PREVENT BLINDNESS POSITION STATEMENT ON SCHOOL-AGED VISION SCREENING AND EYE HEALTH PROGRAMS

REVIEWED AND APPROVED AUGUST 5, 2015

Prevent Blindness recommends a continuum of eye care for children to include both vision screening and comprehensive eye examinations. All children, even those with no signs of trouble, should have their eyes checked at regular intervals. Any child who experiences vision problems or shows symptoms of eye trouble should receive a comprehensive eye examination by an optometrist or an ophthalmologist.

Prevent Blindness, other organizations, and school health personnel often perform vision screenings for children at schools and other settings. While vision screenings and eye examinations are complementary approaches to assessing the eye problems of a child, a screening is used to identify a child at risk for vision problems and does not replace a comprehensive examination performed by an eye doctor. Additionally, vision screenings provide a critical bridge from detection to eye care for families that may not regularly access health or eye care services, may need financial assistance to afford care, or those that may not fully understand the impact an undiagnosed and untreated vision problem might have on the rest of their child's life. Prevent Blindness advocates for good vision for all throughout the life spectrum, and that all children are visually ready as they begin school and beyond.

This document is a position statement, not formal recommendations or protocols, and is meant to guide those charged with developing, implementing and evaluating vision screening programs for school-aged students. The guidance provided in this document was developed on currently available scientific evidence. While we are able to outline and discuss what an ideal screening might look like, current lack of evidence in several areas for this age group results in a screening program that may fall short of that ideal.

The workgroup tasked with the development of this position statement has identified several areas of needed research that would contribute to a more comprehensive vision screening approach in the school-age population. These areas of additional research that have been identified will be considered by the Advisory Committee of the National Center for Children's Vision and Eye Health at Prevent Blindness. This position statement will be updated as new evidence is available and guidance is provided by the Advisory Committee.

School-aged Vision Screening Statement of Purpose

It is important to emphasize that vision screening is not an eye examination, the screening does not replace an eye examination, and the screening will not detect all potential vision disorders or diseases. This statement pertains to vision screening.

The goals of vision screening in school-aged children (defined in this statement as typically developing children aged 6 years through age 17 years) differ from those aged 5 years and younger. The goal of the screening program for school-aged children shifts from a primary focus on prevention of amblyopia and detection of amblyopia risk factors, to detection of refractive errors and other eye conditions that could potentially impact the students' ability to learn or to affect their academic performance. Vision screening – using recommended tools, protocols, and procedures – is a cost-effective method to identify children in need of evaluation and treatment by an optometrist or ophthalmologist. Early diagnosis and treatment of vision disorders will allow for more normal visual development; prevent further loss of vision; and may decrease the impact of learning problems, poor school performance, developmental delays, and behavior concerns.

Periodic vision screening during the school years is important for school-aged children because refractive errors and other visual disorders may emerge for the first time throughout these years. Among school-aged children and adolescents aged 12 through 19 years, around 9% have visual impairment (defined as visual acuity of 20/50 or worse) because of uncorrected refractive error, such as nearsightedness (myopia) or far-sightedness (hyperopia).[1] According to a recent article in *Investigative Ophthalmology & Visual Science*[2], 23.7% of 3,209 children aged 12 through 19 years with correctable refractive error were inadequately corrected and children of Mexican and non-Hispanic black ancestry were at highest risk for inadequate correction of refractive error. Myopia and astigmatism were found to be the most common refractive condition in this age group.

[1] (Vitale S, 2006)
[2] (Qiu, 2014)

Vision screening and eye health should be an integral part of the coordinated school health program. The major objectives of a school-aged vision screening and eye health program should be to:

1) Detect refractive errors and other eye conditions that could potentially impact the students' ability to learn or academic performance.
2) Detect undiagnosed amblyopia and other early childhood vision and eye disorders that are still amenable to some form of treatment. There is a growing body of evidence that amblyopia can be treated in school-aged children.[3]
3) Engage caretakers of children who fail vision screenings through education and provision of culturally and linguistically competent support.
4) Facilitate access to a professional eye care provider for all children who fail a vision screening, for parents or teachers who suspect a vision problem, or for children who are at an increased risk of a vision problem because of an underlying medical condition.
5) Establish follow-up procedures to ensure that each identified student will receive appropriate vision and eye health care.
6) Ensure that vision screening of children is accomplished using valid, reliable, and age-appropriate tools and methods by individuals who completed a training and certification program.
7) Conduct regular assessments of the vision and eye health screening program by employing recommended data collection techniques and performance outcomes measures. For more information on data collection see Vision Screening for Children 36 to <72 Months: Proposed Data System[4].
8) Inform classroom teachers of students with vision deficits of the nature of those deficits and of the appropriate treatment.
9) Ensure that appropriate educational accommodations are provided for students with vision deficits.

