

RESEARCH ARTICLE

Vision Care Utilization and Insurance Coverage Prior to and Following Medicaid Expansion in Ohio

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ABSTRACT

Background: Increased access and utilization of vision care services has the potential to reduce preventable vision loss. The state of Ohio has been uniquely proactive when collecting vision-oriented data through population health surveys, including the Behavioral Risk Factor Surveillance System (BRFSS). These data can be used to better understand vision care utilization patterns and access to insurance.

Methods: Responses to 3 items administered in the Ohio BRFSS that assess vision care utilization and insurance coverage were compared between 2 different administration periods, 2005-2011 and 2018-2019, using chi-square tests. Comparable data from 2 items assessing eye care utilization were available in 2005-2011 and 2019. Comparable data for insurance coverage were available in 2005-2011 and in 2018-2019. Responses were further stratified by population characteristics, including age, gender, household income, and education level.

Results: The percentages of those reporting eye exams in the previous year were not significantly different between 2005-2011 and 2019 (chi-square, $p = 0.06$). In Ohio, the primary reason for not seeing a vision care provider in the past 12 months was "No reason to go" in 2005-2011 and in 2019. The second most common reason for not seeing a vision care provider in the past 12 months was "Cost/insurance," which decreased between 2005-2011 and 2019 (chi-square, $p < 0.001$). Insurance coverage for eye care increased between 2005-2011 and 2018-2019 (chi-square, $p < 0.001$). Important differences were found within the demographic stratification.

Conclusion: Population health surveillance data provide useful insight into vision care utilization and insurance coverage. Despite the increase in insurance coverage, eye care provider utilization remains relatively stable.

Keywords: Vision; Epidemiology; Surveillance; Insurance; BRFSS; Trend analysis

INTRODUCTION

Vision impairment represents a serious public health challenge driven by high prevalence, increased morbidity, economic costs, and poorer health and quality of life.^{1,2} Prevalence rates for vision impairment vary, depending on case definitions and sampling methodology,³ but data from the Behavioral Risk Factor Surveil-

lance System (BRFSS) estimate an overall crude prevalence of 4.9% in the state of Ohio in 2018.⁴ Recent estimates indicate the prevalence of vision loss is increasing in Ohio with an estimated economic burden of \$6.1 billion annually.⁵ Public health surveillance data have demonstrated that those with vision impairment are twice as likely to fall as people without vision impairment,⁶ are more likely to report higher levels of psychological distress,⁷ poor-





er quality of life,⁸ and overall poorer physical health than people without vision impairment.⁹ Those experiencing vision loss are also at greater risk for premature death.¹⁰ Despite the negative impact of vision loss in multiple domains, vision health lacks sufficient recognition as a population health priority.^{11,12}

Prevention of vision loss requires attention to several overlapping factors.¹¹ Generally, prevention strategies are predicated on access and utilization of vision care services,¹³ as most vision loss can be addressed through refractive error correction¹⁴ or is avoidable through timely diagnosis and effective management.¹⁵ Unfortunately, those at greatest risk for vision loss remain least likely to access and/or utilize needed vision services.^{13,16} Factors contributing to inadequate vision care utilization include cost,¹⁷ availability of vision care providers,¹⁸ and health literacy.¹⁹ Underlying reasons for the lack of vision care access and utilization remain only superficially understood, however, and downstream effects of vision impairment on health and social outcomes are well-documented, including decreased educational achievement, poorer physical health, and depression.²⁰ Identifying and understanding more upstream barriers would likely improve delivery of eye care services to those in greatest need and result in broader improved health outcomes across disparate populations.

