

aaapos American Association for Pediatric Ophthalmology and Strabismus


PEDIATRIC VISION SCREENING

GUIDELINES FOR PRIMARY CARE PROVIDERS AND SCHOOL NURSES

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Why Perform Vision Screening?

- Primary Care Providers and School Nurses:
 - The first line of defense to detect preventable vision loss in children.
- Recommended as part of the American Academy of Pediatrics [Bright Futures Periodicity](#) schedule.
 
- Why do children lose vision?
 - **Amblyopia**: commonly referred to as “lazy eye”

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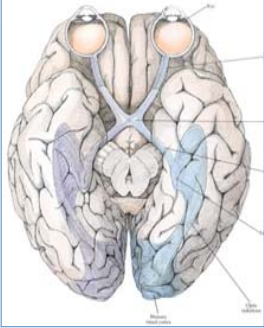
Learning Objectives

- Appreciate the importance of vision screening during childhood.
- Understand methods that enhance the accuracy of visual acuity screening.
- Appreciate new technologies that can identify signs of potential vision problems.

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Amblyopia

- Amblyopia is a decrease in vision development that happens when the brain does not get normal stimulation from the eye(s).
- Abnormal development of vision results when one or both eyes send a blurred or distorted image to the brain.
- The brain is unable to “learn” to see clearly with that eye, even when glasses are used.





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Amblyopia Develops in Children

- If not treated in early childhood, amblyopia results in permanent loss of vision.
 - The most common cause of vision loss in adults 20 - 70 years of age is untreated childhood amblyopia.
- Amblyopia is caused by untreated, usually unequal refractive errors, strabismus, or defects within the eye (e.g. cataract).

Amblyopia

- ❖ Treatment involves addressing underlying cause (glasses, strabismus surgery, cataract removal) and penalization with patching or Atropine drops
- ❖ NIH funded PEDIG studies have looked prospectively at duration of patching, atropine penalization, etc through Amblyopia Treatment Studies
- ❖ Older children (teenagers) may still be amenable to treatment

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Amblyopia

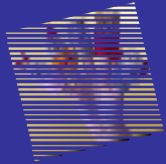
- ❖ Affects 2-4% children in US
- ❖ Most asymptomatic emphasizing importance of careful vision screening
- ❖ "Dull or blunt sight" from abnormal visual experience during the critical period of development (10-12 yo)
- ❖ Most commonly caused by strabismus or anisometropia (unequal focusing errors) or occasionally from ocular media opacities (congenital cataracts) or obstruction of visual axis (severe ptosis, capillary hemangioma)

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Pseudostrabismus

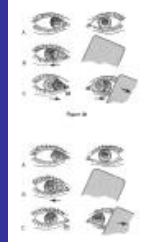
- Optical illusion due to epicanthal folds/wide nasal bridge
- Light reflexes centered in pupils, no movement cover test





Cover Test

- Use a good fixation target
- Lights are poor fixation targets
- Alternatively cover each eye
- Deviated eye will move to pick up fixation if vision present
- Any shift means referral



Accommodative Esotropia

- Usual onset between 1 and 3 years old
- Usually smaller, intermittent esotropia, worse with focusing
- Usually associated with high hyperopia (farsighted)
- Glasses responsive
- Can be non-refractive component (partially accommodative)
- Monitor for amblyopia



Infantile Esotropia

- Onset usually in first year of life
- Typically large angle (really crossed)
- Often cross fixate, may have poor abduction (pseudo-abduction deficit)
- Early surgery gives better chance for binocular vision
- Monitor for amblyopia



Fig. 1 Child with infantile esotropia.

Intermittent Exotropia

- Onset usually between 1 and 4 years old
- Usually worse with fatigue, visual inattention
- Monocular eye closure or squinting in sunlight
- Amblyopia less common
- Surgery for poor fusional control



Fig. 2 Right eye deviated outward.

Red Reflex: Check it at EVERY Well Child Visit



Screening Early is Best

School-aged vision screening may occur too late:

- Amblyopia starts becoming less responsive to treatment after 5 years of age.
- Permanent vision loss occurs by 8 years of age.

Abnormal Red Reflex

- Retinoblastoma
- Congenital cataract
- Other ocular abnormalities (coloboma, Coat's disease, Toxocara infection)



Vision Screening in the United States

- National Eye Institute (NEI)
 - Amblyopia affects 2 - 3% of children in the United States
 - An estimated 4.5 million children with preventable vision loss.



