Vision:
Academic Challenges, Classroom Behaviors, &
Evidence-Based Vision Screening Approaches

Dr. P. Kay Nottingham Chaplin, EdD

Introduction and Disclaimer

• 18 years in vision screening field

• Former Director/Lead Trainer – Vision Initiative for Children – West Virginia University Eye Institute – focus on Head Start, school nurses, pediatric primary care practices

• Member – Advisory Committee to the National Center for Children’s Vision and Eye Health at Prevent Blindness

• Consultant – Vision Screening Committee, American Association for Pediatric Ophthalmology and Strabismus

• Current Director – Vision and Eye Health Initiatives at Good-Lite and School Health Corporation

• Current Education and Outreach Coordinator for the National Center for Children’s Vision and Eye Health at Prevent Blindness

• My focus is to encourage age-appropriate and evidence-based vision screening – based on national guidelines and best practices – as part of a 12-component Strong Vision Health System of Care.
Dr. Nottingham Chaplin has:

- Provided 178 vision screening training workshops; and
- Lectured, trained, and consulted at more than 200 international, national, state, district, and local venues, including national webinar panels, and annual conferences, for example, the:
  - National Association of School Nurses
  - National Head Start Association
  - School-Based Health Alliance
  - National Center on Early Childhood Health and Wellness

Info You Will Take Home …

4 Learning Objectives

- Describe 2 solutions to vision-related academic challenges.
- List 1 website for finding resources to support your vision and eye health program.
- List 2 classroom behaviors that may be related to vision.
- List 2 evidence-based approaches to vision screening and describe what each measures.
Current State of Children’s Vision in the U.S.

Up to 1 in 17 preschool-aged children and up to 1 in 4 school-aged children in the United States has a vision problem that requires treatment.\(^1\)\(^2\)

- Children’s vision problems may lead to permanent vision loss if not treated and
- Cause problems socially, academically, and developmentally.
- Almost all (94%) of these vision problems can be found early.
- In order to find these vision problems, children who do not pass vision screening must:\(^3\)
  - See an eye doctor;
  - Receive treatment, if necessary; and
  - Follow the eye doctor’s suggestions to improve vision.

➤ Only 41% of children ages 5 years and younger are screened for vision problems.\(^4\)

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National Organizations Endorsing Vision Screening and Follow-Up Eye Examinations

Developing Consensus for Children’s Vision and Eye Health Programs

February 2019

Endorsed by the National Center for Children’s Vision and Eye Health at Prevent Blindness, the American Association of Pediatric Ophthalmology and Strabismus, the American Academy of Optometry, the American Association of Certified Orthoptists, the American Academy of Pediatrics and the National Optometric Association.

Purpose of this Consensus Statement: Early detection and treatment of a vision disorder is critical to the long-term vision health of the child, and vision screenings serve a useful role in identifying children in need of further evaluation by an eye care professional. As part of a comprehensive public health approach to eye health, the National Academies of Sciences, Engineering and Medicine (NASEM) recommends the development of a single set of evidence-based clinical practice guidelines and measures that can be used by eye care professionals, other care providers, and public health professionals to prevent, screen for, detect, monitor, and manage vision disorders in children.

While efforts to develop a single set of interorganizational guidelines have begun, national and local organizations devoted to early childhood vision care have provided their own screening and referral guidelines, which often vary in the recommendations provided. These differences can make it unclear to screening providers which guidelines to follow for their work with specific groups of children.

All agree that early detection and treatment of a vision disorder is critical to the long-term vision health of the child, and vision screening serves a useful role in identifying children in need of eye care and promoting further evaluation by an eye care professional.

7 Classroom Behaviors that May be Related to Vision Disorders

1. Talking in class
2. Notably quiet in class
3. “Spacy” children in their own world
4. Difficulty sitting still
5. Frustrated with academic work
6. Squinting during class activities
7. Clumsiness

Behaviors are not always related to vision.

A vision disorder is something to consider when the behaviors occur.

Conduct vision screening to rule out vision as a casual factor.
Talking in class – Child said he talked because he was asking other students to help him read material on board.

Notably quiet in class – Child said she stopped looking at board . . . She couldn’t see material on board.

“Spacy” and in own world – Interrupt story time to come forward to see book pictures. “I can see that now!”

Difficulty sitting still – Up and moving in circle time or watching TV with brother. Loner and bored. Now sits and participates in group activities.

Frustrated with “academic work” – Before glasses, “things looked dusty”. Different child, happier, less frustrated.

Squinting during class activities – “Mommy! There are numbers on that circle on the wall!”

