

# PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## **Instrument-Based Pediatric Vision Screening Policy Statement**

AMERICAN ACADEMY OF PEDIATRICS Section on Ophthalmology and,  
Committee on Practice and Ambulatory Medicine, AMERICAN ACADEMY OF  
OPHTHALMOLOGY, AMERICAN ASSOCIATION FOR PEDIATRIC  
OPHTHALMOLOGY AND STRABISMUS and AMERICAN ASSOCIATION OF  
CERTIFIED ORTHOPTISTS

*Pediatrics* 2012;130:983; originally published online October 29, 2012;  
DOI: 10.1542/peds.2012-2548

The online version of this article, along with updated information and services, is  
located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/130/5/983.full.html>

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2012 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™





## POLICY STATEMENT

# Instrument-Based Pediatric Vision Screening Policy Statement

AMERICAN ACADEMY OF PEDIATRICS Section on Ophthalmology and Committee on Practice and Ambulatory Medicine; AMERICAN ACADEMY OF OPHTHALMOLOGY; AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS; and AMERICAN ASSOCIATION OF CERTIFIED ORTHOPTISTS

**KEY WORDS**

vision screening, young children, instrument-based screening, visual acuity, automated technology

**ABBREVIATION**

RVU—relative value unit

This document is copyrighted and is property of the American Academy of Pediatrics and its Board of Directors. All authors have filed conflict of interest statements with the American Academy of Pediatrics. Any conflicts have been resolved through a process approved by the Board of Directors. The American Academy of Pediatrics has neither solicited nor accepted any commercial involvement in the development of the content of this publication.

All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

[www.pediatrics.org/cgi/doi/10.1542/peds.2012-2548](http://www.pediatrics.org/cgi/doi/10.1542/peds.2012-2548)

doi:10.1542/peds.2012-2548

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2012 by the American Academy of Pediatrics

## abstract

FREE

A policy statement describing the use of automated vision screening technology (instrument-based vision screening) is presented. Screening for amblyogenic refractive error with instrument-based screening is not dependent on behavioral responses of children, as when visual acuity is measured. Instrument-based screening is quick, requires minimal cooperation of the child, and is especially useful in the preverbal, preliterate, or developmentally delayed child. Children younger than 4 years can benefit from instrument-based screening, and visual acuity testing can be used reliably in older children. Adoption of this new technology is highly dependent on third-party payment policies, which could present a significant barrier to adoption. *Pediatrics* 2012;130:983–986

## INTRODUCTION

With recent research and development of improved screening and refractive devices, this policy statement supplants the 2002 position paper<sup>1</sup> and is in accord with the overall vision screening policy of the American Academy of Pediatrics.<sup>2</sup> This statement is cosponsored by the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus, and the American Association of Certified Orthoptists.

The goal of vision screening is to detect subnormal vision or risk factors that threaten visual development, preferably at a time when treatment can be initiated to yield the highest benefit.<sup>3</sup> A primary goal of vision screening in young children is the detection of amblyopia or the risk factors for development of amblyopia, a neural deficit in vision that is estimated to be present in 1% to 4% of children.<sup>4</sup> Amblyopia can be caused by obscured images (eg, from infantile cataracts), misaligned images (eg, from constant strabismus), or defocused images (eg, from different refractive errors between the eyes, termed anisometropia). The hallmark of amblyopia is decreased visual acuity, typically monocular, for which no ocular structural disorder fully accounts. However, successful visual acuity testing by using a vision chart is highly dependent on patient age and screener experience. In children younger than 3 years, few professionals can reliably determine acuity in each eye by using a vision chart.<sup>5</sup> Therefore, for younger children, the preferred methodology is instrument-based detection of risk factors for amblyopia—primarily photostereopsis and autorefractometry.

## PHOTOSCREENERS, AUTOREFRACTORS, AND OTHER INSTRUMENTS

Instrument-based screening, if performed and interpreted correctly by appropriately trained individuals, usually identifies the presence and magnitude of optical and physical abnormalities of the eyes; it is quick and requires minimal cooperation from the child. Instrument-based screening systems typically produce a hard copy or digital record for inclusion in the patient record to document that screening was performed and, in some cases, provide an interpretation of the data.

