**Evan Becker – BRFSS Data Analysis Report on the Comparison of Asthma by Smoking Status Among Arizona and Oklahoma**

Introduction:

The Behavioral Risk Factor Surveillance System (BRFSS) survey serves as a great resource for public health data analysis for a wide variety of variables across the US and territories. This analysis will be focusing on the states Arizona and Oklahoma and if the states differ regarding the variables sex, age group, race, income group, binge drinking status, BMI, BMI category, smoking status, and asthma status. On top of this, the article will identify which variables differ regarding the health condition asthma for the state of Arizona, with an emphasis on the risk factor smoking status.

While Oklahoma and Arizona are relatively close geographically, their health care rankings are different. Oklahoma ranks near the bottom in comparison to all 50 states while Arizona is slightly below average (*Commonwealth Fund*). It has been shown that higher quality health care leads to lower disease rates as well as an improved quality of life (*Health Care*). Therefore, there is an interest in identifying key variables that differ across the two states so that strategies can be put in place to improve healthcare where it is needed most.

Asthma is a chronic lung condition that gives those who have it difficulty breathing as well as other symptoms involving the lungs. It has been shown that different variables, such as exposure to tobacco, can trigger asthma and make symptoms worse (*WHO*). Therefore, there is an interest in identifying demographic, health, and behavioral characteristics that are associated with asthma to identify possible smoking education and other strategies to improve overall physical health. On top of this, there is an interest in determining if the relationship between asthma and smoking status is the same for all income groups. This is because lower income groups have been shown to smoke a larger number of cigarettes compared to higher income groups and generally don’t have the same access to healthcare (*American Lung Association*).

BRFSS Survey Methods:

The Behavioral Risk Factor Surveillance System (BRFSS) survey is a health survey conducted by phone through both landline and cellphones. Since BRFSS is conducted through the phone, the survey is not completely randomly sampled. This is due to different factors like certain demographics being more likely to answer the phone as well as a certain proportion of the population not having phones. To account for this, weighted data analysis should be used to analyze BRFSS data, however, this study did not use weighted analysis.

Data Processing:

For the smoking status variable, SMOKE100, participants were asked: Have you smoked at least 100 cigarettes in your entire life? [Note: 5 packs = 100 cigarettes]. The response “Yes” was coded “100+ cigarettes”, “No” was coded “<100 cigarettes” and the responses “Don’t know” and “Refused” were coded to be blank. It is worth noting that the group of less than 100 cigarettes smoked includes people who have never smoked a cigarette.

For the asthma status variable, ASTHMA3, participants were asked: Ever told you had asthma? The response “Yes” was coded to “Diagnosed with Asthma”, “No” was coded to “Not Diagnosed with Asthma”, and the responses “Don’t know” and “Refused” were coded to be blank.

The remaining variables, \_state for state, sexvar for sex, \_ageg5yr for age group, \_racegr4 for race/ethnicity, income3 for income group, \_rfbing6 for binge drinking status, \_bmi5 for BMI, and \_bmi5cat for BMI category were all coded as they appear in the BRFSS code book. \_BMI5 uses the participants BMI with two extra decimal places at the end. To correct this, a new variable, BMI was created which divided the \_BMI5 variable by one hundred. Any response of “Don’t know” or “Refused” was coded to be blank for each variable.

Statistical Analysis Methods:

Since most of the comparisons were done with frequencies and percentages of categorical data, most of the analysis was done with Chi-square tests. This was chosen over Fischer’s Exact test due to the large sample size of each comparison group. The p-values and frequencies of each category by state can be found in Table 1, while the p-values and frequencies of each category by asthma status can be found in Table 3.

The other analysis method used was the Satterthwaite t-test due to unequal variances of BMI among both state and asthma status. This was used when comparing the mean BMI by state and by asthma status. The data can be found in Table 2 and Table 4.

