Screening for Visual Impairment in Children Younger than Age 5 Years: Recommendation Statement

U.S. Preventive Services Task Force

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This statement summarizes the U.S. Preventive Services Task Force (USPSTF) recommendation on screening for visual impairment in children younger than age 5 years and the supporting evidence, and updates the 1996 recommendations contained in the *Guide to Clinical Preventive Services, Second Edition.* In updating its recommendations for children, the USPSTF limited its review to the most common causes of visual impairment: amblyopia (including amblyogenic risk factors) and refractive error not associated with amblyopia. Explanations of the ratings and of the strength of overall evidence are given in Appendix A and Appendix B, respectively. The complete information on which this statement is based, including evidence tables and references, is available in the Systematic Evidence Review[1] and in the update of the evidence[2] on this topic, available through the USPSTF Web site (www.preventiveservices.ahrq.gov) and through the National Guideline Clearinghouse™ (HYPERLINK "http://www.guideline.gov" www.guideline.gov). The recommendation statement and update of the evidence are also available from the Agency for Healthcare Research and Quality (AHRQ) Publications Clearinghouse in print through subscription to the *Guide to Clinical Preventive Services, Third Edition: Periodic Updates.*

Recommendations made by the USPSTF are independent of the U.S. Government. They should not be construed as an official position of AHRQ or the U.S. Department of Health and Human Services.

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Summary of Recommendation

The USPSTF recommends screening to detect amblyopia, strabismus, and defects in visual acuity in children younger than age 5 years. **B recommendation.**

The USPSTF found no direct evidence that screening for visual impairment in children leads to improved visual acuity. However, 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. The USPSTF found no evidence of harms for screening, judged the potential for harms to be small, and

concluded that the benefits of screening are likely to outweigh any potential harms.

Clinical Considerations

• The most common causes of visual impairment in children are: (1) amblyopia and its risk factors and (2) refractive error not associated with amblyopia. Amblyopia refers to reduced visual acuity without a detectable HYPERLINK "http://cancerweb.ncl.ac.uk/cgi-bin/omd?organic" organic HYPERLINK "http://cancerweb.ncl.ac.uk/cgi-bin/omd?lesion" lesion of the eye and is usually associated with amblyogenic risk factors that interfere with normal binocular vision, such as strabismus (ocular misalignment), anisometropia (a large difference in refractive power between the 2 eyes), cataract (lens opacity), and ptosis (eyelid drooping). Refractive error not associated with amblyopia principally includes myopia (nearsightedness) and hyperopia (farsightedness); both remain correctable regardless of the age at detection.

•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. During the first year of life, strabismus can be assessed by the cover test and the Hirschberg light 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 test these children. Photoscreening can detect amblyogenic risk factors such as strabismus, significant refractive error, and media opacities; however, photoscreening cannot detect amblyopia.

•Traditional vision testing requires a cooperative, verbal child and cannot be performed reliably until ages 3 to 4 years. In children older than age 3 years, stereopsis (the ability of both eyes to function together) can be assessed with the Random Dot E test or Titmus Fly Stereotest; visual acuity can be assessed by tests such as the HOTV chart, Lea symbols, or the tumbling E. Some of these tests have better test characteristics than others.

•Based on their review of current evidence, the USPSTF was unable to determine the optimal screening tests, periodicity of screening, or technical proficiency required of the screening clinician. Based on expert opinion, 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 aged 3 to 5 years, the AAP recommends the aforementioned screening in addition to age-appropriate visual acuity measurement (using HOTV or tumbling E tests) and ophthalmoscopy.[3]

•The USPSTF found that early detection and treatment of amblyopia and amblyogenic risk factors can improve visual acuity. These treatments include surgery for strabismus and cataracts; use of glasses, contact lenses, or refractive surgery treatments to correct refractive error; and visual training, patching, or atropine therapy of the nonamblyopic eye to treat amblyopia.

•These recommendations do not address screening for other anatomic or pathologic entities, such as macro cornea, cataracts, retinal abnormalities, or neonatal neuroblastoma, nor do they address newer screening technologies currently under investigation.

Discussion

Visual impairment caused by refractive error, amblyopia, strabismus, and astigmatism is a common condition among young children, affecting 5% to 10% of all preschoolers. Amblyopia is present in 1% to 4% of preschool children; an estimated 5% to 7% of preschool children have refractive errors.[2] Uncorrected amblyopia may harm school performance, ability to learn, and later, adult self-image.[4] Furthermore, uncorrected amblyopia may be a risk factor for future total blindness. Because visual impairment in children is common and believed to have an early sensitive period when interventions lead to better outcomes, much interest has focused on primary care vision-screening tools for early detection, referral, and treatment.

The USPSTF found no direct evidence that screening for visual impairment, compared with no screening, leads to improved visual acuity. However, the USPSTF found 1 fair quality study showing that intense screening by eye professionals (compared with usual screening) decreases the prevalence of amblyopia.[5] This recent randomized controlled trial in the United Kingdom, the Avon Longitudinal Study of Pregnancy and Childhood (ALSPAC) trial,[5] has reported that intensive screening performed 6 times between ages 8 and 37 months (using the cover test, Cardiff Cards, Kay Picture test, and HOTV letters by an eye professional) led to decreased prevalence of amblyopia and improved visual acuity compared with a 1-time visual screening at age 37 months (using Kays Picture test and HOTV letters). Any child failing a screening test was referred to the hospital eye service for further testing and treatment. Compared with the group screened once at age 37 months, the intensively-screened group had a significantly lower prevalence of severe amblyopia at age 7.5 years (amblyopia B prevalence = 0.6% vs 1.8%) and a lower prevalence of residual amblyopia after treatment (7.5% vs 25%).

