2019

Updated: The Burden of Tobacco in Alabama

Prepared for the Alabama Department of Public Health

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Executive Summary

Tobacco use affects the economic well-being of the state of Alabama and the health of its citizens. Key findings of *Updated: The Burden of Tobacco in Alabama, 2019* are featured below and, unless noted otherwise, the tobacco use, health impact, and economic impact findings refer to 2016 annual estimates while the years of potential life lost findings refer to 2014 annual estimates.

Tobacco Use

- 21.5 percent of adults in Alabama are current cigarette smokers.
  - 23.3 percent of males smoke
  - 20.0 percent of females smoke
- Alabama has the 8th highest adult smoking prevalence rate in the nation.
- 10.1 percent of mothers reported smoking during pregnancy.
- From 1996 to 2016 adult smoking prevalence fell on average only 0.2 percent per year.
- 10.9 percent of high school students are current smokers.

Health Impact of Tobacco

- 8,823 deaths in Alabama were attributable to smoking-related causes.
  - 5,290 deaths due to cardiovascular disease
  - 1,703 deaths due to cancer
  - 1,433 deaths due to respiratory disease
  - 397 deaths due to diabetes
  - 950 deaths due to indirect tobacco-related causes (secondhand smoke, smoking-related fires, prenatal deaths)
- 144,864 years of potential life were lost due to smoking-attributable premature death.
- 16.4 years of life were lost, on average, among Alabama adults who died as a result of a smoking-attributable illness.

Economic Impact of Tobacco

- $5.16 billion in excess personal medical care expenditures were attributable to smoking.
- $887.9 million in productivity losses were estimated as a result of smoking-attributable premature death.
- $1.33 billion in productivity losses were estimated as a result of smoking-attributable illnesses.
- $187.5 million in economic costs were attributed to personal medical costs and productivity losses associated with secondhand smoke.
- $7.6 billion in economic costs was the estimated total annual economic impact of smoking in Alabama.

Introduction

The previous version of *The Burden of Tobacco in Alabama* (Fosson & McCallum, 2011), reported that 22.6 percent of Alabama adults were current smokers, as well as a substantial proportion of middle and high school students. The tobacco prevalence rate for high school males was nearly equal to that of adults at 22.2 percent. That report included the unfortunate statistics that 8,685 deaths in Alabama in 2010 were likely attributable to tobacco use and that Alabama was 47th among the 50 states in tobacco excise tax rates (a metric known to affect prevalence rates, particularly among youth), even while smoking-attributable illness, death, and lost productivity were costing the state approximately $5.6 billion a year. At that time, these numbers indicated that tobacco use was responsible for 18 percent of all adult deaths in the state and the economic costs were equivalent to over 20 percent of the state's entire budget (State of Alabama Legislative Fiscal Office, 2010).

Data contained in the current report indicate that, although tobacco use indicators are improving nationwide, the situation in Alabama has changed little in most cases. Tobacco-attributable illness still claims 17 percent of the lives lost in the state, according to recent estimates. And 21.5 percent of Alabama adults continue to use tobacco regularly, while the equivalent of $7.5 billion in life, medical costs, and economic productivity is lost annually due to tobacco use.

Some good news is contained herein as well. Youth prevalence rates have decreased substantially, although this is known to be somewhat offset by a rise in the use of e-cigarettes among young people in particular. An increase in the state's tobacco tax rate will likely generate an estimated $62 million of revenue annually, while continuing to help reduce young people's initiation of tobacco use. And those adults who do smoke regularly do so less often. While tobacco-attributable deaths due to cardiovascular diseases have increased, deaths due to cancer and respiratory diseases have declined.

The current report provides visualization of updated data, following the format of the original report. Thus, tobacco-use prevalence, smoking-attributable morbidity, mortality, years of potential life lost, medical expenditures, and productivity losses are considered. Where relevant, comparisons are made between current data and those from the previous report, in an attempt to gauge the arc of progress toward reducing tobacco-attributable deaths and other costs in the state of Alabama.

Suggested citation: Dunlap, S.T. & McCallum, D. (2019). *Update: The Burden of Tobacco in Alabama, 2019*. Tuscaloosa, AL: Institute for Social Science Research, University of Alabama.

Tobacco Trends in Alabama

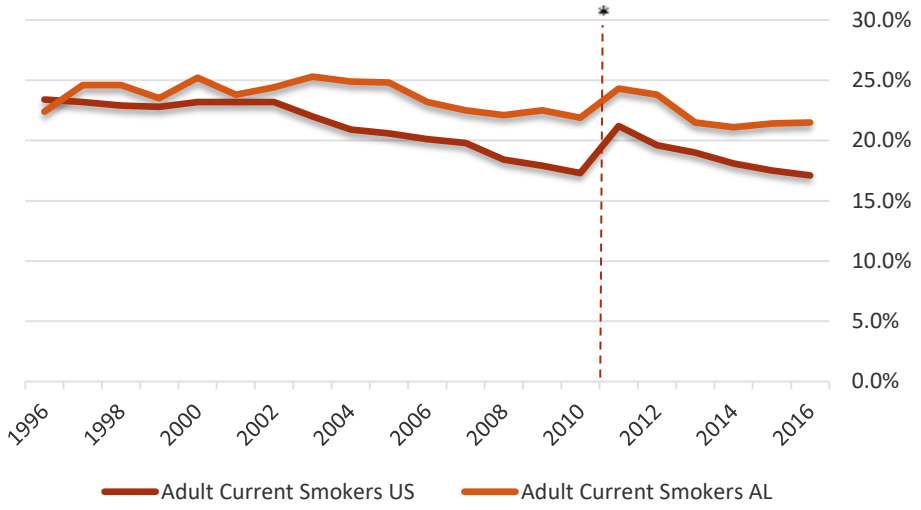
Smoking prevalence trends-
Figure 1
The past two decades have seen little decline in the overall smoking prevalence in Alabama. Less than 1 percentage point separates the adult smoking rate in 1996 from that of 2016 (CDC, 2018a).

The national trend is more promising, as smoking prevalence nationwide has dropped more than 6 percentage points over this period. The adult smoking prevalence in Alabama is now 4.4 percentage points higher than the national rate.

Smoking prevalence ranking-
Figure 2
In 2016, Alabama had the 8th highest smoking prevalence rate among the 50 states and Washington D.C. with a rate of 21.5 percent. Utah had the lowest smoking prevalence rate at 8.8 percent and West Virginia had the highest smoking prevalence rate at 24.8 percent. The median smoking prevalence rate among the 50 states and Washington D.C. was 17.1 percent. All of these rates represent improvements when compared to the previous version of this report (Fosson & McCallum, 2011).

Tobacco Use in Alabama

Figure 1. Smoking prevalence among Alabama adults 18+, 1996 – 2016
Source: CDC, 2018a



*Due to changes in weighting methodology for the Alabama Behavioral Risk Factor Surveillance System, data collected prior to 2011 may not be comparable to that collected at more recent time points

Figure 2. Smoking prevalence among adults in U.S. states by rank (highest to lowest), 2016
Source: CDC, 2018a

