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Vision Screening: Program Models

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Vision Screening

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Introduction

Vision screening is carried out by primary care doctors, ophthalmologists, optometrists, orthoptists, school nurses, parent volunteers, and community organizations using a variety of techniques. Criteria for referral vary between existing screening protocols, instruments, and recommendations of national organizations. Evaluation of vision-screening techniques is an ongoing process. Traditional acuity testing is possible in children beginning at age 3 years. Instrument-based screening can be performed in younger children. Instrument-based screening does not measure traditional visual acuity, but instead screens for risk factors that are likely to lead to amblyopia or poor vision. The American Association for Pediatric Ophthalmology and Strabismus ([AAPOS](#)) has devised standards for comparing pediatric vision screening methods. These guidelines are set against a child's cycloplegic pediatric ophthalmology examination to determine whether the child's vision screening should have prompted a referral for a comprehensive exam. Vision-screening techniques can be evaluated using these guidelines.¹ Literature evaluating instrument-based vision screening techniques is outlined below.

Children Recommended for Direct Referral

Some children should be referred directly for a comprehensive examination.² Children with a family history of childhood eye disease, those with disorders associated with eye problems, and those whose caretakers are suspicious of vision problems should undergo a comprehensive eye exam. Referral should be made for children with apparent ocular abnormalities (e.g., ptosis, strabismus, nystagmus), developmental delay, suspected neurologic abnormality, systemic disorders with associated ocular abnormalities (e.g., juvenile idiopathic arthritis, diabetes mellitus), or a history of eye injury. Newborns with a history of metabolic/genetic disorders, intrauterine growth retardation, prematurity, or a family history of childhood eye disorders (including cataracts or retinoblastoma), should be referred for a comprehensive examination. In addition, premature neonates meeting screening criteria for retinopathy of prematurity (ROP) should be referred to an ophthalmologist experienced in the care of ROP according to American Academy of Pediatrics (AAP) guidelines.³

Infants suspected of having difficulty seeing should be referred. Specifically, infants not demonstrating eye contact in the first 2 months or a social smile and awareness of hands by 3 months. Infants not reaching for toys at 6 months or recognizing faces by 11 months should be referred. If necessary, screening can be used to identify children most in need of a comprehensive eye exam when such resources are limited.

National Organization Policies and Programs

Because many children with eye disease are not known to have risk factors and children typically do not complain of visual difficulties, childhood vision screening remains an essential component of child (and adult) health. Because of the importance of vision screening, several national organizations have developed vision-screening policy recommendations, and a variety of models for community vision screening have emerged. This section presents the most widely used recommendations and models. Several of these programs and organizations collaborate to support and improve vision screening outreach and scope.

The AAP remains the largest voice in vision screening efforts in the United States. The consensus report by the AAP, AAPOS, the American Academy of Ophthalmology (AAO), and the American Association of Certified Orthoptists (AACO) is the most commonly used reference for vision screening standards. This joint policy statement, [Visual System Assessment in Infants, Children, and Young Adults by Pediatricians](#), is reviewed by the respective organizations on an ongoing basis to remain current with clinical research. This document offers specific recommendations for eye and vision screening by age.

General recommendations are that newborns should be examined for structural ocular abnormalities such as cataract, corneal opacity, and ptosis, and red-reflex testing should be performed. Instrument-based screening, when available, should be attempted by age 2 years. Direct testing of visual acuity should begin by age 3 years, using age-appropriate optotypes (Lea Symbols or HOTV). All children found to have an ocular abnormality or who fail a vision assessment should be referred to a pediatric ophthalmologist or an eye care specialist appropriately trained to treat pediatric patients. This joint policy statement is available [on line](#).⁴ In addition, descriptions of the red-reflex test and the AAP's [See Red cards](#) (**Figure 1**) are available through the AAP.⁵ A good demonstration video is available at [Medscape](#).⁶

See RED

Red reflexes from the retinas can be used by the physician to great advantage. The illustration shown here depicts the inequality of the red reflection or the interference with the red reflections in various conditions. The white dots represent corneal light reflexes.

