RESEARCH LETTER

Gaps in the Vision Screening Pathway for School-Aged US Children

Vision screening is a fundamental component of preventive health care delivered to children worldwide.[1] In the US, children may receive vision screening in multiple settings, including primary care clinics, schools, and community events.[2] However, the multifaceted approach and variability in vision screening policies may result in missed care for children with preventable vision loss.[3] The factors contributing to failure at each step along the screening pathway are poorly understood. This study uses a nationally representative survey of the US pediatric population to identify gaps in the vision screening pathway.

Supplemental content

Methods | This cross-sectional study using deidentified data from the National Survey of Children's Health (NSCH) was exempt from review because it was not considered human subjects research by the Boston Children's Hospital Institutional Review Board. We adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

We included school-aged children (aged 6 to <18 years) participating in the 2021 NSCH, a nationally representative survey of the noninstitutionalized US pediatric population.[4] The vision screening questions were updated in 2021, enabling detailed analysis of 3 steps along the vision screening pathway: receipt of screening, referral for eye examination, and establishment of specialty care. Sociodemographic variables included age, sex, race and ethnicity (Hispanic, non-Hispanic Asian, non-Hispanic Black, non-Hispanic White, and other [including Native American and Alaska Native, Native Hawaiian and Other Pacific Islander, and other]), insurance type, household income, caregiver education level, household generation, and primary household language.

We used survey weights to account for the NSCH sampling design, reporting participant counts and survey-weighted per-

Table. Sociodemographic Factors Associated With Steps Along the Vision Screening Pathway

Characteristic	Received vision screening[a]			Referred for eye examination[a]			Established care with specialist[a]		
	No. (%)[b]			No. (%)[b]			No. (%)[b]		
	No (n = 11 679)	Yes (n = 18 494)	*P* value[c]	No (n = 13 360)	Yes (n = 5134)	*P* value[c]	No (n = 311)	Yes (n = 4823)	*P* value[c]
Age, y									
6 to ≤11	4586 (34)	9421 (66)	<.001	7134 (73)	2287 (27)	<.001	179 (9)	2108 (91)	.39
12 to ≤17	7093 (43)	9073 (57)		6226 (66)	2847 (34)		132 (7)	2715 (93)	
Sex									
Male	6075 (38)	9664 (62)	.37	7127 (72)	2537 (28)	.03	173 (9)	2364 (91)	.15
Female	5604 (39)	8830 (61)		6233 (68)	2597 (32)		138 (7)	2459 (93)	
Race and ethnicity[d]									
Hispanic	1674 (40)	2486 (60)	.002	1636 (63)	850 (37)	<.001	67 (10)	783 (90)	.01
Non-Hispanic Asian	761 (47)	957 (53)		568 (58)	389 (42)		30 (10)	359 (90)	
Non-Hispanic Black	843 (40)	1249 (60)		813 (65)	436 (35)		48 (12)	388 (88)	
Non-Hispanic White	7467 (37)	12 291 (63)		9267 (75)	3024 (25)		140 (5)	2884 (95)	
Other[e]	934 (34)	1511 (66)		1076 (71)	435 (29)		26 (7)	409 (93)	
Insurance type									
Private	7432 (36)	12 756 (64)	<.001	9656 (76)	3100 (24)	<.001	145 (6)	2955 (94)	.12
Medicaid	3205 (38)	4772 (62)		3057 (63)	1715 (37)		135 (9)	1580 (91)	
Uninsured	756 (57)	681 (43)		454 (60)	227 (40)		21 (8)	206 (92)	
Highest level of education among caregivers[d]									
More than high school	9283 (36)	15 719 (64)	<.001	11 572 (73)	4147 (27)	<.001	232 (6)	3915 (94)	.12
High school	1919 (42)	2336 (58)		1548 (69)	788 (31)		60 (10)	728 (90)	
Less than high school	477 (50)	439 (50)		240 (48)	199 (52)		19 (13)	180 (87)	
Household income, % of FPL[d]									
≥400	4053 (34)	7425 (66)	<.001	5700 (77)	1725 (23)	<.001	77 (5)	1648 (95)	.04
300-399	1832 (37)	2926 (63)		2131 (72)	795 (28)		39 (6)	756 (94)	
200-299	2072 (38)	3062 (62)		2204 (72)	858 (28)		48 (7)	810 (93)	
100-199	2194 (43)	2995 (57)		2046 (65)	949 (35)		85 (12)	864 (88)	
0-99	1528 (43)	2086 (57)		1279 (59)	807 (41)		62 (9)	745 (91)	

(continued)

Table. Sociodemographic Factors Associated With Steps Along the Vision Screening Pathway (continued)