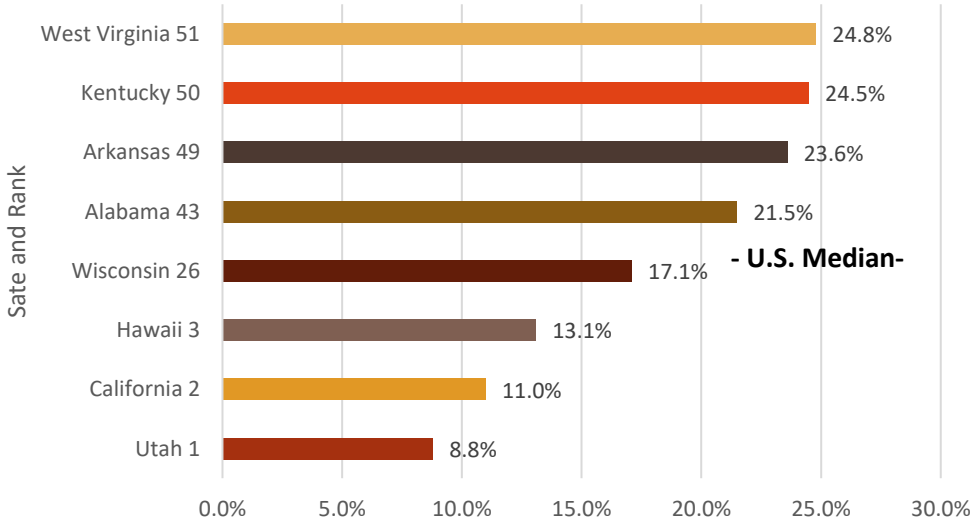


Figure 3. Smoking status among Alabama adults age 18+, 2016

Sources: CDC, 2018a; KFF 2016

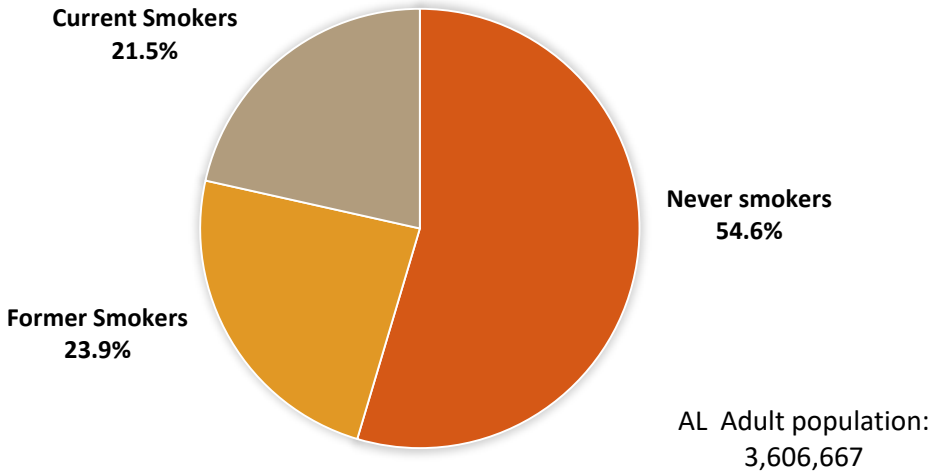
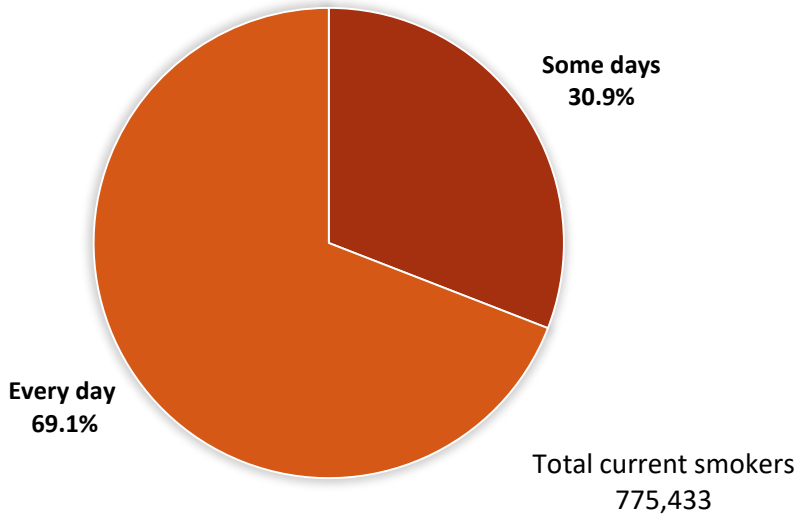


Figure 4. Frequency of cigarette usage among Alabama adults who were current smokers, 2016

Sources: CDC, 2018a; ACHS, 2016



Smoking status- Figure 3
According to recent Behavioral Risk Factor Surveillance System (BRFSS) data, in 2016, 21.5 percent of adults in Alabama reported being current cigarette smokers, 23.9 percent reported being former smokers, and 54.6 percent reported being never smokers (CDC, 2018a). Based on these figures and the current adult population of the state (KFF, 2016), it is estimated that approximately 775,433 adults in Alabama were current cigarette smokers in 2016. This represents a reduction in the smoking prevalence rate from the previously reported rate in 2009 of 22.6 percent as well as an overall decrease in the number of smokers (previously 808,768) since that time.

Frequency of cigarette usage- Figure 4
Among the adults in Alabama who were current smokers, 69.1 percent smoked cigarettes every day, while 30.9 percent smoked cigarettes only on some days. Compared to previously reported data, the rate of everyday smokers has declined, while the rate of those who smoke only on some days has increased.

Adult Smoking Prevalence by Demographics- 2016

Overall adult

The average adult smoking prevalence rate was 21.5 percent.

Pregnant mothers

According to the National Center for Health Statistics (2018), approximately 10.1 of pregnant women in Alabama report smoking during pregnancy.

Gender

Smoking prevalence rates were somewhat higher for males (23.3%) than for females (20.0%).

Race/Ethnicity

Currently, White Alabama residents smoke at a greater rate than those identifying as African American. While smoking prevalence for Hispanic residents in the state has historically been higher than that for both Whites and African Americans, data issues with the 2016 BRFSS do not enable current reporting for this group.

Age

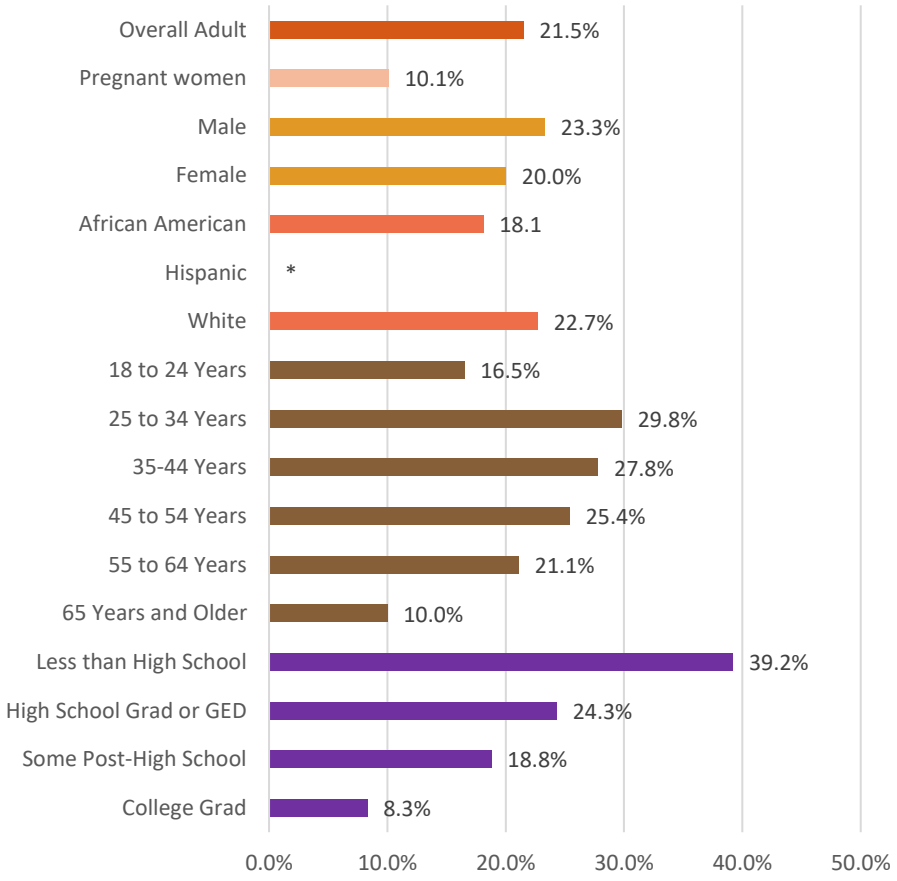
The prevalence of smoking for adults ages 24-54 was significantly higher than for older or younger adults. Rates for 18-24 year olds decreased significantly from the previous report.

Education

Consistent with nationwide data, there is a strong negative association between level of education and smoking prevalence in Alabama. Among adults with less than a high school education, the smoking rate is nearly 5 times higher than for those with a college education. Furthermore, the rate for the 'Less than High School' category has increased since the previous report, while rates for other categories decreased.

Figure 5. Smoking prevalence among Alabama adults by varied demographics, 2016

Source: CDC, 2018a; NCHS, 2018



*Prevalence estimate not available if the unweighted sample size for the denominator was < 50 or the Relative Standard Error (RSE) is > 0.3 or if the state did not collect data for that calendar year.

