RESEARCH ARTICLE

The Prevalence of Adverse Childhood Experiences in Ohio: Changes from 2015 to 2019

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ABSTRACT

Background: Adverse childhood experiences (ACEs) are associated with long-term negative health outcomes including substance use and mental health disorders. Little is known about how exposure to ACEs impacts health care access in adulthood.

Methods: We examined the prevalence of ACEs in 2015 and 2019 in Ohio. We analyzed relationships between ACEs and self-reported health outcomes, with a focus on health care access and utilization. We examined the 2015 and 2019 Behavioral Risk Factor Surveillance System (BRFSS) data from 14 247 persons who resided in Ohio. We stratified participants by ACE prevalence and assessed demographic differences between groups. Multivariable and multinomial logistic regression models were used to analyze health-related outcomes of interest.

Results: The prevalence of experiencing any ACE increased from 2015 to 2019, from approximately 62% to 68%. Exposure to ACEs was associated with smoking (OR = 3.167), binge drinking (OR = 3.259), and heavy drinking (OR = 4.455). Persons with any ACEs had increased odds of no health insurance (OR = 1.435) and increased odds of not having a doctor for any reason (OR = 1.722). Persons with 3 ACEs had 4.307 times the odds of depression, and this increased to 8.250 among persons with 5 or more ACEs. There was no association between ACEs and hypertension, cancer, heart attacks, stroke, and diabetes.

Conclusion: These findings support the hypothesis that ACEs have a long-term effect on health and access to health care. Findings from this study may inform interventions to reduce the incidence and long-term sequelae of ACEs.

Keywords: ACEs; Mental health; Health care utilization; Health care access; Epidemiology

INTRODUCTION

Adverse childhood experiences (ACEs) have long-term effects on health across the lifespan.[1] Adverse childhood experiences include events such as direct experiences of childhood physical and emotional abuse, sexual abuse, witnessing domestic violence, and indirect effects through their home environment such as having a family member with mental illness, a family member in prison, or a family member with substance abuse.[2] Consequences linked to ACEs are varied. Persons who experience ACEs have a propensity for increased physical or mental health problems as adults.[3] Elevated risk of substance use and mental health disorders are linked to ACEs.[4,5] Research has tied ACEs to physical health conditions including cardiovascular diseases and cancers.[6–8] Exposure to ACEs may also result in an elevated risk of detrimental health behaviors and chronic health conditions later in life.[4,9]

A life course perspective offers a plausible relationship between exposure to ACEs and the development of these adverse consequences later in life.[10,11] Through this lens, exposure to harmful events during sensitive periods in development has a long-term impact and impacts the trajectory of a person's life, including socioeconomic status, educational attainment, and health outcomes.[12–15] Closely related to the life course perspective is the

concept of stress proliferation, where stressors such as ACEs give rise to additional stressors later in life.[16-18] Taken together, these perspectives posit that ACEs trigger an initial stress response that predisposes an individual to stressors later in life. As such, ACEs may have a profound impact on health-related outcomes across the lifespan.

Exposure to ACEs in the United States (US) is not uncommon. An estimated 57.8% of US adults experienced at least 1 ACE, and greater than 20% experienced more than 3 ACEs.[19] A separate analysis found that approximately 16% reported 4 or more ACEs.[20] The average number of cumulative ACEs is estimated to be higher among women and young adults.[21] A higher number of cumulative ACEs was reported among those with lower education levels, lower income levels, and among those identifying as a sexual minority.[19,21] Adverse childhood experiences can be framed as preventable risk factors for disease.[22,23] Preventing ACEs is of unique importance to improve the health and safety of children as they develop and mature into adulthood.

Despite the robust literature on the impact of ACEs on health outcomes, substantially less research has focused on the connection between ACEs and both health care utilization and health care access. Evidence suggests that ACEs are associated with increased use and higher health care costs.[24,25] Emerging data indicate that exposure to ACEs is linked to more missed medical appointments and higher unmet care needs.[26,27] Greater exposure to ACEs is also associated with being uninsured later in life.[20,26,28] Early work on this topic has been limited by a focus on highly specialized populations.[29] Previous studies of ACEs assessing outcomes related to health care utilization in large representative surveys of the US are limited by challenges related to the implementation of the Affordable Care Act or the use of a single period.[20,26]

Other limitations to ACEs research include methodological challenges in operationalizing ACEs. While a substantial body of research uses a cumulative risk approach to ACEs, where each additional ACE increases the risk of adverse outcomes, alternative approaches have been developed.[30,31] Individual-risk and latent class approaches include assessments of how each category of ACEs contributes to risk. Findings from these studies highlight that different combinations and types of ACEs may contribute uniquely to health outcomes.[26,30,31] Understanding not only the distribution of cumulative ACEs in the population but also the prevalence of each type is critical to developing effective interventions to mitigate the lifelong harms of ACEs.

In this study, we expand on previous research using representative survey data and report an analysis of ACEs among Ohioans. We describe the prevalence of ACEs by sociodemographic characteristics to highlight the distribution and patterning of ACEs in Ohio. We build off previous literature by assessing the relationship between ACEs, health behaviors, and health care utilization and access within the same population using multiple years of representative survey data. Further, we expand the current litera-

ture through assessments of whether insurance modifies the relationship between ACEs and health care utilization for chronic conditions. Identifying at-risk groups can inform prevention efforts and policy. Findings from the Behavioral Risk Factor Surveillance System (BRFSS) ACEs module may assist in identifying those at increased risk of negative health outcomes. From this, effective screening and interventions can be developed to mitigate the long-term sequelae of ACEs.

METHODS

Study Design and Data Source

This cross-sectional study used publicly available data from the BRFSS from 2015 and 2019. The BRFSS is a nationwide population-based computer-assisted telephone interview survey conducted by the Centers for Disease Control and Prevention (CDC) on noninstitutionalized adults aged 18 years or over.[32] The BRFSS is implemented in each state separately. The Ohio BRFSS consists of a core questionnaire, optional modules, and state-added questions. Data were sourced from the Ohio BRFSS, which included an ACE module in both 2015 and 2019. The psychometric properties of the BRFSS have been tested numerous times and demonstrate high levels of reliability.[33]

We included respondents who completed the core component questions and the ACE module in both 2015 and 2019. In 2019, both the core module and the optional ACE module were completed by 7523 persons, resulting in a weighted sample of 7 434 373. In 2015, both the core module and the optional ACE module were completed by 6724 persons, resulting in a weighted sample of 7 350 673.

Ethical Considerations

This research is a secondary data analysis of the BRFSS, which is a publicly available dataset containing deidentified survey data. As no members of the research team were involved in data collection nor can access participant identifiers linked to the data, this study does not meet the criteria of human subjects research as defined by the National Institute of Health and was not subject to institutional review board (IRB) review.

Measures

The core questions from the Ohio BRFSS used for this analysis included: self-rated health status, health care access, asthma, diabetes, cardiovascular disease, tobacco, and alcohol use. Additional demographic variables such as age, gender, race, marital status, household income, employment status, and education level were included. The age of adults was categorized into 3 groups: 18-49 years, 50-64 years, 65 years and over. Responses to employment items were used to create 2 dichotomous 'employed' and 'unemployed' variables. Employment was defined by responses of 'employed for wages' or 'self-employed'; unemployed was defined by responses of 'out of work' for either less than or more than a year.

Health care access items were sourced from the health care access module. Health care utilization variables included HIV testing, taking blood pressure medication, and having cholesterol checked. Responses were dichotomized such that any affirmative response to having cholesterol checked within the past 5 years was coded as having had cholesterol checked. The BRFSS questions regarding blood pressure medications reflect not taking blood pressure medications for any reason, such as not being prescribed them, and do not reflect adherence to prescribed medications.