**Results:**

Comparison of Oklahoma and Arizona

For the comparison of Arizona and Oklahoma, descriptive statistics for the demographic, health, and behavioral factors are presented in Tables 1 and 2. The amount of missing information varied among the variables, with the highest missing data rates observed for BMI group (9%), binge drinking status (12%), and income group (20%). Respondents from Arizona were more likely to be male compared to respondents from Oklahoma (p=0.021). The age distribution differed between the two states as well (p=<.0001). In Arizona, 32% of respondents were 70 years or older while 25% of respondents from Oklahoma were 70 years or older. The distribution of race/ethnicity also was different in the two states (p<.0001). In Arizona, 8% of respondents reported being Other and Non-Hispanic while 15% of respondents in Oklahoma reported being Other and Non-Hispanic. Looking at health risk variables, residents from Arizona were more likely to binge drink (p=0.0012), additionally, BMI category differed by state (p<.0001). However, smoking status did not differ significantly (p=0.0875). The chronic health condition of interest, asthma did differ between Arizona and Oklahoma (p=0.0005). Looking at Figure 1, respondents from Oklahoma were more likely to be diagnosed with asthma (18%) compared to respondents from Arizona (16%). Finally, the continuous BMI variable differed by state (p<.0001). The mean BMI from the Arizona respondents was 28.22 while the mean BMI from the Oklahoma respondents was 29.29.

Comparison by asthma diagnosis in Arizona

The descriptive statistics for the demographic, health, and behavioral factors by asthma diagnosis are presented in Tables 3 and 4. The amount of missing information varied among the variables, with the highest missing data rates observed for BMI group (10%), binge drinking status (13%), and income group (21%). Asthma diagnosis status differed by sex (p<.0001). 40% of respondents who reported having asthma were male, while 48% of respondents who reported not having asthma were male. The distribution of income also differed by diagnosis (p=0.0355). In the asthma group, 50% of respondents reported having an income of $50,000+ annually while 53% of respondents in the no asthma group reported having an income of $50,000+ annually. Looking at health risk variables, binge drinking status did not differ by asthma diagnosis (p=0.6201), however, the distribution of BMI group did differ by asthma status (p<.0001). Moreover, the mean BMI differed by asthma diagnosis (p<.0001). As seen in Table 4, the mean BMI for the asthma group was 29.66 while the mean BMI among those who have not been diagnosed with asthma was 27.95. Finally, the health risk factor of interest, smoking status, did differ in the two groups (p=0.0002). As seen in Figure 2, respondents who have smoked 100+ cigarettes were more likely to report a diagnosis of asthma (18%) compared to respondents who have not smoked 100+ cigarettes (15%).

Comparison of asthma diagnosis by smoking status, stratified by income group in Arizona

The variable income was stratified to determine if it is a confounding variable (Figure 3). The less than $25,000 annual income who had smoked 100+ cigarettes had the highest prevalence of asthma (20%). In each income group within the sample, the proportion of respondents with asthma who reported smoking 100 or more cigarettes was greater than the proportion of respondents with asthma who reported smoking fewer than 100 cigarettes. However, this difference was only statistically significant in the $50,000+ annual salary group.

[<$25,000 annual income: p=0.1194, $25,000 to <$50,000 annual income: p=0.1320, $50,000+ annual income: p=0.0413]

**Conclusions:**

Through the analysis of BRFSS data, different health care trends have been identified. Although the prevalence of asthma differed between Oklahoma and Arizona, the prevalence of residents who have smoked 100+ cigarettes did not differ by state. However, looking at Arizona, the prevalence of asthma diagnosis was greater in the 100+ cigarette group compared to the less than 100 cigarette group. This shows that in Arizona, those who have smoked 100+ cigarettes are more likely to have an asthma diagnosis compared to those who have not smoked 100+ cigarettes. On top of this, there is statistically significant evidence to suggest that in Arizona, the mean BMI for those who have been diagnosed with asthma was greater than the BMI of those who have not.

**Limitations:**

As stated earlier, this study did not use weighted analysis. The use of sampling weights is key when looking at BRFSS data due to the limitations of data collection. Because of this, the conclusions made in this study may change when using weighted analysis. On top of this, BRFSS data collection can have different complications leading to incorrect analysis. For example, BRFSS data does not include Americans who do not own phones and self-reporting issues are possible. Because of these issues, the data associated with BRFSS can be incorrect. Finally, since not all income groups showed statistical significance when comparing prevalence of asthma diagnosis by smoking status, income group is a possible confounding variable. Therefore, in the $50,000+ income group, different variables, like better access to healthcare, could be causing statistical difference among all income groups when there really isn’t. Because of this, further analysis is required to determine the relationship of income group and prevalence of asthma diagnosis by smoking status.

