

**EVIDENCE-STATEMENT:****CHILD HEALTH PROMOTION (Screening, Counseling, Immunization, Preventive Medication, and Treatment)****Vision (Child) (Screening)****Clinical Preventive Service Recommendations****U.S. Preventive Services Task Force Recommendation**

The U.S. Preventive Services Task Force (USPSTF) recommends screening to detect amblyopia, strabismus, and defects in visual acuity in children younger than age 5 years.<sup>1,2</sup>

**Evidence Rating: B (Recommended/At Least Fair Evidence)**

The USPSTF found at least fair evidence that the service improves important health outcomes and concludes that benefits outweigh harms. The USPSTF found no direct evidence that screening for visual impairment in children leads to improved visual acuity. However, studies from Sweden and Israel suggest that early screening for visual impairment may reduce the prevalence of amblyopia in children.<sup>1</sup> Also, the USPSTF found fair evidence that screening tests have reasonable accuracy in identifying strabismus, amblyopia, and refractive error in children with these conditions; that more intensive screening compared with usual screening leads to improved visual acuity; and that treatment of strabismus and amblyopia can improve visual acuity and reduce long-term amblyopia.<sup>1,2</sup>

**Other Recommended Guidance American Academy of Pediatrics**

The American Academy of Pediatrics (AAP) recommends the following vision screening be performed at all well-child visits for children starting in the newborn period to 3 years: ocular history, vision assessment, external inspection of the eyes and lids, ocular motility assessment, pupil examination, and red reflex examination. For children ages 3 to 5 years, the AAP recommends the aforementioned screening in addition to age-appropriate visual acuity measurement and ophthalmoscopy. All children who fail the vision assessment or who have an ocular abnormality should be referred to a pediatric ophthalmologist or an eye care specialist appropriately trained to treat pediatric patients.<sup>3</sup>

**Evidence Rating:**

Expert Opinion

**Center for Medicare and Medicaid Services (CMS)**

The Center for Medicare and Medicaid Services (CMS) requires that Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) services be provided to all individuals under age 21 enrolled in Medicaid. The EPSDT benefit, at a minimum, must include diagnosis and treatment of defects in vision, including eyeglasses. Vision services must be provided according to a distinct periodicity schedule developed by the state and at other intervals as medically necessary.<sup>4</sup>

**Evidence Rating:**

CMS Mandate

**Information Sources**

The recommendations and supporting information contained in this document came from several sources, including the:

- American Academy of Pediatrics (AAP)
- Centers for Disease Control and Prevention (CDC)
- Center for Medicare and Medicaid Services (CMS)
- National Institutes of Health (NIH)
- Peer-reviewed research

- U.S. Preventive Services Task Force (USPSTF)

The background and supporting information contained in this document is a compilation of research findings. All information presented in this document should be attributed to its referenced source and should not be considered a reflection of other organizations cited in the text.

### Condition/Disease Specific Information

#### Epidemiology of Condition/Disease

Visual impairment is a common condition that affects 7% to 8% of children.<sup>1</sup> Relatively severe bilateral visual impairment with a best corrected visual acuity in the better eye of 20/70 or worse occurs in about 1 per 1,000 children ages 6 to 10 years, and blindness (visual acuity worse than 20/400) occurs in about 4 per 10,000 children.<sup>5</sup>

Causes of visual impairment in children include amblyopia, refractive error not associated with amblyopia, and strabismus. Significant refractive errors are the most common and easily corrected vision disorder, affecting up to 20% of young children.<sup>6</sup> Refractive errors are eye disorders in which the shape of the eye does not allow the light that enters the eye to be focused properly, resulting in blurred vision. Types of refractive errors include myopia (nearsightedness), hyperopia (farsightedness), anisometropia (a difference in refractive error between eyes), and astigmatism (an unequal curvature of the cornea that prevents light rays from focusing clearly at one point on the retina). Refractive errors are strong risk factors for amblyopia.