Photoscreening uses optical images of the eye's red reflex to estimate refractive error, media opacity, ocular alignment, and other factors, such as ocular adnexal deformities (eg, ptosis), all of which put a child at risk for developing amblyopia. Photoscreening instruments, which assess both eyes simultaneously, have been found to be useful for screening children,<sup>6–10</sup> and their output is interpreted by operators, by a central reading center, or by computer.

Autorefraction involves optically automated skiascopy methods or wave-front technology (Shack-Hartmann) to evaluate the refractive error of each eye. The National Institutes of Health–sponsored Vision in Preschoolers Study<sup>7</sup> systematically evaluated instrument-based screening methods and compared them with visual acuity–based screening when administered by licensed eye-care professionals. For the conditions most important to detect and treat early and for a specificity of 90%, autorefraction had sensitivity of 81% to 88%, with the use of specified referral criteria. For these conditions, visual acuity testing had 77% sensitivity at 90% specificity. A disadvantage of autorefractors is that they typically measure only 1 eye at a time, limiting their ability to detect strabismus in the

absence of abnormal refractive error. However, in contrast to tabletop autorefractors, which are difficult to use with very young children, portable, handheld autorefractors are useful for screening young children.<sup>7,11–15</sup> Autorefraction data yield numeric results that are analyzed by the evaluator or by the instrument itself to determine if a child passes or fails the screening.

Other instruments have been or are being developed to objectively evaluate the eye or visual system for the presence of risk factors for amblyopia. These instruments are, at present, without a sufficient evidence base for recommendation.

As with any screening device, the sensitivity and specificity will depend on the referral criteria used. Alterations in referral criteria result in an inverse relationship between sensitivity and specificity, such that high detection of at-risk children (ie, high sensitivity) risks excessive overreferrals (ie, low specificity), and minimization of overreferrals (ie, high specificity) reduces detection of at-risk children (ie, low sensitivity).

Both photoscreening and autorefraction offer hope in improving vision-screening rates in preverbal children, preliterate children, and those with developmental delays, who are the most difficult to screen. Children younger than 4 years can benefit from instrument-based screenings. For children 4 to 5 years of age, photoscreening and autorefraction have not been shown to be superior or inferior to visual acuity testing with the use of vision charts.<sup>7</sup> In children older than 5 years, visual acuity testing by using vision charts can be used reliably and should be performed every 1 to 2 years.<sup>2</sup>

### BARRIERS TO THE USE OF INSTRUMENT-BASED VISUAL SCREENING

Although all of the aforementioned instruments are available for use in

a primary care setting, all of them involve substantial costs to the primary care practice. The instruments themselves often cost thousands of dollars, in addition to the costs of printers and supplies for each test performed. There are additional indirect costs, including space and staff time required to perform these tests, as well as physician time to interpret them. High initial capital investments for these instruments may be reduced if suppliers offer a leasing option as an alternative to purchasing equipment, but these costs must still be calculated into the total costs of performing the test. Although *Current Procedural Terminology* codes are available for such devices, there is never a guarantee of payment from third-party payers, even if the appropriate code is used. Historically, when such codes increase in frequency, third-party payers simply cease paying them. Additionally, visual screening is often inappropriately bundled into a global fee for the health maintenance visit, despite the fact that this is a separately identifiable service with real costs and established relative value units (RVUs). The adoption of any such technology will be highly dependent on the payment decisions of third-party payers. Primary care physicians will likely be slow to adopt these new technologies, despite their merit, if they are expected to absorb the cost without adequate payment for their up-front costs and their time. A level-1 *Current Procedural Terminology* code, 99174 with RVU 0.69, has been assigned to photoscreening. The adequacy of such an RVU depends on the cost of the screening device.

### RECOMMENDATIONS

- Vision screening should be performed at an early age and at regular intervals with age-appropriate, valid methods, ideally within the

medical home. The goal remains to identify and treat preventable visual impairment at the earliest feasible age.

