

2015-2016 Report
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**Kindergarten Vision-Testing
Programme**

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Summary

Every year in Ontario 3% to 5% of children lose the use of one eye—4000 to 6000 children every year—and countless more do poorly in school, because they have an eye problem that is not treated in time. Family doctors are expected to test for eye problems but they do not, and parents do not take young children to optometrists even when targeted by publicity campaigns stating that the exam and any eyeglasses will be free.

To deal with this problem we developed and are testing a programme to (1) screen kindergarteners *in school* for potential eye problems and then (2) arrange optometric examinations *in school*. In one study of 712 children, a single screening detected 84% of those who were found to have eye problems. In another study, screening 2534 children led to 11% of them being treated for eye problems.

We would like to thank Sally Stafford, our Central Coordinator, for her outstanding work. We also want to thank Charles Maurer, who serves as a volunteer programmer, webmaster, and writer, and Jane McWhinney, who volunteered her services as a copy editor for this report.

Note that Drs. Maurer and Wong, who oversee this project, receive no remuneration for it and do not stand to benefit from it financially in any way.

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The main eye problems

Amblyopia. 3% to 5% of children grow up with one eye that is misfocused and/or misaligned (“lazy eye”).¹ Without treatment the brain stops using that eye. The eye effectively goes blind. Treatment before age seven usually maintains the eye’s vision.² Treatment may involve eyeglasses and/or surgery to realign the eyes, and it may require the child to wear an eye patch for part of the day.

Refractive error. Approximately 10% of young children are too far-sighted to read a book comfortably. Another 1% are too near-sighted to read the blackboard. In kindergarten these children already score lower on tests of reading-readiness³ and IQ.⁴ Eyeglasses remedy this.

Eye testing today

Ontario family doctors are supposed to screen children for eye problems but few do, because even when they appreciate the importance, they usually lack the knowledge and the tools.⁵ Nor do many parents take young children to an eye doctor, not even when their family doctor recommends it. Parents say that they don’t understand the need, where to go, what would happen, or what it costs.

The Ontario Association of Optometrists recommends that all children have an annual examination by an optometrist. Since 2011 the Association has promulgated a programme called “Eye See...Eye Learn” that encourages parents to take four-year-olds to an optometrist for a free exam and arranges for free eyeglasses if needed.⁶ Few parents heed this advice.⁷

Our goal

We want to see a vision-testing programme for kindergarten children that is cost-effective and can be offered in all schools across Ontario. To this end we are (1) designing and testing a novel approach, and (2) running a demonstration project that implements this approach in enough schools to identify practical problems.

Our approach

1. Screen children quickly *in school* in junior and senior kindergarten.
2. If a child fails a screening test, book a full optometry exam *in school*.
3. If a child needs eyeglasses, provide them for free.

Our criteria

A screening programme can err in two directions. It can see normal eyes as problematic and it can see problematic eyes as normal. The first leads to needless optometric examinations; the second leads to more children losing the use of an eye or having problems learning to read.