Questions about chronic medical conditions (including asthma, diabetes, chronic obstructive pulmonary disease (COPD), and cardiovascular disease) were asked using a standard format "(ever told) you had…?" Cardiovascular conditions included coronary artery disease, stroke, and heart attack or myocardial infarction. Cancer diagnoses were determined using responses to 2 items: "(ever told) you had skin cancer?" and "(ever told) you had any other types of cancer?" An affirmative response to either question was coded as having a cancer diagnosis.

Heavy drinking was defined as male respondents reporting 15 drinks per week or more, and female respondents who reported having 8 drinks per week or more. Binge drinking was defined as respondents who reported having a drink in the past 30 days and having had 5 or more drinks on one or more occasions in the past month. Definitions of heavy drinking and binge drinking are based on US Government guidelines on alcohol consumption and are shown to correlate with risk of alcohol use disorder (AUD).[34-36] Current tobacco use was operationalized as those who reported smoking at least 100 cigarettes in their lifetime and currently smoked either every day or some days.

Poor mental health was operationalized as a dichotomous indicator of 14 days or more of the past 30 days of self-reported poor mental health. Similarly, poor physical health was operationalized as 14 or more days of the past 30 days of self-reported poor physical health. These metrics are part of the 4-item health-related quality of life measure employed by the CDC and have been demonstrated to have high reliability and validity in the population. The 14-day threshold was originally used in the literature to define frequent mental distress but has also been applied to physical health.[37-42] Depression was included as a separate self-reported health condition.

The ACE questionnaire was included in both the 2015 and 2019 BRFSS. The ACE module was originally developed in 1985 and consists of 11 questions assessing events experienced during childhood.[2] Abuse-oriented questions asked for frequency of occurrence including "never," "once," or "more than once." Questions from the ACE module related to child sexual abuse were collapsed from 3 questions into 1 sexual abuse variable, and questions related to alcohol and drug use were collapsed from 2 questions into 1 substance abuse variable. The ACE items asking for frequency of occurrence were collapsed into "at least once" or "never," creating a dichotomous exposure variable. For the total number of ACEs, or cumulative score, the individual indicators were summed to represent a score bounded by 0 and 8. Due to low counts at the higher ACE scores, those with 5 or more ACEs were collapsed into 1 category. Assessments of the BRFSS ACE module suggest strong reliability and validity.[43-45]

Data Analysis

Participants were stratified by the prevalence of ACEs. We estimated the proportion of demographic variables, including sex, age, race, education level, income level, employment status, and insurance coverage, within each group of ACE prevalence.

Multivariable logistic regressions were used to assess the association between ACEs and the odds of 8 health conditions (ie, high blood pressure, cancer, heart attack, stroke, COPD, diabetes, asthma, and depression), 3 health behaviors (ie, current smoking, heavy drinking, and binge drinking), and 2 indicators of subjective well-being (ie, poor physical health and poor mental health) by number of ACEs. Further, we used multivariable logistic regression models to quantify the relationship between number of ACEs and indicators of health care access and health care utilization. We hypothesized that insurance status may impact an individual's decisions to utilize care, and thus conducted analyses for health care utilization variables both with insurance status as a covariate, and without. No additional covariates were included in these models.

Due to the strong relationship between ACEs and depression, we separately assessed the odds of current poor mental health and lifetime depression among those exposed to each ACE category. This was performed using a multivariable logistic regression model controlling for each category of ACE and respondents' gender. Further, a multinomial logistic regression model was used to assess the odds of days in poor mental health by number of ACEs. No additional control variable was used in this model. All analyses incorporated the use of survey-weights, in accordance with guidelines provided by the CDC and software-specific survey documentation.[46,47] All analyses were completed using Stata (version 17).

RESULTS

Demographic Characteristics

A total of 7523 persons completed the 2019 Ohio Core BRFSS and ACE module, resulting in a weighted sample of 7 434 373 persons. Of the weighted sample, 48.9% were male and 51.1% were female (Table 1). Approximately 81% of the sample self-identified as White/Caucasian. The modal category of education was a high school education or GED, and the modal income category was below $35 000 per year. Nearly 50% of persons were between the ages of 18 and 49 years.

Prevalence of ACEs

Demographic characteristics of Ohioans in 2019 (Table 1) and 2015 (Appendix) are presented both stratified by ACEs and overall. The portion of the sample reported having at least 1 ACE in

Table 1. Demographic Characteristics of Weighted 2019 BRFSS Sample by Prevalence of ACEs

		Overall % (95% CI)	No ACEs % (95% CI)	At least 1 ACE % (95% CI)	Number of ACEs Mean (95% CI)
Total		100%	31.3 (29.7, 32.9)	68.7 (67.1, 70.3)	1.87 (1.80, 1.95)
Biological sex					
	Male	48.9 (47.1, 50.7)	48.0 (45.1, 50.9)	49.3 (47.0, 51.6)	1.76 (1.66, 1.87)
	Female	51.1 (49.3, 52.9)	52.0 (49.1, 54.9)	50.7 (48.4, 53.0)	1.98 (1.87, 2.08)
Age group					
	18-49 years	49.9 (48.2, 51.7)	38.1 (35.1, 41.3)	55.3 (53.2, 57.5)	2.29 (2.16, 2.43)
	50-64 years	26.2 (24.8, 27.7)	28.1 (25.8, 30.5)	25.4 (23.7, 27.2)	1.70 (1.60, 1.81)
	65 years or older	23.0 (22.0, 24.2)	32.5 (30.3, 34.8)	18.7 (17.5, 20.0)	1.18 (1.10, 1.25)
	Missing	0.8 (0.5, 1.1)	1.3 (0.8, 2.0)	0.6 (0.3, 1.0)	
Race					
	White/Caucasian	80.7 (79.0, 82.2)	84.5 (81.9, 86.7)	79.0 (76.8, 81.0)	1.79 (1.71, 1.87)
	Black/African American	10.2 (9.0, 11.6)	8.5 (5.8, 9.5)	11.5 (9.8, 13.3)	2.26 (1.98, 2.53)
	Asian	2.3 (1.8, 2.9)	2.9 (2.0, 4.2)	2.0 (1.4, 2.8)	1.84 (1.25, 2.43)
	Other	5.4 (4.6, 6.4)	3.6 (2.5, 5.2)	6.2 (5.2, 7.6)	2.39 (2.01, 2.78)
	Missing	1.4 (1.1, 1.9)	1.6 (1.0, 2.3)	1.4 (1.0, 2.3)	
Highest level of education					
	Elementary school	9.8 (8.5, 11.4)	7.1 (5.4, 9.3)	11.1 (9.3, 13.1)	2.54 (2.16, 2.92)
	Completed high school/GED	32.7 (31.0, 34.4)	31.1 (28.7, 33.7)	33.4 (31.2, 35.6)	1.98 (1.85, 2.10)
	Some college	30.6 (28.9, 32.3)	28.3 (25.7, 31.1)	31.6 (29.5, 33.8)	1.94 (1.81, 2.07)
	College degree or higher	26.8 (25.3, 28.3)	33.2 (30.6, 35.8)	23.9 (22.2, 25.7)	1.43 (1.33, 1.53)
	Missing	0.2 (0.1, 0.4)	0.3 (0.1, 0.9)	0.2 (0.0, 0.3)	
Employment status[a]					
	Employed	57.9 (56.1, 59.6)	53.0 (50.1, 55.8)	60.1 (57.9, 62.2)	1.92 (1.81, 2.02)
	Unemployed	4.4 (3.6, 5.4)	2.5 (1.6, 3.9)	5.3 (4.3, 6.6)	2.88 (2.39, 3.36)
	Other	37.4 (35.8, 39.0)	43.9 (41.2, 46.7)	34.4 (32.4, 36.4)	1.69 (1.59, 1.80)
	Missing	0.4 (0.2, 0.6)	0.6 (0.3, 1.3)	0.2 (0.1, 0.5)	
Annual household income					
	< $35,000	31.1 (29.4, 32.8)	26.1 (23.6, 28.6)	33.4 (31.3, 35.6)	2.26 (2.11, 2.40)
	$35 000 - $74 999	27.2 (25.5, 28.9)	26.3 (23.8, 29.0)	27.5 (25.4, 29.7)	1.84 (1.69, 1.99)
	≥ $75 000	28.2 (26.6, 29.9)	31.3 (28.6, 34.0)	26.8 (24.8, 28.9)	1.57 (1.46, 1.69)
	Missing	13.6 (12.4, 14.8)	16.3 (14.5, 18.4)	12.3 (10.9, 13.9)	
Health care coverage					
	No	8.6 (7.5, 9.9)	6.8 (5.2, 8.9)	9.5 (8.0, 11.2)	2.58 (2.23, 2.93)
	Yes	91.0 (89.7, 92.2)	92.9 (90.8, 94.5)	90.2 (88.5, 91.6)	1.81 (1.73, 1.88)
	Missing	0.4 (0.2, 0.6)	0.4 (0.1, 0.9)	0.4 (0.2, 0.6)	
Marital status					
	Married	50.5 (48.7, 52.3)	59.4 (56.6, 62.2)	46.4 (44.2, 48.7)	1.58 (1.48, 1.67)
	Divorced/separated	13.0 (12.0, 14.2)	11.5 (9.9, 13.3)	13.7 (12.4, 15.2)	2.11 (1.92, 2.29)
	Widowed	7.9 (7.2, 8.7)	10.0 (8.8, 11.4)	6.9 (6.1, 7.9)	1.53 (1.27, 1.79)
	Never married	27.7 (26.0, 29.6)	18.0 (15.6, 20.6)	32.2 (29.9, 34.6)	2.41 (2.24, 2.58)
	Missing	0.8 (0.6, 1.2)	1.1 (0.7, 1.9)	0.7 (0.4, 1.2)	