Clumsiness until receiving glasses – “I have realized through these screenings that vision can affect a child’s behavior, balance, and academic performance.”

Student with Frequent Headaches?

Screen vision to rule out vision disorder as causal factor.

MinnPost photo by Erin Hinrichs
Kim Meier, a nurse at Kennedy Elementary School in the Hastings Public Schools district, tending to a student.

Multistate Level

- 2015 Vision in Preschoolers – Hyperopia in Preschoolers Study (VIP-HIP) found:
  - Children ages 4 and 5 years with uncorrected hyperopia (farsightedness ≥4.0 D) scored significantly worse on a test of early literacy than children with normal vision.
  - ≤ 4.0 D also had lower scores, but difference not statistically significant

- Test = TOPEL (Test of Preschool Early Literacy)
- Performance most affected:
  - Print knowledge subtest, which assesses the ability to identify letters and written words

Full vision - [http://www.onedollarglasses.org/eye-test/full-vision.html](http://www.onedollarglasses.org/eye-test/full-vision.html)

Vision defect of 4.0 D - [http://www.onedollarglasses.org/eye-test/4-diopters.html](http://www.onedollarglasses.org/eye-test/4-diopters.html)
Diopter defined

- “Diopter” refers to the strength of a prescription lens required to give a child the clearest vision possible. The higher the number, the stronger the prescription lens.

- A child requiring 4 diopters of correction in prescription glasses, or contact lenses, would likely struggle with blurred vision, crossed eyes, or both, and would see much better with prescription glasses.

Multiple Inner City Schools Level

- 317 2nd and 3rd grade students in 12 high-poverty schools in Baltimore City School District in phase 1

- Poor baseline visual acuity and hyperopia associated with reduced reading achievement and worse baseline reading scores

Single School District Level

2015 study of low-income children ages 3 through 5 years screened in South Carolina’s Charleston County School District – **after diagnosis and treatment with prescription glasses** – found:

- Improvement in academic progress.
- Increase in focus during lessons.
- Increase in participation and classroom interaction.
- Improvement in confidence and behavior.


Early Identification & Treatment Make a Difference

- First grade reading ability found to be predictive of 11th grade reading outcomes, including:
  - Reading comprehension,
  - Vocabulary, and
  - General knowledge.

Children who lag in 1st grade but catch up by 3rd or 5th grade have good prognosis for future reading level.

Academic Considerations for Vision

- Improved GPA (reading and math) - more likely for hyperopes than myopes
- Increased satisfaction with school
- Reduced stress
- Improved cognition, attention span, and focus
- Improved test scores
- Less task avoidance and need for discipline
- Less labeling- ADD or ADHD
- Earlier identification leads to improved outcomes

Academic Performance of Oyler School Students after Receiving Spectacle Correction. Thesis by Kimberly L. Renner; Graduate Program in Vision Science; The Ohio State University, 2017

## Cast of Characters for National Guidelines

### NCCVEH (ages 3, 4, and 5 years):
- National Center for Children’s Vision and Eye Health at Prevent Blindness
- Optometry
- Ophthalmology
- Family Advocates
- Nurses
- Public Health Professionals
- Educators

### AAP (all ages):
- American Academy of Pediatrics
- American Association for Pediatric Ophthalmology and Strabismus
- American Academy of Ophthalmology
- American Association of Certified Orthoptists

## 2 Approaches to Vision Screening

1. **Optotype-based screening**
   - Tests of visual acuity using optotypes to measure visual acuity as interpreted by the brain
     - *Quantifiable measurement of the sharpness or clearness of vision when identifying specific optotype sizes at a standardized distance*

2. **Instrument-based screening**
   - Instruments do not measure visual acuity
   - Instruments use an automated image acquisition and analysis system of the eyes to provide information about amblyopia risk factors:
     - Estimates of significant refractive error (hyperopia, myopia, astigmatism)
     - Estimates of anisometropia
     - Estimates of eye misalignment (some, not all)
Threshold & Critical Line Screening

- Threshold screening
  - Move down chart until child cannot correctly identify majority of optotypes

- Critical line screening
  - Use only line child needs to pass according to child’s age

“Not so great” charts . . .
The use of validated and standardized optotypes and acuity charts is important for an accurate assessment of vision.

Children may not know their letters.

Requires discrimination of direction, which is not sufficiently developed in preschool-aged children.

Charts not standardized.

Not well validated in screening environment.