Population health surveillance can identify risk factors associated with vision loss. Stratification of vision impairment by demographic characteristics hints at a wide range of disparities, determinants, and associated outcomes.²¹ Population health surveillance data have demonstrated that vision impairment is more common with advancing age, and females are more likely to report vision impairment than males.³ Individuals living in poverty and those with less formal education also report higher rates of vision impairment.²² National and state-specific vision surveillance mechanisms collect data on factors associated with vision care utilization patterns and unmet need for services,²³ indicating that most individuals who have not received eye care in the previous 12 months cite “no reason to go” as their primary reason for not accessing care,^{24,25} followed by cost, and lack of insurance.²⁵

The expansion of Medicaid in Ohio in 2014 resulted in increased coverage for eye care services. Ohio Medicaid benefits include 1 exam and 1 pair of eyeglasses every 12 months for individuals younger than 21 years and adults over 60 years, and 1 eye exam and 1 pair of eyeglasses every 24 months for all other adults. Coverage also includes glaucoma screenings, contact lenses with prior authorization, and medical and surgical services when medically necessary. Copays for services include \$2 per refractive exam and \$1 for dispensing eyeglasses.¹¹

The Behavioral Risk Factor Surveillance System (BRFSS) is a national surveillance mechanism that collects information related to multiple domains of health, including vision impairment. Optional modules can be included at a state’s discretion, and are typically supported by the US Centers for Disease Control and Prevention (CDC) for a limited time. The CDC supported additional vision-

oriented questions between 2005-2011 for any state that elected to include the module. To better understand the trajectory of vision health in the state of Ohio, a collaborative group of stakeholders, including The Ohio State University, the Ohio Department of Aging, and the Ohio Affiliate of Prevent Blindness, successfully advocated for items from the vision module to be reintroduced into the BRFSS as state-added questions in 2018 and 2019. The goal of this effort was to assess any changes that may have taken place as a result of advocacy efforts and policy changes, including the implementation of the Affordable Care Act.

Ohio BRFSS data from 2005-2011 and 2018-2019 can provide insight into Medicaid expansion’s impact on vision health and access to services. To assess this impact, we analyzed responses from the 3 questions included in the BRFSS vision module from 2005-2011 with responses to those items included as state-added questions in 2018-2019, measuring differences across pre- and post-Medicaid expansion, and assessing different population demographic characteristics to identify potential care access disparities.

METHODS

Data Source:

The Behavioral Risk Factor Surveillance System (BRFSS)

The BRFSS is a state-based cross-sectional survey collecting data through continuous, random digit dialed telephone interviews of noninstitutionalized US civilians aged ≥ 18 years, administered by states and territories in collaboration with the CDC. Participants are selected through a multistage cluster-design procedure. The BRFSS contains deidentified, publicly available data. Details regarding the survey methods, questionnaires, data, and reports can be found at <https://www.cdc.gov/brfss/about/index.htm>. The governing institutional review board considers studies based on publicly available, deidentified data to be exempt from review and oversight.

The BRFSS consists of 3 parts: core questions, optional modules, and state-added questions. Health departments must ask the core component questions and optional modules without modification. Optional CDC modules include topics that states elect to include in their survey. A 10-question vision-related module, “Vision Impairment and Access to Eye Care Module,” often referred to as the vision module, was supported by CDC between 2005-2011. In addition to the required core questions, the Ohio BRFSS typically includes a set of optional modules each year reflecting program and stakeholder interest. Only a limited number of modules are implemented because of cost and time constraints. The inclusion of a module one year does not guarantee its use in following years.

The Behavioral Risk Factor Surveillance System Vision Module

Items related to vision loss, age-related eye diseases, and access and utilization of eye care services were included in the 10-question vision module implemented in 23 states (<https://www.cdc.gov/>



visionhealth/programs/vision-health-toolkit/section-one/brfss-questions-app.html). The vision module included participants aged ≥ 50 years in 2005. After 2005, the module questions were asked of people aged ≥ 40 years. In 2011, BRFSS survey methodology changed to include cell phone and landline; however, in 2011, the questions from the vision module were only conducted using landline. The BRFSS vision module incorporated questions regarding vision care access barriers and the magnitude of those factors. From 2005-2011, the CDC formally supported the incorporation of the vision module in the BRFSS, and Ohio and 22 other states elected to include the additional optional questions.

