Association of household language and vision screening among children in the United States

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The American Academy of Pediatrics recommends annual testing in children beginning at 3 years of age to detect vision problems and prevent amblyopia. However, rates of vision testing in children from non-English primary language (NEPL) households are not well delineated. This study analyzed the 2018-2020 National Survey of Children's Health to examine patterns and predictors of vision testing among children from NEPL households. In this nationally representative cohort of 89,697 children 3-17 years of age, 70.9% of children received vision testing during the previous 12 months. Children from non-English-speaking households were less likely to undergo vision testing (64.3% vs 72.0%; aOR [95% CI] = 0.83 [0.72-0.95], *P* = 0.008). Decreased vision testing among children from NEPL households was driven by lower rates of testing at school (16.1% vs 21.0%; 0.72 [0.57-0.89], *P* = 0.009) or from an ophthalmologist or optometrist (49.0% vs 54.0%; 0.72 [0.61-0.85], *P* = 0.0004), whereas children from NEPL households were more likely to receive vision testing at health clinics (14.4% vs 3.1%; 3.25 [2.40-4.39], *P* < 0.0001). No differences were observed in rates of testing by a pediatrician (41.1% vs 44.0%; 1.05 [0.89-1.23], *P* = 0.69). Interventions to improve language services and health literacy are warranted to increase rates of vision testing among children from NEPL households.

Pediatric vision testing is recommended for children beginning at 3 years of age to detect vision problems and prevent permanent vision impairment.[1] Previous studies have estimated that the prevalence of vision impairment among preschool-aged children will increase by more than 25% by 2060, in large part due to preventable causes.[2]

An estimated 12 million children in the United States primarily speak a language other than English at home.[3] Children whose families required a translator are less likely to utilize pediatric ophthalmology services.[4] Data are limited regarding patterns of vision testing among children from non-English primary language (NEPL) households. This study explored differences in pediatric vision testing by primary household language in a representative cohort of US children.

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Methods

Data were analyzed from children 3-17 years of age enrolled in the 2018-2020 National Survey of Children's Health (NSCH), an annual cross-sectional survey of children by the US Census Bureau. Data were combined, and survey weights, strata, and clustering were used to generate nationally representative estimates of pediatric vision testing, as recommended by the NSCH analytic guidelines.[5]

The primary study outcome was parent-reported vision testing in the previous 12 months, determined by the question, "During the past 12 months, has this child had his or her vision tested, such as with pictures, shapes, or letters?" Respondents were then asked whether the vision testing was performed by an eye doctor or eye specialist, pediatrician, at a health clinic, or at school, with the option to select multiple locations if vision was tested in multiple settings. We also analyzed vision screening, defined as vision testing by a pediatrician or at a health clinic or school, to separate the incidence of initial vision screenings in the community from follow-up vision tests at the ophthalmology or optometry office.

Frequency and prevalence of vision testing were estimated. The Cochran-Armitage trend test was used to evaluate changes in vision testing over the study period. The Rao-Scott χ^2 and multivariable logistic regression models, adjusted for available sociodemographic characteristics, were constructed to examine the association of primary household language (English vs non-English) and vision testing. Covariates included age (3-5, 6-12, 13-17 years), sex (male/female), race (non-Hispanic White, non-Hispanic Black, Hispanic, other multiracial), parental education (no high school degree, high school degree, college degree), income (above/below 400% of federal poverty limit), insurance coverage (private or private and public/public only/no insurance), and US region (Northeast, Midwest, South/West), to isolate the effect of household language. All sociodemographic data were determined by parent report.

Data analyses were conducted in SAS v9.4. A two-sided *P* value of <0.05 was considered statistically significant. Statistical analyses were adjusted for multiple comparisons to minimize the false discovery rate.[6] All data were deidentified, publicly available, and did not constitute human subjects research.

Results

There were 89,697 children ages 3-17 years in our study cohort, including 51.1% male, 49.9% White and 13.6% Black, 25.8% Hispanic ethnicity, 63.2% and 29.7% with private and public health insurance, and 14.6% from NEPL households.

In total, 64,441 (70.9%) children received vision testing in the past 12 months; of these children, 46.6% received testing by an ophthalmologist or optometrist, 43.5% by a pediatrician, 4.7% at a health clinic, 20.4% at school, and 12.9% in multiple settings. Rates of pediatric vision testing decreased from 73.2% in 2018 to 67.2% in 2020 (Cochran-Armitage test, $P < 0.0001$). The highest rates of total vision testing were found in a cluster of states in the Northeast United States: Rhode Island (80.0%), Delaware (78.7%), New Jersey (78.5%), and Pennsylvania (77.9%). Rates of vision testing were lowest in Idaho (61.4%), Nevada

Table 1. Sociodemographic associations with vision testing among US children (N = 89697)