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American Academy of Pediatrics Policy Statement

[Pediatrics January 2016](#)

- Instrument-based screening (photoscreening) is recommended for children 12-months of age and older unless they can reliably perform visual acuity testing with eye charts.
- Direct measurement of visual acuity using eye charts remains the gold standard for vision screening and can often begin by 4-years of age.



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Barriers to Screening

- Poor cooperation of young children
- Takes too long to perform
- Staff not adequately trained
- Poor reimbursement for providers



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Visual Acuity Screening is the Current Gold Standard

- In cooperative children, direct measurement of visual acuity using visual acuity charts remains the gold standard for vision screening.



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Visual Acuity Screening Guidelines

Age-Dependent Thresholds

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Newborn to 35 Months (0-3 years)

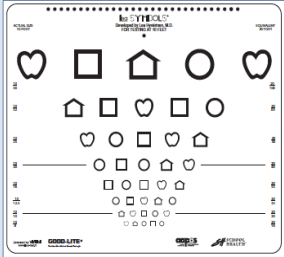
[Procedures for the Evaluation of the Visual System](#)
Pediatrics January 2016

- Take a health history: eye problems in close relatives?
- Check vision (tracking), eye movement (motility) and alignment (strabismus)
 - Corneal light reflexes should be centered
 - Cover testing if able
- Check pupils and red reflexes (round, equal, bright)

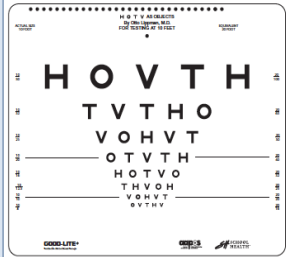
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36 Months to 47 Months (3-4 years) Recommended Chart Types

Lea Symbols



HOTV Letters



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36 Months to 47 Months (3-4 years)

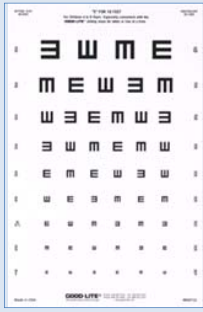
Measure Visual Acuity

- Must be able to identify the majority of the 20/50 line optotypes with each eye.
- Testing should be done at 10 feet.
- Opposite eye must be effectively covered.

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Less than Ideal Chart Choices Not Recommended for Children







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48 Months to 59 Months (4-5 years)

- Must be able to identify the majority of the 20/40 line optotypes with each eye.





HOTV
Match Card

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AAPOS Vision Screening Kit

Conforms to AAPOS/AAO/AACO/AAP Visual Acuity Standards




[AAPOS Vision Screening Kit](#)

- **Contents:**
- Occluder patches
- Occluder glasses
- Occluder paddle
- 10 ft. measuring cord
- Match response card
- Acuity charts:
 - Sloan letters
 - Available with choice of Lea symbols or HOTV letters
- Two instructional DVDs

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60 Months and Older (5+ years)

- Must be able to identify the majority of the 20/32 (or 20/30)* line with each eye.
- Sloan letters (shown)
 - Preferred over Snellen Letters
 - Snellen charts have a 20/30 line*
- Repeat testing:
 - Every 1-2 years

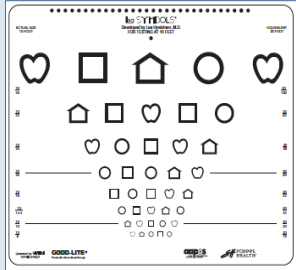


Sloan letter chart

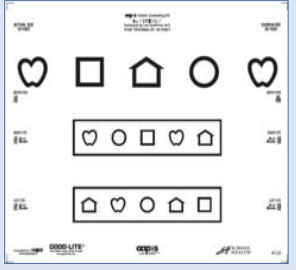
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Threshold and Critical Line Options

Threshold



Critical Line



Threshold Screening

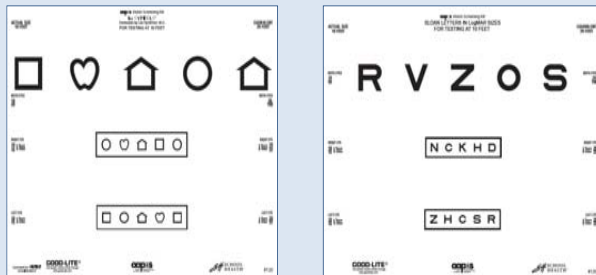
- Reading down the eye chart until a **Threshold line** is crossed...
 - e.g. 20/32 for age 5+ years
- Or as far down as possible.
 - Allows for inter-ocular comparison between the two eyes.
 - Refer children with a two-line difference between eyes.



