



# Prevalence and Trends of Asthma in United States (US) Adults, 2005-2016: A National Health and Nutrition Examination Survey (NHANES) Study

Authors: Oluwakemi Akinniyi, Sedoafia Amelor, Keya Desai, Jocelyn Elias, Ankita Patel, Sandeep Krishna Reddy  
Advisor: Dr. Maureen Kennedy, DrPH

## BACKGROUND

- Asthma is a chronic respiratory disease that causes inflammation and narrowing of the airways. These changes can cause episodes of wheezing, chest tightness, shortness of breath, and coughing.<sup>1</sup>
- Asthma affects 300 million people worldwide with the number of asthmatics projected to rise by 100 million by 2025.<sup>2</sup>
- More than 25 million Americans affected with asthma including 19.2 million adults and 5.5 million children.<sup>3</sup>
- Highest mortality rates seen among adults 65 years and older, females and non-Hispanic blacks.<sup>4</sup>
- The total cost of diagnosed asthma in the United States in 2018 was \$81.9 billion, including medical care, absenteeism and mortality.<sup>5</sup>

## STUDY OBJECTIVES

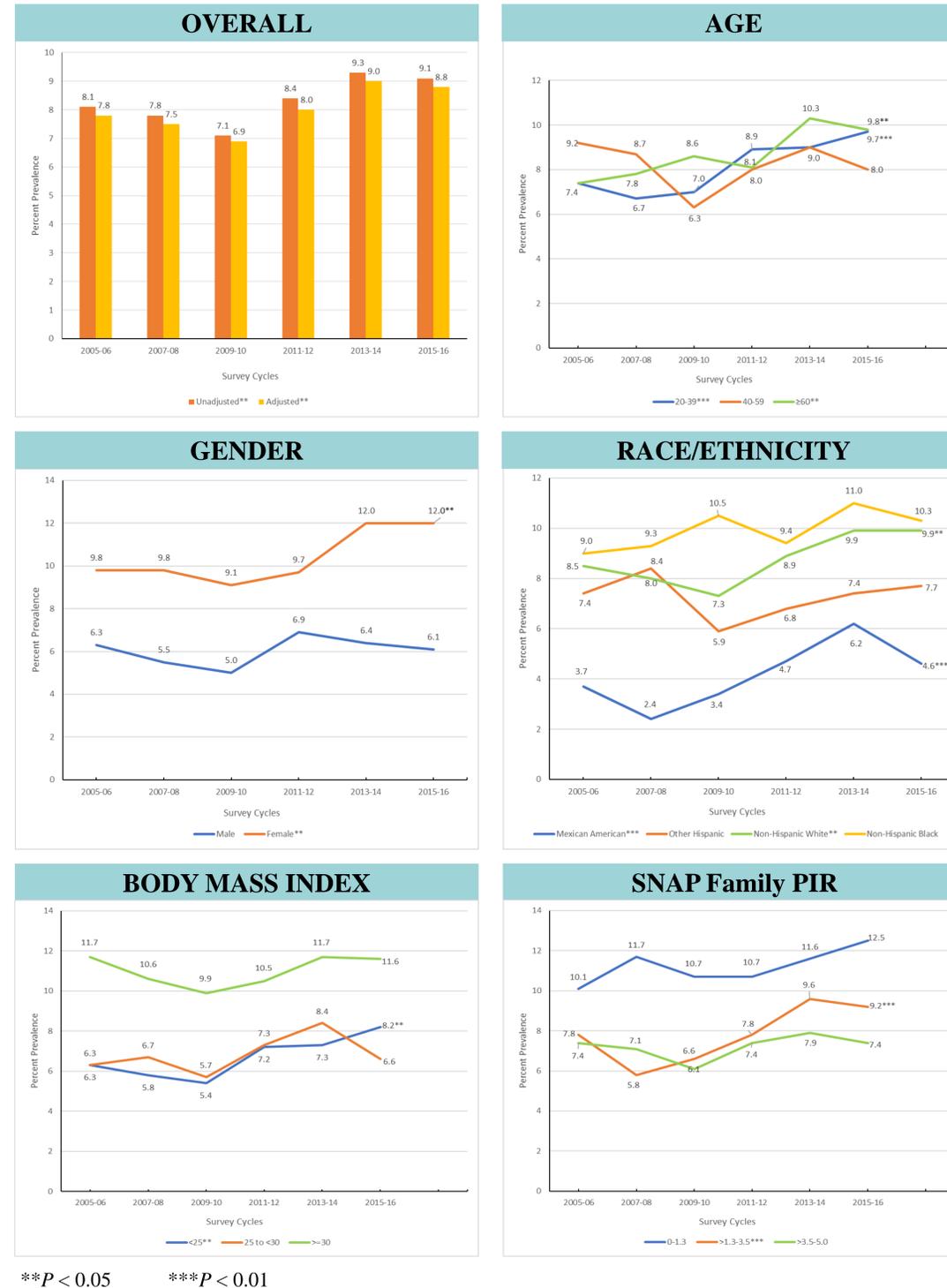
- Estimate the prevalence and trends of asthma for US adults.
- Investigate and identify the potential risk factors of asthma among US adults.
- Derive a predictive model estimating the probability of US adults having asthma.
- Identify health disparities with respect to demographic, behavioral, environmental and clinical characteristics.
- Provide recommendations and support for public health intervention, management, and policy.