Characteristic	No vision testing (n = 25256) Frequency	No vision testing % prevalence (95% CI)	Vision testing (n = 64441) Frequency	Vision testing % prevalence (95% CI)	Adjusted OR (95% CI)	*P* value
Primary household language						
English	23005	28.0 (27.3-28.7)	60317	72.0 (71.3-72.7)	1.0 (ref)	—
Not English	2137	35.7 (33.1-38.3)	3845	64.3 (61.7-66.9)	0.83 (0.72-0.95)	0.02
Sex						
Male	13683	30.3 (29.3-31.2)	32840	69.7 (68.8-70.7)	1.0 (ref)	—
Female	11573	28.0 (27.0-29.0)	31601	72.0 (71.0-73.0)	1.13 (1.05-1.21)	0.003
Age, years						
3-5	6580	40.0 (38.4-41.7)	9462	60.0 (58.3-61.6)	1.0 (ref)	—
6-12	8823	25.4 (24.4-26.5)	28513	74.6 (73.5-75.6)	2.04 (1.87-2.24)	<0.0001
13-17	9853	28.0 (26.9-29.1)	26466	72.0 (70.9-73.1)	1.82 (1.66-1.99)	<0.0001
Income						
<400% poverty line	15283	30.7 (29.8-31.6)	35412	69.3 (68.4-70.2)	0.95 (0.88-1.02)	0.23
≥400% poverty line	9973	26.3 (25.3-27.3)	29029	73.7 (72.7-74.7)	1.0 (ref)	—
Race/ethnicity						
White	16953	28.0 (27.3-28.6)	44040	72.0 (71.4-72.7)	1.0 (ref)	—
Black	1639	27.9 (26.0-29.9)	4380	72.1 (70.1-74.0)	1.09 (0.98-1.21)	0.21
Hispanic	3374	31.5 (29.6-33.5)	7840	68.5 (66.5-70.4)	1.14 (1.02-1.28)	0.04
Multiracial/other	3290	30.4 (28.6-32.1)	8181	69.6 (67.9-71.4)	0.97 (0.88-1.07)	0.68
Education level						
Less than HS	4898	34.6 (33.0-36.3)	9538	65.4 (63.7-67.0)	1.0 (ref)	—
HS degree	6252	30.4 (29.0-31.8)	14859	69.6 (68.2-71.0)	1.14 (1.03-1.27)	0.02
College degree	14106	25.3 (24.5-26.0)	40044	74.7 (74.0-75.5)	1.46 (1.32-1.61)	<0.0001
Insurance coverage						
None	1856	47.2 (43.9-50.6)	2439	52.8 (49.4-56.1)	0.46 (0.40-0.54)	<0.0001
Private	5499	29.8 (28.4-31.3)	12646	70.2 (68.7-71.6)	1.0 (ref)	—
Public	17439	26.5 (25.8-27.2)	48548	73.5 (72.8-74.2)	1.02 (0.93-1.13)	0.73
Region						
Northeast	5154	26.7 (25.6-27.9)	16360	73.3 (72.1-74.4)	1.0 (ref)	—
Midwest	3996	28.8 (27.5-30.1)	10170	71.2 (69.9-72.5)	0.91 (0.83-0.99)	0.04
South	8156	28.7 (27.6-29.8)	21148	71.3 (70.2-72.4)	0.95 (0.88-1.03)	0.30
West	7653	32.4 (30.6-34.2)	16763	67.6 (65.8-69.4)	0.77 (0.69-0.85)	<0.0001

CI, confidence interval; *HS*, high school; *OR*, odds ratio.

(62.4%), and Illinois (65.4%). By comparison, the incidence of vision screening, defined as vision testing by a pediatrician, health clinic, or school, was 41.7% in the overall study cohort.

Compared to those from primarily English-speaking households, children from NEPL households had lower rates of vision testing in models adjusted for age, sex, race, parental education, income, insurance coverage, and geographic location (64.3% vs 72.0%; aOR [95% CI] = 0.83 [0.72-0.95], $P = 0.008$) (Table 1, Figure 1). In addition, NEPL children who received vision testing did so more often at a health clinic (14.4% vs 3.1%; 3.25 [2.40-4.39], $P < 0.0001$) and less frequently at school (16.1% vs 21.0%; 0.72 [0.57-0.89], $P = 0.009$) or from an ophthalmologist or optometrist (49.0% vs 54.0%; 0.72 [0.61-0.85], $P = 0.0004$). There was no difference according to household language in the proportion of tested children who were tested by a pediatrician (41.1% vs 44.0%; 1.05 [0.89-1.23], $P = 0.69$). Stratifying by age, children 3-5 years old from NEPL households were less likely to receive vision testing (50.1% vs 61.7%; 0.68 [0.52-0.90], $P = 0.02$), whereas no statistically significant difference was observed among older children (6-12 years: 68.8% vs 75.5%; 0.90 [0.72-1.13], $P = 0.47$; 13-17 years: 66.3% vs 73.1%; 0.83 [0.66-1.05], $P = 0.20$). There were no two-way interactions between household language and race ($P \geq 0.06$), insurance ($P \geq 0.17$), or income ($P \geq 0.68$) as predictors of vision testing.