Additional considerations for a school-aged vision screening and eye health program may include the provision of information on the development of vision, vision disorders, and age-appropriate eye safety topics.

These recommendations apply to vision screening and eye health programs occurring in school and community settings. Vision deficits might also be detected during well-child care visits in a medical setting, but not all children have access to primary care. School and community screenings may be the only avenue for some children to receive vision screening. When possible vision problems are identified during school and community screenings, and a child has a primary care provider (PCP), communication and coordination with the child's PCP and eye care professional is helpful for ensuring follow-up, diagnosis, and treatment.

When and How Often Should Screening Occur?

Recommendations on the periodicity of vision screening in the school-aged population vary among professional associations. For example, the *Bright Futures* guidelines recommend performance of vision screening annually between the ages of 3 years through 6 years, as well as ages 8, 10, 12, 15, and 18 years with risk assessment at alternate ages. The periodicity schedule is located at: http://www.aap.org/en-us/professional-resources/practice-support/Periodicity/Periodicity%20Schedule_FINAL.pdf

The U.S. Preventive Services Task Force does not have a recommendation for periodicity for this age group. Repeated vision screenings throughout a child's school years are most effective in detecting new or previously undiagnosed vision and eye health problems. For example, a vision screening or comprehensive eye examination is recommended as part of a student's preparation for driver's education classes in many states.

Public health screening principles, including appropriate stewardship of resources and reducing the burden of disease should guide vision screening practice[5]. Focusing vision screening activities on asymptomatic populations is consistent with these principles, as is omitting screening for populations with known risk factors for a higher prevalence of vision problems. In the latter population, screening is an additional step that does not directly contribute to definitive diagnosis and treatment.

[3] (PEDIG, 2004)
[4] (Hartmann, E. E.; Block, S.S.; Wallace, D. K. for the National Expert Panel to the National Center for Children's Vision and Eye Health., 2015)
[5] (Wilson & Junger, 1968)

Children Who Should Bypass Screening*

Vision screening identifies asymptomatic children with possible vision deficits who, then, require a comprehensive eye examination for diagnosis and treatment. Certain children should bypass vision screening and, instead, be referred directly to an optometrist or ophthalmologist for a comprehensive eye examination because these children have a higher rate of vision problems. Children who should bypass vision screening include those with:

- Readily recognized eye abnormalities, such as strabismus or ptosis.
- A known diagnosis of a neurodevelopmental disorder (e.g., hearing impairment, motor abnormalities such as cerebral palsy, cognitive impairment, autism spectrum disorders, or speech delay).
- Systemic diseases known to have associated eye disorders (e.g., diabetes and juvenile rheumatoid arthritis).
- A known family history of a first-degree relative with strabismus, amblyopia, or high refractive error.
- A history of premature birth and low birthweight (<31 weeks and 1,500 grams birthweight) who has not already had a normal comprehensive eye examination.
- Parents (or caregivers) who believe their child has a vision-related problem or have concerns regarding their child's reaching age-appropriate developmental or academic milestones.

* Note, Where specific state protocols exist, screeners should follow those guidelines for screening children as part of the Individualized Education Program process.

Because the purpose of vision screening is to identify children in need of further care, those who received a comprehensive eye examination from an eye care provider within the previous 12 months of the vision screening date do not need to be screened. Once a child has an established relationship with an eye care provider (ECP), the ECP will designate the appropriate frequency for eye examinations based on the child's visual health needs.

It is important to emphasize that the screening is not an eye examination; the screening does not replace an eye examination; and the screening will not detect all potential vision disorders or diseases.

SCHOOL-AGED VISION SCREENING RECOMMENDATIONS

Components of a school- or community-based vision screening for school-aged children should include:

1. Identifying students who should bypass screening,
2. Observing for possible vision problems,
3. Testing for distance visual acuity, and
4. Following up on referrals and documentation.

1. Identifying Students who should Bypass Vision Screening

Prior to screening, identify those students who should bypass vision screening and refer those children for a comprehensive eye examination by an eye care provider (see section above). Student specific data about health conditions that should be directly referred for a comprehensive eye exam may not be readily available in the context of a school/public health screening and may unnecessarily delay the screening process. Refer children known to have the conditions identified above, and screen all others. If there is concern about drawing negative attention to specific students in a mass screening setting, consider using the time with those students who require immediate referral to complete or confirm risk assessment, or related educational activity. Where specific state protocols exist, screeners should follow those guidelines for screening children as part of the Individualized Education Program process

2. Observing for Possible Vision Problems

Children may experience the following signs of a possible vision problem, however they may not feel discomfort or complain about visual difficulties associated with some of the following signs. Parents and classroom teachers may detect various signs or note comments from a child to indicate a possible problem when children do express discomfort or difficulty.