**References:**

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**Table 1: Count and Percentage of factors among state**

| ***Factor*** | | ***Arizona (n=10185)*** | | ***Oklahoma (n=5775)*** | |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | ***Count*** | ***Percent*** | ***Count*** | ***Percent*** | ***P-value*** |
| **Sex of Respondent** | **Male** | **4782** | **47** | **2602** | **45** | **0.0210** |
|  | **Female** | **5403** | **53** | **3173** | **55** | **.** |
| **Age (years)** | **18-29 years** | **910** | **9** | **694** | **12** | **<.0001** |
|  | **30-49 years** | **2212** | **22** | **1604** | **28** | **.** |
|  | **50-69 years** | **3629** | **36** | **1973** | **34** | **.** |
|  | **70 years and older** | **3247** | **32** | **1459** | **25** | **.** |
|  | **Missing** | **187** | **.** | **45** | **.** | **.** |
| **Annual Income** | **Less than $25,000** | **1421** | **18** | **860** | **18** | **0.2676** |
|  | **$25,000 to <$50,000** | **2370** | **30** | **1433** | **30** | **.** |
|  | **$50,000 and greater** | **4226** | **53** | **2408** | **51** | **.** |
|  | **Missing** | **2168** | **.** | **1074** | **.** | **.** |
| **Race/Ethnicity of Respondent** | **White and Non-Hispanic** | **7011** | **72** | **4115** | **73** | **<.0001** |
|  | **Black and Non-Hispanic** | **237** | **2** | **291** | **5** | **.** |
|  | **Other and Non-Hispanic** | **788** | **8** | **846** | **15** | **.** |
|  | **Hispanic** | **1758** | **18** | **412** | **7** | **.** |
|  | **Missing** | **391** | **.** | **111** | **.** | **.** |
| **BMI Category** | **<18.5 kg/m2** | **199** | **2** | **104** | **2** | **<.0001** |
|  | **18.5 to <25 kg/m2** | **2816** | **31** | **1337** | **25** | **.** |
|  | **25 to <30 kg/m2** | **3250** | **35** | **1740** | **33** | **.** |
|  | **>=30 kg/m2** | **2915** | **32** | **2097** | **40** | **.** |
|  | **Missing** | **1005** | **.** | **497** | **.** | **.** |
| **Binge Drinking Status** | **No** | **7700** | **87** | **4582** | **89** | **0.0012** |
|  | **Yes** | **1151** | **13** | **574** | **11** | **.** |
|  | **Don't know/Refused/Missing** | **1334** | **.** | **619** | **.** | **.** |
| **Smoking Status** | **100+ cigarettes** | **3925** | **42** | **2344** | **44** | **0.0875** |
|  | **<100 cigarettes** | **5395** | **58** | **3037** | **56** | **.** |
|  | **Missing** | **865** | **.** | **394** | **.** | **.** |
| **Asthma** | **Diagnosed with Asthma** | **1606** | **16** | **1034** | **18** | **0.0005** |
|  | **Not Diagnosed with Asthma** | **8524** | **84** | **4716** | **82** | **.** |
|  | **Missing** | **55** | **.** | **25** | **.** | **.** |

**Table 2: BMI Statistics by State**

|  | ***Arizona (n=10185)*** | | | | | ***Oklahoma (n=5775)*** | | | | |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Factor*** | ***Median*** | ***P25*** | ***P75*** | ***Mean*** | ***STD*** | ***Median*** | ***P25*** | ***P75*** | ***Mean*** | ***STD*** | ***P-value (t-test)*** |
| **Body Mass Index (kg/m2)** | **27.26** | **23.80** | **31.32** | **28.22** | **6.47** | **28.29** | **24.56** | **32.78** | **29.29** | **6.78** | **<.0001** |