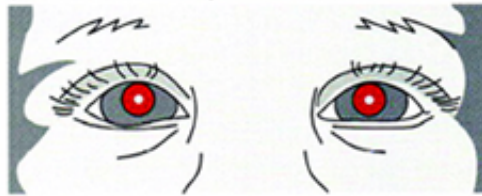
Techniques: Set the ophthalmoscope (preferably one with a halogen light source) on zero or close to zero, stand a few feet away from the child seated in the parent's lap, attract the child with voice or noise encouraging the child to look at the light, compare the red reflection from each pupil. Both red reflections should be viewed simultaneously and alternately. An expanded observation is the position of the white reflection, the corneal light reflex.

The beauty of this test is that it can be done with a "hands-off" approach; it can furnish accurate information ~~without~~ without dilatation of the pupils. As a screening device it is very cost effective. We encourage you to work with this technique. It is useful far beyond all other manual inspection tests for assessments of vision, refraction, motility, alignment, injury evaluations, and eyelid-pupil relationships.

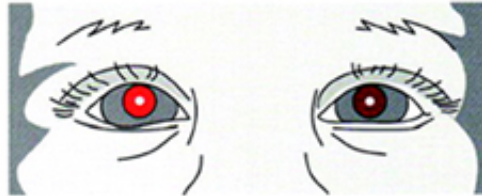


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*Wash Myn Ophthalmoscope # 111720

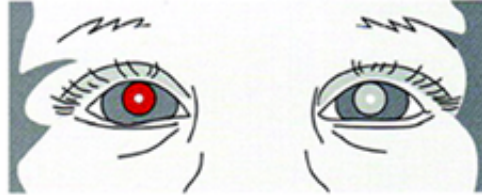
↓ **NORMAL**—Child looks at light. Both red reflections are equal.



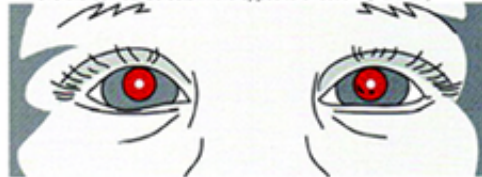
↓ **UNEQUAL REFRACTION**—One red reflection is brighter than the other.



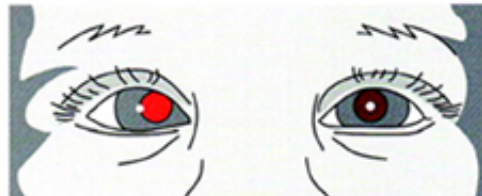
↓ **NO REFLEX (CATARACT)**—The presence of lens or other media opacities blocks the red reflection or diminishes it.



↓ **FOREIGN BODY/ABRASION (LEFT CORNEA)**—The red reflection from the pupil will back-light corneal defects or foreign bodies. Movement of the examiner's head in one direction will appear to move the corneal defects in the opposite direction. (Parallax)



↓ **STRABISMUS**—The red reflection is more intense from the deviated eye.



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Figure 1. American Academy of Pediatrics See Red card.

The AAP Bright Futures program facilitates the AAP recommendations of the joint policy statements. This program provides clinical exam check lists and parental questionnaires to be used by pediatricians. In addition to recommendation for examination of the eyes (inspection, ocular motility assessment, and red-reflex testing), the Bright Futures tools include visual assessment questions at well-child visits. Specifically, visits at 12, 15, and 18 months and 2 and 2.5 years, the caretakers are asked, "Do you have concerns about how your child sees?" Specific questions on the previsit questionnaire include

1 month Is your baby able to follow you with their eyes?

2 months Does your baby look at you?

6 months Does your baby like to look around?

Does your baby smile at people they know?

At 9 months, more detailed questions regarding fixation, strabismus, and ptosis are included. Other questions include

Have your child's eyes ever been injured?

Does your child hold objects close when trying to focus?

Do your child's eyes appear unusual or seem to cross, drift, or be lazy?

Do your child's eyelids droop or does 1 eyelid tend to close?

