

# Results of a primary care–based quality improvement project to optimize chart-based vision screening for preschool age children

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| <b>PURPOSE</b>     | To design chart-based vision screening for preschool-aged children.  |
| <b>METHODS</b>     | Our program consisted of educational sessions for providers as well as hands-on training for practice staff. We evaluated the intervention through pre- and post-intervention review of medical records.   |
| <b>RESULTS</b>     | Completion of full vision screening (distance visual acuity in each eye plus stereovision beginning at 3 years of age, as recommended at the time of the project) at well-child visits improved for 5-year-olds (45.0% to 58.2%; risk difference +13.2% [95% CI, 1.7-24.7]) and 4-year-olds (39.3% to 51.4%; risk difference +12.0% [95% CI, 0.7-23.4]) but declined somewhat among 3-year-olds (23.1% to 14.3%; risk difference, -8.8% [95% CI, -17.7 to 0.0]). Risk factors for not being fully screened included being 3 years old (risk ratio of 4.1 compared to 5-year-olds) and being a patient of a small practice (risk ratio of 1.9 compared to large practices). |
| <b>CONCLUSIONS</b> | This quality improvement project showed that screening for visual acuity and stereovision among preschool-aged children using chart-based techniques is difficult to accomplish and unlikely to be consistently successful, especially among 3-year-olds. (J AAPOS 2016;20:305-309)  |

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Pediatric vision screening is an essential element of well-child care for young children given the importance of adequate vision to overall cognitive and social development. Appropriate vision screening in young children can detect amblyopia or amblyogenic risk factors at a time when treatment is effective, ideally before age 5.<sup>1</sup> The American Academy of Pediatrics, the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus, and the American Association of Certified Orthoptists have made recommendations for routine pediatric vision screening; at the time of this project, these organizations<sup>2</sup>

as well as the Commonwealth of Massachusetts<sup>3</sup> recommended distance visual acuity and stereovision annually beginning at 3 years of age. Traditionally, the recommended techniques have consisted of an eye examination by a health care provider plus standardized chart-based screening using letter or symbol charts to assess visual acuity and the Random Dot E test to assess stereovision. Children who fail or are unable to pass both visual acuity and stereovision screening are recommended to undergo a comprehensive vision examination by a specialist trained in pediatric eye care.

Studies of chart-based screening techniques conducted by carefully trained personnel demonstrate that visual acuity can be adequately screened using chart-based screening in over 95% of preschool aged children<sup>4,5</sup> and that stereovision can be screened in at least 80% using the Random Dot E test.<sup>6,7</sup> Nevertheless, national data show that a substantial proportion of preschool aged children do not effectively complete recommended screening in primary care settings<sup>8-12</sup> and that the rate of amblyopia in the US is 2%-3%, considered well above what it could be were effective primary-care-based screening and referral techniques in place.<sup>13</sup>

Given the current status quo with chart-based screening still serving as the predominant technique in most pediatric primary care practices, we designed a quality improvement (QI) intervention to improve chart-based screening in a large primary care pediatric network.

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## Subjects and Methods

This project met our institution's definition of QI and was therefore exempt from institutional review board review. This study was compliant with relevant regulations of the US Health Insurance Portability and Accountability Act of 1996. The Pediatric Physicians' Organization at Children's (PPOC) is an independent practice association of 80 privately owned pediatric practices affiliated with Boston Children's Hospital that provides primary care to an estimated 400,000 children throughout eastern Massachusetts. At the time of this effort, practices ranged in size from 1 to 10 physicians.