## METHODOLOGY

- A survey analysis of cross-sectional data obtained from the National Health and Nutrition Examination Surveys (NHANES) study from six two-year cycles: 2005-2006, 2007-2008, 2009-2010, 2011-2012, 2013-2014, 2015-2016.<sup>6</sup>
- NHANES is a nationally representative survey of the resident civilian noninstitutionalized US population that uses a complex multistage probability cluster design which samples children and adults in four stages.<sup>7</sup>
- This study included 32,798 participants who were ≥ 20 years old, informed by a doctor they had asthma and had asthma at the time of the survey.
- The outcome variable, asthma, is defined by participants' positive responses to the questions 'Dr. ever told you that you had asthma?' and 'Do you still have asthma?' which was obtained by self-reported information using a standardized questionnaire
- Analyses were performed with SAS version 9.4.
- Weighted percent prevalence and trend analyses were estimated using 'surveymeans' analyses.
- Multivariate analysis was performed with seventeen independent variables with the main effect variable (survey cycle), using the backward stepwise multivariate survey logistic regression technique to arrive at a final model.

## RESULTS

### WEIGHTED TREND ANALYSES



### MULTIVARIATE SURVEY LOGISTIC REGRESSION PREDICTIVE MODEL

$$\ln\text{Odds (Asthma)} = \beta_0 + \beta_1 (\text{Survey Cycle}) + \beta_2 (\text{Gender}) + \beta_3 (\text{Age}) + \beta_4 (\text{Race}) + \beta_5 (\text{SNAP Family PIR}) + \beta_6 (\text{Health Insurance}) + \beta_7 (\text{BMI}) + \beta_8 (\text{COPD}) + \beta_9 (\text{Close relative had Asthma}) + \beta_{10} (\text{Feeling down, depressed or hopeless})$$

## CONCLUSIONS

- From 2005-2016 the overall unadjusted prevalence of asthma increased significantly from 8.1% to 9.1%.
- The probability of having asthma was increased for those who were female, of low SES, obese, had COPD, had a close relative with asthma, and were depressed.
- Early detection, improving treatments, and increasing public health interventions can effectively decrease the prevalence of asthma.

