The following slides are pulled from a longer presentation I provide for local, regional, state, national, and international meetings and conferences.

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Introduction and Disclaimer

• 14 years in vision screening field

• Former Director/Lead Trainer – Vision Initiative for Children – West Virginia University Eye Institute

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

• Co-Chair – NCCVEH Education/Data Subcommittee

• Co-Chair – Prevent Blindness Task Force revisiting school-aged screening policy

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

• Not in sales . . . Focus is to use power of podium to encourage appropriate and evidence-based vision screening as part of a strong Vision Health System of Care
Challenges With Commonly Used Tests of Visual Acuity (Eye Charts) for Optotype-Based Screening

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The next two slides describe the national and international guidelines for standardized eye chart design, along with references.
National and International Distance Visual Acuity Eye
Chart Recommendations

• **1980 - National Academy of Sciences-National Research Council (NAS-NRC)**
  • Recommended Standard Procedures for the Clinical Measurement and Specification of Visual Acuity

• **1984 - International Council of Ophthalmology (ICO)**
  • Visual acuity measurement standard.

• **2003 - World Health Organization Prevention of Blindness & Deafness (WHO)**
  • Consultation on Development of Standards for Characterization of Vision Loss and Visual Functioning
  • 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
  • Performance standard for the optical design of optotypes used in clinical visual acuity measurement systems
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

background with luminance between 80 cd/m² and 160 cd/m²

Similar recommendations across guidelines

Design guidelines = “ETDRS Design”
• 3 Tips for knowing whether the chart is appropriate:

1. Line outside optotypes
2. 20/32 vs. 20/30
3. 10 feet vs. 20 feet
These tests of visual acuity do not fit national/international eye chart design standardization guidelines.
Challenges With 5 Commonly Used Eye Charts

- **Snellen Letters**
- **Kindergarten Test Chart**
- **Tumbling E**
- **Allen Pictures**
- **Lighthouse or “House, Apple, Umbrella”**
3 Challenges With “Snellen Chart”

• Does not meet national/international eye chart design guidelines
• Is not standardized
• Some letters easier than others to identify

“Sailboat” Chart Lacks Scientific Evidence

• Does not meet national/international eye chart design guidelines
• Some optotypes in black “blobs”
• Optotypes of different sizes on same line
• Found 3 studies between 1944 and 1971:
  
  – Only 1 looked at visual acuity, but with colored optotypes = not same chart.

  – Only 1 study pertained to the current chart and the goal was to determine whether children liked the chart.

  – Deemed “too complicated” for 3- and 4-yr-olds.


But . . . New Evidence Just In . . .

- Sailboat chart approximately 1 line worse than LEA Symbols.
- Sailboat generally underestimates visual acuity.
- Clinicians should be cautious in interpretation, which could lead to false-positives and over-referral of children.

American Academy of Optometry, 2014

Overarching Challenge With “Sailboat” Chart: Lacks Scientific Evidence

- Not on recommended list of eye charts in 2003-Policy Statement from:
  - American Academy of Pediatrics
  - American Association of Certified Orthoptists
  - American Association for Pediatric Ophthalmology and Strabismus
  - American Academy of Ophthalmology

- Chart’s history and developer unknown

- Earliest photograph: August 1935 American Optical Company catalog

2 Challenges With Tumbling E

1. Children’s orientation and direction challenges with directional optotypes
   a. Emerging cognitive skill
   b. Up/down emerges before left/right
   c. Usually in place by age 8 years

2. Ability to guess optotype at threshold by looking at solid line or 3 open lines


“Since horizontal direction sense develops later than vertical direction sense, recognition of horizontally pointing E’s by younger children is particularly unreliable.

Test symbols, not depending on the direction sense, improve testability, testing time and visual acuity scores” (p.70).

5 Challenges With Allen Pictures

1. Asking young children to make a “whole” picture from “parts” – or visual closure

2. Cultural bias

3. Calibrated against Snellen 30-ft E, not Landolt C (international standard)

5 Challenges With Allen Pictures

4. Significant differences in discriminability of optotypes

5. Significant visual acuity values compared with reference Landolt C


Lighthouse Chart

• Optotypes easy to guess.
• Poor visual acuity results when compared with international Landolt C standard.

• Not on 2003 list of charts recommended by:
  – American Academy of Pediatrics
  – American Association of Certified Orthoptists
  – American Association for Pediatric Ophthalmology and Strabismus
  – American Academy of Ophthalmology


“Linear-Spaced” Eye Charts

- 100% spacing between optotypes (1 optotype-width)
- Unequal spacing BETWEEN lines – not geometric progression of 0.1 log (logMAR)
- Arbitrary and non-standardized between-line spacing
“Wide-Spaced” Eye Charts

- Between-optotype spacing >100%
- Unequal spacing BETWEEN lines – not geometric progression of 0.1 log (logMAR)
- Between-line spacing is arbitrary
- Basically contains lines of single optotypes
No Single Optotypes or Flashcards Without Surround Bars for Typically Developing Children

- Visual acuity results, on average, 3 lines worse on charts with lines vs. single, non-crowded optotypes
  - For example, 20/32 with single, isolated optotype and 20/80 with line chart