Figure 6. Smoking prevalence among youth in Alabama by school level and gender, 2016

Source: ADPH YTS, 2016

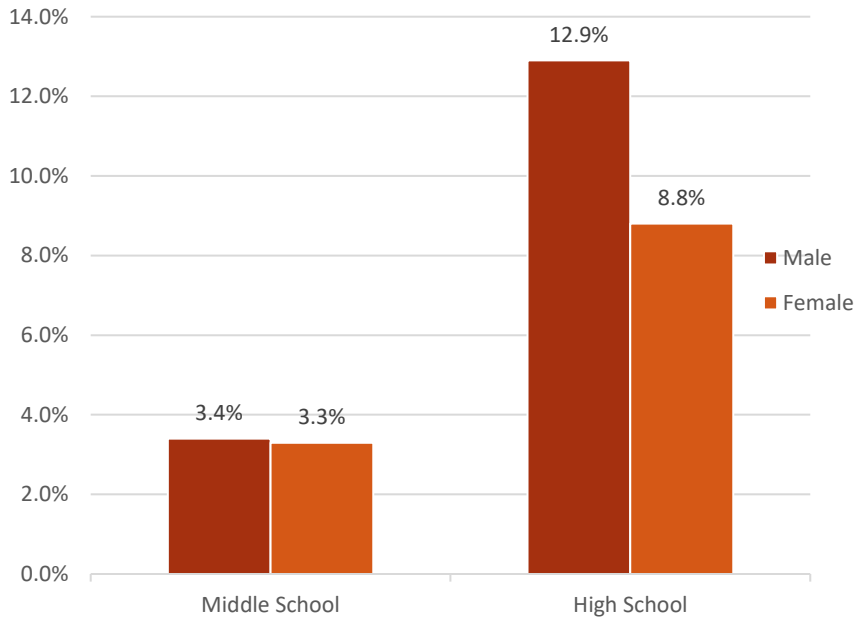
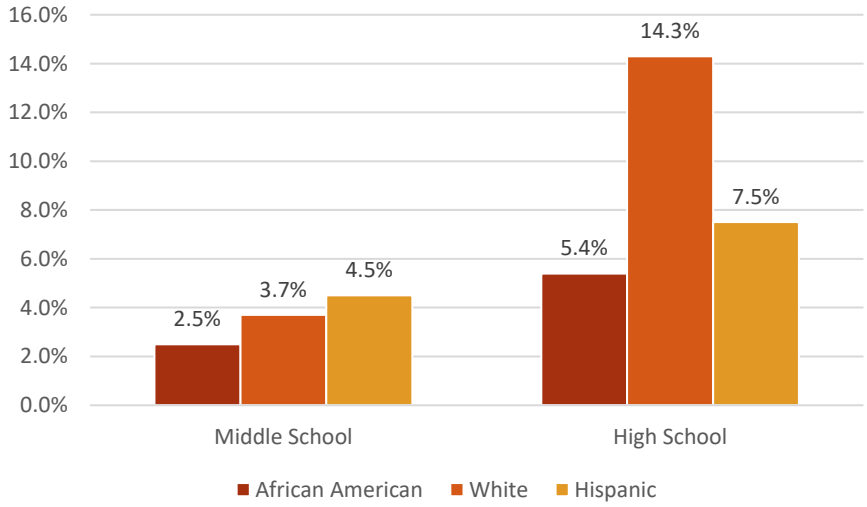


Figure 7. Smoking prevalence among youth in Alabama by school level and racial/ethnic group, 2016

Source: ADPH YTS, 2016



Youth Smoking Prevalence- 2016

The Youth Tobacco Survey (YTS) was administered to Alabama middle school and high school students in 2016 (ADPH, 2016). Students who responded to the survey claiming to have smoked cigarettes on one or more days in the 30 days preceding the survey are considered current smokers.

School level and gender- Figure 6
In 2016, male and female middle school students had nearly identical smoking prevalence rates at 3.4 and 3.3 percent, respectively (middle school rates were 3.4 percent overall). High school rates (10.9 percent overall) differed substantially between males (12.9 percent) and females (8.8 percent). These rates compare favorably to those previously reported (Fosson & McCallum, 2011) with middle school prevalence down approximately 50 percent and high school rates down more than 40 percent.

School level and racial/ethnic group- Figure 7
In middle school, African American students (2.5%) had lower smoking prevalence rates than White students (3.7%) and Hispanic students (4.5%). The smoking disparity between these groups increased in high school where the smoking prevalence rate for White students (14.3%) was nearly twice that of the rate for Hispanic students (7.5%) and nearly three times that of African American students (5.4%).

Tobacco Excise Tax in Alabama

Alabama Tobacco Excise Tax- Table 1

Increasing the cost of cigarettes is among CDC's "Best Practice" recommendations for reducing youth initiation of tobacco use (CDC, 2014). Even so, Alabama excise taxes on tobacco had not changed in more than 10 years prior to a recent increase enacted on October 1, 2016. This legislation raised the tax on a pack of 20 cigarettes by $0.25 per pack to the current rate of $0.675. The tax rate on snuff (per ounce) increased from $0.01 to $0.02. Tax on other tobacco products remains unchanged.

Additional revenue created by cigarette tax increase Table 2

Previous to the 2016 excise tax increase on cigarettes, approximately $125 million of revenue was generated through these taxes annually. Following the new legislation, annual revenue created by this tax represents a 50 percent increase over previous years.

State cigarette excise tax ranking- Figure 8

The recent increase brought Alabama from the 5th lowest excise tax on a pack of cigarettes among the 50 states and Washington D.C. to the 11th lowest. New York and Connecticut share the highest excise tax at $4.35 per pack with Missouri maintaining the lowest tax at $0.17 per pack. The median excise tax per pack of cigarettes among the 50 states and Washington D.C. is $1.60.

Table 1. Alabama excise taxes on tobacco products 2010 and 2018

Source: ADR, 2018

2010 Alabama Excise Tax	Amount
Pack of cigarettes	$0.425
Chewing tobacco (per ounce)	$0.015
Snuff (per ounce)	$0.010
2018 Alabama Excise Tax	**Amount**
Pack of cigarettes	$0.675
Chewing tobacco (per ounce)	$0.015
Snuff (per ounce)	$0.020

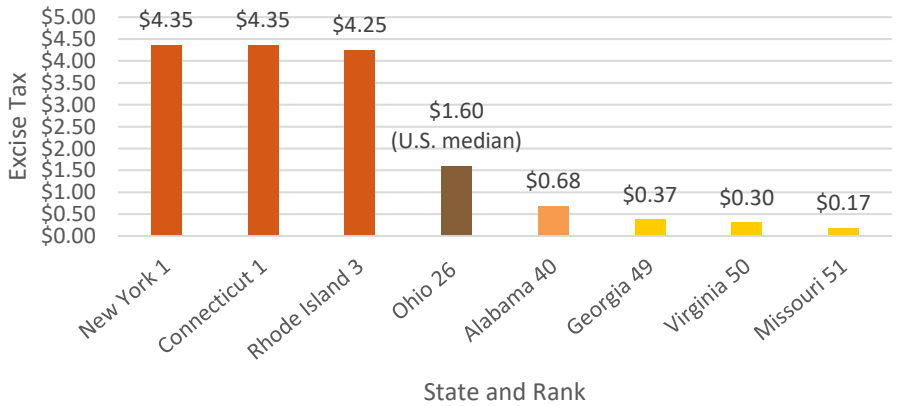
Table 2. Additional revenue generated by $.25/pack cigarette excise tax increase in Alabama, 2016

Source: ADR, 2018

Fiscal year	Tobacco taxes collected
2012-13	$125.4 million
2013-14	$126.6 million
2014-15	$125.4 million
2015-16	$189.5 million
2015/16 increase over previous years' average	**$62.9 million**

Figure 8. State excise tax per pack on cigarettes in U.S. states by rank, 2018

Source: CTFK 2018



The Health Impact of Tobacco

Figure 9. Deaths among adult citizens of Alabama, 2016

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018

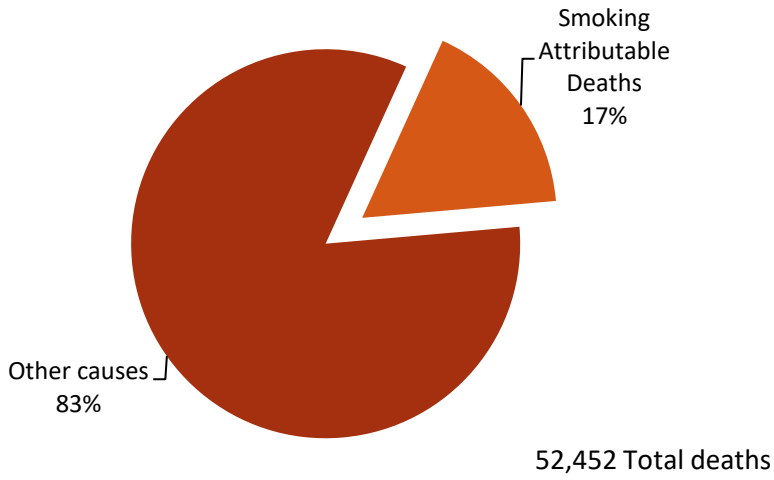
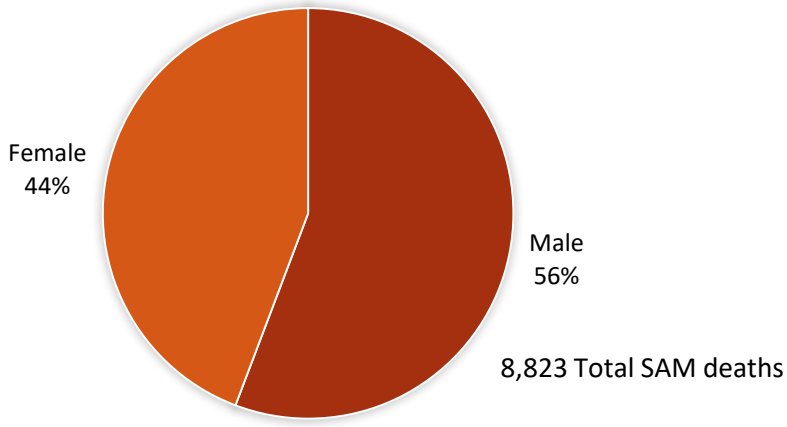


Figure 10. Smoking-attributable deaths among Alabama adults by gender, 2016

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018



Smoking-Attributable Mortality (SAM)

According to the Centers for Disease Control and Prevention (CDC), tobacco use is still the highest single preventable cause of disease, disability, and death in the United States, killing nearly 500,000 Americans each year (CDC, 2018b). SAM is a measure used by the CDC to estimate the number of deaths caused by cigarette smoking. SAM does not account for deaths due to secondhand smoke or fires.