[a] Self-reported employment status. An employment status of other included responses of either "a homemaker," "a student," "retired," or "unable to work."

2019 was 68.7% compared to 62.2% in 2015. The mean ACE score increased from 1.58 in 2015 to 1.87 in 2019. There were no observable changes in the proportion of those with at least 1 ACE when stratified by race, sex, education level, employment status, household income, health care coverage, or marital status from 2015 to 2019.

Men had fewer ACEs on average compared to women, though there was an increase in both from 2015 to 2019. Of those with at least 1 ACE in 2019, 49.3% were male and 50.7% were female. In both 2015 and 2019, older persons tended to have fewer ACEs on average. Among those with at least 1 ACE in 2019, 55.3% were between the ages of 18 and 49 years, which remains consistent from 2015. Since 2015, the mean number of ACEs increased among all age groups. Higher levels of education were associated with a lower number of ACEs in both years.

Notably, higher income levels were also associated with lower average ACE scores. In 2019, those with an income of $35 000 or

less annually had a mean ACE score of 2.26 compared to those with an annual income of $75 000 or more who had a mean ACE score of 1.57. Those who were unemployed had an average of 2.88 ACEs in 2019. These results are consistent with those reported in 2015.

In 2019, the prevalence of sexual abuse was twice as high for women compared to men (17.7% compared to 8.1%, Table 2) and the prevalence of having a family member with mental illness was also higher for women (23.9% compared to 16.4%). The prevalence of other ACE categories was similar between men and women. Those between the ages of 18 and 49 years also had a higher prevalence of experiencing family with mental illness, family in prison, parental separation, and verbal abuse. Compared to White Ohioans, Black Ohioans had a 2 times higher prevalence of having family in prison (19.1% compared to 9.1%) in 2019. In the same year, Black Ohioans also had a higher prevalence of experiencing parental separation, witnessing domestic violence, and

Table 2. Demographic Characteristics of Weighted 2019 BRFSS Populations by Categorized ACEs

	Family with mental illness	Family with substance abuse	Family in prison	Parental separation or divorce	Domestic violence	Physical abuse	Verbal abuse	Sexual abuse
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Total	20.3 (18.7, 21.9)	28.0 (26.4, 29.7)	10.8 (9.5, 12.3)	31.7 (29.9, 33.6)	18.8 (17.4, 20.3)	25.7 (24.1, 27.3)	39.0 (37.2, 40.8)	13.0 (11.8, 14.3)
Biological sex								
Male	16.4 (14.3, 18.7)	26.2 (23.8, 28.7)	11.4 (9.5, 13.7)	32.2 (29.4, 35.0)	17.5 (15.4, 19.7)	25.0 (22.7, 27.4)	39.8 (37.1, 42.5)	8.1 (6.7, 9.8)
Female	23.9 (21.8, 26.2)	29.8 (27.6, 32.1)	10.2 (8.5, 12.2)	31.3 (29.0, 33.8)	20.1 (18.1, 22.2)	26.3 (24.2, 28.6)	38.2 (35.8, 40.6)	17.7 (15.9, 19.8)
Age group								
18-49 years	28.8 (26.0, 31.6)	31.7 (28.9, 34.6)	17.6 (15.2, 20.3)	44.0 (40.9, 47.1)	20.5 (18.1, 23.2)	26.3 (23.6, 29.1)	46.1 (43.0, 49.2)	14.5 (12.5, 16.9)
50-64 years	14.0 (12.1, 16.1)	26.6 (24.1, 29.4)	5.6 (4.3, 7.3)	23.5 (21.0, 26.2)	20.0 (17.7, 22.5)	28.3 (25.7, 31.1)	37.9 (35.1, 40.8)	14.3 (12.3, 16.5)
65 years or older	9.1 (7.8, 10.7)	22.1 (20.1, 24.3)	2.3 (1.7, 3.1)	14.9 (13.1, 16.9)	14.0 (12.2, 15.9)	21.6 (19.6, 23.8)	25.1 (22.9, 27.3)	8.4 (7.2, 9.8)
Race								
White/Caucasian	20.3 (18.6, 22.0)	27.7 (26.0, 29.5)	9.1 (7.8, 10.6)	29.1 (27.2, 31.0)	17.7 (16.2, 19.3)	24.0 (22.4, 25.7)	39.2 (37.2, 41.1)	11.6 (10.4, 12.9)
Black/African American	14.4 (10.1, 20.2)	28.4 (22.6, 35.1)	19.1 (13.7, 26.0)	49.7 (42.8, 56.7)	25.4 (19.8, 31.9)	31.9 (25.8, 38.8)	35.9 (29.2, 43.1)	20.9 (15.6, 27.4)
Asian	22.1 (12.9, 35.30)	24.2 (14.3, 37.9)	6.7 (1.8, 21.6)	29.6 (19.5, 42.2)	16.6 (9.2, 28.0)	27.1 (16.8, 40.7)	38.7 (27.4, 51.3)	18.6 (10.5, 30.9)
Other	29.9 (22.6, 38.4)	32.1 (24.8, 40.5)	19.4 (13.5, 27.2)	38.0 (29.7, 47.0)	23.2 (16.7, 31.3)	36.3 (28.1, 45.3)	42.3 (33.9, 51.0)	17.6 (12.3, 24.6)
Highest level of education								
Elementary school	24.1 (17.7, 32.0)	34.4 (27.5, 42.0)	21.5 (14.8, 30.0)	46.5 (38.7, 54.5)	30.6 (23.6, 38.5)	36.3 (29.0, 44.3)	41.7 (34.1, 49.8)	19.0 (13.2, 26.5)
Completed high school/GED	20.1 (17.5, 23.0)	30.8 (28.0, 33.9)	13.3 (11.0, 16.1)	35.6 (32.5, 38.9)	19.7 (17.3, 22.3)	27.4 (24.7, 30.4)	38.4 (35.3, 41.5)	12.4 (10.5, 14.7)
Some college	21.8 (19.2, 24.7)	28.7 (25.8, 31.8)	10.5 (8.4, 12.9)	32.7 (29.5, 36.1)	19.9 (17.3, 22.7)	26.0 (23.3, 29.0)	40.4 (37.2, 43.8)	14.1 (12.0, 16.5)
College degree or higher	17.3 (15.1, 19.9)	21.7 (19.3, 24.3)	4.3 (3.2, 5.8)	20.5 (18.1, 23.2)	12.2 (10.4, 14.3)	19.3 (17.1, 21.7)	37.1 (34.2, 40.1)	10.2 (8.6, 12.2)
Employment								
Employed	21.8 (19.6, 24.1)	28.6 (26.3, 31.0)	12.2 (10.4, 14.3)	35.0 (32.4, 37.6)	17.7 (15.8, 19.8)	23.7 (21.6, 26.0)	40.9 (38.3, 43.4)	11.8 (10.2, 13.5)
Not employed	18.1 (16.1, 20.3)	27.4 (24.2, 29.7)	8.9 (7.2, 11.0)	27.3 (24.9, 29.8)	20.4 (18.3, 22.7)	28.5 (26.1, 31.0)	36.5 (34.0, 39.1)	14.8 (12.9, 16.9)
Household income								
<$35 000	23.3 (20.6, 26.3)	34.0 (31.0, 37.2)	15.1 (12.6, 18.1)	38.1 (34.8, 41.4)	24.5 (21.8, 27.4)	31.9 (28.9, 35.0)	41.9 (38.7, 45.1)	17.0 (14.7, 19.6)
$35 000-$74 999	20.7 (17.6, 24.2)	28.1 (24.9, 31.6)	11.0 (8.2, 14.5)	30.8 (27.2, 34.6)	18.0 (15.1, 21.4)	24.4 (21.2, 27.9)	38.4 (34.8, 42.1)	12.7 (10.1, 15.7)
≥$75 000	17.6 (15.1, 20.4)	24.2 (21.4, 27.2)	6.1 (4.6, 8.0)	27.6 (24.4, 31.0)	13.7 (11.5, 16.2)	20.4 (17.9, 23.2)	38.2 (34.9, 41.6)	9.6 (7.9, 11.8)
Health care coverage								
Yes	19.8 (18.3, 21.5)	27.5 (25.8, 29.2)	9.6 (8.3, 11.0)	30.1 (28.2, 32.0)	18.3 (16.8, 19.8)	24.9 (23.3, 26.6)	38.0 (36.2, 39.9)	12.5 (11.2, 13.8)
No	24.1 (18.0, 31.6)	34.7 (28.0, 42.1)	23.5 (17.5, 30.9)	48.8 (41.4, 56.3)	14.9 (19.1, 31.8)	33.3 (26.6, 40.7)	49.7 (42.3, 57.1)	19.1 (13.7, 25.9)
Marital status								
Married	15.3 (13.6, 17.2)	25.1 (23.0, 27.2)	6.7 (5.3, 8.4)	25.4 (23.2, 27.8)	16.6 (14.7, 18.6)	22.9 (20.8, 25.0)	35.1 (32.8, 37.5)	10.5 (9.0, 12.3)
Divorced/separated	22.3 (18.7, 26.4)	32.6 (28.6, 37.0)	8.9 (6.6, 12.0)	34.5 (30.3, 39.0)	23.1 (19.5, 27.2)	30.4 (26.5, 34.7)	39.5 (35.3, 43.9)	19.2 (15.9, 22.8)
Widowed	12.7 (9.2, 17.4)	27.4 (22.9, 32.4)	6.8 (3.8, 12.0)	20.0 (16.0, 24.8)	17.5 (13.8, 22.1)	27.5 (23.0, 32.6)	29.2 (24.7, 34.0)	11.6 (8.3, 16.2)
Never married	30.5 (26.8, 34.5)	31.7 (28.0, 35.7)	20.2 (16.8, 24.1)	45.4 (41.2, 49.6)	21.5 (18.3, 25.1)	28.2 (24.6, 32.0)	48.6 (44.4, 52.8)	15.2 (12.6, 18.3)