Amblyopia refers to reduced visual acuity in one or both eyes that is not due to ocular structure anomalies and that is not eliminated when refractive error is corrected. The disorder is most frequently caused by uncorrected anisometropia or strabismus and can also be caused by cataracts.<sup>1</sup> The best estimate of the prevalence of amblyopia is 3% to 4%.<sup>1</sup> An untreated amblyopic eye does not develop normal vision, and the individual has impaired binocular function (ability to use the eyes together, such as in depth perception). In addition, uncorrected amblyopia may be a risk factor for future blindness in later childhood and adulthood and may harm school performance, ability to learn, and later, adult self-image.

Strabismus is present in 3% to 4% of the population.<sup>1</sup> It is a deviation or misalignment of the eyes resulting from the failure of the eye muscles to work together. Most strabismus develops in early childhood and some types may not be cosmetically obvious. Strabismus results in poor to absent binocular function (ability of the eyes to work together) and can result in amblyopia.<sup>1</sup>

#### Condition/Disease Risk Factors

Prematurity and low birth weight are risk factors for amblyopia and strabismus.<sup>7-8</sup> Risk factors for other visual impairment disorders are not well understood.

### Value of Prevention

#### Economic Burden of Condition/Disease

The estimated *lifetime* cost (in year 2003 dollars) for persons born in 2000 with vision impairment is \$2.5 billion. This is a conservative estimate because it applies only to the 1 in 1,000 children with corrected visual acuity of 20/70 or

	<p>worse. The cost estimate includes both direct and indirect costs and refers to all excess costs for individuals with vision impairment.</p> <p>An estimate of the excess costs attributable specifically to vision impairment in children in the United States is not available.</p>
<p><b>Workplace Burden of Condition/Disease</b></p>	<p>The workplace burden of visual impairment in children has not been effectively measured. Indirect costs of visual impairment, which include the value of lost wages when a person either cannot work or is limited in the amount or type of work he or she can do, may be substantial.</p>
<p><b>Economic Benefit of Preventive Intervention</b></p>	<p>No economic evaluation of vision screening in preschool-age children has been published. A primary benefit of screening is the early detection of amblyopia, which allows for earlier treatment and improvement of visual acuity in the affected eye.</p>
<p><b>Estimated Cost of Preventive Intervention</b></p>	<p>The cost of conducting vision screening in young children varies depending on the methods used, the setting, and the type of staff performing the screening. In 2004, the private-sector cost of vision screening averaged \$71; approximately 95% of paid claims fell within the range of \$5 to \$133.<sup>9</sup></p>
<p><b>Estimated Cost of Treatment</b></p>	<p>Treatment for visual impairment varies depending on the type, cause, and severity of impairment. For amblyopia, treatment and associated costs (in year 2001 dollars) are<sup>10</sup>:</p> <ul style="list-style-type: none"> <li>• Nonsurgical amblyopia therapy – \$1,452</li> <li>• Nonsurgical amblyopia therapy and ocular alignment – \$2,190</li> <li>• Nonsurgical amblyopia therapy and cataract extraction – \$2,628</li> <li>• Nonsurgical amblyopia therapy and ptosis repair – \$1,853</li> </ul> <p>The weighted average cost of surgical and nonsurgical treatment was \$1,623 in year 2001 dollars.<sup>10</sup></p>
<p><b>Cost-Effectiveness and/or Cost-Benefit Analysis of Preventive Intervention</b></p>	<p>One cost-effectiveness analysis of treatment for amblyopia in preschool-age children has been published.<sup>6</sup> That study reported that treatment was associated with a mean improvement in visual acuity from 20/80 to 20/32, and an associated improvement of health-related quality of life. The estimated cost per QALY (a measure of health impact) gained from treatment was \$2,281 in year 2001 dollars.<sup>6</sup> In comparison to other preventive interventions and to commonly accepted cost-effectiveness benchmarks, vision screening is highly cost-effective.</p>
<p><b>Preventive Intervention Information</b></p>	
<p><b>Purpose of Preventive Intervention</b></p>	<p>Visual impairment in children is believed to have an early sensitive period when interventions lead to better outcomes. Screening for visual impairment allows clinicians to identify affected patients early and initiate treatment.</p>
<p><b>Benefits and Risks of Intervention</b></p>	<p>The USPSTF found no evidence of harms associated with screening, judged the potential for harms to be small, and concluded that the benefits of screening are</p>