Bright Future protocols include assessment of visual acuity in an age-appropriate manner. A baby is expected to follow horizontally to midline at 1 month, develop vertical movements at 2 months, and demonstrate good saccades and alignment by 3 months. At age 3 years, visual acuity testing is introduced with age-appropriate optotypes (HOTV, Lea symbols). Acuity assessment is recommended at well-child visits at 4, 5, 8, 10, 12, 15 and 18 years. A 1-time color vision test is also recommended for boys.

In addition to the Bright Futures clinical support for pediatricians, resources for parents describing visual development are available. These include [Healthy Children: Warning Signs of Vision Problems](#) and publications of the [Section on Ophthalmology of the AAP](#).

Additionally, the AAPOS vision-screening recommendations are available [here](#).

The [AACO](#) guidelines are aligned with those of AAPOS. The American Academy of Family Physicians ([AAFP](#)) recommends the AAP or the United States Preventative Services Task Force (USPSTF) guidelines.

The National Center for Children's Vision and Eye Health at Prevent Blindness America (PBA), after formal literature review by its national expert panel, has developed [recommendations](#) for recognition acuity that differ slightly from those of the AAP/AAPOS/AAO/AACO. They provide specific technique recommendations for children 36–72 months old (second table). Acceptable practices include using 5- or 10-foot charts of HOTV or Lea symbols optotypes (**Figure 2**) presented as a line or single optotype with crowding bars. The lines and optotypes should be changed for each eye because children tend to memorize the charts very quickly. Other optotypes (e.g., Tumbling E, Landolt C) and methods are considered unacceptable. At the time of their review, they also made recommendations regarding automated screeners, finding evidence to support the use of the Retinomax (Right Manufacturing, Tokyo), the SureSight Vision Screener (Welch-Allyn, Skaneateles Falls, NY), the Plusoptix Photoscreener (Plusoptix, Nuremberg, Germany), and the Welch-Allyn Spot VS100. These recommendations will be continually updated as new technology evolves.

The American Optometric Association (AOA) does not recommend vision screening, but rather baseline comprehensive exams at 6 months, 3 years, before first grade, and every 2 years thereafter.⁷

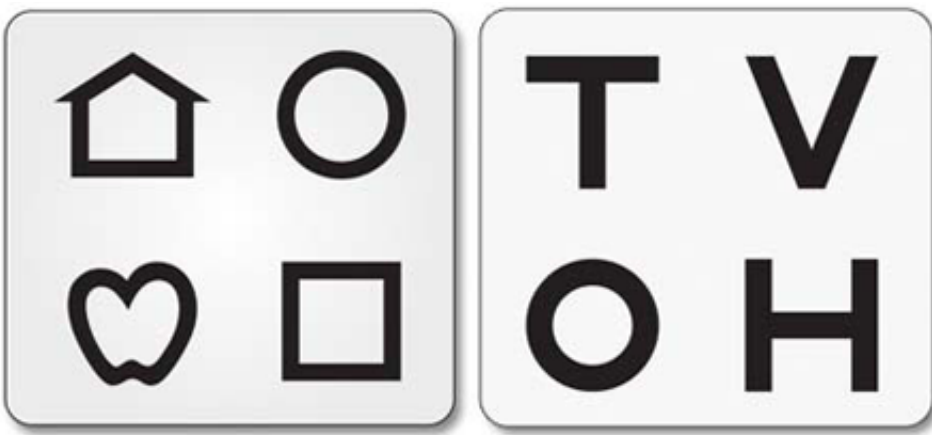


Figure 2. Lea Symbols (left) and HOTV letters (right). Image Courtesy of [Good-Lite Co.](#)

School-Based and Community Screening Protocols

Vision screening in schools provides an opportunity for efficiently screening many children. The National Association of School Nurses (NASN) offers an [instructive video](#) of AAPOS recommendations. However, school screening requirements and recommendations differ by [state](#). Most states recommend that children entering school undergo vision screening. Government supported preschool programs such as [Head Start](#) provide vision screening for preschool-aged children. For infants and toddlers entering government programs, many states have developed vision screening tools used by developmental professionals and vision therapists. Such assessments often include the clinical assessment of visual acuity and visual field as well as face and symbol recognition, orientation in space, and eye-hand coordination. There are multiple such assessments available, often including an extensive questionnaire. Several questions mirror those of the Bright Futures program.⁸

As understanding of visual impairment and learning processes increases, combining vision screening with functional visual assessments becomes important in designing effective therapies. Children with learning disabilities or suspected neurologic disease should have a functional visual assessment as well as a comprehensive ophthalmologic examination.