Adult mortality- Figure 9

SAM calculations are based on 2016 tobacco use prevalence data available through the Behavioral Risk Factor Surveillance System (BRFSS; CDC, 2018a) and mortality data provided in the 2016 Alabama Vital Statistics Report (ACHS, 2016), as well as recently updated tobacco use relative risk of death rates (Ma et al., 2018). Employing these statistics as well as smoking attributable fraction formulas (Lilienfeld and Lilienfeld, 1980) it is estimated that 17 percent (8,823 deaths) of all 52,452 deaths that occurred in Alabama in 2016 were caused by diseases attributable to cigarette smoking.

Gender- Figure 10

In 2016, more males than females experienced smoking-related deaths. Of the 8,823 SAM deaths, it is estimated that 56 percent were male deaths and 44 percent were female deaths, indicating a recent shift toward parity between men and women re: SAM. Previously reported percentages (Fosson & McCallum, 2011) were 63 percent and 37 percent for men and women, respectively.

Disease Categories

Smoking-attributable deaths have been causally linked to four main disease categories: cancer, cardiovascular disease, respiratory disease, and diabetes.

Type of disease- Figure 11
In 2016, cardiovascular diseases caused the greatest proportion of adult SAM deaths (5,290 deaths) at 60 percent. Cancers (1,703 deaths), respiratory diseases (1,433 deaths) and diabetes (397 deaths) were responsible for the remaining 19.3 percent, 17.4 percent, and 4.5 percent of total smoking attributable deaths, respectively.

Disease and gender- Figure 12
Disparate effects between gender categories for SAM were somewhat greater for cancer and cardiovascular disease. For example, 63 percent of smoking-attributable deaths by cancer were male deaths. However, SAM due to diabetes was virtually identical between men and women.

Figure 11. Smoking-attributable deaths among Alabama adults by disease category, 2016

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018

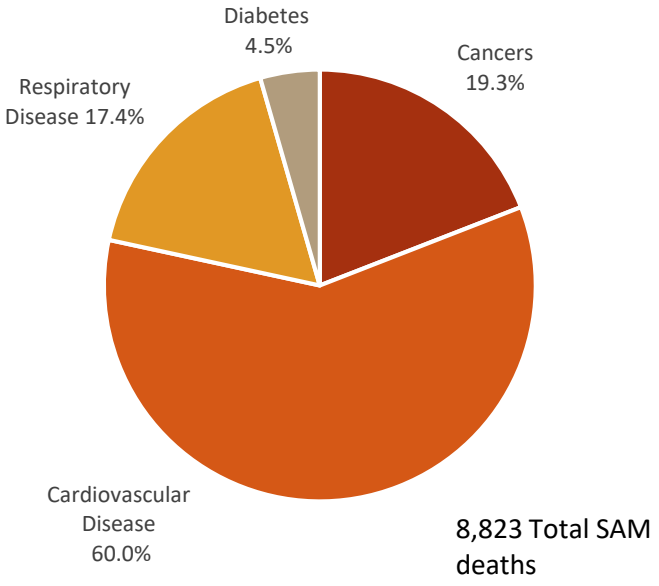


Figure 12. Smoking-attributable deaths among Alabama adults by disease category and gender, 2016

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018

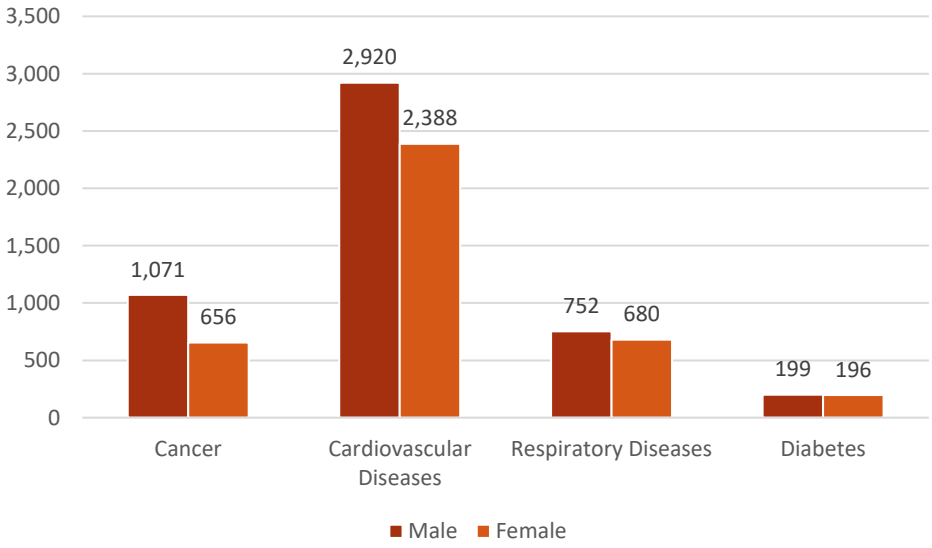


Figure 13. Smoking-attributable infant mortality in Alabama, 2016

Sources: ACHS, 2016; Pineles et al., 2016

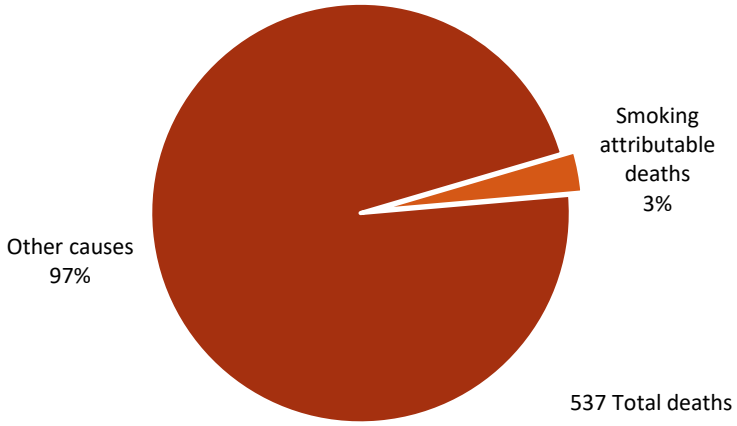
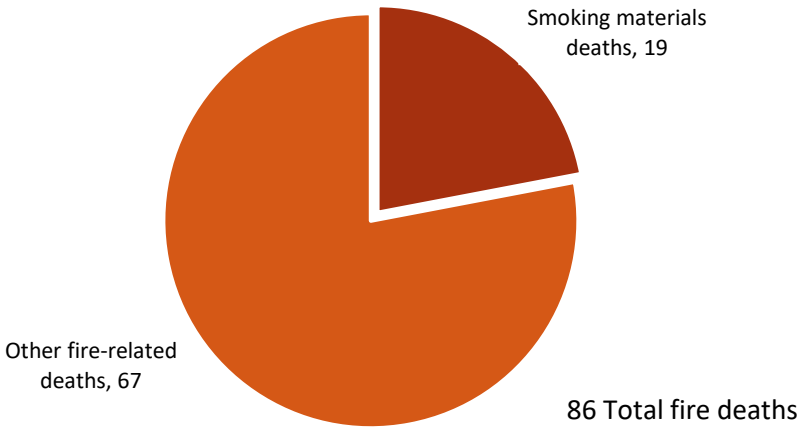


Figure 14. Smoking-related fire deaths in Alabama, 2016

Sources: ACHS, 2016; NFPA, 2017



Indirect Smoking-related Deaths

Infant mortality- Figure 13
Cigarette smoking also contributed to deaths among infants in Alabama. Maternal smoking during pregnancy is estimated to be responsible for three percent (17 deaths) of all 537 infant deaths that occurred in Alabama in 2016.

Smoking-attributable infant deaths are stillbirths or neonatal deaths of infants (perinatal deaths) attributable to maternal smoking or to exposure to secondhand or environmental smoke during pregnancy.

Smoking-related fire deaths- Figure 14
The Alabama Center for Health Statistics reported that in 2016, 86 residents died from accidental exposure to smoke, fire, and flames. Using national averages for fire deaths caused by smoking materials, it is estimated that 19 of the 86 fire deaths (22%) in Alabama in 2016 were caused by smoking materials.

Total Smoking-related Deaths

In 2016, a total of 9,773 deaths in Alabama were attributed to smoking. Of these deaths, 8,823 were directly related to smoking and 950 deaths were indirectly related to smoking and were caused by secondhand smoke exposure, maternal smoking, or fires.