The Behavioral Risk Factor Surveillance System State-Added Questions

Three questions from the vision module were included as state-added questions in Ohio's survey in 2018-2019 and administered to noninstitutionalized adults aged ≥ 18 years:

1. "When was the last time you had your eyes examined by any doctor or eye care provider?" Response categories included "Within the past month (anytime less than 1 month ago)," "Within the past year (1 month but less than 12 months ago)," "Within the past 2 years (1 year but less than 2 years ago)," or "2 or more years ago." In 2019 "Never" was a response option, but it was not a response option in 2018.

Those who responded either "Within the past 2 years (1 year but less than 2 years ago)," "2 or more years ago," or "Never" were asked a follow-up question regarding the reason for not accessing vision care services.

2. "What is the main reason you have not visited an eye care professional in the past 12 months?" Response categories included "Cost/insurance," "Do not have/know an eye doctor," "Cannot get to the office/clinic (too far away, no transportation)," "Could not get an appointment," "No reason to go (no problem)," "Have not thought of it," "Other," "Don't know/Not sure," "Not applicable (Blind)," or "Refused."

Respondents were also asked 1 question regarding insurance coverage.

3. "Do you have any kind of health insurance coverage for eye care?" Response categories included "Yes," "No," "Don't know/Not sure," "Not applicable (Blind)," or "Refused."

Participants and Eligibility Criteria

Our analysis includes answers by respondents to the Ohio administration of the BRFSS between 2005-2011 and 2018-2019. The vision module, administered between 2005-2011, was only administered to those aged 50 years and over in 2005 and those aged 40 years and over in 2006-2011 to more precisely evaluate the influences and outcomes associated with age-related eye diseases. Determinants of vision impairment and outcomes associated with vision loss can vary considerably by age, and even though

the state-added questions, administered between 2018-2019, sampled all adults aged 18 years and over, only responses from those aged 40 years and over were included. This ensured more direct comparisons between the 2 time periods. Because there were minor modifications to the eye care utilization question in 2018, which subsequently impacted the sampling for the follow-up item assessing the most recent eye exam, we could not make direct comparisons with the 2005-2011 data. This limited our analysis of the eye care utilization and most recent eye exam items, which could only be directly compared using 2019 data. However, the vision insurance item could be directly compared between both 2018 and 2019 and the 2005-2011 data.

Statistical Analysis

Descriptive Statistics

Responses to each of the 3 questions were stratified by population characteristics, including age, sex, household income, and education level. The statistical software, SUDAAN, version 11.0.1 (RTI International, Research Park Triangle, NC), was used for the analysis to account for the complex sampling design. Mean response values with 95% confidence intervals (CI) were calculated for each demographic category.

Statistical Comparisons Pre-Medicaid and Post-Medicaid Expansion in Ohio

Chi-square was used to compare responses from the 3 vision module questions between 2005-2011 and the 2018-2019 surveys, where direct comparisons were possible. Age categories used for comparison were 40-49 years, 50-64 years, and ≥ 65 years, to remain consistent with previous BRFSS vision module analyses.²⁶ The full vision module sampled only those 50 years and over in 2005 and those 40 years and over between 2006 and 2011. For our analysis, only data that allowed for direct comparisons across age categories were used. Because the sampling frames differed between the full vision module and the state-added question administrations, direct comparisons could not be made for those under the age of 40 years. "Never" was not a response category for most recent vision care provider visit in 2018, so direct comparisons for this question and the question assessing rationale for not seeking care could only be made between 2005-2011 and 2019 data. Those who selected "Don't know/not sure" or "Refused" for the item assessing the reason for not seeking vision care and for the item assessing insurance coverage were excluded from the analyses. Due to the 3 statistical comparisons included in this analysis, we applied a Bonferroni correction to a 0.05 significance level, which resulted in a statistical significance cutoff of $p = 0.0167$.

There was an insufficient sample size for some of the race/ethnicity categories to yield precise estimates and reliable statistical results. As a result, race/ethnicity was not included in this analysis.



