOR ASSESSING VISUAL ACUITY

The child should be comfortable and in good health at the time of the examination. It is often convenient to have younger children sit on a parent's lap. If possible, some preparation before the actual testing situation is helpful, and parents can assist by demonstrating the anticipated testing procedures for their child. Children who have eyeglasses generally should have their vision tested while wearing the eyeglasses. Eyeglasses prescribed for use only while reading should not be worn when distance acuity is being tested.

Consideration must be given to obtaining good occlusion of the untested eye; cardboard and paddle occluders have been found inadequate for covering the eye because they allow "peeking." Commercially available occluder patches provide complete occlusion necessary for appropriate testing. Vision testing should be performed at 10 feet (except Allen cards) and in a well-lit area. When ordering wall charts, be sure to indicate that a 10-foot testing distance will be used.

Visual Acuity Tests

Snellen Acuity Chart

When performing visual acuity testing, test the child's right eye first by covering the left. A child who has corrective eyeglasses should be screened wearing the eyeglasses. Tell the child to keep both eyes open during testing. If the child fails the practice line, move up the chart to the next larger line. If the child fails this line, continue up the chart until a line is found that the child can pass. Then move down the chart again until the child fails to read a line. After the child has correctly identified 2 symbols on the 10/25 line, move to the critical line (10/20 or 20/40 equivalent). To pass a line, a child must identify at least 4 of the 6 symbols on the line correctly. Repeat the above procedure covering the right eye.

Tumbling E

For children who may be unable to perform vision testing by letters and numbers, the tumbling E or HOTV test may be used. Literature is available from the American Academy of Ophthalmology (Home Eye Test, American Academy of Ophthalmology, PO Box 7424, San Francisco, CA 94109, 415/561-8500 or http://www.aao.org) and Prevent Blindness America (Preschoolers Home Eye Test, Prevent Blindness America, 500 E Remington Rd, Schaumburg, IL 60173, 847/843-2020 or http://www.preventblindness.com) for home use by parents to prepare children for the tumbling E test. This literature contains the practice Es, a tumbling E wall chart, and specific instructions for parents.

HOTV Test (Matching Test)

An excellent test for children who are unable to perform vision testing by verbally identifying letters and numbers is the HOTV matching test. This test consists of a wall chart composed only of Hs, Os, Ts, and Vs. The child is provided an 8-1/2 x 11-inch board containing a large H, O, T, and V. The examiner points to a letter on the wall chart, and the child points to (matches) the correct letter on the testing board. This can be especially useful in the 3- to 5-year-old who is unfamiliar with the alphabet.

Allen Cards

The Allen card test consists of 4 flash cards containing 7 schematic figures: a truck, house, birthday cake, bear, telephone, horse, and tree. When viewed at 20 feet, these figures represent 20/30 vision. It is important that a child identify verbally or by matching all 7 pictures before actual visual testing. Testing should only be performed with the figures that the child readily identified. Perform initial testing with the child having both eyes open, viewing the cards at 2 to 3 feet away. Present 1 or 2 figures to ensure that the child understands the testing procedure. Then begin walking backward 2 to 3 feet at a time, presenting
different pictures to the child. Continue to move backward as long as the child directly calls out the figures presented. When the child begins to miss the figures, move forward several feet to confirm that the child is able to identify the figures at the shorter distance. To calculate an acuity score, the furthest distance at which the child is able to identify the pictures accurately is the numerator and 30 is the denominator. Therefore, if a child were able to identify pictures accurately at 15 feet, the visual acuity would be recorded as 15/30. This is equivalent to 30/60, 20/40, or 10/20. To perform this test in the same way as for HOTV testing, a "matching panel" of all of the Allen figures may be prepared on a copy machine.

LH Symbols (LEA Symbols)

The LH symbol test is slightly different from the Allen card test in that it is made up of flash cards held together by a spiral binding. The flash cards contain large examples of a house, apple, circle, and square; these should be presented to the child before formal vision testing to see if they can be correctly identified. Unlike the Allen cards, the LH symbol test contains flash cards with more than 1 figure per card and with smaller figure sizes so that testing may be performed at 10 feet. Recorded on each card is the symbol size and visual acuity value for a 10-foot testing distance. The visual acuity is determined by the smallest symbols that the child is able to identify accurately at 10 feet. For example, if the child is able to identify the 10/15 symbol at 10 feet, the child's visual acuity is 10/15 or 20/30.

If it is not possible to perform testing at 10 feet, move closer to the child until he or she correctly identifies the largest symbol. At this point, proceed down in size to the smallest symbols the child is consistently able to correctly identify. The vision is recorded as the smallest symbol identified (bottom number) at the testing distance (top number). For example, correctly identifying the 10/15 symbols at 5 feet is recorded as 5/15 or 20/60. Likewise, identifying the 10/30 symbols at 2 feet is 2/30 or 20/300 (both the bottom and top numbers can be multiplied or divided by the same number to give an equivalent vision.) A "matching panel" is provided with the LH test and may be helpful in testing very young children. At least 3 of 4 figures should be identified for each size or distance.