being sexually abused compared to White Ohioans. In the 2019 sample, college graduates had the lowest prevalence of all educational levels across all ACE categories; the prevalence of having experienced parental separation was 46.5% among those with an elementary school education, compared to 35.6% among those with a high school education, and only 20.5% among persons with a college degree. Further, those with a college education also had a lower prevalence of having witnessed domestic violence compared to those with an elementary school education (30.6% compared to 12.2%).

ACEs and Related Health Conditions and Behaviors

Multivariable logistic regressions by ACEs revealed no relationship between the odds of high blood pressure, cancer, heart attack, stroke, or diabetes and the number of ACEs in either the 2015 or 2019 Ohio BRFSS sample (Appendix). However, in 2019, there was a significant relationship between the odds of COPD and the presence of 1 or more ACEs (F(5, 7447) = 6.53, p < 0.001). Fur-

ther, there was a strong association between the odds of asthma and the number of ACEs in 2019, with those with 5 or more ACEs having nearly 4 times the odds of having asthma compared to those with no ACEs (F(5, 7460) = 14.51, p < 0.001, Table 3). Those with greater numbers of ACEs also had higher odds of engaging in unhealthy behaviors. In the 2019 sample, when compared to those with no ACEs, those with 5 or more ACEs had 3.167 times higher odds of being current smokers (F(5, 3377) = 11.02, p < 0.001), 4.455 times the odds of engaging in heavy drinking (F(5, 7201) = 11.88, p < 0.001), and 3.259 times the odds of engaging in binge drinking (F(5, 3167) = 8.96, p < 0.001).

Among 2019 respondents, there was a positive relationship between the odds of ever having been diagnosed with depression and the number of ACEs. Compared to those with no ACEs, those with 3 ACEs had 4.013 times the odds of depression, those with 4 ACEs had 4.307 times the odds of depression, and those with 5 or more ACEs had 8.250 times the odds of depression (F(5, 7448) = 45.80, p < 0.001). These odds of depression represent an increase

compared to 2015 (Appendix). Further, there was a strong positive relationship between having poor mental health and higher numbers of ACEs in the 2019 sample, with those with 5 or more ACEs having 8.353 times the odds of poor mental health compared to those with no ACEs (F(5, 7259) = 34.79, p < 0.001.

The odds of both lifetime history of depression and current poor mental health were increased among persons who had experienced any category of ACE compared to those who had not experienced that category of ACE in both 2015 and 2019 (Appendix). Consistent with what was observed in 2015, in 2019 persons who had a family member with mental illness had the highest observed odds ratio for both lifetime history of depression (OR = 4.468) and current poor mental health (OR = 3.737) when controlling for sex.

ACEs and Perception of Health Status

In the 2019 sample, a worse perception of general health was found to be associated with an increased number of cumulative ACEs (Appendix). Of the persons who reported their health as "excellent," 40.7% had no ACEs, whereas only 7.9% had 5 or more ACEs. In contrast, of those with a rating of "poor," 17.6% had no ACEs, while 23.2% had 5 or more ACEs.

A multinomial logistic regression model, coded to use 0 days in poor mental health in the past month as the referent, showed a strong association between the number of cumulative ACEs and the odds of poor mental health among 2019 respondents (F(10, 7254) = 26.60, p < 0.001, Table 4). The presence of 1 ACE is associated with 1.631 times the odds of having between 1 and 14 days of poor mental health compared to having no days and 1.768 times the odds of having poor mental health. This effect increases with the number of ACEs. Those with 4 ACEs had 7.019 times the odds of being in poor mental health, and those with 5 or more had 14.773 times the odds. Compared to 2015 (Appendix), this represents an increase in the strength of the association between ACEs and mental health impairment.