Children who exhibit the following signs or behaviors should be evaluated by an eye care professional or primary care physician. Continue to screen the child's vision, whether or not the child exhibits any of the following signs. The child should be referred to an eye care professional or primary care physician, even if the child passes vision screening.

Appearance Signs

- Continually watering eyes.
- Red-rimmed, encrusted, or swollen eyelids.
- Cloudiness/haze.
- Unequal pupil size.
- Sties or infections on eyelids.
- Presence of white pupil.This can be associated with a rare but serious eye disease. The white pupil may be observed when looking directly at the individual's eyes, or in his or her photograph.
- Possible eye injury. Watch for eyes that are reddened, bloodshot, blackened, bruised, or swollen, or show evidence of lacerations or abrasions.

Behavior Signs

- Body rigid when looking at distant objects.
- Clumsiness or decreased coordination.
- Thrusting head forward or backward while looking at distant objects.
- Tilting head to one side most of the time.
- Squinting or frowning when trying to focus.
- Excessive blinking.
- Closing or covering one eye while doing near work.
- Holding books close to face when reading
- Sitting close to the television

Complaint Signs

- Headaches, nausea, or dizziness.
- Blurred or double vision.
- Burning, scratchy, or itchy eyes.
- Sees blur when looking up after close work or when looking at whiteboard.
- Unusual sensitivity to light.

3. Testing for Distance Visual Acuity

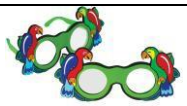
Tests of visual acuity have two formats: full, threshold and critical line eye charts. With full, threshold tests of visual acuity, children identify optotypes beginning at the top of the eye chart and move down the chart until they reach threshold, defined as the line where they can no longer correctly identify the majority of optotypes. Visual acuity for a particular eye is the last line where the majority of optotypes were identified correctly. With critical line tests of visual acuity, children are screened only with the line they should pass according to their age. Critical line charts are quicker to administer, but cannot detect a 2-line or more difference between the eyes.

Screening for distance visual acuity is recommended using the following preferred practice guidelines:

1. Tests of visual acuity should meet national and international eye chart design guidelines. Sloan Letters or LEA NUMBERS® as optotypes are preferred for school-aged children.
2. When dealing with school-aged children who are incapable of participating in vision screening with tests of visual acuity using Sloan Letters or LEA NUMBERS® as optotypes because of shyness, language, or other barriers, appropriately designed eye charts with validated optotypes and matching lap cards should be used. See table in Appendix A for preferred practice alternatives.
3. The testing distance should be 10 feet between the chart and the child's eyes.

4. Lighted cabinets using LED lights provide appropriate illumination. Normal room lighting, a gooseneck lamp, or other portable light without glare or shadows on the front of tests of visual acuity hung on walls is also acceptable.

5. Acceptable occluders include adhesive patches, 2-inch surgical tape, or occluder glasses with opaque or frosted lenses. Paddle occluders (e.g., lollypop) and the hand-held "Mardi Gras mask" for ages 10 years and older are designed to prevent peeking and are acceptable. *Note: Paper fish-shaped occluders, tissues, cups (paper or plastic), and hands should* ***not*** *be used because children can easily circumvent these types of occlusion*.

Adhesive patches	"Mardi Gras mask"	Paddle occluder	Frosted Lenses
			

6. Screen each eye individually (monocularly – beginning at the top of the chart and stopping after the child misses 3 or more optotypes when using full, threshold charts.

   Critical Line Screening Method: Children ages 6 years and older should pass the majority of optotypes on the 20/32 line. Refer for acuity of 20/40 or worse in either eye. Preferred practice tests of visual acuity include:

   - Sloan Letters- Proportionally spaced (e.g., Sloan Letters proportionally spaced 9" x 14" 10 ft. distance chart; Sloan Letters folding chart (avoid charts that are linear- or wide-spaced).
   - LEA NUMBERS®- Proportionally spaced (e.g., LEA NUMBERS® proportionally-spaced 13-line, 10 ft. distance chart; LEA NUMBERS® folding 15-line, 10 ft. distance chart.

