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The Association Between Chronic Diseases and Cigarettes' Smoking In Maine 2013-2017

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THE ASSOCIATION BETWEEN CHRONIC DISEASES AND CIGARETTE SMOKING IN MAINE, 2013-2017

BACKGROUND

Tobacco use and chronic disease have a well-established relationship. Tobacco has a direct causal link to cancer, heart disease, stroke, lung disease, and diabetes, among other chronic conditions (Centers for Disease Control and Prevention, 2020). The relationship between chronic diseases named in the Behavioral Risk Factor Surveillance System (BRFSS) and tobacco use calls for further analysis, but some studies have already defined the parameters of such relationships. In a recent meta-analysis, Rodrick et al. (2019) quantified the global prevalence of tobacco use in patients diagnosed with diabetes and found that 1 in 5 patients diagnosed with type 2 diabetes were tobacco users. Additionally, tobacco use exacerbates the negative impacts of asthma, with smokers experiencing more severe asthma symptoms and outcomes than non-smokers (Tiotiu et al., 2021). Tobacco use has also been found to increase the risk of 17 different cancers in human subjects (Alexandrov et al., 2016), although lifelong smokers have a lower risk of melanoma than non-smokers (Song et al. 2012).

Smoking causes metabolic issues that are linked to a variety of negative cardiovascular related outcomes (Chiolero et al., 2008). Smoking causes higher LDL cholesterol levels and lower HDL cholesterol levels, changes the texture of blood and increases its tendency to clot, and increases the amount of fat and cholesterol plaques in the bloodstream (Centers for Disease Control and Prevention, 2021a). Smoking causes an increased risk of developing hypertension or having a heart attack in smokers older than 35, suggesting that examination of smoking's long-term effects rather than earlier in life can be more telling (Gao, Shi, & Wang, 2017). In a similar vein, current smokers are less likely to be obese than those who have never smoked (Shimokata, Muller, & Andres, 1989), which is not surprising given that smoking increases metabolism. However, in a cross-sectional study of almost 500,000 participants in the U.K., Dare, Mackay, and Pell (2017) found that former smokers are more likely to be obese than current smokers or lifelong non-smokers, even after 30 years of smoking cessation for former smokers. Finally, smoking can have long-term effects on cardiovascular function in particularly debilitating ways. Current smokers are more likely to be at higher risk of stroke than former smokers, and for every five cigarettes smoked daily, one's risk of stroke increases by about 12% (Pan et al., 2019).

TOBACCO USE, DEMOGRAPHICS, AND THEIR RELATIONSHIP TO CHRONIC DISEASES

Tobacco use is a global habit. The Global Burden of Disease (2019) estimates that in 2019, over one billion people were current smokers with an estimated annual consumption of over seven billion cigarettes. Within this global phenomenon, there exist some disparities of usage and chronic disease outcomes among demographic groups. Adolescents are particularly affected by tobacco smoking. The Global Burden of Disease (2021) estimated that over 30% of tobacco products were consumed by adolescents globally. Adolescent regular smoking (equal to or greater than 300 cigarettes a year) is associated with new-onset asthma (Gilliland et al., 2006). Focusing on decreasing adolescent usage of tobacco is especially important for the prevention of future development of chronic disease; Sharapova et al. (2020) found that tobacco use onset at age 13 or younger is associated with daily and more recent tobacco use in older adolescents. Relatedly, lower levels of educational attainment are associated with a higher likelihood of being a smoker, smoking more heavily, and developing lung cancer (Centers for Disease Control and Prevention, 2019). Even

when controlling for socio-economic status, IQ, behavioral differences, and medical problems, people with lower than high school education levels are more likely to smoke, and smoke for longer periods of time in their lives (Gilman et al., 2008). Gilman et al. (2008) suggests that early and broader educationally based interventions are crucial to preventing or decreasing tobacco use over the lifespan.

There are also significant disparities in tobacco usage and outcomes between the male and female sexes. The Global Burden of Disease's (2021) findings suggest that tobacco use was the leading cause of death in males. In a 2019 meta-analysis, Pan et al. (2019), analyzed the relationship between smoking and stroke in 14 studies with more than 300,000 participants, and found that men had a higher risk of stroke than women. However, Peters et al. (2013) found an equivalent risk of stroke in women compared to men. More research is needed to determine the level of smoking disparities between men and women, as well as potential disparities in chronic disease outcomes between the two.

Within the United States, there are stark discrepancies between racial group in tobacco usage rates, as well as in outcomes. American Indians and Alaska Natives have the highest tobacco smoking use rate among all racial groups in the United States, even when excluding ceremonial or traditional use. Unfortunately, American Indians and Alaska Natives also experience negative chronic disease outcomes that are associated with tobacco use. Cardiovascular disease is the primary cause of death for American Indians and Alaska Natives, and lung cancer is the most common type of cancer within their demographic group (Centers for Disease Control and Prevention, 2021c).

Finally, socioeconomic status is related to smoking behaviors. In a meta-analysis, Stringhini et al. (2017) analyzed over 45 cohort studies with more than 1.75 million participants of varying socioeconomic status who were current smokers, measuring the onset of chronic diseases. Among other factors, Stringhini et al. found that low socioeconomic status reduced life expectancy by 2.1 years for people between 40-85 years. Additionally, Stringhini et al. suggest that approximately ¾ years of life were lost for obesity, a little less than four years were lost for diabetes, more than one and half years were lost for hypertension, and a little less than two and half years of life were lost for sedentary behaviors within the smoker population. These disparities suggest that a careful examination of tobacco use and chronic disease outcomes among demographic groups would be meaningful.

PURPOSE

This present study used BRFSS data in Maine to explore the relationship between tobacco use and chronic disease outcomes among demographic groups. Prevalence of current smoking was compared among a variety of demographic variables of interest. Much of the tobacco literature focuses on national data and urban populations, while the present study population is adult Maine residents, a primarily rural population. With these levels of analysis, this study aims to identify the social determinants of health and demographic factors that may predict current smoking behavior, as well as its association with chronic disease.

METHOD

In this study, we used the Maine Behavioral Risk Factor Surveillance System (BRFSS) from 2013 to 2017. We investigated which chronic diseases are associated with current smoking, while controlling for potential confounding factors including age, sex, ethnicity, race, education level, income level, current depression, veteran status, years the BRFSS was conducted, rurality, and insurance status. Rurality was determined based upon zip code. The following chronic diseases were examined: current diabetes, current asthma, history of

cancer diagnosis, any cardiovascular disease history and obesity. Obesity was determined by using BMI thresholds within the height and weight questionnaire. Data preparation and analysis were performed in SAS using procedures to account for the complex sample design (Cary, North Carolina). Descriptive statistics were first calculated in order to examine this distribution of the covariates, using 95% confidence intervals to examine the differences within demographic categories. In analyzing the association between chronic disease and current smoking, two models were used: unadjusted and adjusted. In the unadjusted model, logistic regression analysis was used to generate odds ratios, and significance between odds ratios was measured using a p-value of <0.05. In the adjusted model, forced entry logistic regression was used to generate odds ratios, and significance of the difference between odds ratios was measured using a p-value of <0.05. Data were weighted to adjust for non-response and to be more representative of the Maine adult population. In the results section, all percentages are weighted, while numerators and denominators are unweighted to provide a sense of the sample size. Weighted percentages should be used as they are generalizable to all Maine adults, while unweighted percentages would only be reflective of those who responded to the survey.

RESULTS

HOW IS CHRONIC DISEASE ASSOCIATED WITH CURRENT CIGARETTE SMOKING?

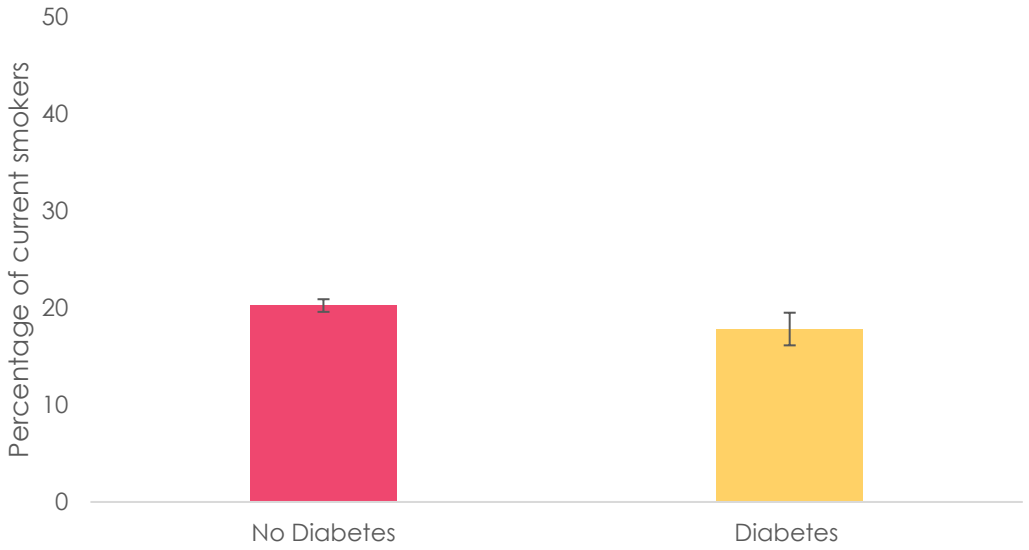
THE ASSOCIATION BETWEEN CURRENT DIABETES AND CURRENT SMOKING

Between 2013 and 2017, a total of 52,616 adults answered the diabetes question on the BRFSS. At the time, 7,952 reported being current smokers. Adults who did not report having a diabetes diagnosis (20.2%), were more likely to be current smokers compared to adults who did report a diabetes diagnosis (17.8%) (see Figure 10).

