Health and Wellness:
Preparing Children to Learn Through Evidence-Based Vision Screening from Birth to 5 Years

Dr. P. Kay Nottingham Chaplin, EdD

• 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
• Provided 178 vision screening training workshops
• Lectured, trained, and consulted at more than 200 international, national, state, district, and local venues, including national webinar panels, and annual conferences
• 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.
Describe the month infants should be referred for a pediatric eye exam if a baby’s eyes continue to cross or wander.

Describe 3 evidence-based vision screening tool for ages 1, 2, 3, 4, and 5 years.

Describe 3 positive outcomes in learning and behaviors after vision screening, an eye examination, and treatment.

Current State of Children’s Vision in the U.S.

Up to 1 in 17 preschool-aged children in the United States has a vision problem that require treatment.

- If left untreated, these eye diseases and vision disorders can lead to permanent vision loss that cannot be corrected with prescription glasses, and/or

- Cause problems socially, academically, and developmentally.

- However . . . almost all (94%) of these vision problems can be found early with a vision screening . . . if children who do not pass vision screening:
  - See an eye doctor;
  - Receive treatment, if necessary; and
  - Follow the eye doctor’s suggestions to improve vision.
7 Behaviors

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

**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.


Screener and parent stories.
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.”


Screener and parent stories.

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

- Performance most affected:
  - Print knowledge subtest,
  - Measuring ability to identify letters and written words

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

What Does an “evidence-based Approach” Mean?

The National Center on Early Childhood Health and Wellness defines evidence-based as: "an umbrella term that refers to the use of the best research evidence (found in health sciences literature) and clinical expertise (what health care providers know).

[Adapted from the National Institutes of Health https://prevention.nih.gov/resources-for-researchers/dissemination-and-implementation-resources/evidence-based-programs-practices.]

For example:

• Simply stating a tool was used to screen 10,000 children does not make the tool evidence-based.

• A peer-reviewed publication stating the tool was used to screen 10,000 children, screening results were compared with eye examination results, and the tool found 90% of children with vision disorders is an example of an evidence-based tool.

18 Vision Development Milestones From Birth to Baby’s First Birthday

P. Kay Nottingham Chaplin, EdD – Kira Baldonado, BA

About this Tool

• This document is a vision screening tool for Early Head Start Parents as Teachers, and other early care and education programs.
• This tool is a table containing vision milestones in order of typical development.
• The 1st column lists the age.
• The 2nd column lists the milestones typically expected to occur for the age.
• The 3rd column lists the questions to ask.
• The 4th column lists the reasons why a referral is needed.

In fact, each child develops differently and may meet the vision milestones at different ages, vision milestones may vary up to 6 weeks, some questions provide signs for re-screening before referring.

Although milestones may vary up to 6 weeks, if baby’s eyes appear to be constantly misaligned (possible strabismus) at age 2 months or older, refer immediately for an eye examination.

When using this tool with children who were born prematurely and have no health challenges, adjust chronological age to the corrected age and use this tool based on corrected age (see above box). Visual development milestones may be delayed if babies have health challenges (i.e., genetic syndromes, neurologic and metabolic conditions, etc.). For these children, use vision screening results from the baby’s primary care provider or eye examination results from the baby’s eye care professionals to meet your vision screening mandate.

Instructions

1. Visual skills typically develop in a particular order. To determine if the baby has met all vision milestones, begin with Page 2 regardless of baby’s age. Do not skip to the chronological or corrected age of the baby you are screening.
2. Check the appropriate boxes in the “Questions” column. Some will require re-screening if the vision milestone has not been met.
3. Complete the “Questions” column of the table before completing the Pass/Retest/Refer Documentation pages beginning on page 10. This tool and the Pass/Refer Reevaluation Documentation can be placed in the baby’s file for record-keeping purposes.
4. Use this tool throughout baby’s first year to review vision development milestones.

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Vision Developmental Milestones Check-off Tool available at:
http://nationalcenter.preventblindness.org/publications-and-presentations

• Time for reaching milestones can vary up to 6 weeks . . . except milestone related to straight eyes.

• Slides show when baby *should* reach milestones.

• Process:
  • Milestone(s) and age or age range when milestone(s) should occur
  • Questions to ask or behaviors to monitor about the milestones
  • What to do if milestones are not met . . . or next steps
Many vision milestones are related to overall developmental milestones . . . want you to think about those milestones from a perspective of vision . . . or how baby’s vision could impact reaching a milestone.
### Using the Milestones Tool – Case Profile #1

**Child’s age:** 5 months  
**Developmental skills exhibited:**  
- Maintaining stable eye contact initiated by an adult  
- Social smile  
- Exploring hands and putting them in their mouth  
- Watching hand movements of others  
- Eyes drift and cross when tired  

**Pass or Refer?**  
**Refer**

### Using the Milestones Tool – Case Profile #2

**Child’s age:** 9 months  
**Developmental skills exhibited:**  
- Maintains stable eye contact initiated by an adult  
- Social smile  
- Exploring hands and putting them in their mouth  
- Watching hand movements of others  
- One eye turns in  
- Goal-directed arm movements  
- Recognizes parents, caregivers, and Grandpa  

**Pass or Refer?**  
**Refer**
Using the Milestones Tool – Case Profile #3

- Child’s age: 9 months
- Developmental skills exhibited:
  - Maintains stable eye contact initiated by an adult
  - Social smile
  - Exploring hands and putting them in their mouth
  - Watching hand movements of others
  - Eyes are straight
  - Goal-directed arm movements
  - Recognizes parents, caregivers, and Grandpa