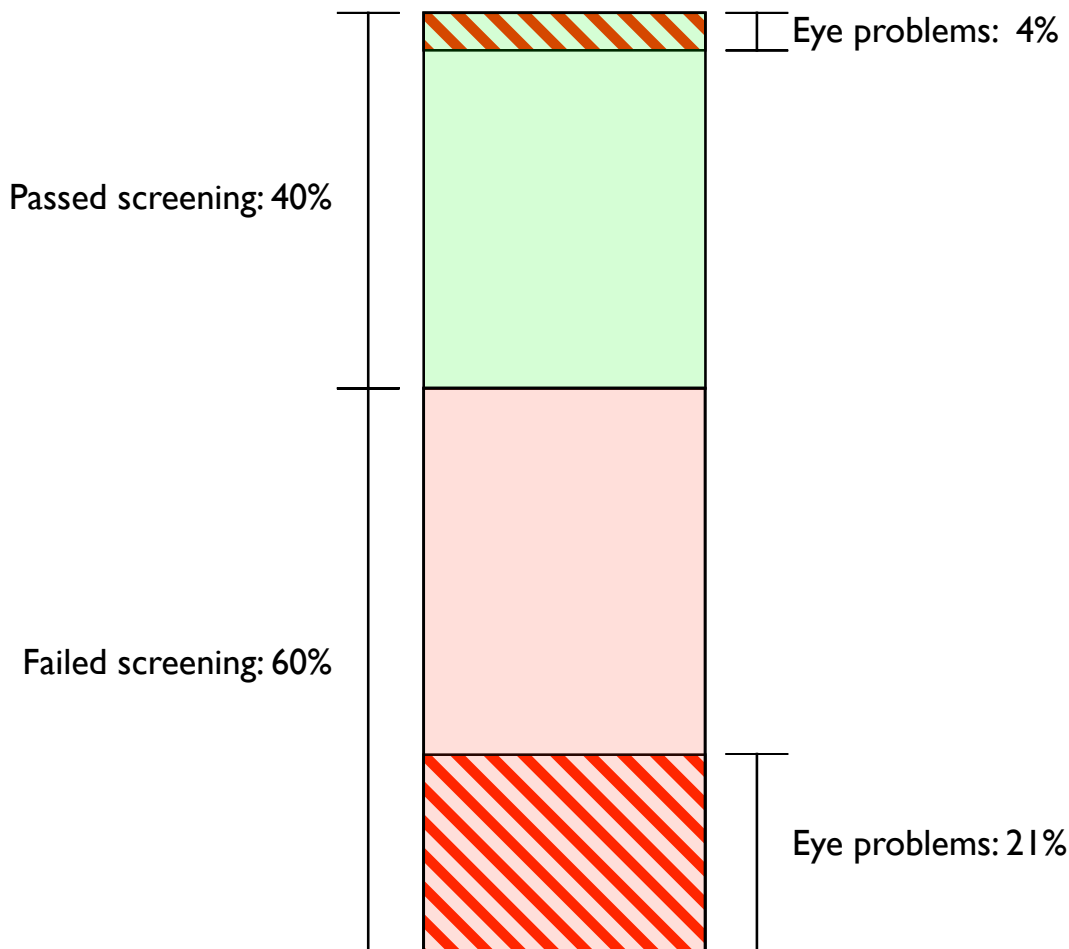
Children who read poorly do poorly in school, end up in less satisfying and remunerative jobs, and are more likely to develop behaviour problems and feed the criminal courts and jails. In the long run it would be cheaper to pay for some extra optometric exams but catch every child who has eye problems.

Indeed, even in the short run it would be cheaper. OHIP pays \$42.50 for each eye exam. In our study OHIP paid roughly \$100 to find each child with bad eyes. Buying eyeglasses for a child costs \$50 to \$100. In contrast, for each child held back one grade because he or she cannot read, the cost of the extra year's schooling averages \$6000.⁸

For these reasons we set our screening criteria to catch as many problems as possible, despite the cost of extra exams.⁹