**Table 3: Count and Percentage of Factors Among Asthma Response**

| ***Factor*** | | ***Diagnosed with Asthma***  ***(n=1606)*** | | ***Not Diagnosed with Asthma***  ***(n=8524)*** | |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | ***Count*** | ***Percent*** | ***Count*** | ***Percent*** | ***P-value*** |
| **Sex of Respondent** | **Male** | **640** | **40** | **4114** | **48** | **<.0001** |
|  | **Female** | **966** | **60** | **4410** | **52** | **.** |
| **Age (years)** | **18-29 years** | **161** | **10** | **747** | **9** | **0.0624** |
|  | **30-49 years** | **363** | **23** | **1842** | **22** | **.** |
|  | **50-69 years** | **593** | **37** | **3014** | **36** | **.** |
|  | **70 years and older** | **473** | **30** | **2757** | **33** | **.** |
|  | **Missing** | **16** | **.** | **164** | **.** | **.** |
| **Annual Income** | **Less than $25,000** | **256** | **20** | **1155** | **17** | **0.0355** |
|  | **$25,000 to <$50,000** | **393** | **30** | **1966** | **29** | **.** |
|  | **$50,000 and greater** | **646** | **50** | **3570** | **53** | **.** |
|  | **Missing** | **311** | **.** | **1833** | **.** | **.** |
| **Race/Ethnicity of Respondent** | **White and Non-Hispanic** | **1148** | **74** | **5828** | **71** | **0.0593** |
|  | **Black and Non-Hispanic** | **30** | **2** | **206** | **3** | **.** |
|  | **Other and Non-Hispanic** | **125** | **8** | **658** | **8** | **.** |
|  | **Hispanic** | **248** | **16** | **1505** | **18** | **.** |
|  | **Missing** | **55** | **.** | **327** | **.** | **.** |
| **BMI Category** | **<18.5 kg/m2** | **25** | **2** | **174** | **2** | **<.0001** |
|  | **18.5 to <25 kg/m2** | **382** | **26** | **2417** | **31** | **.** |
|  | **25 to <30 kg/m2** | **465** | **32** | **2772** | **36** | **.** |
|  | **>=30 kg/m2** | **590** | **40** | **2313** | **30** | **.** |
|  | **Missing** | **144** | **.** | **848** | **.** | **.** |
| **Binge Drinking Status** | **No** | **1241** | **87** | **6421** | **87** | **0.6201** |
|  | **Yes** | **179** | **13** | **967** | **13** | **.** |
|  | **Don't know/Refused/Missing** | **186** | **.** | **1136** | **.** | **.** |
| **Smoking Status** | **Smoked at least 100 cigarettes** | **692** | **47** | **3212** | **41** | **0.0002** |
|  | **Not smoked 100 cigarettes** | **796** | **53** | **4578** | **59** | **.** |
|  | **Missing** | **118** | **.** | **734** | **.** | **.** |

**Table 4: BMI Statistics by Asthma Diagnosis**

|  | ***Diagnosed with Asthma***  ***(n=1606)*** | | | | | ***Not Diagnosed with Asthma***  ***(n=8524)*** | | | | |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Factor*** | ***Median*** | ***P25*** | ***P75*** | ***Mean*** | ***STD*** | ***Median*** | ***P25*** | ***P75*** | ***Mean*** | ***STD*** | ***P-value (t-test)*** |
| **Body Mass Index (kg/m2)** | **28.24** | **24.63** | **33.28** | **29.66** | **7.48** | **27.12** | **23.74** | **31.01** | **27.95** | **6.22** | **<.0001** |

**Figure 1: Prevalence of respondents reporting asthma diagnosis by state of residence, 2022 Behavioral Risk Factor Surveillance System (BRFSS), Survey from Arizona and Oklahoma**



**Figure 2: Prevalence of respondents reporting asthma diagnosis by smoking group, 2022 Behavioral Risk Factor Surveillance System (BRFSS), Survey from Arizona**



**Figure 3: Prevalence of respondents reporting asthma by smoking status, stratified by annual income, 2022 Behavioral Risk Factor Surveillance System (BRFSS) Survey from Arizona**