In contrast to vision testing, rates of vision screening by a pediatrician, health clinic, or school did not differ significantly between children from NEPL and English primary language households (40.5% vs 41.9%; 1.07 [0.94-1.23], $P = 0.40$).

Discussion

In this nationally representative sample, 70.9% of total children underwent vision testing, and children from NEPL households were nearly 20% less likely to receive vision testing. This disparity was driven by lower rates of vision testing from an ophthalmologist or optometrist and at school, whereas a higher proportion of NEPL children received vision testing at a health clinic. Annual vision testing beginning at 3 years of age is recommended to detect undiagnosed vision impairment and prevent progression to amblyopia.[1,2] Language-specific patient education and access to language services during health visits may mitigate disparities in vision testing and

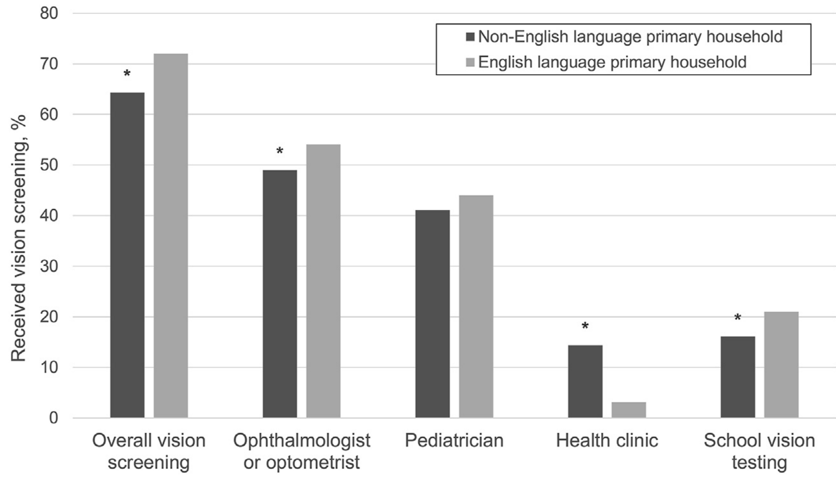

FIG 1. Proportion of children receiving vision testing overall and proportions of those tested in specific settings. The asterisk indicates statistically significant difference between non-English primary language households and English primary language households ($P < 0.05$).

improve vision outcomes for children from NEPL households.

The finding of decreased vision testing observed among NEPL children has multiple possible explanations. A previous study found parents of children from NEPL households reported greater mistrust of clinicians and lower rates of specialist referrals, which aligns with the lower rates of ophthalmologist or optometrist testing observed in this study.[7] Patient need for a translator was also associated with fewer pediatric ophthalmology and teleophthalmology visits during the COVID-19 pandemic.[4] Moreover, many patient education materials in English and Spanish are written above the recommended 7th grade reading level and can contribute to poor parent understanding, and thus parents may be less likely to pursue vision testing.[8] Indeed, in a survey on barriers to pediatric eye care, Hispanic immigrant parents identified cost, language barrier, and lack of information about eye conditions as the biggest barriers.[9] All of these factors likely contribute to limiting access to vision testing, particularly ophthalmologist or optometrist testing, and may lead to worse outcomes. The optimal strategy to reduce disparities by household language likely requires multidisciplinary consideration of all these factors.

NEPL children in our study were more likely to receive vision testing at a health clinic. Based on this finding, policymakers and clinicians can leverage the existing testing efforts by health clinics through collaboration to ensure these children receive appropriate follow-up after vision testing. A randomized controlled trial of children who failed a hearing testing found that social work, care coordination, and patient education at Women, Infants, and Children (WIC) locations decreased loss to follow-up by 66.7%.[10] We also found NEPL children had lower rates of testing at school and the ophthalmology or optometry office. Greater investment in schools that serve NEPL children, expanded vision insurance for NEPL households, and increased reimbursement for pediatric ophthalmology services are potential interventions to mitigate disparities in vision testing. Future studies should investigate the impact of health insurance access and expansion on vision testing trends.

Strengths of this cohort include the large size and survey sampling strategy that allows for representative estimates over the study period. However, there are some limitations. The NSCH collected data on the primary language spoken at home, which is not analogous to English proficiency; children and parents from NEPL households may have high English proficiency. Additional studies are needed to better understand the association of limited child and parent English proficiency and vision testing patterns because the strategies to address these disparities will also be necessarily different. Data were unavailable on other vision care utilization, use of social services, and underlying reasons for less vision testing among children from NEPL households. Also, the NSCH asked about vision testing with pictures, shapes, or letters; however, this may not capture other methods of vision screening such as photoscreening. Further studies are needed to investigate these points.

Children from NEPL households were approximately 20% less likely to undergo recommended vision testing, which was driven by lower rates of testing by an ophthalmologist or optometrist and at schools. These findings suggest unequal access to care by household language and provide actionable data to inform policies and patient care.

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