likely to outweigh any potential harms.<sup>2</sup>

**Initiation, Cessation,  
and Interval of  
Screening**

Based on their review of current evidence, the USPSTF was unable to determine the optimal periodicity of screening. They recommend screening beginning in infancy with the methods of screening depending on the child.

Based on expert opinion, the American Academy of Pediatrics (AAP) recommends the following vision screening be performed at well-child visits for children starting in the newborn period to 3 years: ocular history, vision assessment, external inspection of the eyes and lids, ocular motility assessment, pupil examination, and red reflex examination. Between the ages of 3 and 5 years, visual acuity can be screened using simple recognition charts.<sup>3</sup> After age 5, standard visual acuity charts such as the Snellen Acuity Chart can generally be added to the screening.<sup>11</sup>

**Intervention Process**

Various tests are used widely in the United States to identify visual defects in children, and the choice of tests is influenced by the child's age. Beginning in the first year of life, strabismus can be screened for by using the cover test, the Hirschberg light reflex test, and the red reflex test. Screening children younger than age 3 years for visual acuity is more challenging than screening older children and typically requires testing by specially trained personnel. Newer automated techniques can be used to screen these children. Photo-screening and autorefractors can detect amblyogenic risk factors such as significant refractive error and media opacities; however, these techniques do not provide acuity information on the children screened. In children older than 3 years, stereopsis (ability of both eyes to function together) can be assessed with the Random Dot E test or Titmus Fly. Some of these tests have better test characteristics than others.

Recent results from a large, rigorous evaluation of commonly used preschool vision screening tests supported by the National Institutes of Health (NIH) indicate that some tests outperform others. The Vision in Preschoolers Study (VIP) found that the best tests were able to detect two-thirds of children with vision disorders and that select objective and subjective screening tests can be effective.<sup>11-12</sup>

**Treatment  
Information**

Health benefits should include provisions for follow-up and treatment services.

Significant refractive errors are easily corrected with eyeglasses and some amblyopia and strabismus may be prevented by early detection and correction of significant refractive errors.

Most amblyopia can be treated nonsurgically. Treatment strategies include covering the sound eye with patching or using pharmacologic agents such as eye drops. Amblyopia associated with refractive errors may also be treated with eyeglasses. Select types of amblyopia do require surgical treatments, such as ocular alignment and cataract extraction, in addition to nonsurgical therapy.

Treatment of strabismus largely consists of correction with eyeglasses, surgical correction, and orthoptics (optometric vision therapy). Large constant deviations

present in the first few years usually require surgical intervention, while intermittent or accommodative esotropia, which most commonly develops at 2 to 3 years of age, can almost always be corrected with eyeglasses.

### **Strength of Evidence for the Clinical Preventive Service**

The level of evidence supporting the recommendations contained in this section is described below.