School-based health centers (SBHCs) have become an important method of health care delivery for school-age children.⁹ Several models of vision screening and follow-up care have evolved to provide eye care in schools. These models include mobile eye clinics (such as those in [California](#) and [New England](#)) or use of portable equipment such as in South Carolina to bring screenings, exams, and an optical shop to the school. These programs might use volunteers or ophthalmic technicians for screening and optometrists or ophthalmologists on site for immediate follow-up examinations. Many include an optician and dispensary and the children are given glasses at school. In some school programs, eye examination lanes are permanently placed to service students within the school's medical home. A novel in-school vision screening protocol is that of the validated [EyeSpy](#) program which tests vision while the child plays an adventure game on the computer.¹⁰ The results are integrated into the school health records data system.

Community screening programs use both acuity testing and automated screening techniques. Many volunteer organizations are instrumental in regional, national, and even international vision care. These include Prevent Blindness America, Sight Savers, Lions Club International, Rotary International, the Association for the Blind and Visually Impaired, and many others. The contribution of these organizations in combating amblyopia and visual impairment must be appreciated and applauded.

Parents and caregivers have increasing options to conduct vision screening at home. There are now charts available for computer download and smart phone apps designed to test vision. One of the most popular is an HOTV chart from Prevent Blindness America.¹¹

The PEDIG Jaeb Visual Acuity Screener has a well-validated HOTV chart that can be downloaded for computer use.¹²

Increasingly smart phone apps are being developed for both acuity (Peek Vision) and objective instrument-based screening (GoCheck Kids). These instruments are currently under objective study to validate efficacy and will expand vision screening access.

Recommendation Updates

The emergence of new technology necessitates continued updates of recommendations. The option of new objective instrument based screening provides more tools in the evaluation of younger children. In a review of vision-screening literature, the USPSTF Vision Screening for Children 1 to 5 Years of Age: US Preventive Services Task Force Recommendation Statement¹³ recommends a one-time screening for ages 3–5 years. Recommended techniques include visual acuity, stereoacuity, cover-uncover testing, Hirschberg light reflex, and instrument-based screening. This review finds insufficient evidence to screen children younger than 3 years. However, a large community-based screening program demonstrated that vision screening in children less than 3 years can reliably detect amblyogenic risk factors, and therefore recommends initiation of photoscreening in children aged 1 year and older.¹⁴ The medical community consistently supports vision screening by age-appropriate methods throughout infancy and childhood. It is expected that evaluation of technologic advances will continue to extend opportunities for vision screening.

Repeat Screenings

Repeat screenings are important to maximize screening effectiveness. A single screening is insufficient to detect amblyopia with high sensitivity because children with poor vision might peek at the chart or memorize it to pass the test or to please the examiner. Also, different problems present at different ages: The chance of detecting a problem is greater if the screenings are repeated. Thus, most programs are designed with the expectation of annual or biannual screenings.

Follow-Up

Follow-up care is needed for children found to have a vision or ocular problem. Children should be referred to an eye-care provider experienced in the care of children immediately with the expectation of being seen within 3 months, or as appropriate based on findings, for a comprehensive exam. A comprehensive examination includes a binocularity and strabismus evaluation, a dilated fundus exam, a cycloplegic refraction, and other testing as indicated. A child unable to complete vision screening should undergo a repeat screening within 6 months. Completed examinations should be tracked to improve the sensitivity and specificity of the screening program and to encourage parents who have not had a follow-up examination yet to do so. Lack of follow-up care is often a limitation to program success. An integrated health data system is suggested to improve tracking referrals and evaluation of vision screening programs.¹⁵

Companies and doctors are developing new tools while schools, communities, nurses, and data systems are strengthening vision screening models. Determining the most effective protocol to decrease childhood visual impairment at all ages in different settings will require a continued, consolidated effort.

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