FIGURE 10: PREVALENCE OF CURRENT CIGARETTE SMOKING BY DIABETES DIAGNOSIS FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



Among 52,616 participants included in the logistic regression analysis, current diabetes diagnosis was associated with 15% lower odds of being current smokers (OR = 0.85 [95% CI: 0.76, 0.97], p = 0.0115). In other words, people who reported a diabetes diagnosis were less likely to be current smokers (Appendix A Figures 17 and 19, and Appendix B, Table 1). After adjustment for potential confounding variables including: age, sex, ethnicity, race, education level, income level, current depression, veteran status, years, rurality, and insurance

status, current diabetes diagnosis was associated with a 28% decrease in the odds of being a current smoker (OR = 0.72 [95% CI: 0.61, 0.85], p = < 0.0001) compared to participants with no current diabetes. In sum, after adjusting for potential confounding variables, the relationship between diabetes and current smoking became stronger (Appendix A Figures 18 and 19, and Appendix B Table 1).

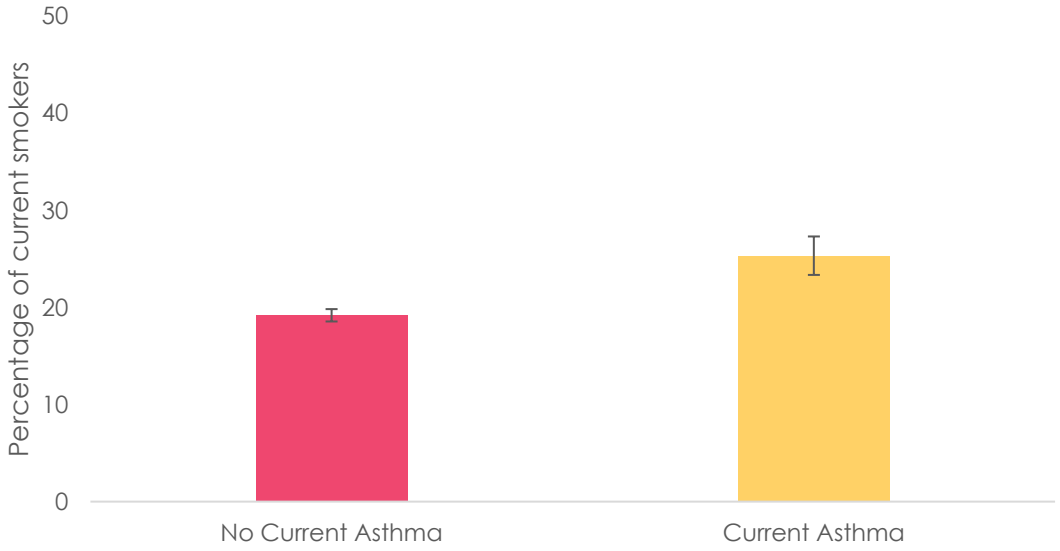
THE ASSOCIATION BETWEEN CURRENT ASTHMA AND CURRENT SMOKING

In this study, 52,376 adults responded to the current asthma question on the BRFSS between 2013 and 2017, and 7,912 adults reported being current smokers. The adults who reported an asthma diagnosis (25.3%), were more likely to be current smokers compared to adults who did not report a diagnosis of asthma (19.2%) (see Figure 11).

FIGURE 11: PREVALENCE OF CURRENT CIGARETTE SMOKING BY ASTHMA DIAGNOSIS FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



Among 52,376 participants included in the logistic regression analysis, current asthma diagnosis was associated with 43% higher odds of being a current smoker (OR = 1.43 [95% CI: 1.28, 1.60], p < 0.0001). This indicates that people who reported an asthma diagnosis were more likely to report being current smokers (Appendix A Figures 17 and 19, Appendix B Table 2). After adjustment for potential confounders such as age, sex, ethnicity, race, education level, income level, current depression, veteran status, years, rurality, and insurance status, there was no association between current asthma diagnosis and smoker status (OR = 1.0 [95% CI: 0.88, 1.16], p = 0.875) compared with participants with no current asthma diagnosis. In sum, after adjusting for potential confounding variables, the relationship between current asthma and current smoking was no longer present (Appendix A Figures 18 and 19).

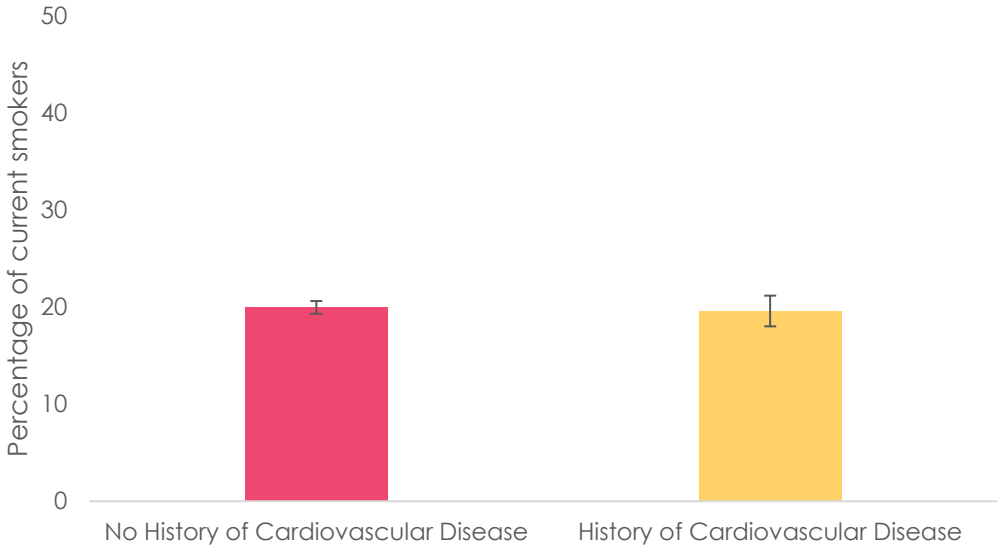
THE ASSOCIATION BETWEEN ANY HISTORY OF CARDIOVASCULAR DISEASE AND CURRENT SMOKING

Between 2013 and 2017, 52,070 Mainers responded to the cardiovascular disease or stroke questionnaire, and 7,847 reported being current smokers. There was no significant difference in current smoking between adults who reported having a history of heart disease or stroke (20.0%) and those who did not report a history of heart disease or stroke (19.6%) (see Figure 13).

FIGURE 13: PREVALENCE OF CURRENT CIGARETTE SMOKING BY ANY HISTORY OF CARDIOVASCULAR DISEASE FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



Among 52,070 participants included in the logistic regression analysis, there was no association between any history of cardiovascular disease and current smoking (OR = 0.98 [95% CI: 0.88, 1.09], p = 0.6759). In other words, there was no significant relationship between any history of cardiovascular disease and current smoking (Appendix A Figures 17 and 19, and Appendix B Table 3). After adjustment for demographic variables including age, sex, ethnicity, race, education level, income level, current depression, veteran status, years, rurality, and insurance status, there was no association between any cardiovascular disease history and current smoking (OR = 1.1 [95% CI: 0.98,1.35] p = 0.0608) compared with participants with no history of cardiovascular disease. In sum, after adjustment of confounding variables, there was no significant relationship between any history of cardiovascular disease and current smoking (Appendix A Figures 18 and 19, and Appendix B Table 3).

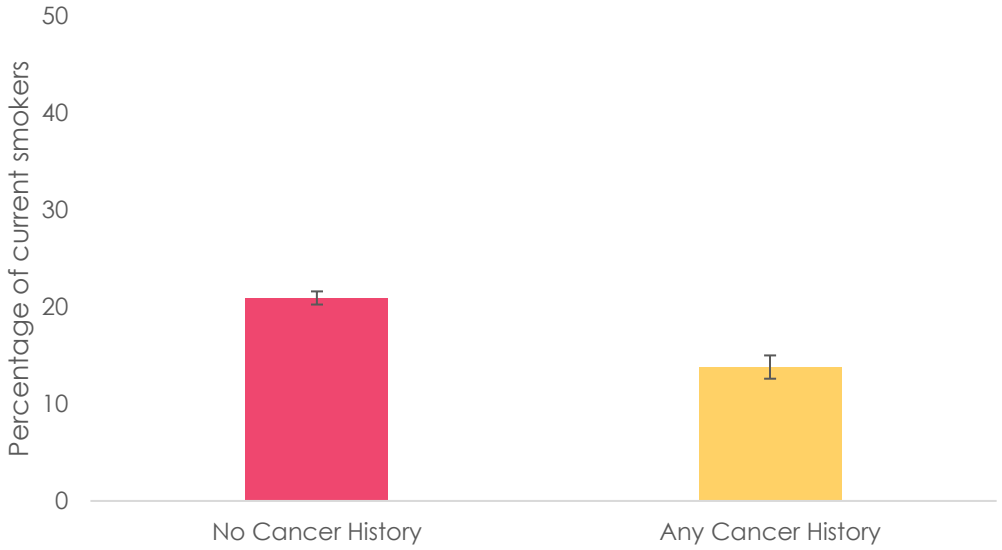
THE ASSOCIATION BETWEEN ANY CANCER HISTORY AND CURRENT SMOKING

Approximately 52,491 respondents answered cancer-related questions on the BRFSS, and 7,922 reported being current smokers. Adults who did not report a history of cancer (20.9%), were more likely to be a current smoker compared to adults who reported having a history of cancer (13.8%) (see Figure 12).