RESULTS

Table 1 summarizes the demographic characteristics of respondents of the 2005-2011 vision module as well as respondents for the 2018-2019 state-added BRFSS questions in Ohio. Respondents were included if they responded to all 5 demographic questions, were at least aged 40 years, and did not respond to any of the vision module questions with “Not applicable (Blind).” Respondents were not included if they answered all 3 vision questions with “Don’t know/Not sure,” “Refused,” had missing responses, or if they were not asked these questions. This totaled 1641 respondents that were excluded across both administration periods. The results from the question “When was the last time you visited ANY eye care professional?” were excluded in 2018; therefore, the 2018 response rate only considers the remaining 2 vision module questions. With those criteria, response rates for at least 1 vision question ranged from 94.5% to 98.2% for the 2005-2011 vision module and 87.2% to 91.0% for the state-added questions in 2018 and

2019. This resulted in 22 265 respondents from 2005-2011 and 7588 respondents from 2018-2019. When stratified by race/ethnicity, the sample size was too small to produce reliable estimates for the majority of racial/ethnic categories. As a result, we could not assess the individual item responses based on race/ethnicity, but include the relative proportion of respondents in Table 1.

Table 2, Table 3, and Table 4 summarize the responses to the 3 vision care access questions by administration periods, 2005-2011 and 2018-2019. Overall, the percentages of those reporting eye exams in the previous year did not significantly increase from 2005-2011 to 2019 (chi-square, $p = 0.06$). In 2005-2011, 60.7% (95% CI, 59.7-61.7%) of respondents reported having an eye exam in the previous year, compared to 64.3% (95% CI, 61.3-67.2%) in 2019. In Ohio, the primary reason for not seeing a vision care provider in the past 12 months was “No reason to go” in 2005-2011 (45.4%, 95% CI, 43.7-47.1%) and in 2019 (48.1%, 95% CI, 45.3-

Table 1. Respondent Demographics 2005-2011 and 2018-2019 Administration of the BRFSS in Ohio

Demographic	2005-2011 % of Subjects (n = 22 265)	2018-2019 % of Subjects (n = 7588)
Age		
40-49 years	32.6	23.7
50-64 years	42.0	43.0
65+ years	25.4	33.3
Gender		
Male	48.6	48.1
Female	51.4	51.9
Race		
White only	88.4	86.0
Black or African American only	7.5	9.4
Asian only	0.7	0.5
Native Hawaiian or other Pacific Islander only	0.0	0.0
American Indian or Alaskan Native only	0.5	0.8
Other race only	0.5	0.2
Multiracial	1.1	1.7
Hispanic	1.2	1.4
Income		
Less than \$15 000	9.2	8.7
Less than \$25 000 (\$15 000 to less than \$25 000)	15.8	17.1
Less than \$35,000 (\$25 000 to less than \$35 000)	11.9	10.5
Less than \$50,000 (\$35 000 to less than \$50 000)	15.3	14.0
\$50 000 or more	47.9	49.7
Education level		
Did not graduate high school	8.6	8.6
Graduated high school	36.5	33.5
Attended college or technical school	25.5	30.7
Graduated from college or technical school	29.5	27.3

Demographic characteristics of respondents of the 2005-2011 vision module as well as the demographic characteristics of the respondents for the 2018-2019 state-added BRFSS questions in Ohio.



Table 2. Percentage Last Visited Any Eye Care Professional in Previous Year

	2005-2011	2019
Overall*	60.7 (59.7, 61.7)	64.3 (61.3, 67.2)
Age		
40-49 years	53.3 (51.2, 55.3)	57.4 (49.6, 64.7)
50-64 years	58.5 (57.0, 60.0)	60.7 (56.1, 65.1)
≥65 years	74.0 (72.5, 75.4)	73.6 (69.7, 77.2)
Gender		
Male	57.7 (56.1, 59.2)	62.6 (58.1, 66.9)
Female	63.6 (62.4, 64.9)	65.9 (61.9, 69.7)
Income		
Less than \$15 000	54.7 (51.5, 57.7)	61.9 (52.2, 70.7)
\$15 000-\$24 999	59.0 (56.7, 61.3)	60.6 (53.5, 67.4)
\$25 000-\$34 999	60.7 (57.8, 63.4)	68.5 (59.4, 76.3)
\$35 000-\$49 999	59.5 (56.9, 62.0)	64.6 (56.7, 71.7)
\$50 000 or more	62.9 (61.4, 64.4)	65.2 (60.8, 69.4)
Education level		
Did not graduate high school	56.4 (52.5, 60.2)	58.4 (46.3, 69.5)
Graduated high school	58.4 (56.8, 60.1)	60.4 (55.1, 65.4)
Attended college or technical school	60.6 (58.6, 62.6)	65.6 (60.1, 70.8)
Graduated from college or technical school	64.9 (63.2, 66.6)	69.2 (64.0, 74.0)