Pass or Refer?
Pass

Vision Screening Years 1 and 2

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Cast of Characters

**NCCVEH:**
- National Center for Children’s Vision and Eye Health at Prevent Blindness
  - Optometry
  - Ophthalmology
  - Family Advocates
  - Nurses
  - Public Health Professionals
  - Educators

**AAP:**
- American Academy of Pediatrics
- American Association for Pediatric Ophthalmology and Strabismus
- American Academy of Ophthalmology
- American Association of Certified Orthoptists

Years 1 and 2 - Vision Screening Tools

**Instrument-based screening**

- Instruments assess the eye STRUCTURE, not how the brain interprets CLEARNESS of vision

- Instruments analyze digital images of the eyes to provide information about amblyopia risk factors:
  - Estimates of significant refractive error (hyperopia [farsightedness], myopia [nearsightedness], astigmatism [blurred vision at both near and far])
  - Estimates of anisometropia (significant difference of refractive error between the two eyes)
  - Estimates of eye misalignment
Instrument-Based Screening

AAP
• Use beginning at age 12 months
• Ages 1 and 2 years


Instruments Vetted by NCCVEH
Include:

Welch Allyn® Spot™ Vision Screener

Plusoptix S12C Vision Screener
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)
“Not so great” charts . . .

**NOT** Recommended by NCCVEH and/or AAP

- "Sailboat"
- Allen Pictures
- Lighthouse or "House, Apple, Umbrella"
- Snellen
- Tumbling E
- Landolt C

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More Charts **NOT** Recommended by NCCVEH

![Image of charts]


https://nationalcenter.preventblindness.org/programs-and-resources

**Why NOT Recommended?**

- 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.


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)
  • www.icoph.org/dynamic/attachments/resources/icovisualacuity1984.pdf

• 2003 - World Health Organization Prevention of Blindness & Deafness (WHO)
  • Prevention of blindness and deafness. Consultation on development of standards for characterization of vision loss and visual functioning. Geneva: WHO;2003 (WHO/PBL/03.91).

• 2010 – American National Standards Institute, Inc.
  • ANSI Z80.21-1992 (R2004) Approved May 27, 2010
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

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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.


How do you use the response panel and 4 individual cards?

- 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 . . .

https://www.schoolhealth.com/eyespy-20-20-vision-screener
Using HOTV letters – NOT Landolt C
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

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 – Younger Children <10 Years

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.

“Untestable” is not a failed vision screening.

- Keep track of “untestable” children.

- Untestable children in VIP study were 2x as likely to have vision problems than those who passed vision screening.

- If possible, rescreen untestable children same day.

- If you have reason to believe that the child may perform better on another day, consider rescreening the child no later than 6 months.


## Referral Criteria

<table>
<thead>
<tr>
<th>NCCVEH</th>
<th>AAP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age 3 years:</strong></td>
<td><strong>Age 3 years:</strong></td>
</tr>
<tr>
<td>Majority of optotypes on 20/50 line</td>
<td>Majority of optotypes on 20/50 line</td>
</tr>
<tr>
<td><strong>Ages 4 and 5 years:</strong></td>
<td><strong>Ages 4 years:</strong></td>
</tr>
<tr>
<td>Majority of optotypes on 20/40 line</td>
<td>Majority of optotypes on 20/40 line</td>
</tr>
<tr>
<td><strong>Ages 6 years and older:</strong></td>
<td><strong>Ages 5 years and older:</strong></td>
</tr>
<tr>
<td>Majority of optotypes on 20/32 line</td>
<td>Majority of optotypes on 20/32 (or 20/30) line</td>
</tr>
<tr>
<td></td>
<td>Or 2-line difference even in passing lines (i.e., 20/20 and 20/32)</td>
</tr>
</tbody>
</table>

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### Choices for Near Vision Screening

Can do critical line only with both eyes open or one eye at a time.

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Stereoacuity Screening if NOT using Spot

If Doing Color Vision Deficiency Screening . . .
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

Instrument-Based Screening

- Use beginning at 12 months (AAP)
- Use instruments OR tests of visual acuity for children ages 3, 4, and 5 years (NCCVEH and AAP)


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.

Instruments Vetted by NCCVEH
Include:

- Welch Allyn® Spot™ Vision Screener
- Plusoptix S12C Vision Screener
• 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 . . .

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

12-Components of a Strong Vision Health System of Care

Visit http://nationalcenter.preventblindness.org/eye-children-vision for information and resources that will help you improve your vision health program.

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

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
Vision Developmental Milestones Check-off Tool available at:

http://nationalcenter.preventblindness.org/publications-and-presentations
Download at: https://eclkc.ohs.acf.hhs.gov/physical-health/article/vision-screening

Year of Children’s Vision

- http://nationalcenter.preventblindness.org/year-childrens-vision
- Archived vision screening webinars in Resources
Resources to Support Families . . .

Financial Assistance Programs

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

Parent Education

http://nationalcenter.preventblindness.org/resources-2

Information about Your Child’s Sight from Prevent Blindness

https://www.preventblindness.org/your-childs-sight

Your Child’s Sight
Get the information you need to help your child see well to learn and grow.
Getting Your Child Ready for School:

https://www.preventblindness.org/getting-your-child-ready-school

Prevent Blindness Children's Vision Screening Certification Course

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

- Use the info you learned to screen vision.
- Evaluate your vision and eye health program.
- Help ensure follow-up to eye care when children do not pass vision screening.

Thank you for your TIME and ATTENTION.

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