   Threshold Screening Method: beginning at the top of the chart screen each eye individually to threshold. Refer for a 2-line difference in either eye, even in the passing range, or acuity 20/40 or worse in either eye. Preferred practice threshold charts include:

   - Sloan Letters- Proportionally spaced (e.g., Sloan Letters proportionally spaced 9" x 14" 10 ft. distance chart; Sloan Letters folding chart (avoid charts that are linear- or wide-spaced).
   - LEA NUMBERS®- Proportionally spaced (e.g., LEA NUMBERS® proportionally-spaced 13-line, 10 ft. distance chart; LEA NUMBERS® folding 15-line, 10 ft. distance chart.

   If using a critical-line test of visual acuity, ensure the eye chart includes a 20/32 line. Follow manufacture instructions regarding whether children need to correctly identify 3 of 5 or 4 of 5 optotypes with each eye to pass.

Computer-Based Testing of Visual Acuity

Such technology is acceptable if programmed to present screening methods that have been validated in children of similar ages and meet standards based upon Amblyopia Treatment Study or American Academy of Pediatrics protocols. An example of such software is **EyeSpy 20/20 (http://www.visionquest2020.org/thesolution.asp)** which utilizes optotypes aligned with recommendations from the National Expert Panel to the National Center for Children's Vision and Eye Health at Prevent Blindness.[6]

Visual Acuity Testing Machines (such as Titmus, Optec, and Keystone View vision screeners)

Visual acuity testing machines screen for near and distance visual acuity and can use a variety of letter or symbol slides. Some machines can test other visual functions. Such machines prevent observation of a child's face and eyes during screening. Child cooperation can be a problem when screening young school-aged children. Insufficient data exist to support machines as preferred practice for school-aged children. If screeners choose to use machines, Sloan Letters or LEA NUMBERS® are the preferred optotypes.

[6] (Trivedi, Wilson, Peterseim, Cole, & Teed, 2010)

4. Following Up on Referrals and Documentation

Follow-up is the process of communication among parents or caregivers, eye care professionals, pediatric primary care or medical home, school, and, if necessary, state officials to ensure that a child who did not pass the vision screening has received an eye examination from an eye care professional. Follow-up also documents that any recommendations made by the eye care professional are implemented. Follow-up is a critical component of care.

Considerations for a Documentation and Follow-Up System

The first step is to have a system in place that ensures screening results are shared with parents or caregivers, results of any referral are sent to the pediatric primary care provider office, and recommended actions are taken by the parent or caregiver. This type of system should document that (1) the child was screened, including screening results; (2) parents or caregivers were notified; (3) the child was evaluated by an eye care professional; and examination findings were recorded in the child's chart. It is important to ensure HIPAA and FERPA compliance with parent release forms and referral documentation so that follow-up examination results may be shared with the child's school as well as with their PCP primary care provider.

Every system should have a tickler or flag for referrals and follow-up with parents or caregivers. Responsible staff should check the log regularly to ensure that referrals were completed within a specified amount of time, a copy of the eye exam results were received and documented in the child's chart.

Whatever system is used, it should alert staff, within a reasonable period, when documentation has not been received. A "reasonable period" for a tickler or flag should be determined based on availability of eye care professionals in the area and urgency of the problem– usually no more than 3 months after making the referral.

Parents and caregivers should understand the results of the vision screening and be assisted (if needed) in arranging and attending an eye examination with an optometrist or ophthalmologist to help ensure their child has the best chance for good vision. To ensure that each child referred to an eye care professional is receiving the appropriate professional attention required, it may be necessary to work with parents or caregivers to resolve any problems with completing the referral and treatment process.

Tips for Follow-Up Practices

How follow-up is conducted is a decision best made locally. Each school or district, or community-based setting, will need to determine the most efficient and effective method for follow-up and use of staff. Compliance and follow-up are more likely to occur if: the process is systematic and efficient.

Tips for school nurses, teachers, or other appropriate staff include:

- Giving, not mailing or sending home in a backpack, referral letters to parents or caregivers.
- Ensuring all information given to parents or caregivers is unbiased, in their native language, and complies with health literacy and cultural competency guidelines.
- Discussing screening results and the reason for referral with parents or caregivers, in their native language.
- Providing parents or caregivers with educational material about the importance of arranging and attending an eye examination.
- Providing a list of available community financial assistance resources, when necessary.
- Using follow-up letters, texts, e-mail, or telephone calls for incompletely documented referrals and treatment.