- Photoscreening and handheld autorefraction may be electively performed in children 6 months to 3 years of age, allowing earlier detection of conditions that may lead to amblyopia, as well as in older children who are unable or unwilling to cooperate with routine acuity screening.
- Photoscreening and handheld autorefraction are recommended as an alternative to visual acuity screening with vision charts from 3 through 5 years of age, after which visual acuity screening with vision charts becomes more efficient and less costly in the medical home. Adequate payment for instrument-based vision-screening services must be ensured if there is to be widespread adoption of this recommendation.
- Alternatively, the use of vision charts and standard physical examination techniques to assess amblyopia in children 3 to 5 years of age in the medical home remains a viable practice at the present time.
- There is no recommendation for mass screening at this time.
- Vision screening is a separately identifiable service and should not be bundled into the global code of well-child care. Adequate payment for photoscreening and handheld autorefraction must be ensured if there is to be widespread adoption of this recommendation.
- Regardless of the type of photoscreening or autorefraction system used, it is recommended that the evaluator know how to apply the technology properly and understand the limitations of the test in relation to the population being tested.
- The American Academy of Pediatrics, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists advocate additional research of photoscreening and handheld autorefraction devices and other vision screening methods to elucidate the validity of results, efficacy, cost-effectiveness, and payment policies for identifying amblyogenic factors in different age groups and subgroups of children. The goal remains to eliminate preventable childhood visual impairment.

## REFERENCES

1. Committee on Practice and Ambulatory Medicine and Section on Ophthalmology; American Academy of Pediatrics. Use of photoscreening for children's vision screening. *Pediatrics*. 2002;109(3):524–525
2. Committee on Practice and Ambulatory Medicine, Section on Ophthalmology, American Association of Certified Orthoptists; American Association for Pediatric Ophthalmology and Strabismus; American Academy of Ophthalmology. Eye examination in infants, children and young adults. *Pediatrics*. 2003;111(4 pt 1):902–907
3. Wilson JMG, Jungner G. Principles and practice of screening for disease. Geneva, Switzerland: World Health Organization; 1968:1–163. Available at: [http://whqlibdoc.who.int/php/WHO\\_PHP\\_34.pdf](http://whqlibdoc.who.int/php/WHO_PHP_34.pdf). Accessed January 24, 2012
4. Simons K. Amblyopia characterization, treatment, and prophylaxis. *Surv Ophthalmol*. 2005;50(2):123–166
5. Cotter SA, Tarczy-Hornoch K, Wang Y, et al; Multi-Ethnic Pediatric Eye Disease Study Group. Visual acuity testability in African-American and Hispanic children: the multi-ethnic pediatric eye disease study. *Am J Ophthalmol*. 2007;144(5):663–667
6. Arthur BW, Riyaz R, Rodriguez S, Wong J. Field testing of the plusoptix S04 photoscreener. *J AAPOS*. 2009;13(1):51–57
7. Schmidt P, Maguire M, Dobson V, et al; 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(4):637–650
8. Donahue SP. Relationship between anisometropia, patient age, and the development

## LEAD AUTHORS

Joseph M. Miller, MD – AAP Section on Ophthalmology  
Herschel R. Lessin, MD – AAP Committee on Practice and Ambulatory Medicine

## SECTION ON OPHTHALMOLOGY EXECUTIVE COMMITTEE, 2011–2012

James B. Ruben, MD, Chairperson  
David B. Granet, MD, Chairperson-Elect  
Richard J. Blocker, MD  
Geoffrey E. Bradford, MD  
Daniel J. Karr, MD  
Gregg T. Lueder, MD, Immediate Past Chairperson  
Sharon S. Lehman, MD  
R. Michael Siatkowski, MD

## LIAISONS

Kyle A. Arnoldi, CO – American Association of Certified Orthoptists  
George S. Ellis Jr, MD – American Academy of Ophthalmology Council  
Christie L. Morse, MD – American Association for Pediatric Ophthalmology and Strabismus, American Academy of Ophthalmology

## STAFF

Jennifer G. Riefe, MEd

## COMMITTEE ON PRACTICE AND AMBULATORY MEDICINE, 2011–2012

Lawrence D. Hammer, MD, Chairperson  
Graham Arthur Barden III, MD  
Oscar "Skip" Wharton Brown, MD  
Edward S. Curry, MD  
James J. Laughlin, MD  
Herschel R. Lessin, MD  
Chadwick Taylor Rodgers, MD  
Geoffrey R. Simon, MD