Causes of death- Figure 15
Comparing the number of deaths attributable to smoking in 2016 with other categories, it is estimated that smoking caused:

- Eight times more deaths than were caused by motor vehicle accidents
- Twelve times more deaths than were caused by suicides
- Eighteen times more deaths than were caused by homicides
- More deaths than have occurred among the U.S. military in Iraq and Afghanistan during the wars over thirteen years of conflict

Similar-sized populations
The number of smoking-attributable deaths is comparable to the population size of towns in Alabama such as Wetumpka and Bay Minette that have populations of 8,148 and 9,169 respectively.

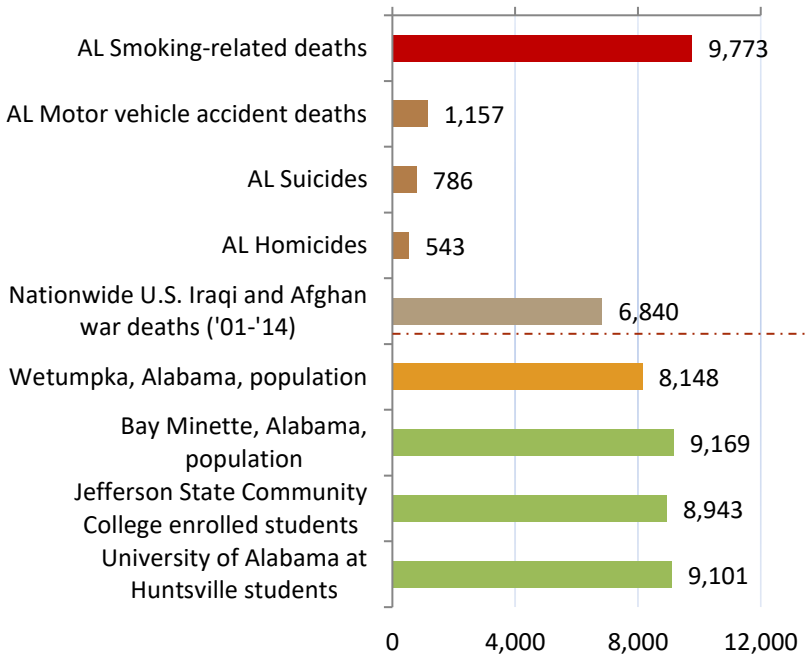
Other similar-sized populations include the enrolled student bodies at Jefferson State Community College (8,943 students) and the University of Alabama at Huntsville (9,101 students).

Table 3. Total smoking-related deaths in Alabama, 2016

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018; CFTKF, 2010; ACHS, 2016; Pineles et al., 2016

Cause of Death	Number of Deaths
Deaths directly related to smoking	
Cardiovascular disease	5,290
Cancer	1,703
Respiratory disease	1,433
Diabetes Mellitus	397
Subtotal Direct	8,823
Deaths indirectly related to smoking	
Secondhand smoke	914
Perinatal conditions- maternal smoking	17
Fires	19
Subtotal Indirect	950
Total Deaths	9,773

Figure 15. Causes of death by frequency and comparable-sized populations, 2016

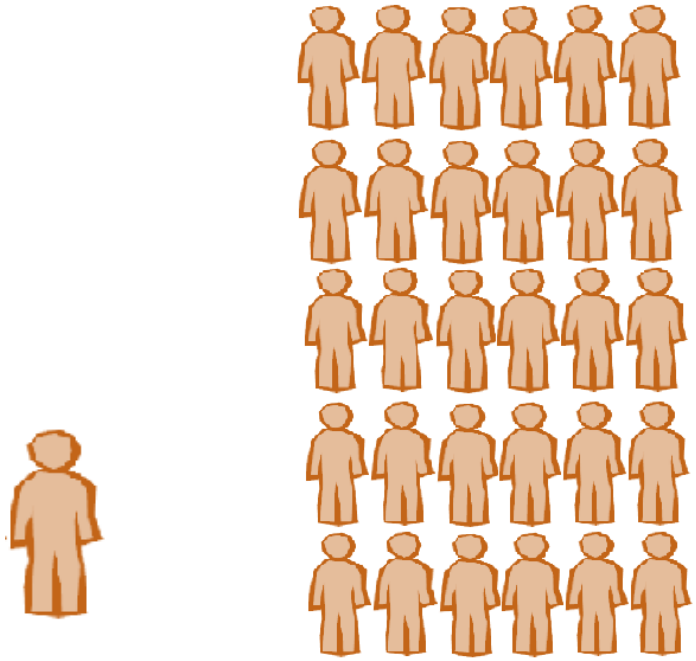


Sources: factfinder.census.gov; jeffersonstate.edu/fast-facts; uah.edu/admissions/undergraduate/discover-uah; adph.org/healthstats; projects.washingtonpost.com/fallen

Figure 16. Smoking-attributable morbidity among Alabama adults, 2017

(Source: CDC, 2018b)

(Ratio of smoking-attributable death to illness 1:30)



SAM deaths
8,823

Adults with a smoking-attributable illness*
264,690

* Smoking causes cancer, heart disease, stroke, lung diseases, diabetes, and chronic obstructive pulmonary disease (COPD), which includes emphysema and chronic bronchitis. Smoking also increases risk for tuberculosis, certain eye diseases, and problems of the immune system, including rheumatoid arthritis. Smoking is a known cause of erectile dysfunction in males.

Smoking-attributable Morbidity

According to the CDC, there are approximately 30 people living with a smoking-attributable illness in the U.S. for every person who dies from a smoking-related disease (CDC, 2018b). Assuming this ratio is true in Alabama, there were an estimated 264,690 adults suffering from a smoking-related illness in the state in 2017.

Years of Potential Life Lost (YPLL)

Years of Potential Life Lost (YPLL) is a measure of premature death used by the CDC to calculate the total years of life lost among adults who die prematurely from smoking-attributable illnesses. The YPLL data refer to adult smokers in Alabama age 35+ and do not account for deaths due to secondhand smoke or fires (U.S. DHHS, 2014).

Disease category- Figure 17
In 2014, a total of 144,864 years of potential life were lost among Alabama adults 35+ due to smoking-attributable illnesses. Cardiovascular disease was responsible for 60 percent (86,856) of the years lost, while cancers accounted for 19 percent (27,961 years), respiratory diseases accounted for 16 percent (23,528), and Diabetes led to 5 percent (6,518) of the potential years lost.

Disease and gender- Figure 18
The YPLL were higher for men than for women for those smokers who died of cancer, cardiovascular, or respiratory disease. However, YPLL due to diabetes was nearly equivalent for men and women.

Figure 17. Years of potential life lost among Alabama adults age 35+ by disease category, 2014

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018

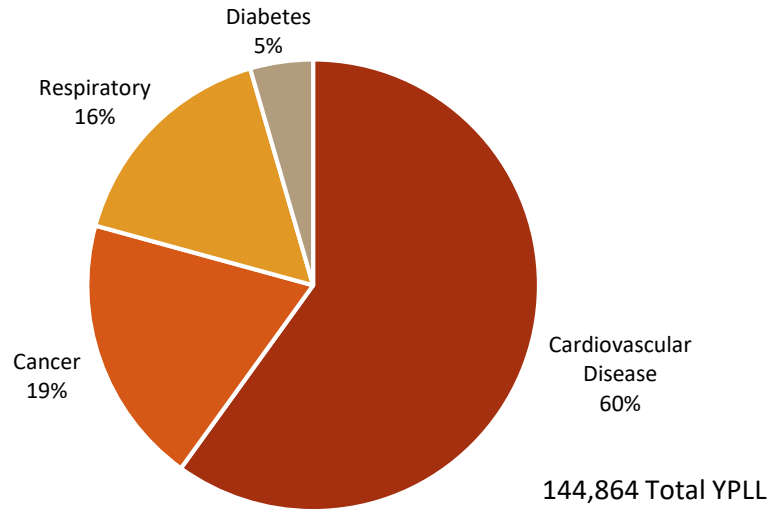


Figure 18. Years of potential life lost among Alabama adults age 35+ by disease category and gender, 2014