FIGURE 12: PREVALENCE OF CURRENT CIGARETTE SMOKING BY ANY CANCER HISTORY FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



Among 52,491 participants included in the logistic regression analysis, any cancer history was associated with 40% lower odds of being current smokers (OR = 0.61 [95% CI: 0.54, 0.68], p < 0.0001). In other words, people who reported having a history of any cancer were less likely to be current smokers (Appendix A Figures 17 and 19, and Appendix B Table 4). After adjustment for potential confounding variables including age, sex, ethnicity, race, education level, income level, current depression, veteran status, years, rurality, and insurance status, there was no association between any cancer history and current smoking (OR = 1.00 [95% CI: 0.86,1.16] p = 0.9956) compared with participants who did not report having any cancer history. In sum, after adjusting for potential confounding variables, there was no significant relationship between people who reported having a history of any cancer and being a current smoker (Appendix A Figures 18 and 19, and Appendix B Table 4).

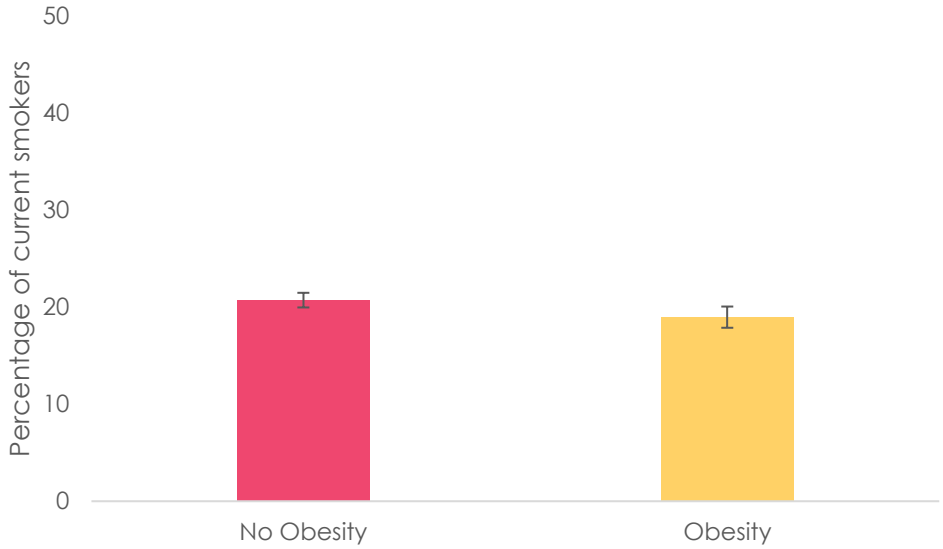
THE ASSOCIATION BETWEEN OBESITY AND CURRENT SMOKING

From 2013 to 2017, approximately 50,689 adults responded to the height and weight questions on the BRFSS, and 7,752 reported they were current smokers. There was no significant difference in current smoking between adults who had obesity (19.0%), and adults who did not have obesity (20.7%) (see Figure 14).

FIGURE 14: PREVALENCE OF CURRENT CIGARETTE SMOKING BY OBESITY FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



Among 50,689 participants included in the logistic regression analysis, obesity was associated with 10% lower odds of being a current smoker (OR = 0.90 [95% CI: 0.82, 0.98], p = 0.0109). This finding indicates that people experiencing obesity were less likely to be current smokers (Appendix A Figures 17 and 19, and Appendix B Table 5). After adjustment for potential confounding variables including age, sex, ethnicity, race, education level, income level, current depression, veteran status, years, rurality, and insurance status, obesity was associated with 34.3% lower odds of being current smokers (OR = 0.66 [95% CI: 0.59, 0.73], p < 0.0001). In other words, after adjusting for covariates, the relationship between obesity and current smoking was significantly stronger (Appendix A Figures 18 and 19, and Appendix B Table 5).

WHAT ARE THE CHARACTERISTICS OF CURRENT CIGARETTE SMOKERS?

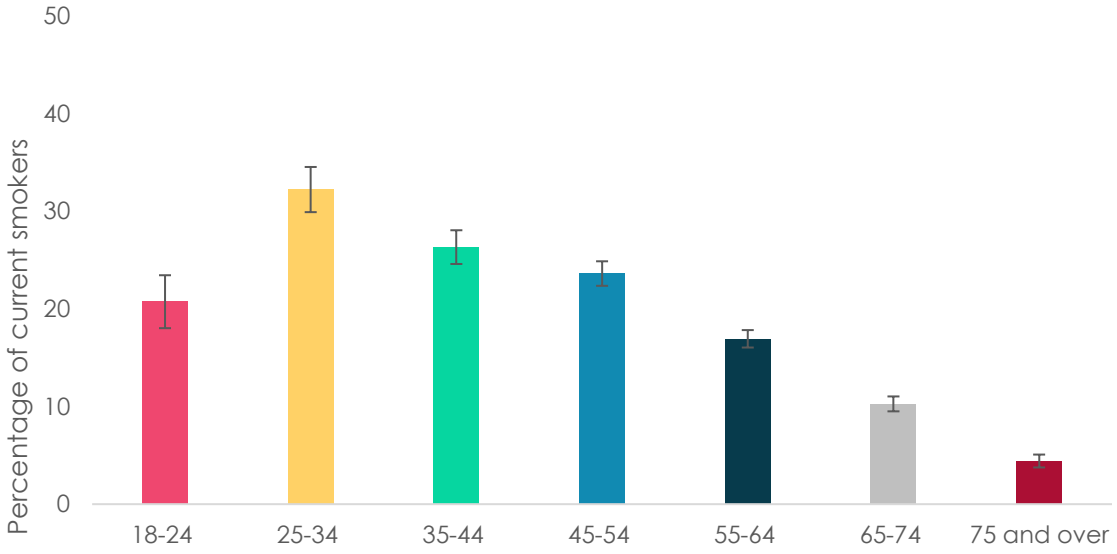
AGE

Between 2013 and 2017, 52,270 adults responded to the Behavioral Risk Factor Survey (BRFSS). Of the 52,270 respondents, 7,921 (15.2%) reported being a current smoker. It is most notable that adults who are 25-34 years old (32.2%) were more likely to be current smokers than any other age group. Further age distribution was as follows: adults between 18-24 years (20.7%) were less likely to be current smokers compared to adults between 25-34 (32.2%), and 35-44 years (26.3%). There was no statistical difference between adults 18-24 years old (20.7%), and adults 45-54 years old (23.6%). However, adults between 55-64 years (16.9%), 65-74 (10.3%), and 75+ years (4.4%) were all significantly less likely to be current smokers than adults aged 18-24, 25-34, 35-44, and 45-54 years (see Figure 1).

FIGURE 1: PREVALENCE OF CURRENT SMOKING BY AGE GROUP FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



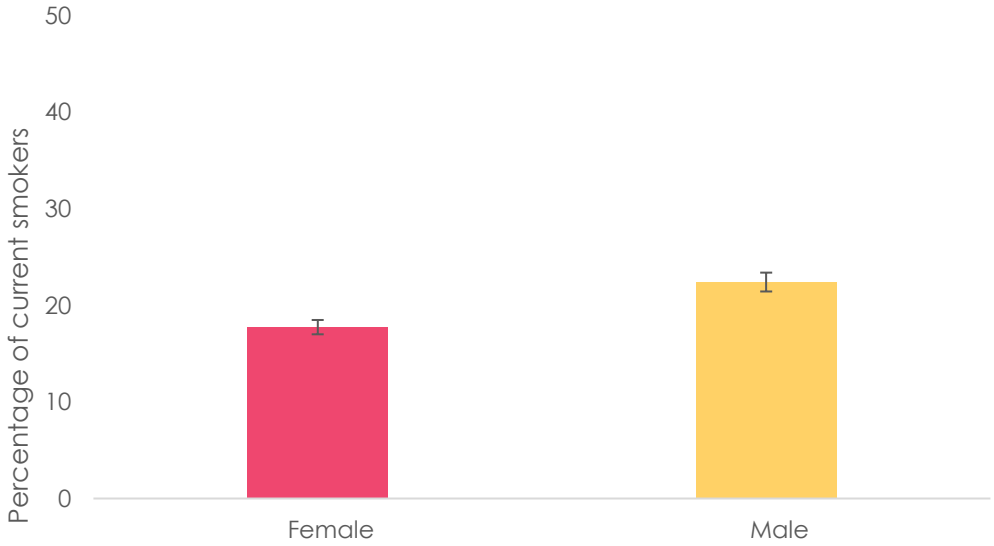
SEX

Between 2013 and 2017, 52,666 adults responded to the BRFSS and reported their sex on the survey. Of those adult respondents, 7,965 said they were a current smoker. Adults who reported their biological sex as male were significantly more likely to be current smokers (22.4%) than females (17.8%) (see Figure 2).