How well our screening works

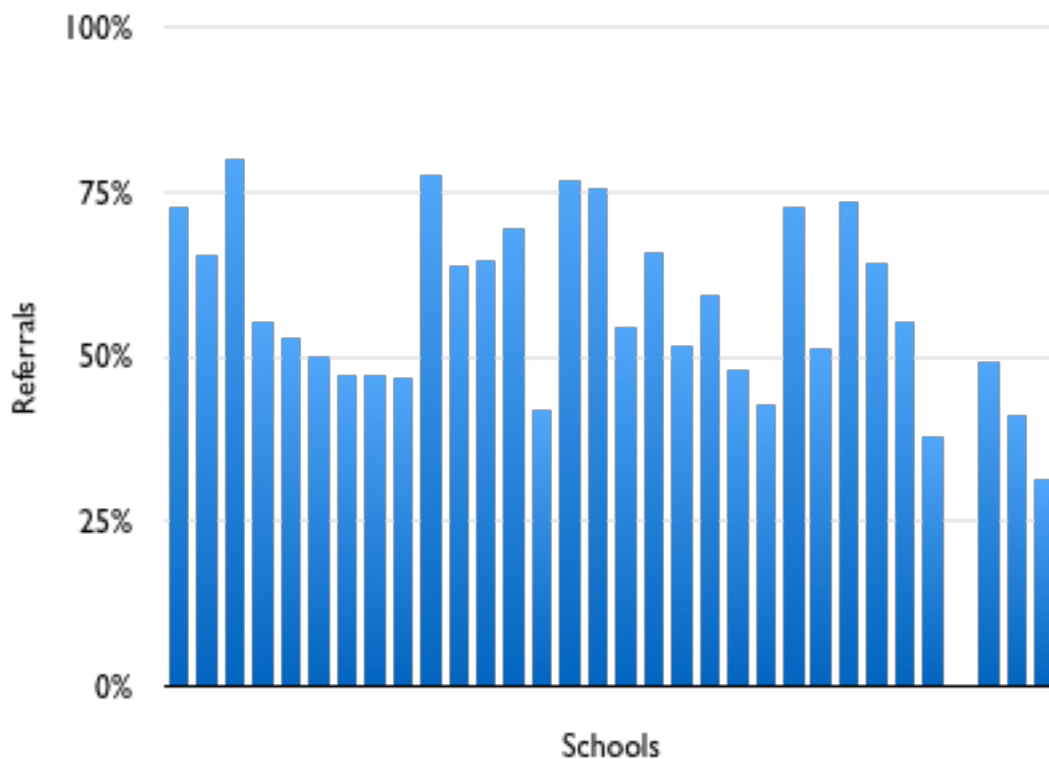
Our screening methods are listed in [Appendix 1](#). To evaluate them, one large kindergarten¹⁰ allowed us to offer screening tests plus a full optometric examination to every child, parent permitting. This let us compare the results for 712 children. The eye exams found 25% of these children to have eye problems. Our screening discovered this in all but 4%. (See the graph below.) If we could have screened each child in both junior and senior kindergarten, we would likely have detected virtually all the problems.



Demonstration project 1: Screening

In 2015-16 we screened 2534 children in 28 Ontario schools outside Aboriginal reserves. The communities we worked in are listed in [Appendix 2](#). The results of our screening varied greatly from one school to another¹¹ (see the graph below), but overall we referred 55% of these children for in-school optometry exams.

We also tested all of the kindergarten and grade one classes in a northern Aboriginal reserve, and had a referral rate of 89%. This is consistent with previous research.¹² With such a high rate of referrals it makes no sense to screen children on reserves. On reserves we recommend that optometrists examine every child.