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018

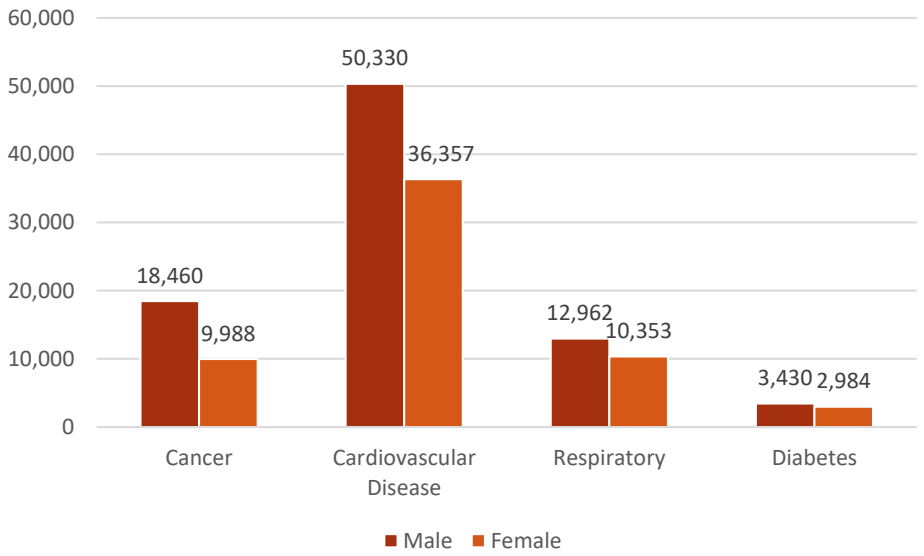
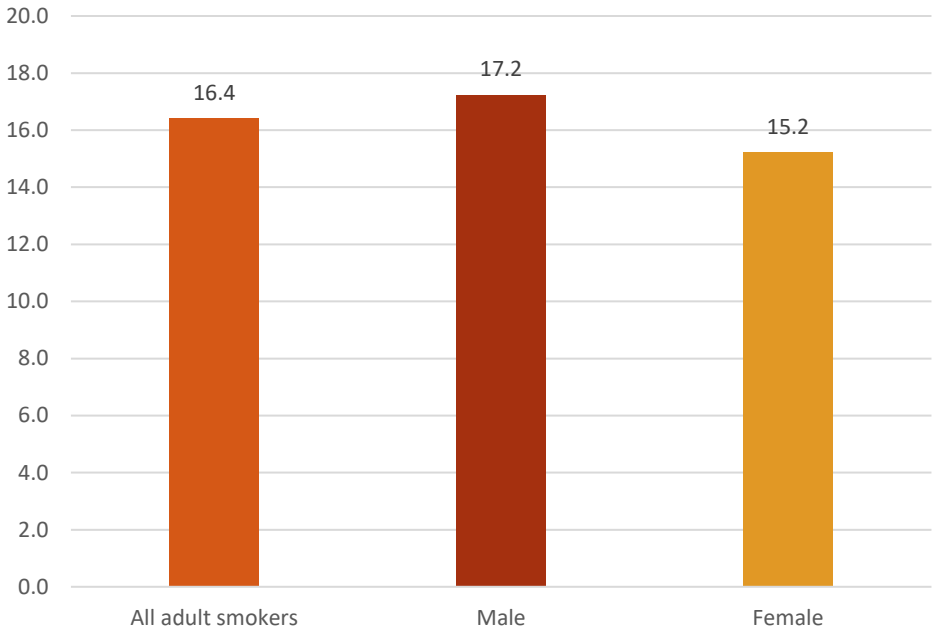


Figure 19. Average years of potential life lost among Alabama adults age 35+ who died of smoking-attributable illnesses by gender, 2014

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018



Average Years of Life Lost

Among the adults who died in 2014 as a result of smoking-attributable illnesses, the average adult lost 16.4 years of potential life. Male smokers lost an average of 17.2 years of life and female smokers lost an average of 15.2 years of life.

Burden of Tobacco in Alabama Statistics by Illness

For detailed, gender specific statistics regarding state wide mortality, SAM, and YPLL due to tobacco use, provided by disease category, see Appendix Table A.

The Economic Impact of Tobacco

Direct Medical Expenditures attributable to smoking

In Alabama, smoking was responsible for approximately $5.16 billion in excess adult medical expenditures in 2016 related to ambulatory care (56%), hospital care (24%), prescription drugs (11%), nursing home care (4%), and other personal health care expenditures (5%) for adults. Compared to previously reported data (Fosson & McCallum, 2011) this represents a greater than 200% increase in direct medical smoking-attributable expenditures, largely due to a substantial increase in the cost of ambulatory care. See page 20 for an explanation of differences in data sources between the two reports.

These expenditures, paid by residents and the state government, are equivalent to costs of:

- $1,066 for every man, woman, and child in Alabama
- $4,101 per household
- $6,522 per smoker in Alabama

Alternative purchases- Table 4

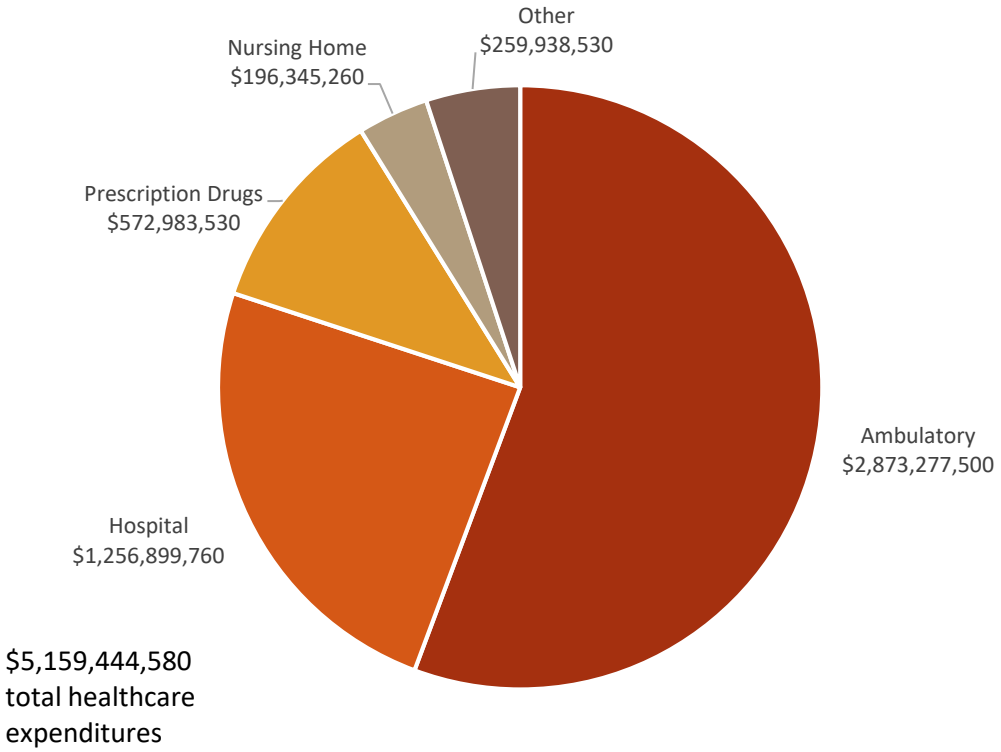
In order to gauge the relative spending power of the $5.16 billion in excess medical costs due to smoking in Alabama, it is beneficial to compare various alternative purchases that could be made with the same amount.

For $5.16 billion:

- Over 119,000 full-tuition four-year college scholarships could be provided to residents of Alabama
- Over 115,000 salaried jobs could be provided at the state's median income level of $44,765

Figure 20. Direct medical expenditures attributable to smoking among Alabama adults, 2016*

Sources: CMMS, 2014; Miller et al., 1999



*estimates are adjusted for inflation

Table 4. Alternative purchases that could be made with amount spent on direct medical expenditures attributable to smoking, 2016

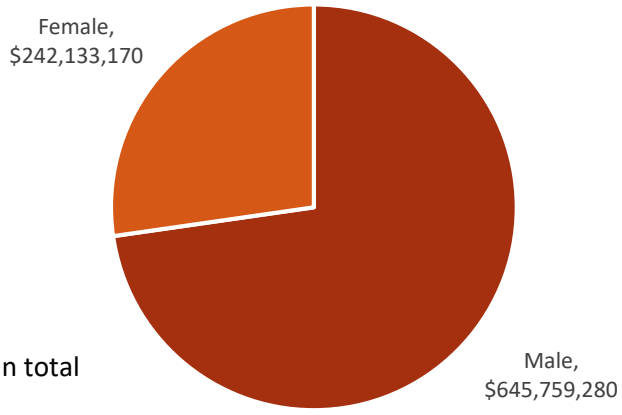
Sources: UA, 2018; USCB, 2016

Alternative Purchase	Number
Full-tuition four-year scholarships to the University of Alabama*	119,653
Salaried jobs at $44,765** each	115,256

*Based on 2018-2019 semester tuition rates of $5,390 for residents and excluding the cost of other enrollment fees and of room and board.
**Median salary in Alabama without benefits.