FIGURE 2: PREVALANCE OF CURRENT CIGARETTE SMOKING BY BIOLOGICAL SEX FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



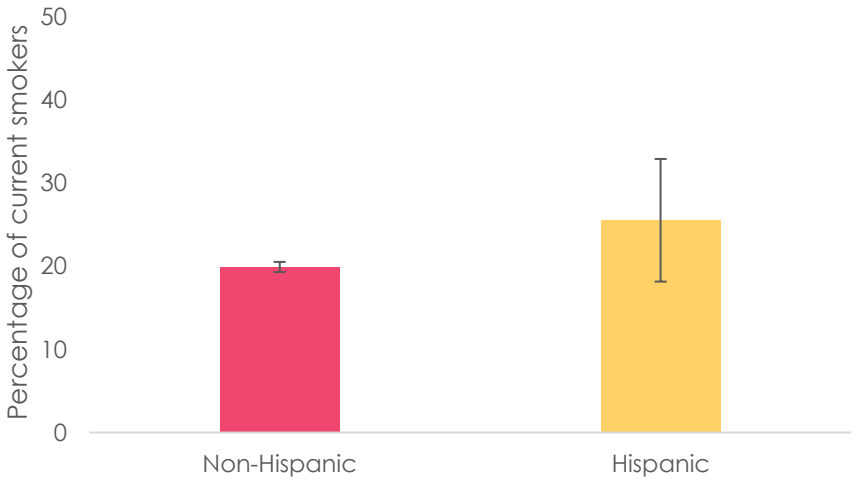
HISPANIC ETHNICITY

Between 2013 and 2017, 52,288 adults responded to the BRFSS and reported on Hispanic ethnicity. Of those adult respondents, 7,911 (15.1%) confirmed they were current smokers. While the prevalence of current smoking was higher among Hispanic Mainers (25.6%) than non-Hispanic Mainers (19.9%), this difference was not statistically significant (see Figure 3).

FIGURE 3: PREVALANCE OF CURRENT CIGARETTE SMOKING BY ETHNICITY FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



RACE

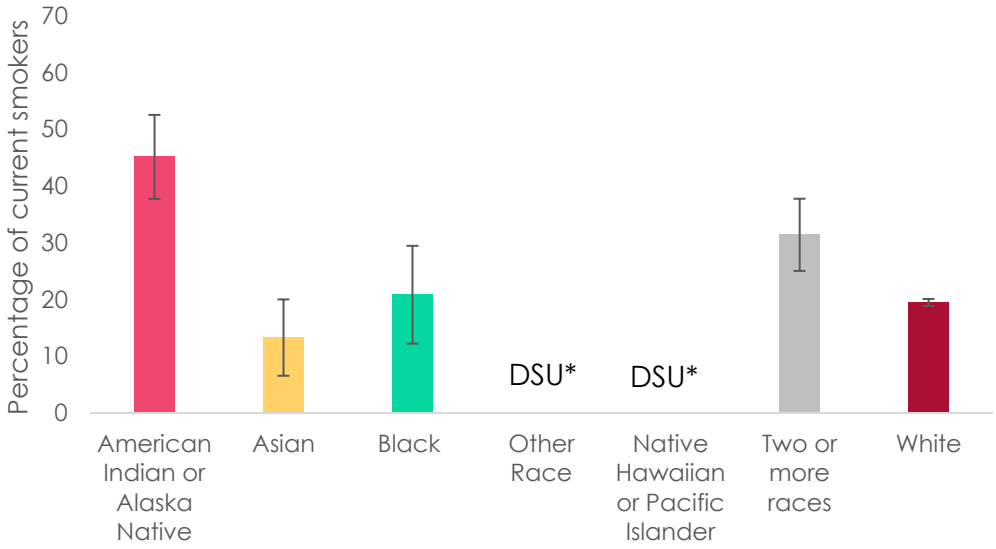
Between 2013 and 2017, 52,119 adults who responded to the BRFSS reported their racial identity. Of those adults, 7,882 reported being a current smoker. Results indicate those who identified as American Indian or Alaska Native (45.2%) were significantly more likely to be current smokers compared to all the other racial groups, including Asian (13.3%), Black (20.9%), two or more races (31.4%), and White (19.5%). Those who identified as other race and as Native Hawaiian or Pacific Islander were suppressed due to low representation. There were no significant differences in current smoking between adults who identified as Asian and adults who identified as Black. Asians were significantly less likely to be current smokers compared to adults who identified as two or more races and adults who identified as White (see Figure 4).

FIGURE 4: PREVALENCE OF CURRENT CIGARETTE SMOKING BY RACE FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

****DSU = Data statistically unreliable.***

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



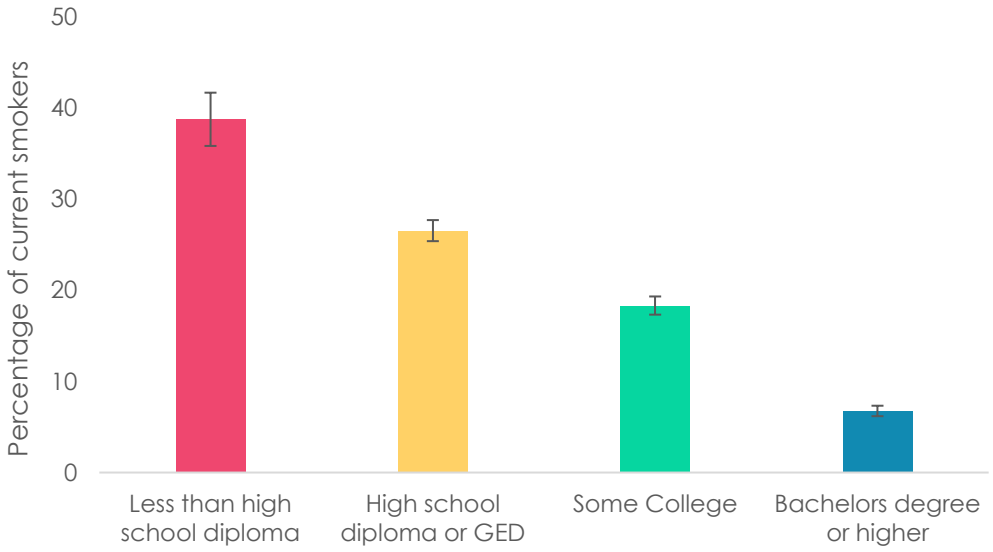
EDUCATION LEVEL

Between 2013 and 2017, 52,550 adults who responded identified their highest level of education. Of those respondents, 7951 adults reported being a current smoker. In this study, level of education and current smoking are significantly negatively correlated. Adults who reported having an educational level less than a high school diploma (38.7%) were significantly more likely to be current smokers compared to adults who reported having a high school diploma or GED (26.5%), some college (18.3%), or a bachelor's degree or higher (6.8%). Adults who reported having a high school diploma or GED were more likely to be current smokers compared to adults with some college or a bachelor's degree or higher. Adults who reported having some college education were more likely to be current smokers compared to those who reported having a bachelor's degree or higher (see Figure 5).

FIGURE 5: PREVALENCE OF CURRENT CIGARETTE SMOKING BY EDUCATION LEVEL FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



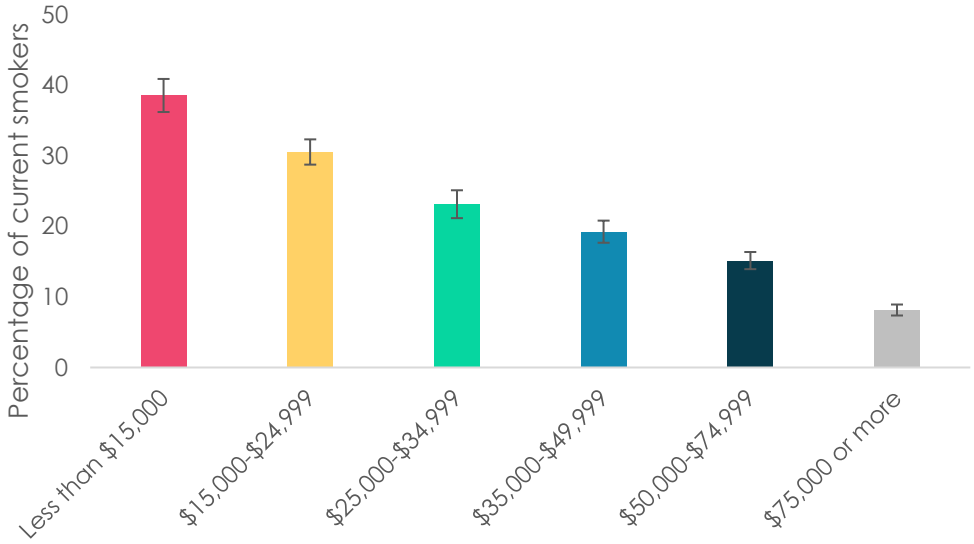
INCOME LEVEL

In this study, 47,693 adults reported their income. Of those respondents, 7,313 reported being a current smoker. Adults who reported an income less than $15,000 a year (38.5%) were significantly more likely to be current smokers than each of the other income levels (i.e., $15,000-24,999 (30.5%), $25,000-34,999 (23.1%), $35,000-49,999 (19.2%), $50,000-74,999 (15.1%), and $75,000 or more (8.1%)). Adults who reported an income of $15,000-24,999 were more likely to be a current smoker compared to adults who reported earning $25,000 or more; adults who reported earning $25,000-34,999 were significantly more likely to be current smokers compared to those earning $35,000 or more; adults who reported earning between $35,000-49,999 were significantly more likely to be current smokers compared to adults who earned $50,000 or more; and adults who earned $50,000-74,999 were significantly more likely to be current smokers compared to adults who earned $75,000 or more. Therefore, adults who earned $75,000 or more were significantly less likely to be current smokers than all other income categories (see Figure 6).

