

# ACEs and Asthma in Adulthood: Results from the Michigan BRFSS, 2013 and 2016

A report of the findings on ACEs and adult asthma from the 2013 and 2016 MiBRFSS.

## What are ACEs?

ACEs are adverse childhood experiences that can be defined as exposure to emotional abuse, physical abuse, neglect, or household dysfunction.



Only **38%** of Michigan residents without asthma reported no ACEs.

And only **26%** of those that have ever had asthma reported no ACEs.

For more information on asthma, or the MiBRFSS, please visit:

[www.Michigan.gov/Asthma](http://www.Michigan.gov/Asthma)

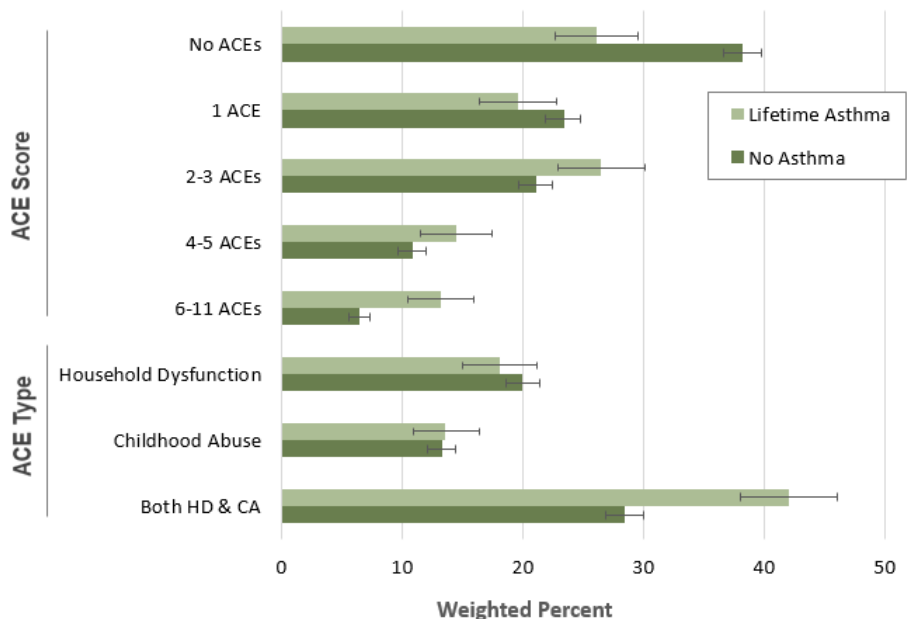
[www.Michigan.gov/AsthmaEpi](http://www.Michigan.gov/AsthmaEpi)

[www.Michigan.gov/BRFS](http://www.Michigan.gov/BRFS)

## Background

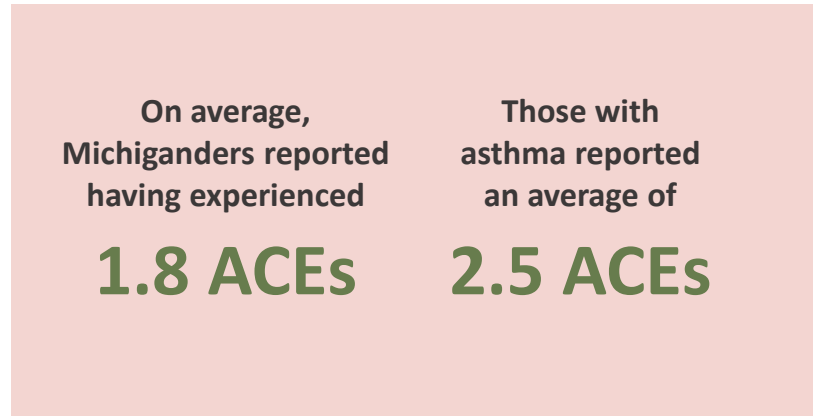
The Michigan Behavioral Risk Factor Surveillance System (MiBRFSS) is an annual, state-based telephone survey of adult Michigan residents that provides population-based estimates of the prevalence of numerous health conditions, behaviors, and clinical preventive practices. In 2013 and 2016, information about the respondents' exposure to adverse childhood experiences (ACEs) was collected. The eleven ACE questions on the MiBRFSS are adapted from the 1998 Kaiser Permanente study and explore an individual's level of exposure to childhood emotional abuse, physical abuse, and household dysfunction.<sup>1</sup>

Some types of early life stress are positive or tolerable; however, others can be described as "toxic". Toxic stress experienced as a result of ACE exposure has been linked to changes in behavior, cognition, and to a number of health conditions, such as cardiovascular disease, diabetes, and asthma.<sup>2</sup> A clear understanding of how ACEs specifically influence health has not yet been established. It has been suggested that ACEs influence the onset and severity of asthma through the dysregulation of stress pathways that in turn increase airway inflammation.<sup>3</sup>