Figure 21. Productivity losses due to smoking-attributable death among Alabama adults by gender, 2016*

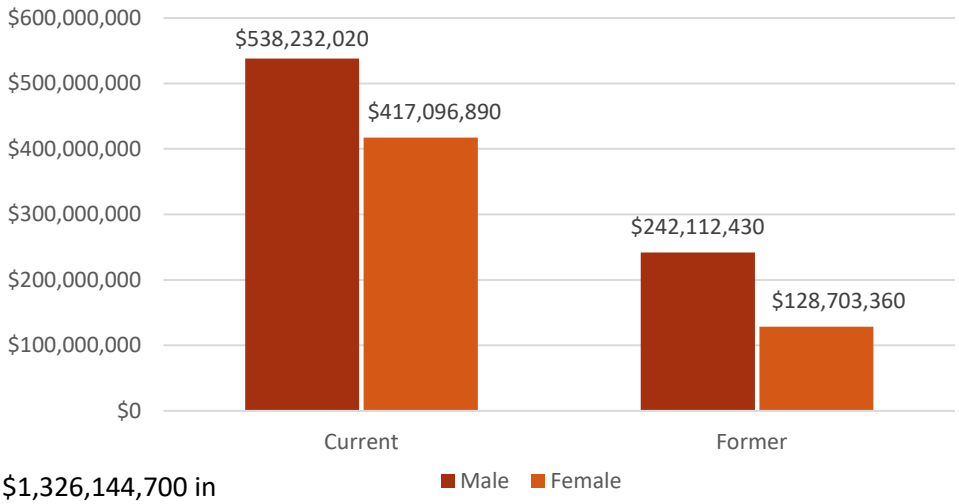
Sources: U.S. BLS, 2016; CDC, 2018a; Rumberger et al., 2010; Bunn et al., 2006



$887,892,450 in total losses

Figure 22. Productivity losses due to smoking-attributable illness among the Alabama workforce by gender and smoking status, 2016*

Sources: U.S. BLS, 2016; CDC, 2018a; Rumberger et al., 2010; Bunn et al., 2006



$1,326,144,700 in total losses

*estimates are adjusted for inflation

Smoking-attributable Productivity Losses

Productivity losses account for a significant portion of the economic burden of tobacco in Alabama. Productivity losses can be calculated as (1) those due to premature death and (2) those due to illness.

Productivity losses due to premature death- Figure 21

Productivity losses due to premature death in 2016 are estimated at over $887 million. Productivity loss estimates due to premature death were more than 2.5 times higher for males ($645.8 million) than they were for females ($242.1 million).

Productivity losses due to illness- Figure 22

Calculations for productivity losses due to illness are derived by comparing the differences among smokers, former smokers, and non-smokers for time missed from work (absenteeism) and unproductive time at work (presenteeism) (Bunn et al., 2006).

The estimated annual net productivity loss was $1,807 for a current smoker and $623 for a former smoker over a non-smoking worker.

In 2016, it is estimated that current smokers were responsible for over $955 million and former smokers for more than $370 million in productivity losses due to smoking attributable illnesses.

Medical Expenditures and Losses- Secondhand Smoke

Scientific research has shown that involuntary exposure to secondhand smoke is causally linked to premature death and disease.

In 2014 a report by the United States Surgeon General concluded that approximately 2.5 million nonsmokers have died in the U.S. from conditions caused by secondhand smoke exposure since 1964 (U.S. DHHS, 2014).

For Alabama it is estimated that secondhand smoke was responsible for approximately $96.6 million in medical costs due to excess morbidity and $90.8 million in productivity losses due to excess mortality and disability in 2016.

The economic costs of secondhand smoke for Alabama were derived from national estimates produced by Behan et al. (2005).

Table 5. Medical expenditures attributable to secondhand smoke in Alabama, 2016*

Source: Behan et al., 2005

Category	Morbidity	Direct Medical Cost of Excess Morbidity**	Cost of Excess Mortality and Disability†
Cancer	Lung cancer	$3,705,179	$9,098,058
	Cervical cancer	$271,584	$2,133,873
Respiratory system	Asthma	$14,995,307	$3,123,214
	Otitis media	$1,028,139	$17,187,377
Chronic pulmonary disease		$23,569,597	$53,385,622
Cardiovascular system	Coronary heart disease	$47,565,968	$3,375,399
Perinatal manifestations	Low birth weight Miscarriage SIDS	$8,845,873	$5,509,272
Subtotal		$96,645,046	$90,844,792
Total Cost			**$187,489,838**

*Estimates are adjusted for inflation
**Estimated economic value of direct medical costs.
† Estimated economic value of lost wages, fringe benefits, and services.

Table 6. Total smoking-attributable economic costs in Alabama, 2016*

Sources: CMMS, 2014; Miller et al., 1999; Adams et al., 2002; U.S. BLS, 2016; CDC, 2018a; Rumberger et al., 2010; Bunn et al., 2006; Behan et al., 2006

Smoking-attributable Costs	Total
Direct Costs	
Adult healthcare expenditures	
Ambulatory care	$2,873,277,500
Hospital care	$1,256,899,760
Prescription drugs	$572,983,530
Nursing care	$196,345,260
Other care	$259,938,530
Total Direct Costs	**$5,159,444,580**
Indirect Costs	
Productivity losses due to smoking	
Losses due to premature mortality	$887,892,450
Losses due to illness	$1,326,144,700
Subtotal productivity losses	**$2,214,037,150**
Secondhand smoke	
Healthcare expenditures	$96,645,046
Productivity losses	$90,844,792
Subtotal secondhand smoke	**$187,489,838**
Total Indirect Costs	**$2,401,526,988**
Total Economic Costs	**$7,560,971,568**

*estimates are adjusted for inflation

Total Economic Costs

The total economic impact of tobacco in Alabama is estimated at over $7.5 billion.

Direct costs
Adult personal health care expenditures account for 68 percent ($5.16 billion) of the total economic cost of tobacco in Alabama.

Indirect costs
Productivity losses to smokers, due to premature death and to illness attributed to smoking, account for 29 percent ($2.21 billion) of the total economic cost of tobacco in Alabama.

The indirect costs of secondhand smoke, including healthcare expenditures and productivity losses among non-smokers caused by secondhand smoke exposure, accounted for two percent ($187 million) of the total economic costs of smoking in Alabama.

Methodology and Limitations

Smoking Prevalence

Smoking prevalence data were taken from CDC's Behavioral Risk Factor Surveillance System (BRFSS) from the year 2016 (CDC, 2018a). BRFSS categorizes smokers using two questions: (1) "Have you smoked at least 100 cigarettes in your entire life?" and (2) "Do you now smoke cigarettes every day, some days, or not at all?" Current smokers are those who reported ever smoking 100 cigarettes *and* who currently smoke every day or some days. Former smokers are those who reported ever smoking 100 cigarettes but who currently do not smoke. Never smokers are those who reported never having smoked 100 cigarettes in their lifetime. In order to increase accuracy, respondents who refused to answer or answered "don't know" to question (1) were excluded from the analysis. The BRFSS data are also weighted to account for problems of non-coverage and non-response among segments of the population. See the BRFSS website for details on weighting.

Smoking Attributable Fraction (SAF) and Smoking-Attributable Mortality (SAM) Estimates

The Smoking-Attributable Fraction (SAF) is defined as the proportion of deaths for a particular disease that are attributed to smoking. The gender specific number of deaths for each disease category is multiplied by the corresponding SAF to produce estimates of Smoking-Attributable Mortality (SAM). SAM estimates were derived using the number of deaths for specific disease categories (ACHS, 2016; WHO, 2018) and a smoking-attributable fraction SAF formula (CDC, 2016; Lilienfeld & Lilienfeld, 1980):

$$SAF = [(p0 + p1(RR1) + p2(RR2)) - 1] / [p0 + p1(RR1) + p2(RR2)]$$

$$SAM = \text{Number of deaths} \times SAF$$

	Adult SAF	Neonatal SAF
p0	Percentage of adult never smokers in study group	Percentage of maternal nonsmokers in study group
p1	Percentage of adult current smokers in study group	Percentage of maternal smokers in study group
p2	Percentage of adult former smokers in study group	Not applicable
RR1	Relative risk of death for adult current smokers relative to adult never smokers	Relative risk of death for infants of maternal smokers relative to infants of maternal nonsmokers
RR2	Relative risk of death for adult former smokers relative to adult never smokers	Not applicable

Years of Potential Life Lost (YPLL)

Estimates for Years of Potential Life Lost (YPLL) attributed to smoking were produced using data from Ma et al., (2018), who estimated the overall smoking-attributable YPLL for each state. Proportions of deaths caused by each smoking-attributable disease (ACHS, 2016) in Alabama were applied to these estimates to derive the YPLL to each disease for each gender.

Smoking-Attributable Healthcare Expenditures

Direct medical costs of smoking-attributable adult healthcare were calculated based on National Health Expenditure Accounts (NHEA) data available from the Centers for Medicare and Medicaid Services (CMMS, 2014). These data include official estimates of total health care spending in the U.S., listed by state and service category. Five major expenditure categories are used for its estimates: ambulatory care, hospital care, prescription drugs, nursing home care, and other care. Other care includes home health, nonprescription drugs, and nondurable medical products.

Smoking-attributable fractions (SAF) for each expenditure category, developed and published by Miller et al. (1999) were applied to NHEA data for Alabama to estimate the SAF of medical costs for the state in 2014, the most recent data available. The SAFs are equal to the proportion of annual personal health care expenditures that would be avoided if smoking did not occur within the population. These amounts were adjusted for inflation to 2016 dollars using the U.S. Bureau of Labor Statistics inflation calculator (U.S. BLS, 2018).