Characteristic	Received vision screening[a]			Referred for eye examination[a]			Established care with specialist[a]		
	No. (%)[b]			No. (%)[b]			No. (%)[b]		
	No (n = 11 679)	Yes (n = 18 494)	*P* value[c]	No (n = 13 360)	Yes (n = 5134)	*P* value[c]	No (n = 311)	Yes (n = 4823)	*P* value[c]
Household generation									
Child and all parents born in US	8318 (36)	13 899 (64)	<.001	10 304 (73)	3595 (27)	<.001	196 (6)	3399 (94)	.007
Child and parents born outside US	411 (44)	386 (56)		239 (59)	147 (41)		17 (22)	130 (78)	
Child born in US and ≥1 parent born outside US	1913 (41)	2894 (59)		1921 (64)	973 (36)		73 (9)	900 (91)	
Child born in US and parents are not listed	728 (46)	974 (54)		641 (65)	333 (35)		20 (7)	313 (93)	
Primary household language									
English	10 534 (37)	17 095 (63)	<.001	12 518 (72)	4577 (28)	<.001	253 (7)	4324 (93)	.03
Non-English	1091 (46)	1284 (54)		767 (56)	517 (44)		55 (13)	462 (87)	

Abbreviation: FPL, federal poverty level.

[a] Three binary outcomes were investigated: (1) receipt of screening was evaluated by the question, "During the past 2 years, has this child received a vision screening from a care provider other than an eye doctor?"; (2) referral for eye examination was assessed with the follow-up question, "If yes, was it recommended that this child see an eye doctor or other eye care provider for an eye examination or additional vision services as a result of the vision screening?"; and (3) among those referred for an eye examination, establishing care with a specialist was evaluated with the question, "During the past 2 years, has this child seen an eye doctor?"

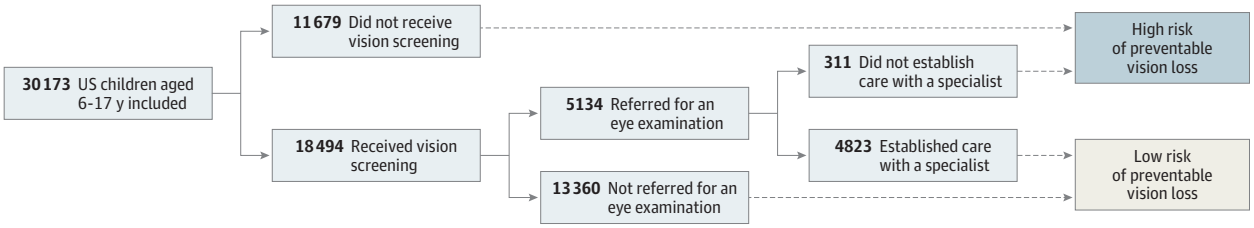
[b] Unweighted number of survey participants (survey-weighted percentage).

[c] χ^2 Test with Rao and Scott's second-order correction.

[d] The National Survey of Children's Health provides imputed data files for the missing values in race and ethnicity, caregiver education, and household income that were calculated using sequential regression imputation methods.

[e] Includes Native American and Alaska Native, Native Hawaiian and Other Pacific Islander, and other race and ethnicity.

Figure. Vision Screening Pathway for School-Aged Children in the 2021 National Survey of Children's Health



centages. χ^2 Tests with Rao and Scott's second-order correction were used to assess the association of each sociodemographic factor with the 3 steps along the vision screening pathway (eAppendix in Supplement 1). Analyses were performed using R version 4.2.1 (R Foundation) with 2-tailed tests and without adjustment for multiple comparisons.

Results | Demographic characteristics of the 30 173 children are summarized in the **Table**. Vision screening within the last 2 years was reported by 18 494 participants (survey-weighted 61%). Among those receiving screening, 5134 (survey-weighted 30%) were referred for an eye examination. Among those referred, 4823 (survey-weighted 92%) reported establishing care with a specialist (**Figure**). Children identifying as Hispanic, non-Hispanic Asian, or non-Hispanic Black, residing in low-income households, and with a non-English primary household language were less likely to receive screening, more likely to be referred for an eye examination, and less likely to establish care with a specialist. Adolescents, children without health insurance, and children with caregivers with less than high school education were less likely to receive screening and more likely to be referred for an eye examination (Table).

Discussion | The current approach to vision screening in the US may not adequately provide care to all children. At each stage along the care pathway, children from historically marginalized racial and ethnic groups, low-income households, and non-English language speakers experience worse outcomes—they were less likely to receive screening, more likely to be referred for failed screening, and less likely to establish care with a specialist. High referral rates in these vulnerable groups may suggest higher prevalence of undiagnosed conditions or elevated false-positive results from suboptimal screening strategies. The cumulative effect of each step along the pathway may contribute to the racial, ethnic, and socioeconomic disparities in visual outcomes that are already evident by adolescence.[5]

Limitations of this study include the potential for recall bias given the caregiver-reported survey responses.[6] This analysis did not include preschool-aged children, as those aged 5 years or younger were given a different set of survey questions. Further investigation is needed to determine whether these findings can be generalized to younger populations, where the opportunity to prevent vision loss is likely even greater.

There is evidence of inequitable opportunities for access to vision screening and subsequent care experienced most often by socioeconomically vulnerable groups. Novel strate-

gies are needed to improve our ability to identify children at greatest risk of preventable vision loss.

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