## STAFF

Elizabeth Sobczyk

- of amblyopia. *Am J Ophthalmol*. 2006;142(1):132–140
9. Atkinson J, Braddick O, Nardini M, Anker S. Infant hyperopia: detection, distribution, changes and correlates—outcomes from the Cambridge infant screening programs. *Optom Vis Sci*. 2007;84(2):84–96
10. Kirk VG, Clausen MM, Armitage MD, Arnold RW. Preverbal photoscreening for amblyogenic factors and outcomes in amblyopia treatment: early objective screening and visual acuities. *Arch Ophthalmol*. 2008;126(4):489–492
11. Borchert M, Wang Y, Tarczy-Hornoch K, et al; MEPEDS Study Group. Testability of the Retinomax autorefractor and IOLMaster in preschool children: the Multi-ethnic Pediatric Eye Disease Study. *Ophthalmology*. 2008;115(8):1422–1425, e1
12. Cordonnier M, De Maertelaer V. Comparison between two hand-held autorefractors: the Sure-Sight and the Retinomax. *Strabismus*. 2004;12(4):261–274
13. Luorno JD, Grant WD, Noël L-P. Clinical comparison of the Welch Allyn SureSight handheld autorefractor versus cycloplegic autorefraction and retinoscopic refraction. *J AAPOS*. 2004;8(2):123–127
14. Kemper AR, Keating LM, Jackson JL, Levin EM. Comparison of monocular autorefraction to comprehensive eye examinations in preschool-aged and younger children. *Arch Pediatr Adolesc Med*. 2005;159(5):435–439
15. Steele G, Ireland D, Block S. Cycloplegic autorefraction results in pre-school children using the Nikon Retinomax Plus and the Welch Allyn SureSight. *Optom Vis Sci*. 2003;80(8):573–577

**Instrument-Based Pediatric Vision Screening Policy Statement**  
AMERICAN ACADEMY OF PEDIATRICS Section on Ophthalmology and,  
Committee on Practice and Ambulatory Medicine, AMERICAN ACADEMY OF  
OPHTHALMOLOGY, AMERICAN ASSOCIATION FOR PEDIATRIC  
OPHTHALMOLOGY AND STRABISMUS and AMERICAN ASSOCIATION OF  
CERTIFIED ORTHOPTISTS  
*Pediatrics* 2012;130;983; originally published online October 29, 2012;  
DOI: 10.1542/peds.2012-2548

<b>Updated Information &amp; Services</b>	including high resolution figures, can be found at: <a href="http://pediatrics.aappublications.org/content/130/5/983.full.html">http://pediatrics.aappublications.org/content/130/5/983.full.html</a>
<b>References</b>	This article cites 14 articles, 2 of which can be accessed free at: <a href="http://pediatrics.aappublications.org/content/130/5/983.full.html#ref-list-1">http://pediatrics.aappublications.org/content/130/5/983.full.html#ref-list-1</a>
<b>Citations</b>	This article has been cited by 1 HighWire-hosted articles: <a href="http://pediatrics.aappublications.org/content/130/5/983.full.html#related-urls">http://pediatrics.aappublications.org/content/130/5/983.full.html#related-urls</a>
<b>Subspecialty Collections</b>	This article, along with others on similar topics, appears in the following collection(s): <b>Committee on Practice &amp; Ambulatory Medicine</b> <a href="http://pediatrics.aappublications.org/cgi/collection/committee_on_practice_-_ambulatory_medicine">http://pediatrics.aappublications.org/cgi/collection/committee_on_practice_-_ambulatory_medicine</a> <b>Section on Ophthalmology</b> <a href="http://pediatrics.aappublications.org/cgi/collection/section_on_ophthalmology">http://pediatrics.aappublications.org/cgi/collection/section_on_ophthalmology</a> <b>Ophthalmology</b> <a href="http://pediatrics.aappublications.org/cgi/collection/ophthalmology_sub">http://pediatrics.aappublications.org/cgi/collection/ophthalmology_sub</a>
<b>Permissions &amp; Licensing</b>	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: <a href="http://pediatrics.aappublications.org/site/misc/Permissions.xhtml">http://pediatrics.aappublications.org/site/misc/Permissions.xhtml</a>
<b>Reprints</b>	Information about ordering reprints can be found online: <a href="http://pediatrics.aappublications.org/site/misc/reprints.xhtml">http://pediatrics.aappublications.org/site/misc/reprints.xhtml</a>

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2012 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