The USPSTF reviewed the evidence for the accuracy of vision screening tests in children younger than age 5 years. The USPSTF found no evidence evaluating the role of screening for family history or parental concern, or evaluating the accuracy of the clinical examination to detect visual impairments such as cataracts or strabismus. One fair quality study of children aged 3 to 5 years screened by public health nurses with annual tests, including Cambridge Crowding Cards, the Hirschberg test, and the Titmus Fly Stereotest, reported an overall sensitivity of 60% to 71% and a specificity of 70% to 80%.[6] A good quality systematic review, evaluating the accuracy of the Snellen E test or Stycar graded balls and the Titmus Fly Stereotest in children aged 3 to 5 years, reported an estimated sensitivity of 9% to 12.5% and a specificity of 99%.[7] Three poor quality studies

examined the accuracy of the Medical Technology Incorporated (MTI) photoscreener™ in a population of children younger than age 3 years with a high prevalence of visual impairment. Sensitivity ranged from 37% to 88%, and specificity ranged from 40% to 88%.[8-10] For the Visiscreen™ in children younger than age 3 years, overall sensitivity and specificity were 85% and 94%, respectively.[11]

The USPSTF found fair quality evidence that early treatment of amblyogenic risk factors, including strabismus, refractive error, and cataracts, prevents amblyopia.[12-15] Indirect evidence for the effectiveness of amblyopia treatment comes from cross-sectional studies that show lower prevalence of visual impairment in screened populations compared with unscreened populations.[16,17] Cohort studies show that among children who have been diagnosed with visual impairment, amblyopia is unlikely to improve without therapy.[18] Both prospective and retrospective studies report that between approximately 40% and 95% of persons with amblyopia have improved visual acuity after treatment.[19-31] Two fair quality studies of treatment for amblyopia have found that successful outcomes depend on earlier treatment.[32,33] In these studies, treatment efficacy steadily decreased after age 3 years; by age 12 years, treatment was ineffective. However, there is fair evidence to suggest that a modest delay in treatment does not harm outcomes.[34] Since the USPSTF found no studies that followed patients into adulthood, the long-term effectiveness of the interventions for amblyopia is unclear.

The USPSTF found no studies detailing permanent harms resulting from screening or data regarding the harms of false-positive screening. However, potential harms of screening may include "labeling" and the costs associated with the further evaluation of children with false-positive screening results. Potential harms of interventions include disruption of normal eye development and temporary loss of visual acuity of the nonamblyopic eye, which resolves weeks after completion of therapy.[35]

There is limited research regarding the performance of vision screening tests in the primary care setting, although there are studies currently underway comparing various screening methods.[36-38] Current studies reviewed by the USPSTF, including the ALSPAC study,[5] support the effectiveness of intensive screening; however, it is not clear whether the magnitude of benefit observed in the United Kingdom study is generalizable to the United States population, to children younger than age 3 years, or to services provided by primary care clinicians. It would be helpful if similar studies comparing early, intensive screening to usual visual screening were performed in children younger than age 5 years using screening tests commonly performed in the United States by primary care clinicians.

Recommendations of Other Groups

The recommendation of the American Academy of Family Physicians can be accessed at *HYPERLINK "http://www.aafp.org/x7661.xml" www.aafp.org/x7661.xml*. The joint recommendation of the American Academy of Pediatrics, American Association for

Pediatric Ophthalmology and Strabismus, and the American Academy of Ophthalmology, can be accessed at *HYPERLINK "http://aap.org/policy/s0208.html" http://aap.org/policy/s0208.html*.
The clinical practice guideline of the American Optometric Association can be accessed at HYPERLINK "http://www.aoa.org/eweb/Documents/CPG-2.pdf" *www.aoa.org/eweb/Documents/CPG-2.pdf*. The recommendation of the Canadian Task Force on the Periodic Health Examination can be accessed at *HYPERLINK "http://www.ctfphc.org" www.ctfphc.org*.

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APPENDIX A

U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATIONS AND RATINGS

The Task Force grades its recommendations according to one of 5 classifications (A, B, C, D, I) reflecting the strength of evidence and magnitude of net benefit (benefits minus harms):

A. The USPSTF strongly recommends that clinicians provide [the service] to eligible patients. *The USPSTF found good evidence that [the service] improves important health outcomes and concludes that benefits substantially outweigh harms.*

B. The USPSTF recommends that clinicians provide [the service] to eligible patients. *The USPSTF found at least fair evidence that [the service] improves important health outcomes and concludes that benefits outweigh harms.*

C. The USPSTF makes no recommendation for or against routine provision of [the service]. *The USPSTF found at least fair evidence that [the service] can improve health outcomes but concludes that the balance of benefits and harms is too close to justify a general recommendation.*

D. The USPSTF recommends against routinely providing [the service] to asymptomatic patients. *The USPSTF found at least fair evidence that [the service] is ineffective or that harms outweigh benefits.*

I. The USPSTF concludes that the evidence is insufficient to recommend for or against routinely providing [the service]. *Evidence that [the service] is effective is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.*

APPENDIX B

U.S. PREVENTIVE SERVICES TASK FORCE
STRENGTH OF OVERALL EVIDENCE

The USPSTF grades the quality of the overall evidence for a service on a 3-point scale (good, fair, poor):

Good: Evidence includes consistent results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes.

Fair: Evidence is sufficient to determine effects on health outcomes, but the strength of the evidence is limited by the number, quality, or consistency of the individual studies, generalizability to routine practice, or indirect nature of the evidence on health outcomes.

Poor: Evidence is insufficient to assess the effects on health outcomes because of limited number or power of studies, important flaws in their design or conduct, gaps in the chain of evidence, or lack of information on important health outcomes.