Responses to the BRFSS item assessing the eye care utilization divided by administration periods, 2005-2011 and 2018-2019.

* The percentages of those reporting eye exams in the previous year were not significantly different between 2005-2011 and 2019 (chi-square, $p = 0.06$).

51.0%). The second most common reason for not seeing a vision care provider in the past 12 months was “Cost/insurance,” which decreased from 26.0, 95% (CI, 24.6-27.5%) in 2005-2011 to 20.6% (95% CI, 18.5-23.0%) in 2019 (chi-square, $p < 0.001$). In 2005-2011, 60.2% (95% CI, 59.2-61.1%) reported having insurance that covered eye care, which increased significantly to 70.7% (95% CI, 69.2-72.1%) in 2018-2019 (chi-square, $p < 0.001$).

Stratification by Age

In both 2005-2011 and 2019, those in the ≥65 year age category had the highest percentage of exams in the previous 12 months, followed by those aged 50-64 years, and those aged 40-49 years (Table 2). The primary reason for not seeing a vision care provider in the past 12 months was “No reason to go,” and “Cost/insurance” was the second most common response for each age group. For each of the 3 cohorts, the percentage of respondents reporting any kind of health insurance coverage for the eye increased.

Stratification by Gender

In both 2005-2011 and 2019, females reported the highest percentage of exams in the previous 12 months (Table 2). The primary reason for not seeing a vision care provider in the past 12 months for males and females was “No reason to go” in both periods. The second most common reason for not seeing a vision care

provider for both groups was “Cost/insurance” in 2005-2011 and remained the second most common response for females in 2019. For the male cohort in 2019, “Cost/insurance” was the third most common response, slightly behind “Other,” cited by 16.8% (95% CI, 14.0-19.9%) of male respondents. The difference in reported insurance coverage was higher in 2018-2019 compared to 2005-2011 for both cohorts.

Stratification by Household Income Level

In 2005-2011, the percentage of those reporting eye exams in the previous 12 months was highest in the ≥\$50 000/year household income cohort and lowest in the <\$15 000/year household income cohort (Table 2). In 2019, the percentage reporting eye exams in the previous 12 months was highest in the \$25 000-\$34 999/year household income cohort and lowest in the \$15 000-\$24 999/year household income cohort. In 2005-2011, the primary reason for not seeing a vision care provider was “Cost/insurance” for the <\$15 000 household income cohort and the \$15 000-\$24 999 income cohort. “No reason to go” was the primary reason for the other 3 income levels. In 2018-2019, the primary reason for not seeing a vision care provider remained “Cost/insurance” for the <\$15 000 income cohort and “No reason to go” was the primary reason for all of the other income cohorts. There was an increase