**Figure 1.** Prevalence of ACEs by Score and Type between for Lifetime Asthma. MiBRFSS, 2013 and 2016.

In addition to other established genetic, behavioral, and environmental predictors of asthma, ACEs may play an important role in the development of asthma across the lifecourse. Positive associations have been found between the number of ACEs an individual is exposed to and their likelihood for developing asthma by previous researchers.<sup>2,4</sup> However, there is limited information on the relationship between ACEs and asthma in a sample of adult, Michigan residents. Additionally, very few have examined the association between ACEs and asthma with consideration of ACE type.<sup>4</sup> Therefore, the results report the odds of asthma for ACE score, as well as for ACE type (childhood abuse and household dysfunction). Understanding the prevalence of ACEs and their association with asthma in adulthood may shed light on the high burden of asthma in Michigan, which ranked as the sixth highest state for current asthma prevalence in 2016 (10.9%).<sup>5</sup> Moreover, it may inform public health professionals and providers about the impact of ACEs and how to identify those at a higher risk for developing asthma.



	Weighted % (n)	
	Sample (n=6,961)	Lifetime Asthma
<b>Total</b>	--	15.4 (1,039)
<b>Survey Year</b>		
2013	51.9 (3,603)	53.1 (538)
2016	48.1 (3,358)	46.9 (501)
<b>Race</b>		
White, non-Hispanic	79.8 (5,844)	75.4 (823)
Black, non-Hispanic	13.0 (579)	16.6 (112)
Hispanic	3.0 (111)	3.1 (16)
Other, non-Hispanic	4.2 (336)	4.9 (76)
<b>Sex</b>		
Male	48.6 (3,077)	42.0 (379)
Female	51.4 (3,884)	58.0 (660)
<b>Age</b>		
18-44 years	43.0 (1,874)	50.8 (343)
45-64 years	36.0 (2,682)	33.7 (398)
65+ years	21.0 (2,356)	15.4 (291)
<b>Education</b>		
Less than high school	10.5 (333)	14.4 (75)
Graduated high school	29.6 (1,959)	26.4 (283)
Some college	35.2 (2,142)	36.7 (330)
Graduated college	24.8 (2,518)	22.5 (350)
<b>Income</b>		
< \$15,000	10.2 (547)	17.0 (144)
\$15,000 - \$24,999	16.1 (979)	21.4 (182)
\$25,000 - \$34,999	11.9 (758)	11.2 (105)
\$35,000 - \$49,999	15.1 (946)	14.6 (130)
> \$50,000	46.7 (2,805)	35.7 (353)

**Table 1.** Descriptive Characteristics Among the Total and Lifetime Asthma Samples. MiBRFSS, 2013 and 2016.

## Methods

The 2013 and 2016 MiBRFSS included demographic questions as well as questions on ACEs and lifetime asthma. Lifetime asthma was defined as the proportion of adults ever told by a doctor, nurse, or other health care professional that they had asthma. The ACE modules for each survey year had a shared eleven questions.

ACEs were classified in two ways. The first method summed ACE scores and divided them into five categories for analysis: (1) 0 ACEs, (2) 1 ACE, (3) 2-3 ACEs, (4) 4-5 ACEs, and (5) 6+ ACEs. ACE scores were grouped into categories for analysis because ACEs typically do not occur independent of one another.<sup>6</sup> The second method examined the relationship ACE exposure type, separating ACEs into categories of reporting (1) only childhood abuse, (2) only household dysfunction, (3) both childhood abuse and household dysfunction, or (4) neither. Childhood abuse consists of five questions about physical, emotional, and sexual abuse, while household dysfunction refers to the six questions about adult substance use, violence, parental separation, mental illness, and incarceration.<sup>4</sup> The additional variables, race, sex, age, income, and education, were included as confounders in the analysis. Income and education refer to characteristics of a

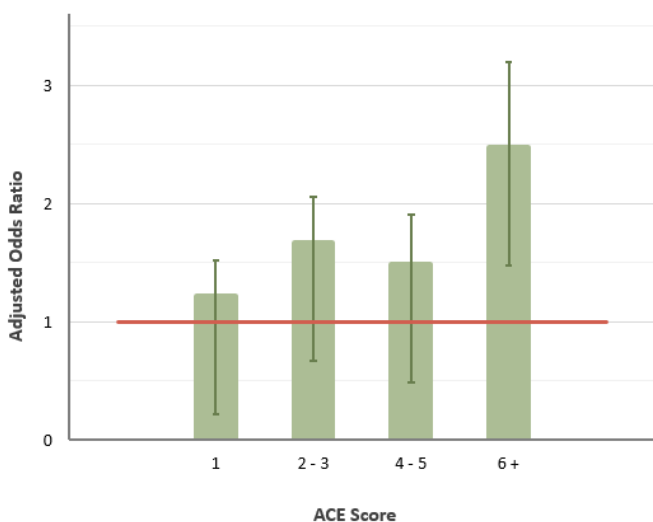
respondent's adult life, but they were included as proxy measures intended to approximate childhood socioeconomic status (SES) and reduce possible confounding effects. Although adult income and education are imperfect measures for this analysis, there is evidence for an association between SES and the development of asthma.<sup>8</sup>