This procedure allowed the recreation of estimates comparable to those presented in the previous version of this report (Fosson & McCallum, 2011) which were sourced from the CDC SAMMEC (Smoking Attributable Mortality, Morbidity, and Economic Costs) application, no longer available. Such costs are referred to as smoking-attributable expenditures (SAE) and are defined as the excess personal health care costs of smokers and former smokers compared with those of individuals who have never smoked.

Smoking-attributable neonatal healthcare expenditures were sourced from Adams et al. (2002) who estimated these costs for each state based on data available from the CDC's Pregnancy Risk Assessment Monitoring System (PRAMS) database. These estimates were also adjusted to 2016 dollars.

Fire-related Deaths

Deaths caused by smoking-related fires were estimated using the national percentage of fire deaths caused annually by smoking materials (NFPA, 2017) and the number of total deaths caused by fire in Alabama in 2016 (ACHS, 2016).

Secondhand Smoke (SHS)

Mortality Estimates

Estimates for morality due to secondhand smoke exposure in Alabama were calculated using national estimates from the CDC (2018b) of annual deaths attributable to SHS in two disease categories: Ischemic heart disease and lung cancer. The Alabama estimate was produced by multiplying the total number of secondhand smoking-attributable deaths in the U.S. by the proportion of the U.S. smoking population that resides in Alabama. The population estimates used to derive this proportion came from U.S. Census Bureau data for 2016 (USCB, 2017).

Economic Costs

The economic costs of secondhand smoke were derived using national estimates from Behan et al. (Behan, Eriksen, & Lin, 2005). Behan et al. used data on U.S. population exposure to secondhand smoke and disease-specific relative risk estimates to measure excess morbidity in the United States. Average total costs were assigned to each disease category in the model and the average cost per disease was then multiplied by the excess number of cases per disease to estimate the annual direct medical cost of exposure to secondhand smoke for each disease.

In order to derive estimates for Alabama, the estimated excess economic costs of morbidity and of mortality and disability were multiplied by the proportion of the U.S. population that resides in Alabama. The population estimates were taken from the U.S. Census bureau (USCB, 2016). Finally, the estimates were adjusted for inflation to 2016.

Productivity Losses

Mortality

Productivity losses resulting from smoking-attributable mortality were calculated using Bureau of Labor Statistics estimates of smokers and former smokers in the workforce in Alabama (U.S. BLS, 2016) and dollar amount estimates of workforce productivity lost per smoker and former smoker compared to non-smokers developed by Penn State University (Rumberger et al, 2010). Estimates were then adjusted to 2016 dollars (U.S. BLS, 2018).

Morbidity (Illness)

In order to calculate losses in workplace productivity due to morbidity, data were taken from research conducted by Bunn et al. (Bunn et al., 2006). Bunn et al. studied the negative economic impact of cigarettes in the workplace and determined the cost of health-related productivity losses through a large

cross-sectional study of employees throughout the United States. Calculations for productivity loss are derived by observing the time missed from work (absenteeism) and unproductive time at work due to illness (presenteeism) among smokers, former smokers, and non-smokers. Bunn et al. found that the annual average costs of lost productivity for current smokers and former smokers above that of non-smokers, were $1807 and $623 respectively. Labor force data for employed workers in Alabama again came from the Bureau of Labor Statistics (U.S. BLS, 2016). The smoking prevalence rate for the year 2016 was taken from BRFSS data and the percentages of current and former smokers were 21.5 percent and 23.9 percent respectively, as estimated by the CDC (2018a). The following equation was used to calculate losses in workplace productivity due to illness:

# of smokers in the workforce x Net loss per smoker = Total productivity loss

This equation is used separately for current smokers and former smokers. Estimates were adjusted for inflation to 2016.

Limitations

Fire-related Deaths

- Estimates for fire-related deaths were derived from the national estimates as state-level data were not available for Alabama.

Productivity losses due to Illness

- In the study by Bunn et al., the figure used in the model for hourly compensation was higher than the national average.
- The labor force data taken from the BLS does not account for part-time workers.

Secondhand Smoke

- Mortality and economic impact estimates due to secondhand smoke were derived from national estimates because specific population attributable risk (PAR) figures were not available for Alabama. Estimates were only produced for a limited number of disease categories.

Glossary

Absenteeism
Time missed at work due to smoking-related illness.

Average Years of Potential Life Lost
Average years of potential life lost among individuals who died from smoking-related illness.

Behavioral Risk Factor Surveillance System (BRFSS)
A nationwide health survey system which operates in all fifty U.S. states tracking health conditions and risk behaviors.

Current Adult Smokers
Individuals who have smoked over 100 cigarettes in their lifetime *and* who currently smoke every day or some days.

Current Youth Smokers
Students who have smoked cigarettes on one or more of the 30 days preceding the survey.

Former Smoker
Individuals who have smoked over 100 cigarettes during their lifetime *and* who currently do not smoke.

Maternal Smoker
A mother who indicated having smoked during her pregnancy.

Never Smokers
Individuals who have never smoked 100 cigarettes during their lifetime.

Perinatal healthcare expenditures
Healthcare expenditures relating to the time, usually a number of weeks, immediately before and after birth

Presenteeism
Unproductive time at work due to smoking-related health conditions.

Productivity losses due to illness
The present value of losses in future earnings and unpaid household production, forgone due to smoking-attributable illness.

Productivity losses due to premature death
The present value of losses in future earnings and unpaid household production, forgone due to smoking-attributable premature death.

Smoking-Attributable Mortality (SAM)
The number of deaths attributable to cigarette smoking within 19 disease categories for which smoking has been causally linked.

Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC)
Monetary amounts representing the health and economic impact of smoking within selected populations. CDC previously provided an online application that allowed the user to calculate these costs for adults and infants on a statewide basis or for other selected populations. This application was used for the 2011 Burden Report; however, it is no longer available, thus other resources were used to compute these estimates for the 2019 report.

Smoking prevalence
The percentage of current smokers within a selected population.

Years of Potential Life Lost (YPLL)
The difference between average life expectancy and actual years lived among residents who died prematurely from smoking-attributable illnesses.

Youth Tobacco Survey (YTS)
A state survey which gathers data from middle and high school students regarding their use of tobacco, smoking cessation, knowledge and attitudes about tobacco, exposure to secondhand smoke, and familiarity to media messages.

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Appendix

Table A. Total deaths, SAM deaths, and YPLL among Alabama adults by disease type and gender, 2016*

Sources: CDC, 2018a; ACHS, 2016; U.S. DHHS, 2014; Ma et al., 2018

	Female			Male			Total		
Disease Category	**Deaths 2016**	**SAM 2016**	**YPPL 2014**	**Deaths 2016**	**SAM 2016**	**YPPL 2014**	**Deaths 2016**	**SAM 2016**	**YPPL 2014**
Malignant Neoplasms									
Lip, Oral Cavity, Pharyn	48	15	227	143	52	896	191	64	1,054
Esophagus	51	16	241	181	66	1,134	238	80	1,314
Stomach	81	25	382	100	36	627	181	61	999
Pancreas	341	106	1,610	383	139	2,400	724	243	3,997
Larynx	13	4	61	63	23	395	76	26	420
Trachea, Lung, Bronchu	1,356	421	6,401	1,752	637	10,980	3,108	1,045	17,157
Cervix, Uteri	87	27	411	0	0	0	87	29	480
Kidney and Renal Pelvis	80	25	378	140	51	877	220	74	1,215
Urinary Bladder	58	18	274	182	66	1,141	240	81	1,325
Subtotal	2,115	656	9,983	2,944	1,071	18,450	5,065	1,703	27,960
Cardiovascular Diseases									
Ischemic Heart Disease	2,134	662	10,073	2,898	1,054	18,162	5,032	1,692	27,778
Other Heart Disease	3,618	1,122	17,078	3,586	1,304	22,474	7,204	2,422	39,768
Cerebrovascular Diseas	1,696	526	8,005	1,266	460	7,934	2,962	996	16,351
Atherosclerosis	60	19	283	53	19	332	113	38	624
Aortic Aneurysm	62	19	293	80	29	501	142	48	784
Other Arterial Disease	132	41	623	148	54	928	280	94	1,546
Subtotal	7,702	2,388	36,355	8,031	2,920	50,331	15,733	5,290	86,851
Respiratory Diseases									
Pneumonia, Influenza	527	163	2,488	460	167	2,883	987	332	5,449
Bronchitis, Emphysema	34	11	160	52	19	326	86	29	475
Other Lower Respirator	1,633	506	7,708	1,557	566	9,758	3,190	1,073	17,610
Subtotal									
Diabetes Mellitus	633	196	2,988	548	199	3,434	1,181	397	6,519
Total	**12,644**	**3,921**	**59,682**	**13,592**	**4,942**	**85,182**	**26,242**	**8,823**	**144,864**

*Death statistics and SAM estimates are based on 2016 data while YPLL estimates are based on data from 2014