FIGURE 6: PREVALENCE OF CURRENT CIGARETTE SMOKING BY INCOME LEVEL FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



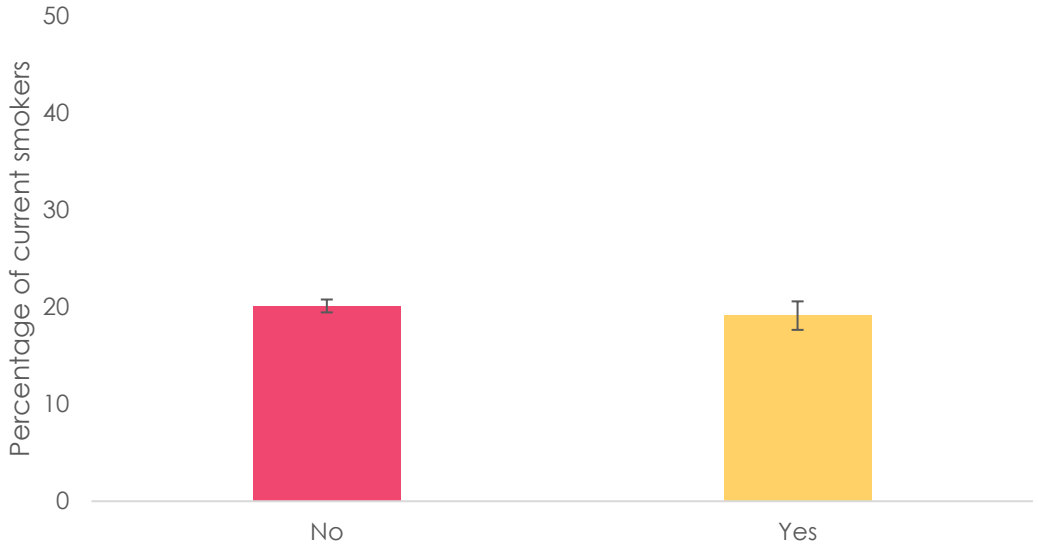
VETERAN STATUS

In this study, between 2013 and 2017, 52,622 adults responded and reported their veteran status. Of those adults, 7,950 reported being a current smoker. However, there was no significant difference in smoking status between adults who reported being a veteran (19.1%) or civilian (20.1%) (see Figure 7).

FIGURE 7: PREVALENCE OF CURRENT CIGARETTE SMOKING BY VETERAN STATUS FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



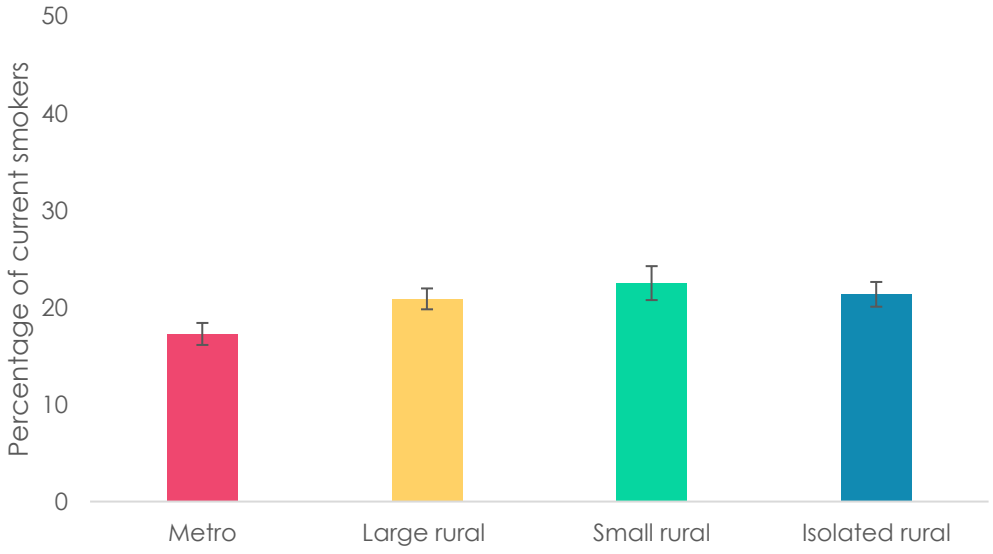
RURAL STATUS

From 2013 to 2017, 50,828 adults responded to the BRFSS question regarding rural status and 7,683 were current smokers. Those who lived in a metropolitan area (17.3%), were less likely to be current smokers compared to large rural (20.9%), small rural (22.5%), and isolated rural (21.4%) categories. There was no significant difference between large, small, and isolated rural categories (see Figure 15).

FIGURE 15: PREVALENCE OF CURRENT CIGARETTE SMOKING BY RURAL STATUS FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



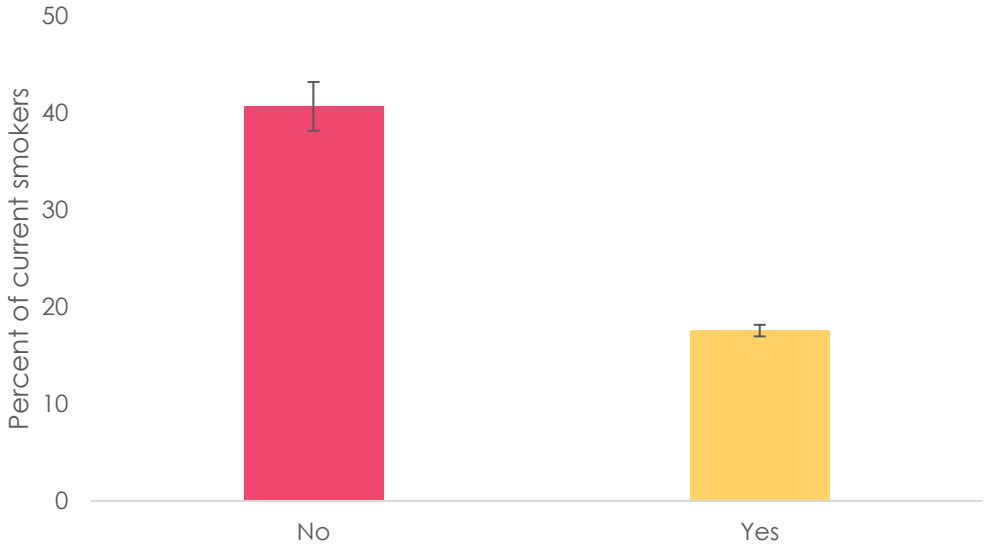
HEALTH INSURANCE STATUS

From 2013 to 2017, 52,545 adults responded to BRFSS questions regarding health insurance status and 7,947 were current smokers. Adults who reported not having insurance coverage (40.7%) were significantly more likely to be current smokers compared to adults who reported having insurance coverage (17.0%) (see Figure 16).

FIGURE 16: PREVALENCE OF CURRENT CIGARETTE SMOKING BY HEALTH INSURANCE STATUS FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



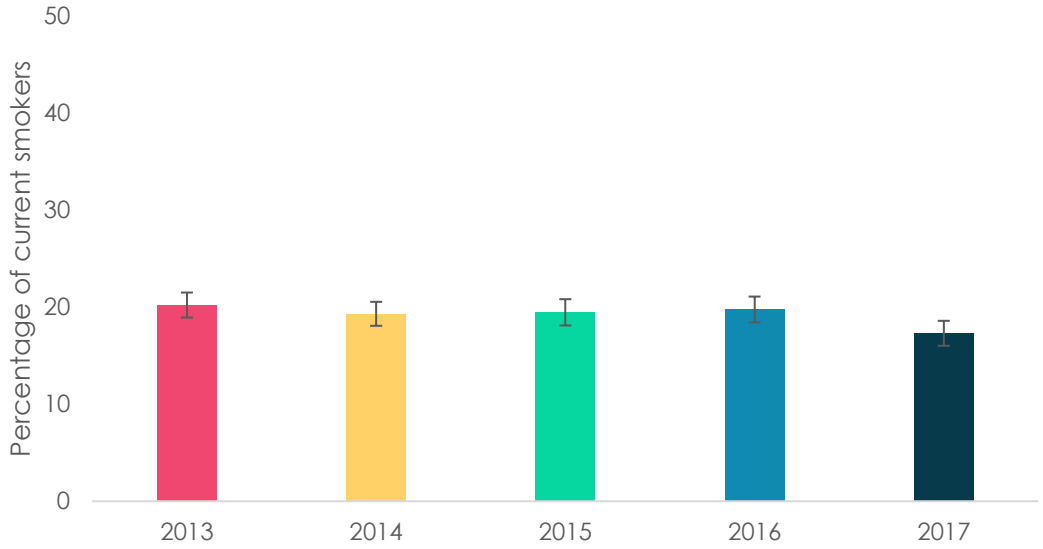
BRFSS STUDY YEARS

From 2013 to 2017, 44,696 adults responded to the BRFSS and 6,758 reported they were current smokers. Within this group of current smokers, there was no significant difference in current smoking between 2013 (20.2%), 2014 (19.3%), 2015 (19.5%), and 2016 (17.3%). Compared to 2013, significantly fewer adults reported being a current smoker only in 2017 (17.3%). However, no significant difference was observed when comparing 2017 to 2014, 2015, and 2016 (see Figure 8).