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Importance of Appropriate Tools

- “Visual acuity scores can be significantly affected by the chart design.” (p. 1248)

- Excluding optotype size, “each visual acuity level on a test chart should present an essentially equivalent task”. (p. 740)

National and international distance visual acuity eye chart design recommendations

- **1980 - National Academy of Sciences-National Research Council (NAS-NRC)**

- **1984 - International Council of Ophthalmology (ICO)**

- **2003 - World Health Organization Prevention of Blindness & Deafness (WHO)**

- **2010 – American National Standards Institute, Inc.**
Optotypes approximately equal in legibility

Horizontal between-optotype spacing = 1 optotype width

Vertical between-line spacing = height of next line down

Geometric progression of optotype sizes of 0.1 log units (logMAR, ETDRS)

5 optotypes per line

Optotypes black on white background with luminance between 80 cd/m² and 160 cd/m²

Similar recommendations across guidelines

Tips:

- Line outside optotypes
- 20/32 vs. 20/30
- 10 feet vs. 20 feet
Do the following eye charts fit national/international eye chart design guidelines?

Yes or No?

✓ NO

Preferred Optotypes for Ages 3 to 6 Years

- NCCVEH
- AAP
- Recommend LEA SYMBOLS® and HOTV letters as optotypes


Preferred Optotype Format

NCCVEH national guidelines call for using single, LEA SYMBOLS® or HOTV letter optotypes surrounded with crowding bars for children ages 3, 4, and 5 years at 5 feet.

- Card with 4 optotypes – use as matching game
- Individual cards may be placed on floor in front of child – ask child to step on card matching optotype to identify

Options: Critical Line Screening at 10 feet

Sight Line Kit

Also acceptable . . .
Preferred Optotypes for Ages 7 Years & Older

- AAP
  - Recommends Sloan Letters

American Academy of Ophthalmology
- Recommends Sloan Letters and numbers


Options - Kits From AAPOS
(American Association for Pediatric Ophthalmology and Strabismus)

- AAPOS Vision Screening Kit
- AAPOS Vision Screening Kit: Supplemental Screening Package
Screening Distance

- 10 feet from chart to child’s eyes

- New, standardized distance charts will be at 10 feet for children and adults

- 10/xx on left side of chart with 20/xx on right side – report 20/xx

Occluders – 3 Years to <10 Years
**Unacceptable** Occluders Ages 3, 4, and 5 years

- Hand
- Tissue
- Paper or plastic cup
- Cover paddle

• Why unacceptable?

• Children can easily peek

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**Occluders – Aged 10 Years and Older**

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To Point or Not to Point . . . ?

- Pointing to each optotype to help children know where they are on the chart is permissible.
  - True or False?
  - False

- 1.8 “Line-by-line isolation or pointing may be used, but not letter by letter.”

No Pointing at Optotypes

- Holding pointer at optotype makes optotype easier to identify.

- Instead . . . briefly point under or over top of optotype and quickly remove pointer.

- If line has a box around optotypes, stay outside the box with pointer.
No Need to Read Each Optotype on Every Line

World Health Organization (2003) says:
• *May be less tedious for children to read 1st optotype on left-side of chart until missing one and then moving up a line and reading entire line*

• Camparini et al. found: ETDRS-Fast (reading 1 letter per row until a mistake is made) yields accurate results compared with standard method of reading each optotype on every line.
• Also – *significantly reduced test time*


2 Approaches to Vision Screening

1. **Optotype-based screening**
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2. **Instrument-based screening**
   • Instruments do not measure visual acuity
   • *Instruments use an automated image acquisition and analysis system of the eyes to provide information about amblyopia risk factors:*
     • Estimates of significant refractive error (hyperopia, myopia, astigmatism)
     • *Estimates of anisometropia*
     • Estimates of eye misalignment
**National Guidelines for Instrument-Based Screening**

- Use beginning at age 12 months (AAP)
- Use for ages 1 and 2 years (AAP)
- Use instruments OR tests of visual acuity for children ages 3, 4, and 5 years (NCCVEH and AAP)
- Use instruments at any age for 6 years and older if child or young adult cannot do test of visual acuity (AAP)

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**Instrument-Based Screening**

- If use instruments, no need to also do visual acuity screening unless you want to check both VA and refractive error.

- If cannot “capture” a pass or refer result... refer child for comprehensive eye exam.

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• Do not attempt to convert estimated refractive error to visual acuity value.
• Child could fail vision screening with instrument, but pass with conversion and miss opportunity for eye exam.