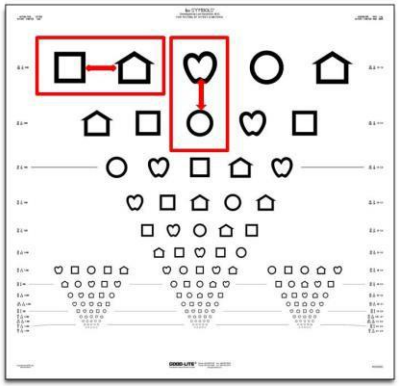
Regardless of whether the child passes or fails the vision screening, the screening system is only successful when the results are used in a meaningful way. Screening results must be recorded and communicated to the child's parents or caregivers, and, as appropriate, to the medical home/primary care provider, the school, and necessary state agency, with subsequent referral to an ophthalmologist or optometrist for examination and care when indicated. Specific data systems must be established to facilitate this process and programs should monitor overall system performance at the population level to ensure that screening goals are being met.

APPENDIX A – TESTS OF VISUAL ACUITY

Preferred Eye Chart Guidelines [7,8,9,10,11]*:*

National and International Eye Chart Design Guidelines:

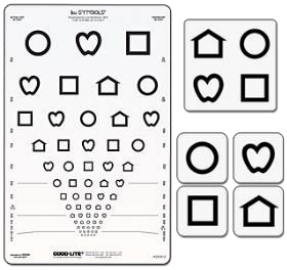
- Optotypes should be of almost equal legibility.
- Each line on an eye chart should have the same number of optotypes (see image below). Smaller 9 x 14 eye charts may have fewer optotypes near the top of the chart to accommodate the chart size. This is acceptable.
- The horizontal between-optotype spacing should be equal to the width of the optotypes on a line (see image below).
- The vertical between-line spacing should be the height of the optotypes in the next line down.
- The size of optotypes should progress geometrically up or down the chart by 0.1 log units between rows (charts will have 20/32 instead of 20/30 lines).



The table below outlines charts that **are preferred** or **not recommended** based on whether or not they follow national and international eye chart design guidelines:

Type of Test of Visual Acuity and Example	Recommended - Meets National and International Guidelines	Challenges/Benefits/Notes:
Sloan Letters 	**YES**	BENEFITS: 1. Meets national and international eye chart design guidelines. 2. Evidence-based[12] . NOTES: Recommended by American Academy of Ophthalmology Pediatric Ophthalmology & Strabismus Panel and AAPOS.[13,14]

[7] (Nottingham Chaplin & Bradford, 2011)
[8] (Committee on Vision, 1980)
[9] (International Council of Ophthalmology, 1984)
[10] (World Health Organization, 2003)
[11] (American National Standards, Inc., 2010)
[12] (Ferris, Freidlin, Kassoff, Green, & Milton, 1993)
[13] (American Academy of Ophthalmology Pediatric Ophthalmology and Strabismus Panel, 2012)
[14] (American Association for Pediatric Ophthalmology and Strabismus, 2014)

HOTV - proportional spacing 	**YES**	CHALLENGES: 1. HOTV letters lacked similar visual acuity mean values and significantly differed in optotype discriminability when compared with the Landolt C international reference optotype.[15] . BENEFITS: 1. Meets all but one national and international eye chart design guideline. 2. Children can match optotypes with response panel. 3. Optotypes have left-right symmetry to eliminate left-right confusion.[16] 4. Boxes around symbols in other HOTV formats help to ensure appropriate crowding.[17,18] 5. Evidence-based.[19,20] NOTES: Acceptable in young school-aged children until they are comfortable with Sloan Letters or LEA NUMBERS®.
LEA SYMBOLS® Chart 	**YES**	BENEFITS: 1. Meets national and international eye chart design guidelines. 2. Optotypes blur equally at threshold to reduce guessing[21,22,23] 3. Optotypes calibrated against the Landolt C, the international reference optotype.[24] 4. Optotypes shown to be nearly equal in discriminability.[25] 5. Optotypes are culturally neutral. 6. Evidence-based.[26, 27,28] 7. Optotypes have left-right symmetry to eliminate left- right confusion.[29] NOTES: For information on chart design specific for use in preschool-aged children (ages 3 through 5 years) please refer to the vision screening methodology described on http://visionsystems.preventblindness.org. Acceptable in young school-aged children until they are comfortable with Sloan Letters or LEA NUMBERS®.
LEA NUMBERS® 	**YES**	BENEFITS: 1. Can be used with children who use English as a second language. 2. Meets national and international eye chart design guidelines. 3. Evidence-based.[30]. NOTES: Recommended by American Academy of Ophthalmology Pediatric Ophthalmology & Strabismus Panel.[31]