Access to Health Care and Health Care Utilization

We also examined the association between ACEs and a person's access to health care through estimates of weighted proportions (Appendix) and multivariable logistic regression models (Table 5). In 2019, there appeared to be a positive correlation between the number of ACEs and the proportion of respondents indicating inability to access or utilize health care, with the exception of HIV testing. Compared to those reporting no ACEs, persons reporting at least 1 ACE had higher odds of not having a doctor because of cost (OR = 2.777, t(7466) = 6.66, p < 0.001); there was also a 72.2% increase in the odds of not having a personal doctor for any reason (t(7458) = 4.75, p < 0.001). While having any ACE was associated with increased odds of not having health insurance, when stratified by ACE score, only those with 4 or more ACEs had significantly increased odds of not having health insurance. Interestingly, HIV testing was significantly associated with ACE scores, with those reporting no ACEs having higher odds of never being tested for HIV (F(1, 7192) = 99.48, p < 0.001). These estimates were consistent between 2015 and 2019 (Appendix).

Cumulative ACEs can also significantly impact the utilization of health care (Table 5). The presence of ACEs was associated with increased odds of never having had cholesterol checked in 2019 (OR = 1.593, t(7102) = 2.61, p = 0.009). When analyzed by the number of ACEs, this effect was only significant among persons with 3 ACEs or 5 or more ACEs. Exposure to ACEs was also associated with not taking any blood pressure medications (OR = 2.009, t (3397) = 18.54, p < 0.001). Higher ACE scores were associated with higher odds of not taking blood pressure medication. There was no evidence that adjusting for health insurance status modified the association between ACEs and health care utilization indicators in the 2019 sample.

DISCUSSION

We found evidence that exposure to ACEs was associated with numerous indicators of health care access. As health insurance

Table 3. Odds Ratios Health Conditions, Behaviors, and Well-being by Cumulative ACEs with No ACEs as Referent Category, 2019 Ohio BRFSS

	1 ACE OR (95% CI)	2 ACEs OR (95% CI)	3 ACEs OR (95% CI)	4 ACEs OR (95% CI)	≥5 ACEs OR (95% CI)
Health conditions					
High blood pressure	0.850 (0.702, 1.028)	0.910 (0.734, 1.129)	0.762 (0.586, 0.991)	0.879 (0.646, 1.195)	0.698 (0.536, 0.908)
Cancer	0.880 (0.711, 1.089)	1.016 (0.785, 1.315)	0.776 (0.571, 1.056)	0.893 (0.611, 1.303)	0.734 (0.507, 1.063)
Heart attack	1.145 (0.772, 1.699)	1.165 (0.825, 1.645)	0.919 (0.562, 1.504)	1.330 (0.766, 2.301)	1.282 (0.844, 1.947)
Stroke	1.142 (0.746, 1.748)	1.312 (0.829, 2.077)	0.986 (0.574, 1.696)	1.699 (0.939, 3.077)	1.080 (0.628, 1.859)
COPD	1.258 (0.930, 1.701)	1.474 (1.081, 2.010)	1.557 (1.070, 2.265)	1.920 (1.271, 2.901)	2.501 (1.785, 3.504)
Diabetes	0.905 (0.716, 1.142)	0.766 (0.581, 1.010)	0.656 (0.468, .920)	0.934 (0.616, 1.416)	0.796 (0.574, 1.103)
Asthma	1.845 (1.377, 2.472)	1.852 (1.354, 2.534)	2.547 (1.762, 3.682)	2.107 (1.377, 3.222)	3.755 (2.728, 5.169)
Lifetime depression	1.782 (1.356, 2.342)	2.857 (2.137, 3.820)	4.013 (2.932, 5.494)	4.307 (3.091, 6.002)	8.250 (6.088, 11.181)
Unhealthy behaviors					
Current smoking	1.411 (1.036, 1.922)	1.785 (1.292, 2.466)	2.291 (1.579, 3.325)	2.388 (1.598, 3.569)	3.167 (2.232, 4.494)
Heavy drinking	1.774 (1.235, 2.549)	1.688 (1.137, 2.505)	2.294 (1.506, 3.496)	2.207 (1.371, 3.554)	4.455 (3.020, 6.572)
Binge drinking	2.089 (1.512, 2.888)	1.535 (1.074, 2.195)	2.576 (1.697, 3.911)	1.801 (1.117, 2.904)	3.259 (2.141, 4.917)
Well-being					
Poor mental health	1.562 (1.077, 2.268)	3.100 (2.101, 4.575)	4.634 (3.127, 6.866)	5.553 (3.656, 8.434)	8.353 (5.765, 12.104)
Poor physical health	1.279 (1.039, 1.575)	1.400 (1.106, 1.773)	2.223 (1.697, 2.913)	1.972 (1.443, 2.694)	2.592 (1.966, 3.418)

Table 4. Odds Ratios for Current Episodes of Poor Mental Health by Cumulative ACE, 2019 Ohio BRFSS

	1 ACE (95% CI)	2 ACEs (95% CI)	3 ACEs (95% CI)	4 ACEs (95% CI)	≥5 ACEs (95% CI)	Any ACE (95% CI)
Days in poor mental health						
1-14 days	1.631 (1.269, 2.096)	2.049 (1.561, 2.689)	1.984 (1.426, 2.762)	2.265 (1.547, 3.316)	4.682 (3.338, 6.567)	2.140 (1.761, 2.601)
≥14 days	1.768 (1.214, 2.576)	3.779 (2.545, 5.612)	5.586 (3.727, 8.370)	7.019 (4.548, 10.859)	14.773 (9.931, 21.976)	4.612 (3.429, 6.223)

coverage does not modify the relationship between health care utilization and ACEs, there may be other factors that should be investigated to further examine that relationship. The relationship between a lack of health insurance and utilization of preventative medical care may be at least partially explained by the lower socioeconomic status of those who experienced 1 or more ACEs.

While we found that exposure to ACEs was negatively associated with having never tested for HIV, previous literature has found that exposure to childhood trauma was associated with increased odds of unprotected sex, medication nonadherence, and HIV disease progression.[48] It is possible that our findings concerning HIV testing may be confounded by the relationship between ACEs and risky sexual behavior or HIV disease progression. One potential hypothesis for our results is that persons with exposure to ACEs may engage in riskier sexual behaviors and are aware of the risks associated with these behaviors and are thus more likely to be tested for HIV, but this was not assessed.

There were notable differences in the prevalence of ACEs by age, race, gender, and education. Younger persons, racial minorities, and those with lower education levels were more likely to have experienced greater numbers of ACEs. One potential explanation for lower numbers of ACEs in persons aged 65 years and older is premature mortality. Past research suggests that premature death is associated with cumulative ACEs. Individuals with 6 or more cumulative ACEs have an expected life expectancy of 20 years shorter, on average, than those with no ACEs.[49]

Our analysis found evidence for a strong dose-response relationship between cumulative ACEs and odds of current poor mental health. Other literature has found strong links between ACEs and depressive disorders. A 2013 systematic review found that emotional abuse, sexual abuse, and physical abuse were the most important risk factors for the development of depression.[50] We found that all ACEs were strong risk factors for depression, though having a family member with mental illness was the strongest predictive ACE. This suggests a need to target clinical interventions and prevention programming for those who have experienced early childhood maltreatment.

Consistent with a national study of ACEs in 5 states,[51] we found the most prevalent ACEs reported were emotional/verbal abuse (39.0%), parental separation or divorce (31.7%), and living with a family member with substance abuse (28.0%). In our analysis, emotional or verbal abuse was highly prevalent across all demographic characteristics. Being exposed to a family member with

substance abuse in childhood was most prevalent among uninsured persons (34.9%) and those with an elementary school education (34.4%). Finally, currently uninsured individuals (48.8%), those with an elementary education (46.5%), and those never married (45.4%) experienced the highest prevalence of childhood divorce. These demographic patterns point to an association between social determinants of health and the experiences of childhood adversities.