FIGURE 8: PREVALENCE OF CURRENT CIGARETTE SMOKING BY YEAR FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



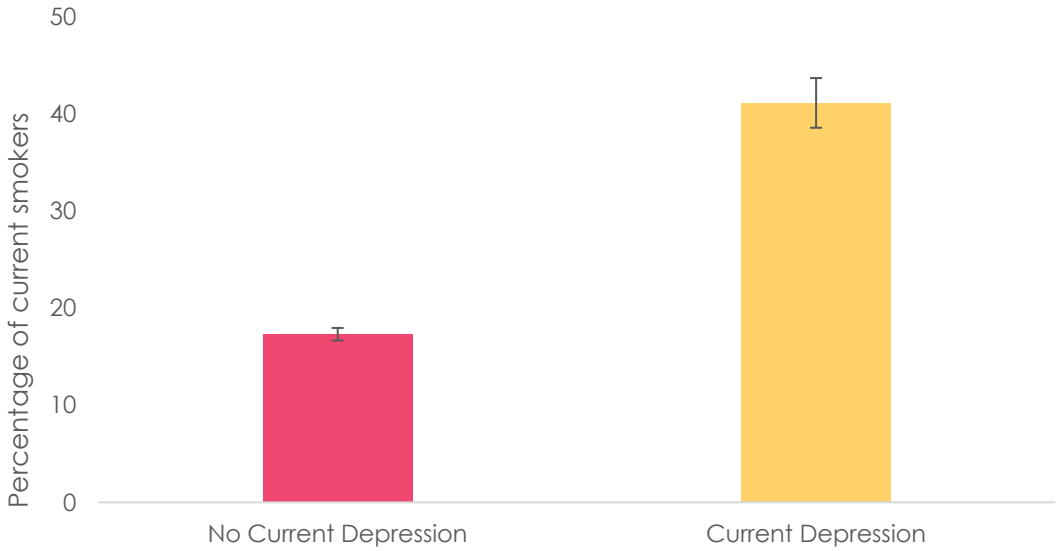
CURRENT DEPRESSION

From 2013 to 2017, 46,720 adults responded to the depression question in the BRFSS and 6,949 reported being current smokers. Adults who reported having a depression diagnosis (41.2%), were significantly more likely to be current smokers compared to adults who did not report a depression diagnosis (17.3%) (see Figure 9).

FIGURE 9: PREVALENCE OF CURRENT CIGARETTE SMOKING BY DEPRESSION STATUS FOR ADULTS 18 YEARS OR OLDER, MAINE, 2013-2017

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Data source: 2013-2017 Behavioral Risk Factor Surveillance System (BRFSS).



CONCLUSION & RECOMMENDATIONS

This study shows that there is a complex relationship between chronic disease and current smoking in Maine. Some major patterns of interest emerged in this study, including that those with current diabetes are less likely to be current smokers, especially after adjusting for the covariates of interest. Those with obesity are less likely to be current smokers as well, and that difference is more marked after adjusting for the covariates of interest. Those with current asthma are more likely to be current smokers, but this was no longer significant in the adjusted model. Those with cancer history are less likely to be current smokers, but this pattern did not emerge in the adjusted model. Finally, there was no association between a history of cardiovascular disease and current smoking.

One major recommendation to further explore the results from this study is to establish temporal precedence in the study design. Temporal precedence is necessary to show which variables occurred first in time, and would allow researchers to establish causation, which is crucial to prevention planning efforts. It could be particularly useful to conduct a longitudinal study and measure the development (or lack thereof) of chronic disease and/or smoking in participants over time. Finally, one could improve upon the results of the present study by using a different regression function to measure significance. It could be particularly powerful to use relative risk instead of odds ratios since odds ratios tend to overestimate associations.

LIMITATIONS

One major limitation in this study is that it is cross-sectional, so there is no way to establish temporal precedence, or determine which conditions occurred first in time. Following participants over time in a longitudinal design would allow researchers to determine if smoking or chronic disease occurred first. Another limitation is that the study design relies on self-reported data, so individuals may either misremember and/or misreport data for reasons of social desirability or other motivations. It is also likely the way the BRFSS is conducted results in both self-selection bias and recruitment bias; since data collection relies on those who complete the entirety of the survey over the phone, it is likely not representative of the entire population of any given state. Data were weighted to adjust for non-response and to be more representative of the Maine adult population. Finally, this study is subject to selection bias, as it only samples those who were currently living at the time of the study, were not institutionalized, and were able to communicate over the phone. Since chronic disease is the exposure of interest, it is likely some members of the general population may have passed away or be living in institutional settings due to chronic diseases (which may have been caused by smoking) and thus not accounted for in this study.

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APPENDIX A

FIGURE 17: THE UNADJUSTED ASSOCIATION BETWEEN CHRONIC DISEASE EXPOSURE AND CURRENT SMOKING AMONG PARTICIPANTS IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY, 2013-2017

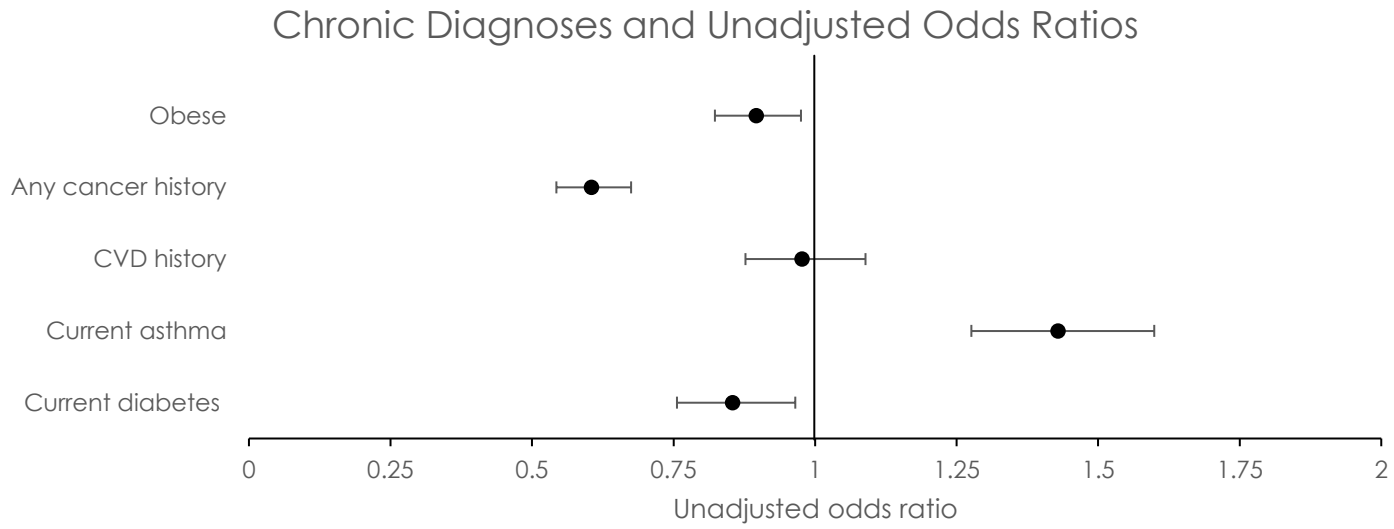


FIGURE 18: THE ADJUSTED ASSOCIATION BETWEEN CHRONIC DISEASE EXPOSURE AND CURRENT SMOKING AMONG PARTICIPANTS IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY, 2013-2017

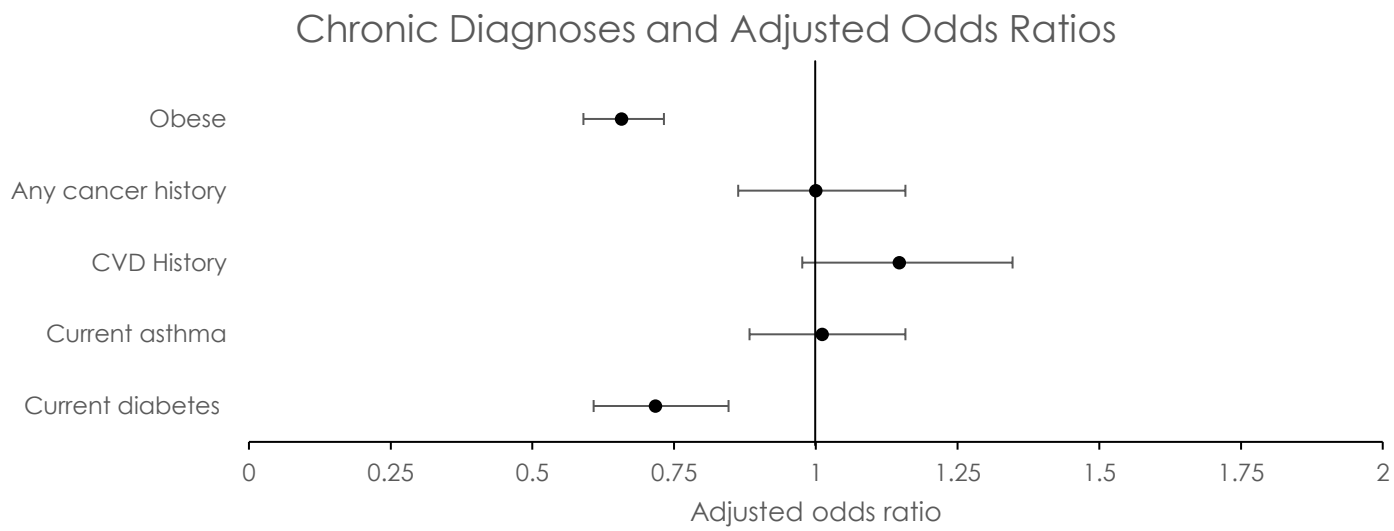
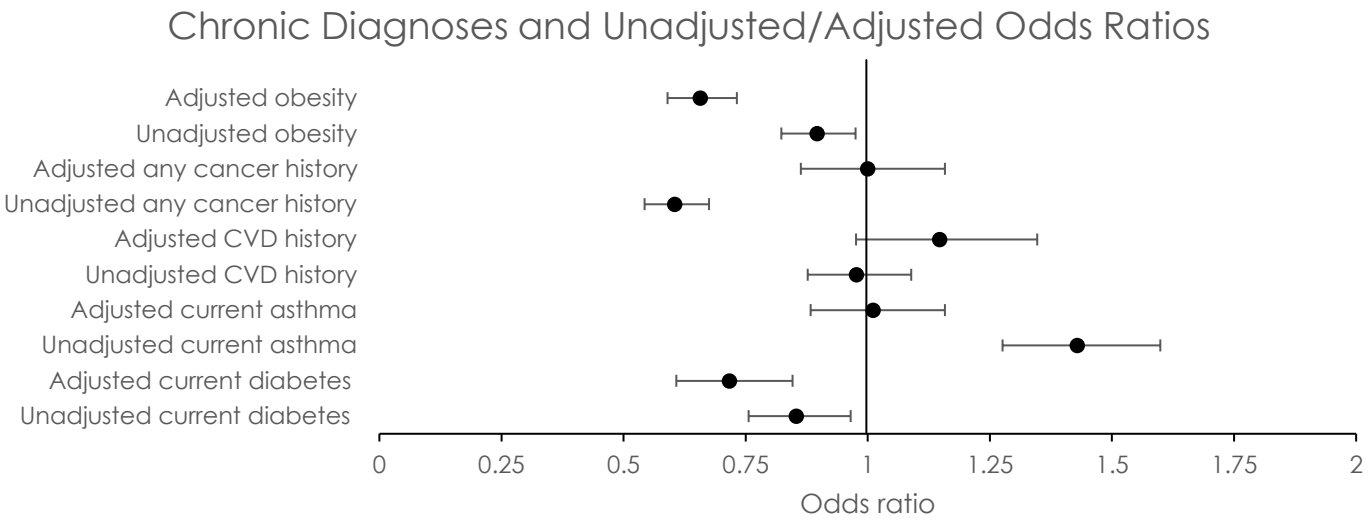