### Conversion Chart: Refractive State to “estimated” Visual Acuity

<table>
<thead>
<tr>
<th>Minus (-) Sphere</th>
<th>Myopia</th>
<th>Hyperopia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ages: All</td>
<td>Estimated Visual Acuity</td>
<td>Plus (+) Sphere</td>
</tr>
<tr>
<td>Ages: 9y to 18y</td>
<td>Ages: 6y to 9y</td>
<td></td>
</tr>
<tr>
<td>-0.5</td>
<td>20/30-40</td>
<td>+2.00</td>
</tr>
<tr>
<td>-0.75</td>
<td>20/50</td>
<td><strong>+3.00</strong></td>
</tr>
<tr>
<td>-1</td>
<td>20/60</td>
<td>+3.25</td>
</tr>
<tr>
<td>-1.25</td>
<td>20/70</td>
<td>+3.75</td>
</tr>
<tr>
<td>-1.5</td>
<td>20/100</td>
<td>+4.25</td>
</tr>
<tr>
<td>-2.5</td>
<td>20/200</td>
<td>+4.75</td>
</tr>
</tbody>
</table>

1. Spherical results are based upon minus (-) cylinder convention.

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**Instruments Vetted by NCCVEH**

- Welch Allyn® Spot™ Vision Screener
- Welch Allyn® SureSight™ Vision Screener
- Retinomax (Right Mfg. Co Ltd.- Tokyo, Japan)
- Plusoptix S12C Vision Screener

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• Instruments typically will not capture readings on 100% of children (e.g., 97%).

• If doing instrument-based screening, still want optotype-based screening tool . . . just in case for other 3%.

• Example . . .

Choices for Near Vision Screening

Can do critical line only with both eyes open.
Stereoacuity Screening if NOT using Spot

PASS 2 Smile Test

Choices for Color Vision Deficiency Screening

Good-Lite ColorCheck Complete Vision Screener

Waggoner Color Vision Testing Made Easy
Vision Screening is . . .

• Part of a process...not a single event.

• 1 of 12 components of a strong vision health system of care.

Evaluating *Your* Vision Health Program

https://www.nasn.org/nasn-resources/practice-topics/vision-health
A Historical Review of Distance Vision Screening Eye Charts
What to Toss, What to Keep, and What to Replace

Vision and Eye Health
Moving into the Digital Age with Instrument-Based Vision Screening


An Eye on Vision

Seven Questions About Vision Screening and Eye Health—Part 4

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12 Components of a Strong Vision Health System of Care

Components 1 and 2—Family Education and Comprehensive Communication/Approval Process

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Resources to Support Families . . .

Financial Assistance Programs
Tips for Wearing Eye Glasses
https://www.preventblindness.org/your-childs-glasses

http://nationalcenter.preventblindness.org/resources-2
Year of Children’s Vision

- [http://nationalcenter.preventblindness.org/year-childrens-vision](http://nationalcenter.preventblindness.org/year-childrens-vision)
- Archived vision screening webinars in Resources

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**THINK OF VISION**
Guide for Preschool Teachers

A young child does not know how they should see and cannot tell us about their vision. One or two children in every preschool classroom will have a vision disorder that, left unaddressed and untreated, could interfere with their development and acquisition of early literacy skills. As a preschool teacher, you can support the vision of the children you teach.

THINK OF VISION: A comprehensive eye exam often conducted by an eye doctor should be part of the evaluation process of a child.

- **APPEARANCE:**
  - Eye injury or unusual eye appearance
  - Eye redness, watery or bloodshot
  - Bulging eye or enophthalmos

- **BEHAVIOR:**
  - Poor eye contact
  - Shy or fearful
  - Poor performance
  - Difficulty with fine motor skills
  - Poor handwriting

- **BIOLOGY:**
  - Congenital anomaly
  - Prematurity
  - Diabetes
  - Congenital cataracts

- **CABINET:**
  - Early intervention
  - Vision therapy
  - Assistive technology
  - Other care providers

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Prevent Blindness Position Statement on School-Aged Vision Screening and Eye Health Programs

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 through 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 position statement shall not constitute a legal standard or enforceable requirement for any school district. It is not intended to be exhaustive or all inclusive.


Helpful info and statistics for grant proposal writing . . .

NASN Vision and Eye Health Resource

(National Center for Children’s Vision and Eye Health and NASN partnership)

https://www.nasn.org/nasn-resources/practice-topics/vision-health

Info for Prevent Blindness nationally recognized vision screening certification you can do online at your own pace

http://nationalcenter.preventblindness.org/prevent-blindness-childrens-vision-screening-certification-course

800-331-2020 Nottingham@preventblindness.org
Call to Action

- Conduct evidence-based screening.
- Evaluate your vision and eye health program annually.
- Help ensure follow-up to eye care when children do not pass vision screening.
- Help ensure children follow their treatment plans at school.

Burning Questions?
Thank you for your TIME and ATTENTION. . .