Interventions to address issues related to the social determinants of health have been advanced as a method to reduce the incidence of ACEs.[52] Research demonstrates that preventative interventions, such as educational enrichment and comprehensive family services in early childhood, can improve adult health and well-being.[53] Further, sociodemographic interventions that target upstream structural determinants that contribute to childhood adversity may reduce ACEs.[54,55] While these interventions have shown promise through modest effect sizes, more robust evaluation designs are needed to evaluate the causal effect of these programs.

Trauma-informed care (TIC) is currently used in health services with the goal of health care workers becoming more approachable to individuals who have experienced ACEs.[56] This framework promotes information and values about how to promote and build alliances with those who have experienced trauma, with a focus on recognizing signs and symptoms of trauma and the integration of trauma knowledge into practices.[57] Trauma-informed care may help reduce the stigma associated with trauma and its potential health effects. As a large percentage of Ohioans have experienced trauma, implementing TIC practices in social service and health care settings could also help reduce retraumatization of individuals with ACEs and improve long-term health outcomes.

Our study has a few limitations. First, the BRFSS and ACE modules are self-report instruments that are subject to recall bias. This effect may be amplified as older respondents are being asked about events in early childhood. Second, our analysis uses a cross-sectional design and temporality must be inferred from the data. A longitudinal study may better illustrate the causal effect of ACEs on health outcomes. Similarly, due to the design of BRFSS as a telephone survey, there is the potential that those who choose to participate in BRFSS are substantially different from those who do not participate (ie, nonresponse bias). It is possible that given the surge of telemarketing calls experienced in the past few years, fewer persons may participate in BRFSS surveys as is evidenced

Table 5. Odds Ratio for Access to Health Care Indicators and Utilizations for Chronic Conditions (crude and adjusted by insurance status) by Cumulative ACEs, 2019 Ohio BRFSS

	1 ACE (95% CI)	2 ACEs (95% CI)	3 ACEs (95% CI)	4 ACEs (95% CI)	≥5 ACEs (95% CI)	Any ACE (95% CI)
Health care access						
No doctor because of cost	1.272 (0.855, 1.895)	1.916 (1.235, 2.975)	3.204 (2.105, 4.875)	5.113 (3.254, 8.034)	5.849 (3.999, 8.555)	2.777 (2.056, 3.751)
No personal doctor	1.330 (0.986, 1.795)	1.610 (1.170, 2.216)	2.214 (1.573, 3.117)	2.219 (1.484, 3.318)	1.943 (1.393, 2.711)	1.722 (1.376, 2.155)
No health insurance	0.836 (0.523, 1.335)	1.188 (0.695, 2.029)	1.445 (0.876, 2.385)	2.745 (1.605, 4.694)	2.253 (1.409, 3.602)	1.435 (1.021, 2.015)
Never tested for HIV	0.666 (0.525, 0.846)	0.405 (0.314, 0.521)	0.358 (0.269, 0.476)	0.263 (0.190, 0.365)	0.224 (0.169, 0.298)	0.400 (0.334, 0.479)
Health care utilization						
Never had cholesterol checked (no insurance)	1.503 (0.964, 2.342)	1.030 (0.635, 1.671)	2.203 (1.361, 3.565)	1.338 (0.756, 2.371)	2.187 (1.340, 3.571)	1.593 (1.123, 2.260)
Never had cholesterol checked with insurance	1.520 (0.972, 2.377)	0.999 (0.614, 1.627)	2.137 (1.316, 3.469)	1.199 (0.668, 2.153)	1.986 (1.211, 3.257)	1.536 (1.081, 2.183)
Not taking blood pressure medications (no insurance)	1.598 (1.045, 2.443)	1.607 (1.011, 2.555)	1.903 (1.109, 3.266)	2.418 (1.338, 4.371)	3.866 (2.425, 6.161)	2.009 (1.462, 2.760)
Not taking blood pressure medications with insurance	1.668 (1.089, 2.556)	1.690 (1.050, 2.722)	1.747 (1.020, 2.994)	2.102 (1.712, 3.771)	3.909 (2.431, 6.288)	2.007 (1.457, 2.765)

by declining response rates. However, response rates tend to be an unreliable marker of nonresponse bias.[58] Nonetheless, this should be considered as an inherent limitation of telephone-based surveys.

A final limitation is that our analysis focuses on ACEs. In the past few years, literature on positive childhood experiences (PCEs) has highlighted their importance in moderating the negative effects of ACEs and in promoting more favorable outcomes.[59] However, the effects of PCEs on physical health outcomes and health behaviors have been mixed.[59] Future studies on ACEs and health care access and utilization should incorporate PCEs as potential mitigating factors. Despite these limitations, our analyses support the need for interventions to reduce the experience of childhood adversities and prevent their consequences once they have occurred.

PUBLIC HEALTH IMPLICATIONS

Adverse childhood experiences remain a highly prevalent preventable risk factor for Ohioans. Adverse childhood exerpiences are strongly associated with adverse health outcomes and health behaviors. Implementation of evidence-based programs to reduce the prevalence of ACEs and support those affected by traumatic experiences has the potential to improve the health of the population, particularly among vulnerable groups disproportionately impacted by ACEs.