**Table 3. Main Reason for Not Visiting Eye Care Professional in Previous Year**

		2005-2011	2019	
Overall	Cost**	26.0 (24.6, 27.5)	20.6 (18.5, 23.0)	
	No reason to go	45.4 (43.7, 47.1)	48.1 (45.3, 51.0)	
Age	40-49 years	Cost	27.5 (24.9, 30.3)	
		No reason to go	45.5 (42.5, 48.5)	
	50-64 years	Cost	28.0 (25.9, 30.1)	
		No reason to go	42.3 (39.9, 44.6)	
	≥65 years	Cost	17.5 (15.0, 20.3)	
		No reason to go	53.2 (49.9, 56.5)	
Gender	Male	Cost	20.7 (18.6, 22.9)	
		No reason to go	50.5 (48.0, 53.0)	
	Female	Cost	31.9 (29.9, 34.0)	
		No reason to go	39.7 (37.6, 41.8)	
	Income	Less than \$15 000	Cost	55.5 (50.8, 60.2)
			No reason to go	24.4 (20.8, 28.4)
\$15 000-\$24 999		Cost	41.5 (37.7, 45.3)	
		No reason to go	34.8 (31.3, 38.6)	
\$25 000-\$34 999		Cost	32.1 (27.6, 36.9)	
		No reason to go	39.6 (35.2, 44.3)	
\$35 000-\$49 999		Cost	23.2 (19.7, 27.0)	
		No reason to go	45.6 (41.3, 49.9)	
\$50,000 or more		Cost	12.9 (11.3, 14.7)	
		No reason to go	55.5 (53.0, 58.1)	
Education level		Did not graduate high school	Cost	39.0 (33.2, 45.0)
			No reason to go	36.0 (30.4, 41.9)
	Graduated high school	Cost	29.9 (27.5, 32.4)	
		No reason to go	43.7 (41.0, 46.3)	
	Attended college or technical school	Cost	28.5 (25.5, 31.8)	
		No reason to go	42.8 (39.5, 46.2)	
	Graduated from college or technical school	Cost	13.3 (11.5, 15.3)	
		No reason to go	53.7 (50.5, 56.8)	

Responses to the BRFSS item assessing “Cost” and “No reason to go” as reasons for not seeking vision care services in the previous 12 months, divided by administration periods, 2005-2011 and 2018-2019. “No reason to go” remained the most common response.

in those reporting health insurance for the eye between 2005-2011 and 2018-2019 in all of the household income cohorts.

Stratification by Education Level

In 2005-2011 and in 2019, the percentage of those reporting eye exams was lowest in those not graduating high school and highest in those reporting graduating college or technical school (Table 2). In 2005-2011, the primary reason for not seeing a vision care provider was “Cost/insurance” for those not graduating high school. “No reason to go” was the primary reason for all other education

cohorts. In 2018-2019, the primary reason for not seeing a vision care provider was “No reason to go” for all education cohorts. There was an increase in those reporting health insurance coverage for the eye between 2005-2011 and 2018-2019 for all education cohorts.

DISCUSSION

A critical factor in developing effective interventions to reduce vision loss is an understanding of the utilization patterns of vision care services. Using BRFSS data from 2 different time periods,



Table 4. Has Any Kind of Health Insurance for Eye Care

	2005-2011	2018-2019
Overall**	60.2 (59.2, 61.1)	70.7 (69.2, 72.1)
Age		
40-49	66.3 (64.3, 68.2)	78.4 (74.9, 81.6)
50-64	62.3 (60.8, 63.7)	72.4 (70.0, 74.6)
≥65	48.7 (47.1, 50.4)	62.8 (60.6, 65.0)
Gender		
Male	60.6 (59.0, 62.1)	68.9 (66.6, 71.1)
Female	59.8 (58.5, 61.0)	72.3 (70.4, 74.1)
Income		
Less than \$15 000	42.0 (39.0, 45.1)	69.8 (64.3, 74.8)
\$15 000-\$24 999	42.3 (40.0, 44.6)	60.4 (56.5, 64.2)
\$25 000-\$34 999	53.4 (50.5, 56.2)	59.0 (54.1, 63.7)
\$35 000-\$49 999	58.6 (56.1, 61.1)	64.4 (60.2, 68.3)
\$50 000 or more	71.6 (70.2, 72.9)	78.5 (76.6, 80.3)
Education level		
Did not graduate high school	50.4 (46.6, 54.3)	68.3 (61.6, 74.4)
Graduated high school	55.8 (54.2, 57.5)	65.5 (62.8, 68.1)
Attended college or technical school	60.9 (59.0, 62.9)	70.7 (67.9, 73.4)
Graduated from college or technical school	67.6 (65.9, 69.2)	77.5 (75.2, 79.7)

Responses to the BRFSS item assessing insurance coverage for eye care, divided by administration periods, 2005-2011 and 2018-2019.