## DISCUSSION

### PUBLIC HEALTH IMPLICATIONS

<b>Health Disparities</b>	<ul style="list-style-type: none"> <li>➤ Females</li> <li>➤ Non-Hispanic blacks</li> <li>➤ Low socioeconomic status</li> </ul>												
<b>Relevant Comorbidities</b>	<ul style="list-style-type: none"> <li>➤ COPD</li> <li>➤ Obesity</li> <li>➤ Depression</li> <li>➤ Family history of a close relative who had asthma</li> </ul>												
<b>Emerging Risk Factors</b>	➤ Prevalence increasing among the following US adult populations: those 20-39 years, NHW, middle SES, and overweight persons												
<b>Medical Costs<sup>8</sup></b>	<table border="1"> <thead> <tr> <th>Year</th> <th>Direct –</th> <th>Indirect –</th> </tr> </thead> <tbody> <tr> <td>2019</td> <td>\$14.62 billion</td> <td>\$32.2 billion</td> </tr> <tr> <td>2028</td> <td>\$15.08 billion</td> <td>\$33.2 billion</td> </tr> <tr> <td>2038</td> <td>\$15.23 billion</td> <td>\$33.5 billion</td> </tr> </tbody> </table>	Year	Direct –	Indirect –	2019	\$14.62 billion	\$32.2 billion	2028	\$15.08 billion	\$33.2 billion	2038	\$15.23 billion	\$33.5 billion
Year	Direct –	Indirect –											
2019	\$14.62 billion	\$32.2 billion											
2028	\$15.08 billion	\$33.2 billion											
2038	\$15.23 billion	\$33.5 billion											

## STRENGTHS & LIMITATIONS

LIMITATIONS	STRENGTHS
➤ Cross-Sectional study: no temporality, no causality, and cannot measure risk	➤ NHANES' complex survey design method results in high external validity
➤ Self-reported NHANES data may lead to reporting bias, and potential response bias	➤ Weighted analysis
➤ Due to NHANES' probability sampling, data on independent environmental factors was inconsistent	➤ Generalizability with representation of resident civilian noninstitutionalized US population
➤ Variables such as: smoking, alcohol could not be included due to substantial missing	➤ Reliable with large sample size ~ high power observations

## FUTURE DIRECTIVES

- Further studies should be carried out focusing on independent environmental factors, smoking, alcohol intake, and moderate physical activity.
- Provide improved health management and evidence-based interventions to those adults who are: ≥60 years, NHB, lower SES, obese, depressed and those diagnosed with COPD.
- Broaden target groups of prevention and intervention strategies to include emerging at-risk populations, such as: 20-39 years, overweight, middle SES and those who have depression.

## REFERENCES

1. Bateman ED, Hurd SS, Barnes PJ, et al. Global strategy for asthma management and prevention: GINA executive summary. *European Respiratory Society*. <https://erj.ersjournals.com/content/31/1/143>. Published January 1, 2008
2. Nunes C, Pereira A, Morais-Almeida M. Asthma costs and social impact. *Asthma Res Pract*. 2017;3(1). doi:10.1186/s40733-016-0029-3.
3. FastStats - Asthma. Centers for Disease Control and Prevention. <https://www.cdc.gov/nchs/fastats/asthma.htm>. Published January 19, 2017.
4. Asthma as the Underlying Cause of Death. Centers for Disease Control and Prevention. [https://www.cdc.gov/asthma/asthma\\_stats/asthma\\_underlying\\_death.html](https://www.cdc.gov/asthma/asthma_stats/asthma_underlying_death.html). Published April 24, 2018.
5. Asthma costs the US economy more than \$80 billion per year. *ScienceDaily*. <https://www.sciencedaily.com/releases/2018/01/180112091212.htm>. Published January 12, 2018
6. Johnson CL, Paulose-Ram R, Ogden CL, et al. National health and nutrition examination survey: analytic guidelines, 1999-2010. *Vital and health statistics Series 2. Data evaluation and methods research*. 2013;14(1):1-24.
7. Centers for Disease Control and Prevention (CDC). Survey Participants. [https://www.cdc.gov/nchs/nhanes/participant/participant\\_selected.html](https://www.cdc.gov/nchs/nhanes/participant/participant_selected.html) Page updated October 19, 2018. Accessed March 14, 2020
8. Yaghoubi M, Adibi A, Safari A, Fitzgerald JM, Sadatsafavi M. The Projected Economic and Health Burden of Uncontrolled Asthma in the United States. *American Journal of Respiratory and Critical Care Medicine*. 2019;200(9):1102-1112. doi:10.1164/rccm.201901-0016oc.