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APPENDIX

Demographic Characteristics of Weighted 2015 BRFSS Sample by Prevalence of ACEs

	Overall N % (95% CI)	No ACEs % (95% CI)	At least one ACE % (95% CI)	Number of ACEs Mean (95% CI)
Total	100.0	37.8 (36.0, 39.6)	62.2 (60.4, 64.1)	1.58 (1.50, 1.66)
Biological sex				
Male	48.7 (46.7, 50.7)	48.1 (45.2, 51.0)	49.1 (46.4, 51.8)	1.51 (1.39, 1.62)
Female	51.3 (49.3, 53.3)	51.9 (49.0, 54.8)	50.9 (48.3, 53.4)	1.65 (1.54, 1.76)
Age group				
18-49 years	50.2 (48.3, 52.1)	38.1 (35.1, 41.3)	57.6 (55.2, 60.0)	1.96 (1.82, 2.11)
50-64 years	27.8 (26.2, 29.3)	30.3 (27.9, 32.8)	26.2 (24.3, 28.3)	1.39 (1.29, 1.49)
65 years or older	24.5 (20.4, 22.7)	30.7 (28.6, 33.0)	15.9 (14.7, 17.3)	0.95 (0.88, 1.02)
Missing	0.5 (0.4, 0.7)	0.8 (0.6, 1.3)	0.3 (0.2, 0.5)	
Race				
White/Caucasian	82.7 (81.0, 84.4)	88.2 (86.0, 90.1)	79.4 (76.9, 81.7)	1.49 (1.40, 1.57)
Black/African American	10.3 (8.9, 11.9)	6.1 (4.8, 7.8)	12.9 (10.9, 15.2)	2.02 (1.69, 2.35)
Asian	2.1 (1.6, 2.8)	2.8 (1.8, 4.4)	1.6 (1.1, 2.3)	1.33 (0.88, 1.78)
Other	3.6 (2.9, 4.5)	1.6 (1.0, 2.6)	4.8 (3.7, 6.1)	2.60 (2.14, 3.06)
Missing	1.3 (1.0, 1.2)	1.3 (0.8, 2.0)	1.3 (0.8, 2.1)	
Highest level of education				
Elementary school	11.1 (9.5, 12.8)	8.5 (6.5, 10.9)	12.6 (10.6, 15.1)	2.15 (1.76, 2.54)
Completed high school/GED	33.4 (31.6, 35.3)	32.7 (30.1, 35.3)	33.9 (31.5, 36.4)	1.57 (1.45, 1.69)
Some college	30.8 (29.0, 32.7)	30.2 (27.5, 33.1)	31.2 (28.7, 33.7)	1.65 (1.50, 1.80)
College degree or higher	24.5 (23.0, 26.0)	28.6 (26.2, 31.0)	22.0 (20.2, 24.0)	1.24 (1.13, 1.34)
Missing	0.2 (0.1, 0.4)	0.1 (0.0, 0.3)	0.3 (0.1, 0.7)	
Employment status (Self-reported employment status. An employment status of other included responses of either "a homemaker," "a student," "retired," or "unable to work."				
Employed	57.8 (55.9, 59.7)	54.8 (52.0, 57.6)	59.6 (57.0, 62.2)	1.59 (1.49, 1.70)
Unemployed	5.0 (4.0, 6.1)	2.2 (1.5, 3.4)	6.6 (5.2, 8.4)	2.90 (2.29, 3.51)
Other	36.9 (35.1, 38.7)	42.6 (39.8, 45.4)	33.4 (31.1, 35.8)	1.38 (1.28, 1.48)
Missing	0.4 (0.2, 0.6)	0.4 (0.2, 0.7)	0.4 (0.2, 0.7)	
Annual household income				
<$35 000	31.1 (29.2, 33.0)	24.3 (21.9, 26.8)	35.2 (36.7, 37.9)	1.96 (1.80, 2.13)
$35 000-$74 999	26.9 (25.2, 28.6)	28.3 (25.7, 30.9)	26.1 (23.9, 28.4)	1.48 (1.34, 1.62)
≥$75 000	27.4 (25.6, 29.2)	30.2 (27.5, 33.0)	25.6 (23.3, 28.1)	1.33 (1.19, 1.47)
Missing	14.7 (13.4, 16.1)	17.3 (15.3, 19.5)	13.1 (11.4, 15.0)	
Health care coverage				
Yes	90.6 (88.9 92.0)	93.2 (90.7, 95.1)	89.0 (86.7, 90.9)	1.51 (1.43, 1.59)
No	8.7 (7.4, 10.2)	6.3 (4.5, 8.8)	10.1 (8.4, 12.2)	2.25 (1.43, 1.59)
Missing	0.7 (0.3, 1.8)	0.5 (0.2, 0.9)	0.9 (0.3, 2.8)	
Marital status				
Married	51.6 (49.6, 53.5)	60.1 (57.1, 63.0)	46.4 (43.8, 49.0)	1.31 (1.22, 1.41)
Divorced/separated	13.7 (12.4, 15.0)	11.0 (9.5, 12.8)	15.2 (13.6, 17.1)	1.79 (1.62, 1.97)
Widowed	7.9 (7.2, 8.6)	10.3 (9.0, 11.6)	6.4 (5.6, 7.3)	1.15 (0.99, 1.31)
Never married	26.6 (24.5, 28.7)	18.1 (15.3, 21.4)	31.7 (29.0, 34.6)	2.11 (1.89, 2.33)
Missing	0.4 (0.2, 0.6)	0.5 (0.3, 0.8)	0.3 (0.1, 0.7)	

Odds Ratios Health Conditions, Behaviors, Well-being by Cumulative ACEs with No ACEs as referent category (2015 DATA)

	1 ACE OR (95% CI)	2 ACEs OR (95% CI)	3 ACEs OR (95% CI)	4 ACEs OR (95% CI)	≥5 ACEs OR (95% CI)
Health conditions					
High blood pressure	0.847 (0.692, 1.036)	0.967 (0.761, 1.229)	0.776 (0.582, 1.036)	0.947 (0.666, 1.348)	0.769 (0.555, 1.065)
Cancer	0.751 (0.593, 0.950)	0.828 (0.608, 1.127)	0.755 (0.498, 1.146)	0.613 (0.401, 0.938)	0.594 (0.379, 0.929)
Heart attack	1.061 (0.733, 1.536)	1.092 (0.676, 1.763)	0.995 (0.566, 1.745)	0.700 (0.396, 1.235)	0.517 (0.280, 0.956)
Stroke	1.106 (0.713, 1.716)	0.639 (0.393, 1.039)	1.052 (0.643, 1.722)	1.569 (0.787, 3.130)	0.714 (0.378, 1.351)
COPD	1.170 (0.798, 1.714)	1.816 (1.208, 2.731)	1.701 (1.108, 2.613)	2.439 (1.450, 4.102)	1.971 (1.256, 3.093)
Diabetes	0.727 (0.558, 0.947)	0.867 (0.636, 1.183)	0.883 (0.613, 1.272)	1.041 (0.650, 1.666)	0.872 (0.590, 1.288)
Asthma	1.485 (1.081, 2.041)	1.899 (1.323, 2.727)	1.913 (1.284, 2.852)	1.933 (1.231, 3.038)	4.717 (3.148, 7.068)
Lifetime depression	1.421 (1.083, 1.865)	2.162 (1.609, 2.904)	2.762 (1.971, 3.869)	4.207 (2.877, 6.152)	7.390 (5.177, 10.549)
Unhealthy behaviors					
Current smoking	1.921 (1.393, 2.651)	2.159 (1.492, 3.123)	3.207 (2.122, 4.847)	2.887 (1.814, 4.594)	5.947 (3.935, 8.987)
Heavy drinking	2.029 (1.413, 2.913)	1.979 (1.248, 3.137)	2.785 (1.733, 4.476)	3.226 (1.878, 5.542)	3.426 (2.149, 5.463)
Binge drinking	1.788 (1.292, 2.473)	1.940 (1.304, 2.885)	1.863 (1.206, 2.879)	2.589 (1.518, 4.415)	2.225 (1.343, 3.687)
Well-being					
Poor mental health	1.527 (1.041, 2.241)	1.494 (1.004, 2.221)	2.858 (1.874, 4.358)	3.055 (1.809, 5.159)	5.550 (3.645, 8.451)
Poor physical health	1.237 (0.982, 1.558)	1.408 (1.084, 1.828)	1.597 (1.183, 2.157)	1.463 (1.018, 2.105)	2.534 (1.812, 3.542)

ACEs and History of Depressive Disorders Adjusting for Sex (2015 DATA)

	Lifetime history	Current poor mental health
Household mental illness	4.185 (3.194, 5.485)	3.578 (2.636, 4.857)
Emotional/verbal abuse	2.787 (2.273, 3.419)	2.213 (1.706, 2.870)
Physical abuse	2.583 (2.001, 3.334)	2.594 (1.916, 3.512)
Sexual abuse	4.250 (3.196, 5.651)	3.593 (2.558, 5.047)
Domestic violence	2.348 (1.832, 3.011)	2.179 (1.614, 2.943)
Household substance use	2.870 (2.294, 3.590)	2.569 (1.957, 3.372)
Parental separation/divorce	1.445 (1.147, 1.819)	1.326 (1.003, 1.753)
Family in prison	2.546 (1.671, 3.880)	1.922 (1.216, 3.038)

ACEs and History of Depressive Disorders Adjusting for Sex (2019 DATA)

	Lifetime history	Current poor mental health
Household mental illness	4.468 (3.642, 5.481)	3.737 (2.962, 4.713)
Emotional/verbal abuse	3.023 (2.527, 3.618)	2.671 (2.153, 3.314)
Physical abuse	2.660 (2.201, 3.214)	2.226 (1.787, 2.772)
Sexual abuse	2.957 (2.344, 3.731)	2.242 (1.720, 2.921)
Domestic violence	2.128 (1.727, 2.621)	2.311 (1.833, 2.914)
Household substance use	2.169 (1.802, 2.610)	2.562 (2.064, 3.181)
Parental separation/divorce	1.557 (1.285, 1.886)	2.331 (1.870, 2.905)
Family in prison	2.269 (1.696, 3.036)	3.105 (2.294, 4.204)

Self-reported General Health Rating by ACEs (2015 DATA)