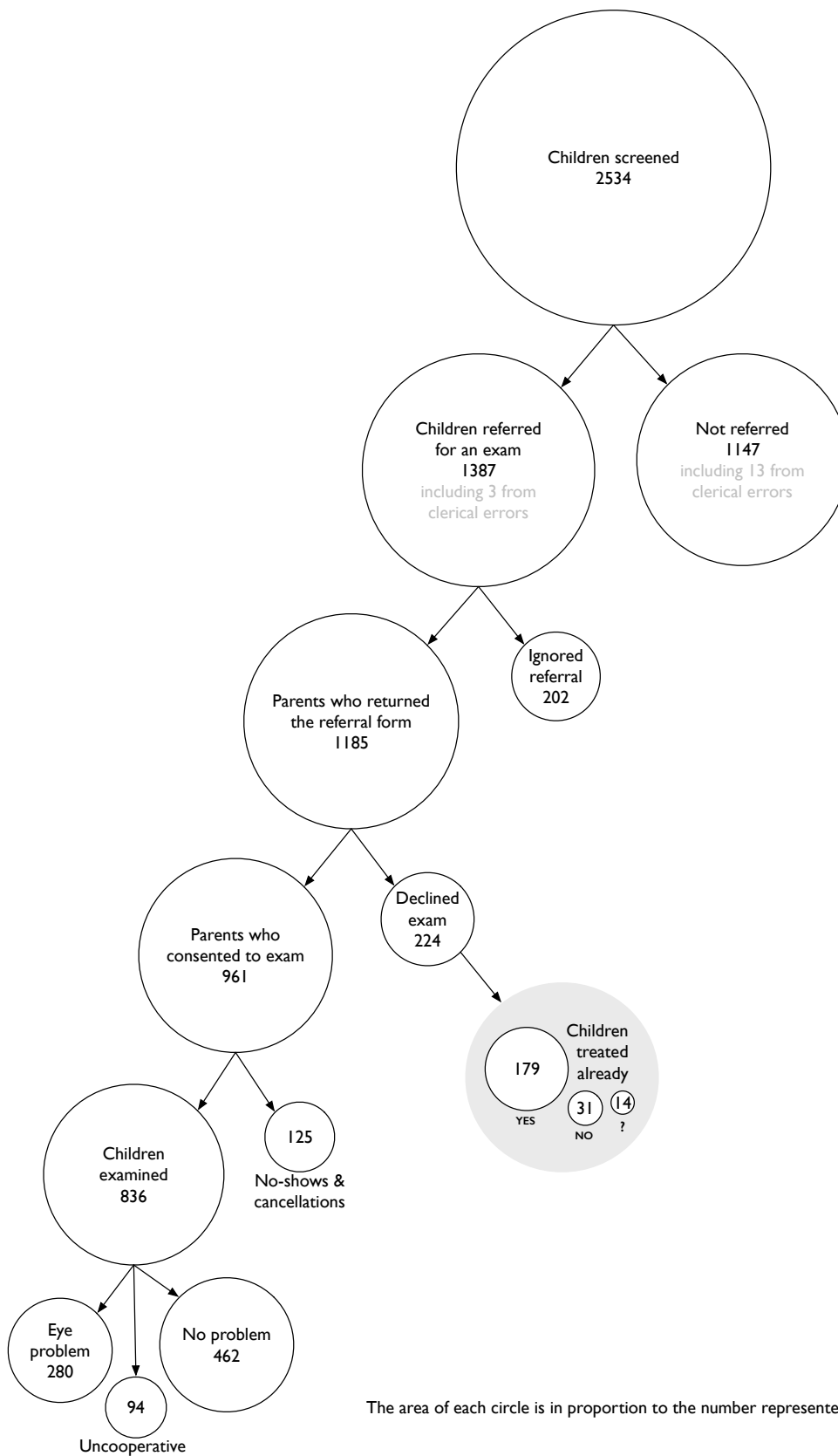


The three bars on the right represent schools where we were unable to use one of our machines. Using it would have led to more referrals.

Demonstration project 2: Optometry exams

If a child failed any of our screening tests, we sent a note home asking the parents to consent to a free optometric examination in school,¹³ and scheduling a tentative appointment.¹⁴ The letter was commonly in multiple languages and it explained how to change the appointment if necessary. The letter also promised that any eyeglasses needed would be free.¹⁵

Of the parents whose children failed screening, 13% told us they were already taking their child to an optometrist or ophthalmologist. Of the others, 60% brought in their child for an examination. Some of the children were uncooperative, but of those who allowed themselves to be examined, 33% evinced eye problems warranting either immediate treatment or close scrutiny. Those children represented 11% of all the children we screened. (See [Appendix 3](#) for definitions of eye problems.) Here are the numbers:



Demonstration project 3: Is all this necessary?

If vision screening is warranted, it must catch more problems during the first year of school than parents, teachers, and family doctors normally catch. To see whether it does, we compared three schools where we worked to three schools where we did not. After one school year, three times as many children wore eyeglasses in the schools where we worked.¹⁶

	Children	Wearing eyeglasses September	Wearing eyeglasses June
No programme	661	15 = 2%	20 = 3%
Our programme	581	14 = 2%	56 = 10%

Next year

In 2016-17 we are returning to the same schools to screen kindergarteners. Some of these children we shall be screening for the second time (in junior kindergarten last year and senior kindergarten this year). This will allow us to see how many more eye problems a second screening will catch.