[15] (Candy, Mishoulam, Nosofsky, & Dobson, 2011)
[16] (Vision in Preschoolers Study Group, 2010)
[17] (Leat, Li, & Epp, 1999)
[18] (Saarela, Westheimer, & Herson, 2010)
[19] (Vision in Preschoolers Study Group, 2004)
[20] (Vision in Preschoolers Study Group, 2005)
[21] (Candy, Mishoulam, Nosofsky, & Dobson, 2011)
[22] (Hered, Murphy, & Clancy, 1997)
[23] (Hyvärinen, Näsänen, & Laurinen, New visual acuity test for pre-school children, 1980)
[24] (Hyvärinen, Development of the LEA optotypes)
[25] (Candy, Mishoulam, Nosofsky, & Dobson, 2011)
[26] (Vision in Preschoolers Study Group, 2004)
[27] (Vision in Preschoolers Study Group, 2005)
[28] (Hered, Murphy, & Clancy, 1997)
[29] (Vision in Preschoolers Study Group, 2010)
[30] (Candy, Mishoulam, Nosofsky, & Dobson, 2011)
[31] (American Academy of Ophthalmology Pediatric Ophthalmology and Strabismus Panel, 2012)

Handy Eye Test 	**YES**	1. Meets national and international eye chart design guidelines. 2. Optotypes validated against the ETDRS optotypes in children ages 6-18[32] 3. Reliability of optotypes tested in children age 6-18[33].
HOTV- wide-spaced 	**NO**	CHALLENGES: 1. Wide-spaced charts have between-optotype spacing >100%. 2. Arbitrary spacing between lines to fit chart size. 3. No 0.1 log unit geometric progression. 4. A chart of single optotypes and using single, isolated optotypes can result in misleading visual acuity values.[34,35]
Tumbling E Chart 	**NO**	CHALLENGES: 1. Deemed unacceptable by the National Expert Panel to the National Center for Children's Vision and Eye Health at Prevent Blindness.[36] 2. Challenges with children's orientation and direction skills, which are emerging and not present until around ages 8 or 10 years.[37] 3. Charts with linear spacing have appropriate 100% horizontal between-optotype spacing.
Snellen Chart 	**NO**	CHALLENGES: 1. Variable number of optotypes per line. 2. Unequal horizontal between-optotype spacing (e.g., line 9.) 3. Unequal geometric progression between lines. 4. Distance between rows arbitrary (e.g., lines 6 and 7 and 8 and 9). 5. Unequal optotype legibility (A and L easy, E difficult).[38,39] 6. Not standardized.[40,41]

[32] (Comelin, Candy, Lynn, Harrington, & Hutchinson, 2012)
[33] (Toner, Lynn, Candy, & Hutchinson, 2014)
[34] (Youngson, 1975)
[35] (Hilton & Stanley, 1972)
[36] (Cotter, Susan A.; Cyert, Lynn A.; Miller, Joseph M.; Quinn, Graham E.; for the National Expert Panel to the National Center for Children's Vision and Eye Health, 2015)
[37] (Elkind, 1961)
[38] (Ferris, Kassoff, Bresnick, & Bailey, 1982)
[39] (Kaiser, 2009)
[40] (Ferris, Kassoff, Bresnick, & Bailey, 1982)
[41] (Kaiser, 2009)

APPENDIX B – STATEMENTS ON OTHER SCREENING TESTS

1. STEREOACUITY SCREENING

Stereoacuity screening is conducted to determine if the eyes are working together. When the brain is able to blend the separate images from each eye into one image, the child can perceive 3-dimensional space and is said to have stereopsis, or binocular vision. In the child whose eyes are not working together, the brain is unable to blend the separate images from each eye.

Stereoacuity screening is **not** recommended for school-aged children as a part of routine and mass vision screening. While studies have been conducted on the effectiveness of stereoacuity screening in the preschool-age population, insufficient evidence exists to support its use in school-aged screening as a part of a mass public health screening effort. The usefulness of the stereoacuity test in a clinical setting has been documented as an appropriate tool in a comprehensive vision assessment.

When stereoacuity screening is required or desired for screening, the Preschool Assessment of Stereopsis with a Smile (PASS) II test is preferred because it performs better than the Random Dot E (RDE) test of stereoacuity.[42] As new research emerges, the role of stereoacuity screening in combination with other vision screening tests will be reviewed.

2. NEAR VISUAL ACUITY SCREENING

The current scientific literature has little to no evidence to support near visual acuity screening and most vision experts do not believe near visual acuity screening is necessary as a part of a mass screening program in a school- or community-based setting. It is the consensus of the Prevent Blindness expert workgroup that adding near acuity testing will increase the amount of time required for a vision screening and will result in a low yield for near visual acuity problems relative to the amount of effort required.