Do not allow “Peeking”

- Be sure that eye not being tested is completely covered
- No hints from siblings or parents

Critical Line Screening is *Faster* Only read a single “critical” line with each eye



Each chart has two boxed critical lines: one for each eye.

Supplemental AAPOS Vision Screening Kit

- Basic kit plus
- Stereo testing
 - Color vision testing
 - Near acuity charts for testing at 16 inches.




[AAPOS Supplemental Screening Package](#)

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Computerized Eye Charts

- Apps for tablets / phones
- Desk and Laptop programs
- On-line programs




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On-line Visual Acuity Screening

- The **Jaeb Center for Health Research** is a nonprofit center for clinical trials and epidemiologic research in ophthalmology and diabetes.
 - Pediatric Eye Disease Investigator Group (PEDIG)
- JVAS (Jaeb Visual Acuity Screener) is free for Windows PCs. [JVAS](#)
 - Pediatric visual acuity screener meant for non-ophthalmic health care professionals.

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AAPOS Vision Screening App. for iPad

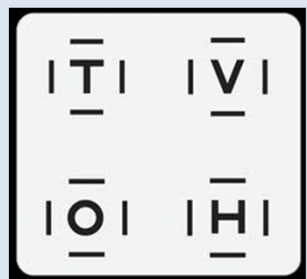


[AAPOS Vision Screening App for iPad available in iTunes Store](#)

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JVAS (Jaeb Visual Acuity Screener)

- Test distance 5 feet (1.5 m)
- [JVAS](#) also has an HOTV matching card PDF available for download



[JVAS HOTV matching card](#)

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Reimbursement for Acuity Screening


CPT 99173

- Use with screening tests of visual acuity
 - Wall charts
 - Computerized eye charts
 - AAPOS Vision Screening Kit

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Instrument-Based Screening: Commonly Called “Photoscreening”

- Photoscreeners, autorefractors, and other devices **do not replace visual acuity screening with eye charts.**
- Particularly helpful in children ages 1-5 years.



PlusOptix S12c

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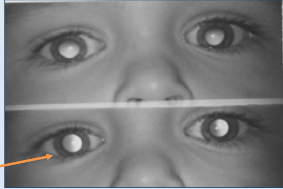

PEDIATRIC INSTRUMENT-BASED VISION SCREENING

“Photoscreening”

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Photoscreeners

- One of original screening instruments
- Took 2 Polaroid photos of the eyes
- Size and shape of the red reflex crescent used to estimate refractive error and amblyopia risk

MTI Photoscreener

Instrument-Based Screening When to Screen?

- The AAPOS Vision Screening Committee recommends instrument-based screening for children ages 1 to 3 years.
- Instrument-based screening is also an acceptable alternative to vision screening with an acuity chart for children ages 3 to 5 years.

What is the Difference Between Vision Screening with Eye Charts and Vision Screening Devices?

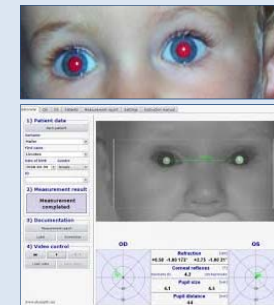
- Vision screening with eye charts tests the actual visual acuity (20/20 etc.)
- Vision screening devices typically do not test visual acuity directly.
 - Screening devices test for eye conditions or risk factors that may cause decreased vision or amblyopia

Visual Acuity Screening is the Current Gold Standard

- Direct measurement of visual acuity using vision charts is the current gold standard for vision screening, unless the child is not reliably able to perform such a test

Instrument Screening: What is a Photoscreener or Autorefractor?

- An instrument that takes a photographic image of the eye's red reflex, or some other measurement, to estimate the refractive error.
 - “prescription” of the eye
- Also may detect ocular misalignment and other conditions degrading or blocking line of sight (cataract).