In 2015-16 we brought optometrists into the schools. Although we supplied them with a complete kit of testing gear (see [Appendix 4](#)), they would have preferred to work in their offices with their normal staff and set-up. Although most parents will not act on a family doctor’s referral to an optometrist, we are hoping that they will act on a note stating specifically that their child’s eyes were checked and found likely to have a problem. To see if they will, in 2016-17 we are not bringing optometrists into schools, we are referring parents to local optometrists instead.

Our data will also permit us to analyze the economic costs and benefits of screening.

Conclusion

In an ideal world with infinite resources, every child would have an annual eye exam, but given limits to resources and to parents' time, it makes sense to screen all children quickly and be sure optometrists examine all of those with likely problems. That is the reason for school-based visual screening. From our work to date there seems no question that the government ought to screen kindergarteners' vision province-wide.

Appendix 1: Screening tests

1. Cambridge Crowding Cards (5-10 minutes). This is an eye chart designed for pre-schoolers (5-10 minutes). It detects:

- amblyopia caused by a difference in acuity between the eyes
- myopia
- significant astigmatism

2. Randot Preschool Stereoacuity Test (2 minutes). This detects amblyopia caused by a reduction in binocular 3-D vision.

3. The PlusoptiX S12 and, initially, the Spot Autorefractor (1 minute each). These detect refractive errors. After using both for two years we stopped using the Spot.¹⁷

4. Pediatric Vision Scanner (1 minute). This is an experimental machine—our use of it is formally a Health Canada clinical trial—that detects eye misalignment.¹⁸

Appendix 2: List of communities by population

Rockwood	4000
Kirkland Lake	8000
Eramosa	9000
Wellesley	11,000
Norwich	11,000
Fergus	19,000
Woodstock	38,000
Sarnia	90,000
Guelph	120,000
Cambridge	130,000
Kitchener	220,000
Hamilton	520,000
Ottawa	890,000
Toronto	6,000,000

Appendix 3: Definitions of eye problems

To define eye problems we used the recommendations of the American Association for Pediatric Ophthalmology and Strabismus.¹⁹

For children aged 31-48 months of age:

- astigmatism >2.0 D
- hyperopia >4.0D
- myopia >3.0D
- anisometropia >2.0 D

For children >48 months of age:

- astigmatism >1.5 D
- hyperopia >3.5D
- myopia >1.5D
- anisometropia >1.5 D

Visually significant media opacities and manifest (not intermittent) strabismus should be detected at all ages.

Appendix 4: Optometry equipment taken to each school

Muscle light and charging handle

Randot stereo test

HOTV letters

Snellen letter

HRR colour test

Kowa SL-17 handheld slit lamp

Prism bar

Pinhole occluder

Titmus stereo test

Streak retinoscope head & battery handles

Ophthalmoscope head & battery handle

Desk Charger two handles

Trial lenses (full set)

Welch Allyn indirect ophthalmoscope and battery

20D lens

Reichert Phoropter (negative cylinder) and tabletop stand

Pediatric trial frame, axis adjustable
Retinoscopy rack
Lensometer
Macbeth easel lamp and True Daylight Illuminator
Spot hand-held autorefractor
Lea Symbols
iCare tonometer
Kay picture test
Ruler
Acuity Pro Computer System and Monitor
Pupilometer

Appendix 5: Collaborators

Vision screening:

- Timiskaming Public Health
- Lambton Public Health
- Oxford County Public Health
- Gift of Sight and Sound, Toronto Foundation for Student Success
- Volunteers from district A15 Lions Clubs: Fergus, Rockwood, Guelph Royal City, Galt Cambridge, Wellesley, and Ariss-Maryhill
- iScreen (volunteers from University of Ottawa Medical School)

Optometrists:

- Ontario Association of Optometrists (“Eye See...Eye Learn[®]”)
- School of Optometry, University of Waterloo
- Gift of Sight and Sound, Toronto Foundation for Student Success

Complimentary eyeglasses:

- Clearly
- Nikon
- OGI

Notes

1 Drover, J.R., Kean P.G., Courage M.L., Adams R.J. “Prevalence of amblyopia and other vision disorders in young Newfoundland and Labrador children.” *Canadian Journal of Ophthalmology*. 2008;43:89-94. For other countries see Chia, A., Dirani, M., Chan, Y-H., Gazzard, G., Au Eong, K-G., Selvaraj, P., Ling, Y., Quah, B-L., Young, T. L., Mitchell, P., Varma, R., Wong, T-Y., & Saw, S-M. “Prevalence of amblyopia and strabismus in young Singaporean Chinese children.” *Clinical & Epidemiologic Research*, 2010; 51:3411-3417.