However, requirements vary from state to state. If near visual acuity screening is required, the best technique to use would be a near visual acuity Sloan Letters or LEA NUMBERS® chart at a 16" distance- implemented monocularly with screening to threshold. Near tests of visual acuity with attached cords will help prevent children from moving closer to the eye chart. Children ages 6 years and older should pass the majority of optotypes on the 20/32 line. Refer for 2-line difference, even in the passing range, or acuity of 20/40 or worse in either eye.

Plus-lens testing is **not** recommended as it is not a test of near visual acuity either directly or indirectly. It is not an evidence-based test of detecting children with significant refractive error, including moderate to high degrees of hyperopia. There is a lack of evidence of its effectiveness, and thus it does not meet current standards as an acceptable vision screening technique.

3. INSTRUMENT-BASED SCREENING

Instrument-based screening refers to vision screening using automated technology. Generally, instrument-based screening is quick to administer and requires minimal cooperation from the child, making it especially useful for shy, non-communicative, or pre-verbal children. A recent policy statement published by the American Academy of Pediatrics[43] noted that an instrument-based approach can be used in the medical home as an alternative to visual acuity screening for children ages 3 through 5 years. However, little evidence currently exists to support the use of instrument-based screening in the school-aged population. In addition, refractive error cutoffs for referral criteria are age dependent and should be reflected in the instrument settings or manually selected by the screener. No national guideline is available for instrument referral criteria settings. Most children are able to participate in optotype-based screening with a "high degree of success and reliability by age 5".[44] Therefore, instrument-based screening is not recommended for mass screenings of school-aged children.

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[42] (Ciner, E. B.; Gi-shaung, Y.; Kulp, M. T.; Maguire, M. G.; Quinn, G. E.; Orel-Bixler, D.; Cyert, L. A.; Moore, B.; Haung, J . for the Vision in Preschoolers (VIP) Study Group, 2014)

[43] (American Academy of Pediatrics, Committee on Practice and Ambulatory Medicine, Section on Ophthalmology; Orthoptists, American Association of Certified; Strabismus, American Association for Pediatric Ophthalmology and; Ophthalmology, American Academy of, 2003)

[44] (American Association for Pediatric Ophthalmology and Strabismus, 2014)

Autorefraction (such as Welch Allyn SureSight® and Righton Retinomax)

Autorefractors are computerized instruments that provide a numeric estimate of refractive error. When used for vision screening purposes, the operator or the instrument must interpret the refractive error measurement as a pass or fail. Although accurate determination of refractive error (hyperopia in particular) requires the instillation of eye drops to provide cycloplegia, eye drops are not used in the screening environment. Vision screening by autorefraction only provides an estimate of refractive error; it is not a substitute for an eye examination and refraction by an ophthalmologist or optometrist. Autorefraction is not recommended for mass school-aged vision screening.

Photorefraction/Photoscreening (such as Plusoptix and Welch Allyn Spot™ Vision Screener)

Photorefraction or photoscreening devices use optical images of the eyes' red reflexes to provide a simultaneous, binocular estimate of refractive error. In addition, some instruments have the capability to evaluate ocular alignment and identify media opacities. Depending on the instrument, results may be provided immediately on the device's viewing screen or interpreted by trained personnel off-site, away from the screening venue. Some instruments allow the implementation of user-defined refractive error criteria to determine the pass-fail cut-offs. Photorefraction/Photoscreening is not recommended for mass school-aged vision screening.

Additionally, vision screening personnel who use a vision screening instrument should **not** attempt to convert instrument results to an estimated visual acuity value (e.g., +3.00 to 20/40, etc.). Most instruments capture a multitude of measures of eye health based on an assessment of the structure of the eye. Measures of visual acuity, on the other hand, assess how the brain interprets the visual signals received from the optic nerve. These two separate approaches to how a child sees cannot be compared with each other.

4. COLOR VISION DEFICIENCY SCREENING

While color vision deficiency testing as a component of a comprehensive eye exam has long been established, from a broader public health perspective, however, there is some question as to its overall utility or benefit for screening school-aged children en masse. As such, there is significant variance as to screening practices across the country. Currently, only 17 states require some type of color vision screening with significant variance in protocol (see Table below). If not required by state mandate, color vision deficiency screening is not recommended for mass school-aged vision screening. See below for further information on the value of color vision screening.

The scientific evidence does not make a strong case regarding the negative associations of color deficiencies. With an inconclusive degree of negative impact and limited intervention strategy (e.g., education), it may be argued that congenital color vision deficiency does not qualify as an "important public health problem" as it does not meet the gold standard criteria for screenings originally established by Wilson and Jungner in 1968 and adopted by the World Health Organization (WHO).[45] [46] On the other hand, a more contemporary set of screening guidelines (see Table 2) might conclude that current evidence is enough to suggest that color vision deficits fairly constitute a "recognized need" within a "target population".[47] It is important to note, however, that despite a higher prevalence among boys, the target population of "boys" is not specific. The evidence should be weighed to consider the best age at which to screen "boys".