During a year-long longitudinal learning community on the provision of high-quality well-child care that PPOC was conducting with a subset of its practices, providers identified vision screening for preschool age children as a recommended preventive health care service that they felt they were not providing reliably and with high quality. In response to this perceived need, PPOC leadership developed a program to improve the provision of vision screening to this population within the network. The program consisted of 2 elements. First, local pediatric vision experts were invited to offer an education session covering the background, techniques, and recommendations for vision screening among preschool aged children; this educational session was delivered on three separate occasions between March and August 2013. Based on expert recommendations<sup>2</sup> and state mandates at the time,<sup>3</sup> the techniques taught in the training were Lea symbol charts at 10 feet for visual acuity assessment and Random Dot E testing for stereovision assessment. Second, PPOC offered hands-on vision screening training sessions at various sites throughout our network's geographic area between April and July 2013. These sessions were run by a single trainer who serves as the Northeast Regional Director of Prevent Blindness (KM) and were based on a train-the-trainer model, wherein one of more key personnel from each participating practice received the training and then brought the techniques back to their practice to train additional staff who would be responsible for performing the screening. On completion of the training, participants received certification in vision screening through Prevent Blindness' national program for training and certifying vision screeners. Sessions lasted 4.5 hours and consisted of three parts: (1) a didactic presentation covering the importance of vision screening for young children, conditions that can be identified by appropriate screening, appropriate equipment and environmental conditions for screening, and identification of which children should be referred for a comprehensive eye examination; (2) a discussion of barriers experienced by practices and ways to overcome them; and (3) hands-on training in which participants performed chart-based visual acuity and stereovision screenings on one another under supervision of the trainer.

To analyze the effect of our efforts on vision screening of preschool age children, we defined the preintervention period as the calendar year 2011 and the postintervention period as October 2013 through January 2014. For these two time periods, we identified all children 3, 4, and 5 years of age who had a well-child visit (CPT code 99382, 99383, 99392, or 99393) within

Table 1. Patient demographics

| Characteristics                | Before intervention, no. (%)<br>N = 432 | After intervention, no. (%)<br>N = 441 | P value |
|--------------------------------|---|--|---------|
| Age, years                     |   |  |         |
| 5                              | 140 (32.4)                              | 146 (33.1)                             | 1.0     |
| 4                              | 145 (33.6)                              | 148 (33.6)                             |         |
| 3                              | 147 (34.0)                              | 147 (33.3)                             |         |
| Sex                            |   |  |         |
| Female                         | 230 (53.2)                              | 206 (46.7)                             | 0.05    |
| Male                           | 202 (46.8)                              | 235 (53.3)                             |         |
| Race                           |   |  |         |
| White, non-Hispanic            | 200 (46.3)                              | 211 (47.8)                             | 0.09    |
| Black, non-Hispanic            | 15 (3.5)                                | 18 (4.1)                               |         |
| Hispanic                       | 15 (3.5)                                | 30 (6.8)                               |         |
| Other/Unknown                  | 202 (46.8)                              | 182 (41.3)                             |         |
| Practice size (no. physicians) |   |  |         |
| Large (6-10)                   | 198 (45.8)                              | 177 (40.1)                             | 0.1     |
| Medium (3-5)                   | 123 (28.5)                              | 153 (34.7)                             |         |
| Small (1-2)                    | 111 (25.7)                              | 111 (25.2)                             |         |

practices of our network who utilized our network's centralized electronic health record system (51 practices at the time of the project). We then randomly selected 150 3-year-olds, 150 4-year-olds, and 150 5-year-olds for medical records review using a random number generator. A single pediatric ophthalmologist (SJ) reviewed each chart for evidence of visual acuity and stereovision screening and for evidence of a referral to an ophthalmologist or optometrist for a comprehensive eye examination for children who did not pass or were unable to be screened. We defined a full vision screen as one documenting an adequate result for visual acuity in each eye independently and for stereovision.

## Data Analysis

Pre- and postintervention results and risk factors for not being fully tested were analyzed using a modification of logistic regression that allows for estimation of risk differences and risk ratios.<sup>14,15</sup> All analyses were performed with SAS version 9.3 (Cary, NC).

## Results

In total, PPOC offered 11 vision-screening training sessions between April and July 2013, which were attended by 163 professionals from 56 PPOC practices, representing 70% of the network's 80 practices. For the preintervention period, we identified 7,345 3-year-olds, 7,547 4-year-olds, and 7,116 5-year-olds who had a well-child visit within network using our centralized electronic health record; 150 of each age group were selected randomly for record review. Three records were excluded because the visit identified was not a well-child visit and an additional 15 records were excluded because there was evidence in the well-child visit documentation that the child was already under the care of an eye specialist, leaving 432 records for analysis. For the postintervention period, we identified 3,184

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