2 Bradfield, Y.S. “Identification and treatment of amblyopia.” *American Family Physician*. 2013;87:248-52.

3 Shankar, S., Evans, M.A., Bobier, W.R. “Hyperopia and emergent literacy of young children: Pilot study.” *Vision Science*. 2007;84:1031-1038

4 Roch-Levecq, A.C., Brody, B.L., Thomas, R.G., Brown, S.I. “Ametropia, preschoolers’ cognitive abilities, and effects of spectacle correction.” *Archives of Ophthalmology*. 2008;126:252-258.

5 Tran, L.D., Raashid, R.A., Colpa, L., Noble, J., Ali, A., Wong, A.M. “Pediatric vision screening in the primary care setting in Ontario.” *Paediatrics & Child Health*. In press.

6 OHIP pays for children’s optometric exams. In addition, “Eye See...Eye Learn” receives funds from the Ontario Ministry of Health and Long-Term Care, Nikon and OGI provide complimentary eyeglasses, and optometrists in the programme charge no dispensing fee.

7 “As of February 2015, only 4.5% out of 101,292 of eligible children in the regions where the programme presently exists have enrolled in E.S.E.L. [‘Eye See...Eye Learn’].” Page 38 of *Optimizing Optometry’s Role in Ontario: A White Paper by the Ontario Association of Optometrists* (April 2015).

8 Craig, W., Schumann, L., Petrunka, K., Khan, S., and Peters, R. “Government Costs Associated with Delinquent Trajectories.” *International Journal of Child, Youth and Family Studies* 2, no. 2.1 (2011): 263-293.

9 This is opposite to the practice in the United States, which makes it impossible to compare screening studies there and here.

10 The Fraser Mustard Early Learning Academy in Toronto is a normally sized school with only kindergarten classes.

11 We do not know why but we do know that refractive error is related to fat and to inadequate time spent outdoors, and both of these are affected by a community’s culture—do parents push hockey or homework?—and by climate and the availability of places to play outside. Fen, Y., Chongming Y., Yuzhong, L., Shuzhen, P., Bei, L., Xudong, G., & Xiaodong, T. “Associations between Body Mass Index and Visual

Impairment of School Students in Central China.” *International Journal of Environmental Research & Public Health*. 2016;13(10),1024;doi:10.3390/ijerph13101024.

12 Chiarelli, C.A., & Chris, A.P. “Visual status of First Nations children: The Sagamok First Nation Vision Care Project.” *Canadian Journal of Optometry*, 2013;75:39-46.omni

13 O.H.I.P pays for children’s optometry exams.

14 If a child passed all of our screening tests, we sent a note home saying that quick tests had found no problem but that to be certain the parents should arrange a full eye exam at their local optometrist, which OHIP would pay for.

15 Clearly, Nikon, and OGI donate eyeglasses.

16 This year we are offering our programme to the three schools where we did not work last year.

17 The two autorefractors agreed 89% of the time. When they disagreed, the PlusoptiX combined with the three other tests caught all but one child with eye problems, but the Spot with the three other tests missed six.

18 Loudon, S.E., Rook, C.A., Nassif, D.S., Piskun, N.V., & Hunter, D.G. “Rapid, high-accuracy detection of strabismus and amblyopia using the Pediatric Vision Scanner.” *Investigative Ophthalmology & Vision Science*, 2011;52:5043-5048.

19 “Guidelines for automated preschool vision screening: a 10-year, evidence-based update.” *Journal of AAPOS: the official publication of the American Association for Pediatric Ophthalmology and Strabismus/American Association for Pediatric Ophthalmology and Strabismus*. 2013;17:4-8.