	0 ACEs % (95% CI)	1 ACE % (95% CI)	2 ACEs % (95% CI)	3 ACEs % (95% CI)	4 ACEs % (95% CI)	≥5 ACEs % (95% CI)
General health						
Excellent	42.1 (37.5, 46.9)	27.5 (22.8, 32.7)	11.1 (8.5, 14.4)	8.2 (5.5, 12.1)	4.9 (2.9, 8.1)	6.2 (3.9, 9.5)
Very good	40.7 (37.5, 44.0)	25.9 (22.9, 29.1)	12.6 (10.4, 15.1)	9.3 (7.5, 11.5)	4.5 (3.3, 6.0)	7.1 (5.4, 9.3)
Good	36.4 (33.1, 39.7)	24.2 (21.3, 27.4)	11.3 (9.5, 13.3)	8.6 (6.9, 10.7)	7.0 (5.5, 9.0)	12.5 (9.8, 15.9)
Fair	30.0 (25.8, 34.4)	23.0 (18.7, 27.9)	13.2 (10.3, 16.7)	13.4 (9.9, 17.9)	8.8 (6.0, 12.8)	11.7 (8.3, 16.4)
Poor	27.4 (20.8, 35.1)	22.7 (16.0, 31.2)	14.2 (9.8, 20.1)	10.1 (6.1, 16.1)	6.7 (3.8, 11.5)	18.9 (13.4, 26.1)

Self-reported General Health Rating by ACEs (2019 DATA)

	0 ACEs % (95% CI)	1 ACE % (95% CI)	2 ACEs % (95% CI)	3 ACEs % (95% CI)	4 ACEs % (95% CI)	≥5 ACEs % (95% CI)
General health						
Excellent	40.7 (36.0, 45.6)	23.5 (19.2, 28.4)	12.6 (9.5, 16.6)	10.1 (7.2, 14.1)	5.2 (3.3, 8.0)	7.9 (5.5, 11.3)
Very good	36.1 (33.3, 39.0)	22.5 (20.0, 25.2)	15.0 (13.0, 17.3)	11.5 (9.5, 13.9)	6.5 (5.1, 8.3)	8.4 (6.7, 10.4)
Good	27.1 (24.7, 29.8)	25.7 (22.9, 28.6)	15.7 (13.5, 18.2)	10.7 (8.8, 13.0)	8.4 (6.7, 10.6)	12.4 (10.0, 15.3)
Fair	24.5 (21.1, 28.3)	19.0 (15.9, 22.7)	16.1 (12.9, 20.0)	12.3 (9.5, 15.8)	7.8 (5.9, 10.4)	20.2 (16.6, 24.3)
Poor	17.6 (13.4, 22.7)	15.9 (11.9, 20.9)	17.3 (12.4, 23.7)	17.5 (11.6, 25.4)	8.6 (5.6, 13.0)	23.2 (17.2, 30.5)

Odds Ratios for Current Episodes of Poor Mental Health by Cumulative ACEs (2015 DATA)

	1 ACE (95% CI)	2 ACEs (95% CI)	3 ACEs (95% CI)	4 ACEs (95% CI)	≥5 ACEs (95% CI)	Any ACE (95% CI)
Days in Poor Mental Health						
1-14 days	1.598 (1.192, 2.142)	2.295 (1.670, 3.156)	2.618 (1.824, 3.755)	3.015 (1.987, 4.575)	3.994 (2.614, 6.101)	2.248 (1.792, 2.819)
≥14 days	1.683 (1.144, 2.477)	1.824 (1.219, 2.731)	3.648 (2.355, 5.652)	4.108 (2.395, 7.046)	8.392 (5.386, 13.074)	2.881 (2.138, 3.883)

Odds Ratios for Access to Health Care Indicators by Cumulative ACEs (2015 DATA)

	1 ACE (95% CI)	2 ACEs (95% CI)	3 ACEs (95% CI)	4 ACEs (95% CI)	≥5 ACEs (95% CI)	Any ACE (95% CI)
No doctor because of cost	1.389 (0.901, 2.141)	1.431 (0.931, 2.201)	2.178 (1.319, 3.597)	3.012 (1.775, 5.113)	5.752 (3.616, 9.149)	2.227 (1.610, 3.080)
No personal doctor	1.444 (1.036, 2.012)	1.196 (0.785, 1.822)	2.285 (1.524, 3.428)	2.416 (1.490, 3.915)	3.937 (2.626, 5.905)	1.921 (1.493, 2.471)
No health insurance	1.479 (0.903, 2.424)	0.888 (0.492, 1.603)	1.484 (0.793, 2.777)	2.022 (1.047, 3.904)	3.355 (1.836, 6.130)	1.675 (1.106, 2.536)
Never tested for HIV	0.458 (0.354, 0.593)	0.569 (0.423, 0.766)	0.267 (0.193, 0.368)	0.250 (0.172, 0.363)	0.212 (0.149, 0.302)	0.364 (0.298, 0.444)

Odds Ratios for Health Care Utilizations for Chronic Conditions, Crude and Adjusted by Insurance Status

	1 ACE (95% CI)	2 ACEs (95% CI)	3 ACEs (95% CI)	4 ACEs (95% CI)	≥5 ACEs (95% CI)	Any ACE (95% CI)
Never had cholesterol checked (no insurance)	1.586 (1.095, 2.298)	0.984 (0.641, 1.509)	1.794 (1.136, 2.835)	2.056 (1.247, 3.392)	2.975 (1.945, 4.551)	1.712 (1.285, 2.280)
Never had cholesterol checked w/ insurance	1.428 (1.005, 2.030)	1.019 (0.667, 1.557)	1.831 (1.133, 2.959)	1.905 (1.156, 3.137)	2.656 (1.678, 4.202)	1.612 (1.218, 2.134)
Not taking blood pressure medications (no insurance)	1.823 (1.154, 2.882)	1.931 (1.120, 3.329)	2.082 (1.179, 3.677)	2.971 (1.568, 5.628)	3.590 (1.917, 6.720)	2.199 (1.527, 3.167)
Not taking blood pressure medication with insurance	1.751 (1.107, 2.769)	1.952 (1.124, 3.390)	2.045 (1.155, 3.621)	2.900 (1.497, 5.616)	2.929 (1.555, 5.515)	2.088 (1.435, 3.038)

Survey-weighted Percentage of Respondents Within Each Category of Health Care Access Indicators and Health Care Utilization Indicators by Cumulative ACEs, 2019 Ohio BRFSS

	0 ACEs (95% CI)	1 ACE (95% CI)	2 ACEs (95% CI)	3 ACEs (95% CI)	4 ACEs (95% CI)	≥5 ACEs (95% CI)
Health care access						
No doctor because of cost	6.1 (4.7, 7.8)	7.6 (5.8, 10.0)	11.0 (8.0, 14.9)	17.1 (13.0, 22.3)	24.8 (18.7, 32.2)	27.4 (22.4, 33.1)
No personal doctor	14.5 (12.5, 17.3)	18.7 (15.4, 22.5)	21.8 (17.7, 26.5)	27.7 (22.4, 33.8)	27.7 (21.2, 35.4)	25.2 (20.4, 30.7)
No health insurance	6.8 (5.2, 8.9)	5.8 (4.1, 8.3)	8.0 (5.2, 12.0)	9.6 (6.6, 13.8)	16.7 (11.3, 24.0)	14.2 (10.2, 19.3)
Never tested for HIV	77.7 (75.0, 80.2)	69.9 (65.9, 73.6)	58.5 (53.5, 63.3)	55.5 (49.4, 61.3)	47.8 (40.7, 55.0)	43.8 (38.0, 49.8)
Health care utilization						
Never had cholesterol checked	8.3 (6.3, 10.9)	12.0 (9.0, 15.8)	8.5 (6.0, 12.0)	16.6 (12.1, 22.5)	10.8 (7.0, 16.4)	16.5 (11.9, 22.5)
Not taking blood pressure medications	15.9 (12.7, 20.0)	23.2 (17.8, 30.0)	23.3 (17.2, 30.7)	26.4 (18.3, 36.5)	31.3 (21.1, 43.7)	42.2 (33.2, 51.7)