Testing Procedures for Assessing Ocular Alignment

Corneal Light Reflex Test

A penlight may be used to evaluate light reflection from the cornea. The light is held approximately 2 feet in front of the face to have the child fixate on the light. The corneal light reflex (small white dot) should be present symmetrically and appear to be in the center of both pupils. A reflex that is off center in 1 eye may be an indication of an eye muscle imbalance. A slight nasal displacement of the reflex is normal, but a temporal displacement is almost never seen unless the child has a strabismus (esotropia).

Simultaneous Red Reflex Test (Bruckner Test)

This test can detect amblyogenic conditions, such as unequal refractive errors (unilateral high myopia, hyperopia, or astigmatism), as well as strabismus and cataracts. When both eyes are viewed simultaneously through the direct ophthalmoscope in a darkened room from a distance of approximately 2 to 3 feet with the child fixating on the ophthalmoscope light, the red reflexes seen from each eye should be equal in size, brightness, and color. If 1 reflex is different from the other (lighter, brighter, or bigger), there is a high likelihood that an amblyogenic condition exists. Any child with asymmetry should be referred for additional evaluation. Examples of normal and abnormal Bruckner test appearances are available from the AAP. "See Red" cards are available for purchase at http://www.aap.org/sections/opthalm.htm.

Cross Cover Test

To perform the cross cover test, have the child look straight ahead at an object 10 feet (3 meters) away. This could be an eye chart for older children or a colorful noise-making toy for younger children. As the child looks at a distant object, cover 1 eye with an occluder and look for movement of the uncovered eye. As an example, if the occluder is covering the left eye, movement is looked for in the uncovered right eye.
This movement will occur immediately after the cover is placed in front of the left eye. If the right eye moves outward, the eye was deviated inward or esotropic. If the right eye moves inward, it was deviated outward or exotropic. After testing the right eye, test the left eye for movement in a similar manner. If there is no apparent misalignment of either eye, move the cover back and forth between the 2 eyes, waiting about 1 to 2 seconds between movements. If after moving the occluder, the uncovered eye moves in or out to take up fixation, a strabismus is present. Any movement in or out when shifting the cover indicates a strabismus is present, and a referral should be made to an ophthalmologist.

**Random Dot E Stereo Test**

The random dot E stereo test measures stereopsis. This is different from the light reflex test or the cover test, which detects physical misalignment of the eyes. Stereopsis can be absent in patients with straight eyes. An ophthalmologic evaluation is necessary to detect the causes of poor stereo vision with straight eyes. To perform the random dot E stereo test, the cards should be held 16 inches from the child's eyes. Explain the test to the child. Show the child the gray side of the card that says "model" on it. Hold the model E in the direction at which the child can read it correctly. Have the child touch the model E to understand that the picture will stand out. A child should be able to indicate which direction the legs are pointing. Place the stereo glasses on the child. If the child is wearing eyeglasses, place the stereo glasses over the child's glasses. Make sure the glasses stay on the child and the child is looking straight ahead. The child should be shown both the stereo blank card and the raised and recessed E card simultaneously. Hold each card so you can read the back. The blank card should be held so you can read it. The E card should be held so you can read the word "raised." Both cards must be held straight. Do not tilt the cards toward the floor or the ceiling—this will cause darkness and glare. Ask the child to look at both cards and to point to or touch the card with the picture of the E. The E must be presented randomly, switching from side to side. The child is shown the cards up to 6 times. To pass the test, a child must identify the E correctly in 4 of 6 attempts.

**REFERENCES**

Appendix E
RESOLUTION

Adopted by the National Parent Teachers Association (PTA)  
June 1999

LEARNING RELATED VISION PROBLEMS  
EDUCATION AND EVALUATION

WHEREAS  
It is estimated that more than 10 million children (ages 0 to 10) suffer from vision problems; and

WHEREAS  
Many visual skills are necessary for successful learning in the modern classroom; and skill deficiencies may contribute to poor academic performance; and

WHEREAS  
Typical "vision" evaluations/screenings only test for a few of the necessary learning related visual skills (distance acuity, i.e. 20/20 eyesight, stereo vision, and muscle balance), leaving most visual skill deficiencies undiagnosed; and

WHEREAS  
Learning related vision problems, when accurately diagnosed, can be treated successfully and permanently; and

WHEREAS  
Knowledge regarding the relationship between poorly developed visual skills and poor academic performance is not widely held among students, parents, teachers, administrators and public health officials; now therefore be it

RESOLVED  
That National PTA, through its constituent organizations, provide information to educate members, educators, administrators, public health officials and the public at large about learning related visual problems and the need for more comprehensive visual skill tests in school vision screening programs performed by qualified and trained personnel; and be it further

RESOLVED  
That National PTA, through its constituent organizations, urge schools to include in their vision screening programs tests for learning related visual skills necessary for success in the classroom.