PlusOptix S09 Screenshot

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Common Photoscreeners and Autorefractors

Welch Allyn SureSight

Righton Retinomax

iScreen

PlusOptix S12R

Welch Allyn "Spot"

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Welch Allyn Spot

- Supports AAP screening guidelines for early detection of amblyopic risk factors
- Automated screening provides thorough, objective, and easy-to-understand results
- Easy to use, easy to implement with minimal user training required
- Adequately powered for mass screening events
- Captures readings 97% of the time helping to screen otherwise difficult patients
- Screens for refractive errors, strabismus and anisocoria
- Uses lights and sounds to help engage children
- MSRP of \$7,500

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Typical Photoscreeners in Use

iScreen

PlusOptix S12


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iScreen Vision

- iScreen Vision provides a fast, easy, and portable pediatric vision screening solution for infants and pre-school and school-age children that is as simple as using a digital camera.
- iScreen Vision's vision screening process is covered by many insurers under CPT code 99174 for "instrument-based ocular screening."
- One keystroke sends images and information to iScreen Vision Central Analysis for an independent clinical review by a trained technician
- A full patient report is usually returned to the physician before the patient leaves the office – typically within minutes
- List price of \$4,000 plus per screen cost

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Plusoptix

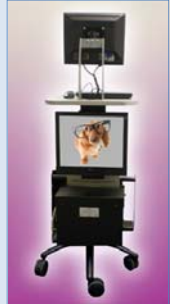


- 20 years of Pediatric vision screening experience
 - Created the *worlds first* immediate read vision screener and *first* pediatric auto-refractor
- Specificity and Sensitivity as high as 95%
- 3 different models of Pediatric vision screeners from \$5,500 to \$6,500
 - Screens for refractive errors, strabismus and anisocoria
- Warranty covers accidental damage

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Diopsys “Enfant”

- Diopsys “Enfant” VEP vision test.
- Tests the entire visual pathway: “front to back”
 - Eye
 - Optic nerve
 - Visual cortex



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Other Vision Screening Devices

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EyeSpy 20/20

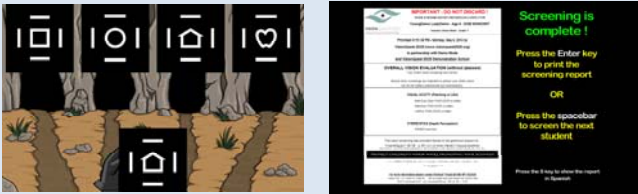
- Automated computer software
- Tests:
 - Visual acuity
 - Stereopsis
 - Color vision
- Runs on a standard laptop or desktop computer



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EyeSpy 20/20

After testing the visual acuity of each eye, the program generates a report

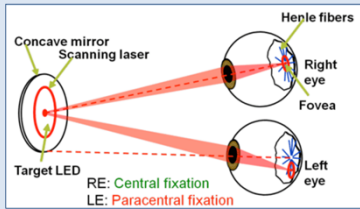


With cloud-based storage, EyeSpy 20/20 can integrate and store data collected from other devices such as photoscreeners and school databases

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REBIScan Pediatric Vision Scanner


- Assesses foveal fixation
- Amblyopic eyes are found to have abnormal fixation (microstrabismus).



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REBIScan Pediatric Vision Scanner

- Retinal birefringence technology.
- Tests for the amblyopia by detecting microstrabismus.



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GoCheck Kids Vision Screening App

- A modern version of the “photoscreener”
- Smartphone app analyzes the red reflex of the eye



When to Photoscreen?

- Generally not before 1 year of age.
 - Poor fixation behavior impedes measurement.
- The false positive rate is high.
- There is a low likelihood of ophthalmic intervention.
 - Except for constant strabismus, cataract, glaucoma, retinoblastoma.
 - Correction of refractive error typically delayed.

Instrument Screening is Not Experimental

- The United States Preventative Services Task Force (USPSTF) has recognized photoscreening as appropriate methodology for vision screening of children aged 3-5 years.

US Preventive Services Task Force. Vision screening for children 1 to 5 years of age: US Preventive Services Task Force Recommendation statement. Pediatrics. 2011;127:340-6.

Instrument Screening is Useful For:

- All children ages 1-3 years
 - Usually unable to perform visual acuity chart tests
- Some children ages 3-5 years
 - Acuity chart testing is preferred, but...
 - Instrument-based screening is an acceptable alternative
- Older children who are non-verbal, developmentally delayed or otherwise unable to perform testing with acuity charts

Photoscreening is Endorsed by the American Academy of Pediatrics

- The American Academy of Pediatrics has issued a policy statement supporting the use of these technologies for preschool vision screening

Miller JM, Lessin HR, American Academy of Pediatrics Section on Ophthalmology; Committee on Practice and Ambulatory Medicine; American Academy of Ophthalmology: American Association for Pediatric Ophthalmology and Strabismus; American Association of Certified Orthoptists. Instrument-based pediatric vision screening policy statement. Pediatrics. 2012;983-6.

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Instrument Screening May be Better?

- A randomized, controlled, multi-centered cross-over study demonstrated photoscreening to be superior to direct testing of visual acuity for screening of well children ages 3-6 years in the pediatric office.