**Insurance coverage for eye care increased between 2005-2011 and 2018-2019 (chi-square, $p < 0.001$).

2005-2011 and 2018-2019, we found that the percentage of those receiving vision care services remained relatively stable in Ohio, despite efforts by advocates actively promoting greater vision care access. The primary reason for not obtaining care from an eye care professional remained the same, but insurance coverage that included eye care increased over time. These findings underscore the complex interaction between insurance coverage, vision care access, and utilization and provide insight into aspects of vision health that need prioritization.

Stratification by demographic characteristics using BRFSS data provides important insight into those seeking eye care and the frequency of eye care visits. It is encouraging that the oldest cohort reported the highest rates of vision care in the previous 12 months, as that age group is at highest risk for vision loss, comorbidities that include vision loss, and other associated health outcomes,²⁷⁻²⁹ including falls.⁶ We found lower examination rates in younger age cohorts, indicating further work is needed to identify barriers resulting in this disparity. This is particularly important because the leading causes of permanent vision loss are predominantly asymptomatic in the earliest stages, and early detection combined with effective management can significantly reduce irreversible vision loss in sight threatening eye diseases such as glaucoma³⁰ and diabetic eye disease.¹⁵

When stratified by household income, there were small increases in the frequency of vision care services in all of the income cohorts between 2005-2011 and 2019. Those reporting the lowest rate of eye care provider visits for both time periods were those with incomes $< \$15\,000$. This finding is important because previous studies indicate preventable vision impairment is correlated with lower socioeconomic status.^{22,31}

The questions included in the BRFSS also assess the reasons why individuals did not seek or receive eye care services in the previous 12 months. In both time periods, the most common reason cited for not seeing an eye care professional was “No reason to go.” This finding is consistent with reports from other states implementing the vision module^{24,25} and is particularly troubling, given the asymptomatic nature of the most common sight-threatening diseases. Interestingly, the primary reason for the \$15 000-\$24 999 cohort changed in 2019 from “Cost/insurance” to “No reason to go,” while the percentage reporting “Cost/insurance” in the $< \$15\,000$ income group decreased between the time periods, indicating a potential shift in the affordability of vision care services in this specific demographic cohort. “No reason to go” was also the primary reason for not seeking vision care for all educational cohorts, with the exception of those not graduating high school, where “Cost/insurance” was the primary reason. This finding indicates that inadequate health care literacy with respect



to vision care is not limited to those with lower formal educational attainment.

Given Medicaid's expansion in Ohio, we anticipated that individuals in the Medicaid-eligible income cohorts would report an increase in care utilization. Since this was not the case, more complex influences involving vision care access for this population must be at play. These influences are likely multifactorial in nature, with previous studies suggesting that health literacy, transportation, and distribution of vision care providers may all play some role.³² Additional factors likely include conflicting messaging regarding the recommended frequency of vision care, lack of coordination with primary care providers and medical homes, lack of providers accepting Medicaid reimbursements, lack of convenient hours for providers accepting Medicaid, lack of practices providing services in convenient locations, and lack of understanding of vision care benefits under Medicaid and by other insurance carriers. This complexity is supported by research in Ohio by Hurley et al³³ studying the relationship between county-level estimates of vision impairment, reported unmet need, and optometrist distribution. In Ohio, reported unmet vision care need did not correlate with the number of providers at the county level, indicating that individuals may not be far from providers but nonetheless report lack of access to care.³³ This discrepancy between unmet need and provider distribution was significant in the Medicaid-eligible population, indicating that Medicaid coverage alone may be insufficient in addressing barriers to vision care access. Even with insurance, out-of-pocket costs for vision care and materials may excessively strain the resources of individuals not covered by Medicaid,³⁴ and it is possible that the residual cost of vision care services or materials, including glasses, contact lenses, and visual assistive devices, may preclude some from seeking care.^{35,36}