FIGURE 19: COMPARING ADJUSTED AND UNADJUSTED ASSOCIATION BETWEEN CHRONIC DISEASE EXPOSURE AND CURRENT SMOKING AMONG PARTICIPANTS IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY, 2013-2017



APPENDIX B

TABLE 1: THE ASSOCIATION BETWEEN CURRENT DIABETES AND CURRENT SMOKING AMONG 52,616 PARTICIPANTS IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY, 2013-2017

			95% Confidence Interval		
	Predictor	Odds Ratio	Lower Limit	Upper Limit	p-value
Model 1	Current Diabetes (N = 52,616)				
	No current diabetes	Reference			
	Current diabetes	0.85	0.76	0.97	0.0115
Model 2	Current Diabetes				
	No current diabetes	Reference			
	Current diabetes	0.72	0.61	0.85	<0.0001
	Age, in years				
	18-24 years	Reference			
	25-34 years	2.2	1.75	2.80	<0.0001
	35-44 years	2.1	1.67	2.66	<0.0001
	45-54 years	1.7	1.35	2.13	<0.0001
	55-64 years	1.0	0.84	1.31	0.6892
	65-74 years	0.5	0.42	0.67	<0.0001
	75 years and over	0.2	0.12	0.23	<0.0001
	Sex				
	Female	Reference			
	Male	1.1	1.03	1.25	0.0150
	Ethnicity				
	Non-Hispanic	Reference			
	Hispanic	0.8	0.51	1.35	0.4513
	Race				
	White	Reference			
	American Indian or Alaska Native	1.7	1.22	2.37	0.0019
	Asian	0.8	0.43	1.64	0.5986
	Black	0.6	0.30	1.25	0.1789
	Other Race	1.3	0.12	15.35	0.8170
	Native Hawaiian or Pacific Islander	0.4	0.07	2.63	0.3532
	Two or more races	1.2	0.86	1.68	0.2856
	Education level				
	Less than high school diploma	Reference			
	High school diploma or GED	0.5	0.43	0.61	<0.0001
	Some College	0.4	0.31	0.44	<0.0001

Bachelor's degree or higher	0.2	0.12	0.18	<0.0001
Income level				
Less than $15,000	Reference			
$15,000-$24,999	0.9	0.76	1.04	0.1358
$25,000-$34,999	0.7	0.55	0.78	<0.0001
$35,000-$49,999	0.6	0.47	0.66	<0.0001
$50,000-$74,999	0.5	0.39	0.56	<0.0001
$75,000 or more	0.3	0.22	0.33	<0.0001
Current Depression				
No Current Depression	Reference			
Current Depression	2.0	1.75	2.34	<0.0001
Veteran Status				
No	Reference			
Yes	1.3	1.16	1.55	<0.0001
Years				
2013	Reference			
2014	1.0	0.85	1.11	0.6833
2015	1.0	0.83	1.16	0.7936
2016	1.1	1.00	1.32	0.0587
2017	1.0	0.84	1.12	0.6523
Rural Status				
Metro	Reference			
Large rural	1.2	1.07	1.39	0.0022
Small rural	1.2	1.03	1.39	0.0181
Isolated rural	1.1	0.95	1.24	0.2324
Insurance Status				
No	Reference			
Yes	0.6	0.52	0.69	<0.0001

Global Null Hypothesis Likelihood Ratio p = <0.0001.

Type 3 Analysis of Effects for diabetes (p = <0.0001), age (p = <0.0001), sex (p = 0.0150), ethnicity (p = 0.4513), race (p = 0.0313), educational level (p = <0.0001), income level (p = <0.0001), current depression (p = <0.0001), veteran status (p = <0.0001), year (p = 0.1141), rural status (p = 0.0099), and insurance status (p = <0.0001).

TABLE 2: THE ASSOCIATION BETWEEN CURRENT ASTHMA AND CURRENT SMOKING AMONG 52,376 PARTICIPANTS IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY, 2013-17.

			95% Confidence Interval		
	Predictor	Odds Ratio	Lower Limit	Upper Limit	p-value
Model 1	Current Asthma (N= 52,376)				
	No current asthma	Reference			
	Current asthma	1.43	1.276	1.599	<0.0001
Model 2	Current Asthma				
	No current asthma	Reference			
	Current asthma	1.01	0.883	1.158	0.8750
	Age, in years				
	18-24 years	Reference			
	25-34 years	2.3	1.79	2.86	<0.0001
	35-44 years	2.1	1.68	2.67	<0.0001
	45-54 years	1.7	1.34	2.11	<0.0001
	55-64 years	1.0	0.82	1.27	0.8707
	65-74 years	0.5	0.40	0.64	<0.0001
	75 years and over	0.2	0.12	0.22	<0.0001
	Sex				
	Female	Reference			
	Male	1.1	1.02	1.25	0.0170
	Ethnicity				
	Non-Hispanic	Reference			
	Hispanic	0.8	0.52	1.38	0.4999
	Race				
	White	Reference			
	American Indian or Alaska Native	1.7	1.17	2.32	0.0042
	Asian	0.8	0.43	1.65	0.6220
	Black	0.5	0.24	0.93	0.0289
	Other Race	1.3	0.11	14.56	0.3315
	Native Hawaiian or Pacific Islander	0.4	0.07	2.50	0.8569
	Two or more races	1.2	0.85	1.64	0.3213
	Education level				
	Less than high school diploma	Reference			
	High school diploma or GED	0.5	0.43	0.62	<0.0001
	Some College	0.4	0.31	0.45	<0.0001
	Bachelor's degree or higher	0.2	0.13	0.19	<0.0001
	Income level				
	Less than $15,000	Reference			

$15,000-$24,999	0.9	0.75	1.03	0.1116
$25,000-$34,999	0.7	0.55	0.78	<0.0001
$35,000-$49,999	0.5	0.45	0.64	<0.0001
$50,000-$74,999	0.5	0.39	0.56	<0.0001
$75,000 or more	0.3	0.22	0.33	<0.0001
Current Depression				
No Current Depression	Reference			
Current Depression	1.9	1.67	2.22	<0.0001
Veteran Status				
No	Reference			
Yes	1.3	1.16	1.55	<0.0001
Years				
2013	Reference			
2014	1.0	0.84	1.10	0.5603
2015	1.0	0.82	1.14	0.6836
2016	1.1	0.99	1.31	0.0682
2017	0.9	0.82	1.10	0.4801
Rural Status				
Metro	Reference			
Large rural	1.2	1.08	1.39	0.0017
Small rural	1.2	1.05	1.41	0.0114
Isolated rural	1.1	0.96	1.26	0.1836
Insurance Status				
No	Reference			
Yes	0.6	0.52	0.69	<0.0001

Global Null Hypothesis Likelihood Ratio p = <0.0001.

Type 3 Analysis of Effects for current asthma (p = 0.0875), age (p = <0.0001), sex (p = 0.0170), ethnicity (p = 0.4999), race (p = 0.0185), educational level (p = <0.0001), income level (p = <0.0001), current depression (p = <0.0001), veteran status (p = <0.0001), year (p = 0.0807), rural status (p = 0.0074), and insurance status (p = <0.0001).

TABLE 3: THE ASSOCIATION BETWEEN ANY HISTORY OF CARDIOVASCULAR DISEASE AND CURRENT SMOKING AMONG 52,070 PARTICIPANTS IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY, 2013-17.