#### ***Evidence-Based Research:***

U.S. Preventive Services Task Force (USPSTF)

Strength of Evidence: B (Recommended/At Least Fair Evidence)

- The USPSTF found at least fair evidence to recommend screening to detect amblyopia, strabismus, and defects in visual acuity in children younger than age 5 years.<sup>2</sup>

#### ***Recommended Guidance:***

American Academy of Pediatrics (AAP)

Strength of Evidence: Expert Opinion

- The American Academy of Pediatrics (AAP) found good evidence to support the following components of vision screening at all well-child visits for children starting in the newborn period to 3 years: ocular history, vision assessment, external inspection of the eyes and lids, ocular motility assessment, pupil examination, and red reflex examination. For children ages 3 to 5 years, the AAP recommends the aforementioned screening in addition to age appropriate visual acuity measurement and ophthalmoscopy.<sup>3</sup>

Center for Medicare and Medicaid Services (CMS)

Strength of Evidence: CMS Mandate

- The Center for Medicare and Medicaid Services (CMS) requires that Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) services be provided to all individuals under age 21 enrolled in Medicaid. The EPSDT benefit, at a minimum, must include diagnosis and treatment of defects in vision, including eyeglasses. Vision services must be provided according to a distinct periodicity schedule developed by the state and at other intervals as medically necessary.<sup>4</sup>

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Grosse S, Biernath K. Vision evidence-statement: screening. In: Campbell KP, Lanza A, Dixon R, Chattopadhyay S, Molinari N, Finch RA, editors. *A Purchaser's Guide to Clinical Preventive Services: Moving Science into Coverage*. Washington, DC: National Business Group on Health; 2006.

**Vision (Child) (Screening)**

1. Kemper A, Harris R, Lieu TA, Homer CJ, Whitener BL. Screening for vision impairment in children younger than age 5 years: a systematic evidence review for the U.S. Preventive Services Task Force Systematic Evidence Review Number 27. Research Triangle Institute, Research Triangle Park, NC. Available from: <http://www.ahrq.gov/downloads/pub/prevent/pdfser/visualseer.pdf>.
2. U.S. Preventive Services Task Force. *Guide to Clinical Preventive Services*, 3rd ed. Rockville (MD): Agency for Healthcare Research and Quality; 2003.
3. American Academy of Pediatrics Committee on Practice and Ambulatory Medicine, Section on Ophthalmology. Eye examination in infants, children, and young adults by pediatricians. *Pediatrics* 2003;111(4):902-7.
4. Centers for Medicare and Medicaid Services. Medicaid Early & Periodic Screening and Treatment Benefit. Available from: [http://www.cms.hhs.gov/MedicaidEarlyPeriodicScrn/02\\_Benefits.asp](http://www.cms.hhs.gov/MedicaidEarlyPeriodicScrn/02_Benefits.asp). Accessed October 23, 2006.
5. Center for Preventive Ophthalmology and Biostatistics. University of Pennsylvania School of Medicine. Vision in Preschoolers Study. Available from: [http://www.med.upenn.edu/cpob/studies/studies\\_vip.shtml](http://www.med.upenn.edu/cpob/studies/studies_vip.shtml).
6. Robaei D, Kifley A, Gole GA, Mitchell P. The impact of modest prematurity on visual function at age 6 years: findings from a population-based study. *Arch Ophthalmol* 2006;124(6):871-7.
7. Centers for Disease Control and Prevention. Economic costs associated with mental retardation, cerebral palsy, hearing loss, and vision impairment—United States, 2003. *MMWR* 2004;53(3):57-9.
8. Rudanko SL, Fellman V, Laatikainen L. Visual impairment in children born prematurely from 1972 through 1989. *Ophthalmology* 2003;110(8):1639-45.
9. Thomson Medstat. MarketScan. 2004.
10. Membreno JH, Brown MM, Brown GC, Sharma S, Beauchamp GR. A cost-utility analysis of therapy for amblyopia. *Ophthalmol* 2002;109:2265-71.
11. The Vision in Preschoolers Study Group. Comparison of preschool vision screening tests as administered by licensed eye care professionals in the Vision in Preschoolers Study. *Ophthalmology* 2004;111:637-650.
12. The Vision in Preschoolers Study Group. Preschool vision screening tests administered by nurse screeners compared with lay screeners in the Vision in Preschoolers Study. *Invest Ophthalmol Vis Sci* 2005;46(8):2639-2648.