While the findings of this study provide considerable insight into vision care utilization and insurance coverage, there are a number of important limitations that must be considered. Constraints inherent in self-report population health surveillance include recall and social desirability bias. Additional limitations include the lack of standardization in the design and administration of vision questions across years, complicating comparisons. For example, the 2005-2011 version of the CDC vision module only sampled individuals 50 years and over in 2005 but expanded the sampling frame to include those 40 years and over from 2006-2011. Additionally, response categories for the question asking about the last eye exam differed between the 2018 and 2019 administration of the state-added BRFSS questions. In 2018, the response categories did not include the option of "Never." While a seemingly minor omission, this complicates the compatibility between all other years the question was administered, potentially biasing the results, and preventing any direct comparisons for this study. As a result, the follow-up question inquiring about the reason for not seeking care in 2018 was also excluded from our analysis in order to make responses as directly comparable as possible. Finally, some of the racial/ethnic demographic categories had an insuffi-

cient sample size to allow valid statistical comparisons, making it difficult to fully appreciate any racial/ethnic disparities to care access and insurance coverage. To address this shortcoming, additional emphasis needs to be placed on sampling populations from diverse race/ethnic backgrounds, particularly since there are well-documented racial/ethnic disparities in vision health outcomes.²²

Despite limitations in the current study, the underlying findings have significant public health implications and can provide unique guidance for advancing vision care access and utilization in Ohio. The findings of this study should be considered in the context of the complex array of determinants that impact the utilization of vision care services and in turn influence the rate of vision loss in the United States. While insurance coverage may be a convenient surrogate for access to vision care services, the current study suggests the assumption that insurance coverage necessarily equates to vision care access is likely misplaced. The fact that the percentage of respondents reporting care utilization remained relatively stagnant between the 2 collection periods is problematic and indicates a need for sustained and consistent messaging to improve health literacy around vision and eye health. This messaging should also target other health care providers, including primary care physicians, who demonstrate the greatest influence when recommending eye exams³⁷ and are the providers most likely to see patients in younger age groups where increased awareness is needed. Primary care providers could also be important facilitators in more comprehensive approaches to chronic disease management where vision is a relatively common comorbidity.³⁸

To our knowledge, Ohio is the only state where BRFSS vision module questions were included as state-added questions following the implementation of the vision module. Similar work is needed in other states to better understand the impact of Medicaid expansion, or lack thereof, on insurance coverage, access to care, and care utilization. Future work should be concentrated on standardizing the collection of these and similar data. Additional longitudinal analyses with sample sizes large enough to provide insight into more population demographics are also needed, but this study represents a useful foundation for future work.

While we cannot assert a causal relationship between Medicaid expansion and changes observed in responses to the BRFSS, it can be reasonably assumed that a significant proportion of those in the lower income categories who report a higher percentage of insurance coverage would be covered by Medicaid. Increased insurance coverage for the medically vulnerable is important, as these are the individuals most likely to experience vision loss and develop vision impairment. Nevertheless, insurance coverage is only beneficial if individuals actively seek and are able to obtain care. The overarching goal of this research is to improve vision health surveillance in order to detect trends in determinants and health disparities. This will allow the public health and clinical communities to identify the most at-risk and medically vulnerable populations and develop interventions to address those needs. To



accomplish that goal, ongoing inclusion of vision-oriented questions in health surveillance mechanisms is necessary, with support for future analyses of those data. Defining populations where vision health literacy is lacking would be beneficial in developing more directed messaging to improve vision health awareness. The inclusion of vision module items as state-added questions in other states is also needed and would help improve our understanding of vision health influences and outcomes associated with vision loss.

PUBLIC HEALTH IMPLICATIONS

Vision care utilization is dependent on a complex set of factors. Improved population health surveillance can be used to better assess utilization, rationale for not seeking care, and impact of insurance coverage. Understanding the upstream factors that influence vision loss, including access to care, is important in reducing avoidable vision impairment.

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