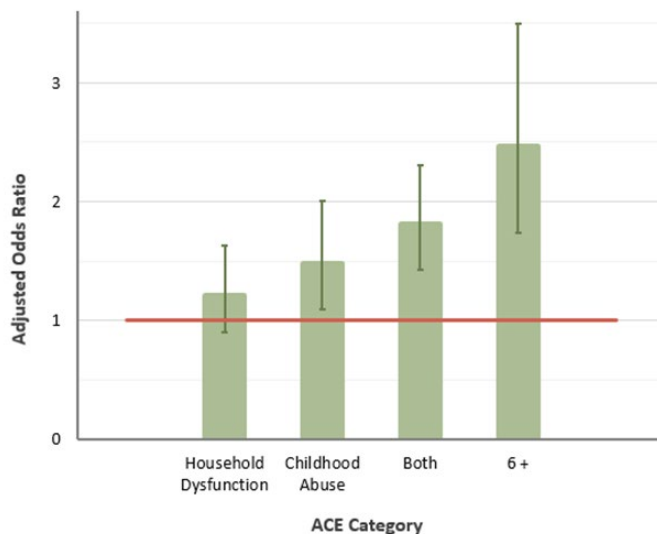
The analytic sample consisted of 6,961 respondents. Analyses were performed using SAS survey procedures (SAS PROC SURVEYFREQ and PROC SURVEYLOGISTIC) to account for the complex survey design and weighting of the MiBRFSS and produce demographic and prevalence estimates, as well as adjusted odds ratio estimates. The associations between ACEs and asthma are presented as odds ratios obtained using logistic regression models with adjustment for confounders. However, an adjustment for collinearity between income and education was not included in the analysis.

## Results

The distribution of demographic characteristics among the total analytic sample and in those reporting lifetime asthma are shown in Table 1 (page 2). Higher proportions of Black, non-Hispanic respondents, Female respondents, and respondents in the lower income brackets within the lifetime asthma population are found as compared to the total number of respondents. In Figure 1 (page 1), the prevalence of ACEs are displayed by type and summed score for comparison between those with lifetime asthma and those without. The proportion of reporting no ACEs in those that have never had asthma is 26.1%, while in those with lifetime asthma it is 38.2%. The prevalence of reporting more than one ACE is consistently larger for respondents with lifetime asthma as compared to those without asthma. Respondents in both asthma status groups more frequently reported experiencing household dysfunction over childhood abuse, however, joint exposure to both ACE types was commonly reported. Additionally, the prevalence of experiencing both household dysfunction and childhood abuse was significantly higher in the lifetime asthma group (42.1%) in comparison to those without asthma (28.5%).



**Figure 2.** Adjusted Odds Ratios of Lifetime Asthma by ACE Score. MiBRFSS, 2013 and 2016.



**Figure 3.** Adjusted Odds Ratios of Lifetime Asthma by ACE Category. MiBRFSS, 2013 and 2016.

In Figure 2 (page 3), the odds ratios are presented for each category of ACE score with adjustment for race, sex, age, income, and education. For those that had ACE scores greater than one, their adjusted odds of asthma over the lifecourse was significantly greater than those that experienced none. There is a general trend in increased odds of lifetime asthma with increasing ACE score category compared to those with no ACEs. In examining the association between ACEs and lifetime asthma, there are important differences in the odds of asthma depending on the type of ACE experienced (Figure 4). For those reporting childhood abuse only, there was a 48% greater odds of asthma as compared to those that experienced no ACEs. Additionally, those that experienced both household dysfunction and childhood abuse had an 81% greater odds of asthma as compared to no ACEs. However, there was not significant evidence of increased odds for those that only reported household dysfunction when compared to no ACEs.

## Discussion

The results of this study support trends observed in previous studies and conclusions on early life trauma, the body's stress responses, and chronic disease.<sup>2,4,7</sup> These findings suggest that independent of confounding factors, exposure to ACEs is associated with an increased likelihood of reporting lifetime asthma. The greater odds of asthma in groups with higher ACE exposure is significant since having just one ACE increases your likelihood of having additional ACE exposures.<sup>6</sup> The likelihood of asthma is not typically examined by ACE type; however, these results suggest that childhood abuse has a greater influence on asthma than household dysfunction does. Future analyses may benefit from consideration of the type of ACE in addition to the ACE score.

Asthma is influenced by wide range of risk factors but why ACEs are associated with greater asthma prevalence has not yet been established. However, the association may be due to toxic stress, environmental factors associated with ACE exposure, or adoption of unhealthy coping behaviors, such as smoking. This evidence of varying asthma odds by ACE type may reflect these mechanistic differences in how toxic stress develops through the lifecourse.

This analysis provides greater insight as to how ACEs influence health in Michigan. Data from the MiBRFSS demonstrates the positive association between increasing ACE exposure and reported lifetime asthma. Therefore, asthma screening in children and adolescents exposed to a high number of ACEs is encouraged for possible reduction of the asthma burden in Michigan through timely management.

## References

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