Salcido AA, Bradley J, Donahue SP. Predictive value of photoscreening and traditional screening of preschool children. J AAPOS 2005 Apr;9(2):114-20.

TABLE 2 AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS' RECOMMENDED AMBLYOPIA RISK FACTOR TARGETS

REFRACTIVE RISK FACTOR TARGETS				
Age, months	Astigmatism	Hyperopia	Anisometropia	Myopia
12-30	>2.0 diopters	>4.5 diopters	>2.5 diopters	>-3.5 diopters
31-48	>2.0 diopters	>4.0 diopters	>2.0 diopters	>-3.0 diopters
>48	>1.5 diopters	>3.0 diopters	>1.5 diopters	>-1.5 diopters

NONREFRACTIVE RISK FACTOR TARGETS	
All ages	Media opacity >1 mm Manifest strabismus >8 prism diopters in primary position

From Donahue SP, et al.⁵

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Referral Criteria for Instrument Screening

Considerations:

- Age of patient
 - Passing criteria are more generous (higher thresholds) for younger children and more stringent (lower thresholds) for older children.
- Sensitivity
 - High rate of detection but also high rate of referrals for false positives.
- Specificity
 - Fewer false positives but will miss some at-risk kids.

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Warning!

- There is a difference between the Refractive Risk Factor Target numbers on the preceding table and what the screening instrument settings should be.
- Children can accommodate tremendous amounts (change the focusing power of their eyes).
 - this potentially affects some of the instrument readings
- Device manufacturers will have guidelines specific to your needs.

Reimbursement for Instrument Screening

CPT 99174

- Use with automated photoscreening and autorefractometry:
 - Photoscreeners
 - Autorefractors
 - Fixation “Pediatric Vision Scanner”
 - Do not use 99173 which is only for tests of actual visual acuity (eye charts)

References and Links


- [Visual System Assessment in Infants, Children and Young Adults by Pediatricians](#)
 - American Academy of Pediatrics Policy Statement
 - Pediatrics. January 2016. Volume 137. Issue 1
- [Procedures for the Evaluation of the Visual System by Pediatricians](#)
 - American Academy of Pediatrics Clinical Report
 - Pediatrics. January 2016. Volume 137. Issue 1

Reimbursement for Acuity Screening


- For screening tests of visual acuity
 - [99173](#) is used for tests such as wall charts or computerized eye charts where the child identifies letters or symbols.
 - Example: AAPOS Vision Screening Kit

References and Links

- [Bright Future and Preventative Medicine Coding Fact Sheet](#)
 - American Academy of Pediatrics
 - AAP.org → Professional Resources → Practice Transformation → Coding at the AAP
 - Updated January 2016



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Vision Screening Recommendations

AGE	TESTS	REFERRAL CRITERIA COMMENTS
Newborns to 12 months	<ul style="list-style-type: none"> Ocular history Visual assessment External inspection of the eyes and lids Ocular motility assessment Pupils examination Red reflex examination 	<ul style="list-style-type: none"> Refer infants who do not track well after 3 months of age. Refer infants with an abnormal red reflex or history of retinoblastoma in a parent or sibling.
12 to 36 months	<ul style="list-style-type: none"> Ocular history Visual assessment External inspection of the eyes and lids Ocular motility assessment Pupils examination Red reflex examination Visual acuity testing Objective screening device Photostereogram Dyphthalmscopy 	<ul style="list-style-type: none"> Refer infants with strabismus. Refer infants with chronic tearing or discharge. Refer children who fail photostereogram.
36 months to 5 years	<ul style="list-style-type: none"> Ocular History Visual assessment External inspection of the eyes and lids Ocular motility assessment Pupils examination Red reflex examination Visual acuity testing (preferred) or photostereogram Dyphthalmscopy 	<p>Visual Acuity Thresholds:</p> <ul style="list-style-type: none"> Ages 36-47 months: Must correctly identify the majority of the optotypes on the 20/50 line to pass. Ages 48-59 months: Must correctly identify the majority of the optotypes on the 20/40 line to pass. Refer children who fail photostereogram.
5 years and older*	<ul style="list-style-type: none"> Ocular history Visual assessment External inspection of the eyes and lids Ocular motility assessment Pupils examination Red reflex examination Visual acuity testing Dyphthalmscopy 	<ul style="list-style-type: none"> Refer children who cannot read at least 20/22 with either eye. Must be able to identify the majority of the optotypes on the 20/22 line. Refer children not reading at grade level.

*Repeat screening every 1-2 years after age 5.