			95% Confidence Interval		
	Predictor	Odds Ratio	Lower Limit	Upper Limit	p-value
Model 1	Any CVD History (N=52,070)				
	No CVD History	Reference			
	CVD History	1.0	0.88	1.09	0.6759
Model 2	Any CVD History				
	No CVD History	Reference			
	CVD History	1.1	0.98	1.35	0.0608
	Age, in years				
	18-24 years	Reference			
	25-34 years	2.2	1.72	2.74	<.0001
	35-44 years	2.0	1.62	2.57	<.0001
	45-54 years	1.6	1.27	2.00	<.0001
	55-64 years	1.0	0.77	1.20	0.7296
	65-74 years	0.5	0.38	0.60	<.0001
	75 years and over	0.1	0.11	0.20	<.0001
	Sex				
	Female	Reference			
	Male	1.1	1.02	1.24	0.0245
	Ethnicity				
	Non-Hispanic	Reference			
	Hispanic	0.8	0.49	1.32	0.3796
	Race				
	White	Reference			
	American Indian or Alaska Native	1.7	1.18	2.36	0.0035
	Asian	0.9	0.44	1.66	0.6401
	Black	0.6	0.31	1.25	0.1806
	Other Race	1.3	0.11	14.62	0.8575
	Native Hawaiian or Pacific Islander	0.4	0.07	2.46	0.3234
	Two or more races	1.2	0.84	1.63	0.3673
	Education level				
	Less than high school diploma	Reference			
	High school diploma or GED	0.5	0.40	0.60	<.0001
	Some College	0.4	0.29	0.44	<.0001
	Bachelor's degree or higher	0.1	0.12	0.19	<.0001
	Income level				

Less than $15,000	Reference			
$15,000-$24,999	0.9	0.76	1.05	0.1816
$25,000-$34,999	0.7	0.55	0.79	<.0001
$35,000-$49,999	0.6	0.48	0.68	<.0001
$50,000-$74,999	0.5	0.40	0.58	<.0001
$75,000 or more	0.3	0.23	0.34	<.0001
Current Depression				
No Current Depression	Reference			
Current Depression	1.9	1.68	2.26	<.0001
Veteran Status				
No	Reference			
Yes	1.3	1.16	1.55	0.0001
Years				
2013	Reference			
2014	1.0	0.86	1.12	0.7810
2015	1.0	0.82	1.15	0.7489
2016	1.1	0.99	1.32	0.0651
2017	1.0	0.83	1.11	0.6164
Rural Status				
Metro	Reference			
Large rural	1.2	1.07	1.39	0.0023
Small rural	1.2	1.04	1.41	0.0135
Isolated rural	1.1	0.95	1.25	0.2057
Insurance Status				
No	Reference			
Yes	0.6	0.54	0.73	<.0001

Global Null Hypothesis Likelihood Ratio p = <0.0001.

Type 3 Analysis of Effects for any CVD (p = 0.0968), age (p =<0.0001), sex (p = 0.0245), ethnicity (p = 0.3796), race (p = 0.0532), educational level (p <0.0001), income level (p = <0.0001), current depression (p = <0.0001), veteran status (p = 0.0001), year (p = 0.1309), rural status (p = 0.0099), and insurance status (p = <0.0001).

TABLE 4: THE ASSOCIATION BETWEEN ANY CANCER HISTORY AND CURRENT SMOKING AMONG 52,491 PARTICIPANTS IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY, 2013-17.

			95% Confidence Interval		
	Predictor	Odds Ratio	Lower Limit	Upper Limit	p-value
Model 1	Any Cancer History (N = 52,491)				
	No cancer history	Reference			
	Any cancer history	0.6	0.54	0.68	<0.0001
Model 2	Any Cancer History				
	No cancer history	Reference			
	Any cancer history	1.0	0.86	1.16	0.9956
	Age, in years				
	18-24 years	Reference			
	25-34 years	2.2	1.72	2.75	<0.0001
	35-44 years	2.1	1.63	2.59	<0.0001
	45-54 years	1.6	1.29	2.03	<0.0001
	55-64 years	1.0	0.79	1.23	0.89
	65-74 years	0.5	0.39	0.62	<0.0001
	75 years and over	0.2	0.12	0.22	<0.0001
	Sex				
	Female	Reference			
	Male	1.1	1.02	1.25	0.0188
	Ethnicity				
	Non-Hispanic	Reference			
	Hispanic	0.8	0.507	1.341	0.4376
	Race				
	White	Reference			
	American Indian or Alaska Native	1.7	1.17	2.33	0.0041
	Asian	0.8	0.43	1.64	0.6162
	Black	0.6	0.31	1.25	0.1846
	Other Race	1.3	0.11	14.53	0.0857
	Native Hawaiian or Pacific Islander	0.4	0.07	2.49	0.3274
	Two or more races	1.2	0.85	1.66	0.3073
	Education level				
	Less than high school diploma	Reference			
	High school diploma or GED	0.5	0.43	0.61	<0.0001
	Some College	0.4	0.30	0.44	<0.0001
	Bachelor's degree or higher	0.2	0.12	0.19	<0.0001
	Income level				
	Less than $15,000	Reference			

$15,000-$24,999	0.9	0.76	1.05	0.1574
$25,000-$34,999	0.7	0.55	0.79	<0.0001
$35,000-$49,999	0.6	0.48	0.67	<0.0001
$50,000-$74,999	0.5	0.40	0.57	<0.0001
$75,000 or more	0.3	0.23	0.33	<0.0001
Current Depression				
No Current Depression	Reference			
Current Depression	2.0	1.72	2.29	<0.0001
Veteran Status				
No	Reference			
Yes	1.3	1.157	1.55	<0.0001
Years				
2013	Reference			
2014	1.0	0.85	1.11	0.6312
2015	1.0	0.82	1.15	0.7561
2016	1.1	0.99	1.32	0.0643
2017	1.0	0.83	1.11	0.5832
Rural Status				
Metro	Reference			
Large rural	1.222	1.076	1.388	0.002
Small rural	1.208	1.039	1.403	0.0137
Isolated rural	1.081	0.944	1.238	0.2599
Insurance Status				
No	Reference			
Yes	0.598	0.519	0.688	<0.0001

Global Null Hypothesis Likelihood Ratio p = <0.0001.

Type 3 Analysis of Effects for any cancer history (p = 0.9956), age (p= <0.0001), sex (p = 0.0188), ethnicity (p = 0.4376), race (p = 0.0544), educational level (p = <0.0001), income level (p = <0.0001), current depression (p = <0.0001), veteran status (p = <0.0001), year (p = 0.1044), rural status (p = 0.0073), and insurance status (p = <0.0001).

TABLE 5: THE ASSOCIATION BETWEEN OBESITY AND CURRENT SMOKING AMONG 50,689 PARTICIPANTS IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY, 2013-17.

	Predictor	Odds Ratio	Lower Limit	Upper Limit	p-value
Model 1	Obesity (N=50,689)				
	No Obesity	Reference			
	Obesity	0.90	0.82	0.98	0.0109
Model 2	Obesity				
	No Obesity	Reference			
	Obesity	0.66	0.59	0.73	<0.0001
	Age, in years				
	18-24 years	Reference			
	25-34 years	2.3	1.84	2.97	<0.0001
	35-44 years	2.2	1.75	2.80	<0.0001
	45-54 years	1.8	1.40	2.22	<0.0001
	55-64 years	1.1	0.85	1.33	0.5968
	65-74 years	0.5	0.41	0.66	<0.0001
	76 years and over	0.2	0.11	0.21	<0.0001
	Sex				
	Female	Reference			
	Male	1.1	0.99	1.21	0.0895
	Ethnicity				
	Non-Hispanic	Reference			
	Hispanic	0.9	0.54	1.47	0.6395
	Race				
	White	Reference			
	American Indian or Alaska Native	1.7	1.20	2.38	0.0026
	Asian	0.8	0.40	1.59	0.5143
	Black	0.5	0.24	1.00	0.0483
	Other Race	1.3	0.11	15.51	0.8408
	Native Hawaiian or Pacific Islander	0.4	0.06	2.33	0.2846
	Two or more races	1.1	0.82	1.61	0.4148
	Education level				
	Less than high school diploma	Reference			
	High school diploma or GED	0.5	0.44	0.63	<0.0001
	Some College	0.4	0.31	0.46	<0.0001
	Bachelor's degree or higher	0.2	0.12	0.19	<0.0001
	Income level				
	Less than $15,000	Reference			
	$15,000-$24,999	0.9	0.76	1.05	0.1733

$25,000-$34,999	0.7	0.55	0.78	<0.0001
$35,000-$49,999	0.5	0.45	0.64	<0.0001
$50,000-$74,999	0.5	0.38	0.54	<0.0001
$75,000 or more	0.3	0.21	0.31	<0.0001
Current Depression				
No Current Depression	Reference			
Current Depression	2.0	1.71	2.28	<0.0001
Veteran Status				
No	Reference			
Yes	1.4	1.17	1.57	<0.0001
Years				
2013	Reference			
2014	1.0	0.86	1.13	0.8524
2015	1.0	0.82	1.14	0.6865
2016	1.2	1.02	1.35	0.0284
2017	1.0	0.83	1.11	0.5486
Rural Status				
Metro	Reference			
Large rural	1.2	1.07	1.39	0.0029
Small rural	1.2	1.04	1.41	0.0136
Isolated rural	1.1	0.96	1.26	0.1856
Insurance Status				
No	Reference			
Yes	0.6	0.53	0.71	<0.0001

Global Null Hypothesis Likelihood Ratio p = <0.0001.

Type 3 Analysis of Effects for obese (p = <0.0001), age (p = <0.0001), sex (p = 0.0895), ethnicity (p = 0.0395), race (p = 0.0180), educational level (p = <0.0001), income level (p = <0.0001), current depression (p = <0.0001), veteran status (p = <0.0001), year (p = 0.0453), rural status (p = 0.0127), and insurance status (p = <0.0001).