Roughly 8% of Caucasian males and 0.4% of females have color vision deficits.[48] More recently, however, the first comprehensive look at the prevalence of color vision deficiencies across multiple ethnicities among preschool children in California found that while color vision deficits are most common among Caucasian boys (5.6%), there was a decreasing prevalence among Asian boys (3.1%), Hispanic boys (2.6%), and African American boys (1.4%).[49] The higher prevalence of color vision deficiency among boys, combined with parental concern regarding potential stigmatization of those children whom are more likely to mislabel certain colors, may lend to the argument of a demonstrated "need" among boys in early school years. The question is whether those concerns warrant the "evidence" traditionally required to rationalize a need for population screening.

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[45] (Wilson & Junger, 1968)
[46] (World Health Organization, 2003)
[47] (Andermann, Blancquaert, Beauchamp, & Dery, 2008)
[48] (Birch, 2012)
[49] (MPEDS)

The U.S. Preventive Services Task Force (USPSTF) does not make any recommendation as to the inclusion of color vision testing within school-aged vision screenings, and the American Academy of Pediatrics (AAP) merely recommends "consideration" of color vision screening. The American Optometric Association (AOA) promotes early detection of color vision anomalies via a comprehensive eye exam prior to school age, while also contending, "Though color vision deficiency can be a frustration and may limit participation in some occupations, in most cases it is not a serious threat to vision and can be adapted to your lifestyle with time, patience and practice."

While adults with color vision deficits have reported some difficulty with daily tasks and it is well known that those deficits preclude individuals from obtaining entry into specific careers, color vision deficiencies have not been shown to significantly impact road traffic accidents, nor do they appear to influence educational attainment or personal injury.[50] [51] [52] It would certainly be rare for a program to justify population-based color vision screening based simply upon the need for occupational counseling. Still, the fact that color deficiency might create undue stress in a school-aged population, particularly if academic assignments or a grade relies upon specific color-coding skills, is a concern shared by professionals and parents alike and one taken seriously by the greater vision care community. As such, intervention becomes a salient issue that may or may not be adequately addressed in a screening environment.

It must be understood that a screening test is not diagnostic, nor does a positive finding indicate color "blindness" which is often confused with a mild color deficit. In a screening environment, appropriate counseling and/or education for parents may not be available. Due to a broad range of color vision deficiencies, a visit to an eye care professional is most appropriate to diagnose the type and extent of the deficiency. Only then can parents be assured that they are properly educated regarding the potential impact on color naming/matching in school and impact upon future career choice.

Despite the limited evidence base regarding the negative impact of color vision deficits, it is acknowledged that lack of evidence of impact is not evidence of lack of impact. At this time, the gravity of the overall negative impact is unclear and difficult to translate into an effective argument in support of mass population screening of color vision. This makes it challenging to endorse color vision deficiency as "an important public health problem" let alone rationalize the use of resources for inclusion of color vision screening en masse.

Color Vision Testing by State

State	Color Vision Testing
Alaska	Pseudoisochromatic plates
Arizona	Color Vision Testing Made Easy
Arkansas	Pseudoisochromatic plates
California	Obtain pseudoisochromatic or isochromatic plates from any optical supply company
Colorado	1st grade only; Pseudoisochromatic plates
Delaware	Pseudoisochromatic plates
Georgia	Color vision test
Illinois	Yes
Iowa	Ishihara in Grade 3
Minnesota	Ishihara, Good-Lite Color Vision Plates, or Waggoner Color Vision Testing Made Easy; 1st grade or referral
New Mexico	Standard color vision chart
New York	Pseudoisochromatic plates
North Carolina	Optional
Ohio	One time, males only; 1) Ishihara – 14-plate. 2) Pseudoisochromatic color testing – 16-plate. 3) Color Vision Testing Made Easy.
Pennsylvania	1st or 2nd grade; 1. Pseudoisochromatic Test Plates (e.g., Ishihara) 2. Automated Vision Screener 3. Color Vision Testing Made Easy®.
Rhode Island	Any isochromatic test
Utah	As requested, only once per lifetime
Virginia	Ishihara Test in 1st grade
West Virginia	Optional

[50] (Ramachandran & Wilson, 2014)
[51] (Cumberland, Rahi, & Peckham, 2004)
[52] (Stewart & Cole, 1989)

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