Are state-level income-based disparities in adult smoking declining?

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Abstract

The United States (US) has identified income-based disparities in smoking as a critical public health issue, but the extent to which these disparities are changing over time within states is not well documented. This study examined recent trends in current cigarette smoking in each state and the District of Columbia by self-reported annual household income. Data came from the Behavioral Risk Factor Surveillance System, a state-representative survey of US adults. Sample sizes for each state and year ranged from 2,914 to 36,955 participants. We fit logistic regression models to examine linear time trends in cigarette smoking status in each state between 2011 and 2017. In every state, the odds of smoking were 1.4 to 3.0 times greater in the lower-income group as compared to the higher-income group in 2017. Among 47 states, linear time trends in smoking did not significantly differ by income group, suggesting no change in income-based disparities. In three states (Florida, Maine, West Virginia) disparities widened, primarily because smoking prevalence only dropped among higher-income groups. Disparities declined in only one state. In New York, smoking prevalence declined more for lower-income groups compared to higher-income groups. Findings from this study suggest that little progress has been made toward reducing income-based differences in smoking and additional policy and tobacco control efforts may be required to meet national disparity reduction goals.

Keywords

tobacco use; health disparities; income

Despite marked reductions in smoking prevalence in the United States (US), disparities in smoking by income persist. In 2017 14% of US adults were current cigarette smokers.[1] Smoking prevalence was higher among individuals reporting an annual household income less than $35,000 (21%) as compared to those reporting an income of $35,000 - $74,999 (15%).[1] The disparity in smoking prevalence was even greater when compared to higher-income groups.[1] Nationally, although smoking prevalence has decreased among all income groups, the greatest declines have been among higher-income groups.[2,3]

The Centers for Disease Control and Prevention (CDC) states that reducing tobacco-related disparities is a priority for tobacco control.[4] Numerous reports, including those by the Surgeon General, have documented income-based disparities in smoking and the consequences of these disparities on health outcomes.[4,5,6] One of the major conclusions of the 2014 Surgeon General's Report, *The Health Consequences of Smoking-50 Years of Progress*, was that large disparities in smoking according to socioeconomic status remain to be addressed.[6] CDC has launched initiatives, such as the National Networks for Tobacco Control and Prevention, that focus on reducing income-based disparities in tobacco use.[4]

Federal initiatives and policies, however, are only one component of tobacco control efforts. States have significant authority to implement tobacco control programs and policies. Studies suggest that certain tobacco control policies have differential effects dependent on income.[7] For example, raising the price of cigarettes reduces smoking more among lower-income smokers compared to higher-income smokers.[8,9] State programs support other activities that may reduce income-based disparities in smoking, such as increasing the number of people covered by smoke-free air laws and reducing exposure to tobacco industry advertising.[4,10] Given variation in state tobacco control efforts, as well as other policies affecting health and income, income-based differences in smoking likely vary across states. Tracking state-specific trends in these differences could identify those places making progress toward national equity.

To examine whether progress has been made in reducing income-based disparities in smoking in the different US states, the present study used data from the annual, state-representative Behavioral Risk Factor Surveillance System (BRFSS) to examine disparities in cigarette use by self-reported annual household income, as well as changes in those disparities in each state and the District of Columbia (DC) from 2011 to 2017. To our knowledge, this is the first state-based analysis to examine recent trends in income-based disparities in the US.

Methods

Data were drawn from the BRFSS, a state-based, random-digit-dialed telephone (landline and cellular telephone) survey that collects data on the non-institutionalized adult population (18 years) in the US. Detailed information about the BRFSS survey design and methods are available at www.cdc.gov/brfss. The survey is conducted annually in 50 states, Washington, D.C. (DC), and participating US territories (Guam, Puerto Rico, US Virgin Islands). In the present study, BRFSS data from the 50 states and DC were used. The 50 states and DC will be referred to as states. The BRFSS core survey includes questions about

current cigarette smoking. For the present study, BRFSS data from 2011 to 2017 were used. Over 350,000 respondents completed a survey each year between 2011 and 2017. Sample sizes for each state and year ranged from 2,914 to 36,955 participants (Appendix 1), and the BRFSS weighting procedures make the survey state representative. The median response rate across states ranged from 45.2% to 49.7% over the time period, comparable to other federal surveys.[11] The BRFSS makes up to 15 attempts to reach a respondent before designating the respondent as non-responsive.[11]

Measures

Smoking.—Cigarette smoking was assessed in the core survey using two questions. Respondents were asked, "Have you smoked at least 100 cigarettes in your entire life?" and "Do you now smoke cigarettes every day, some days, or not at all?" Current cigarette smokers were defined as respondents who reported smoking at least 100 cigarettes in their entire lifetime and currently smoke every day or some days.

Demographic Characteristics.—Demographic characteristics were collected in the core questionnaire. The following variables and categories were employed for analysis: age group (18–24, 25–34, 35–44, 45–54, 55–64, 65 or older); sex (male, female); race/ethnicity (non-Hispanic White only, non-Hispanic Black only, non-Hispanic Other race only/Multiracial, Hispanic); educational attainment (did not graduate high school, graduated high school, attended college or technical school, graduated from college or technical school); annual household income (less than $15,000, $15,000 to less than $25,000, $25,000 to less than $35,000, $35,000 to less than $50,000, $50,000 to less than $75,000, and $75,000 or more); and survey year (2011, 2012, 2013, 2014, 2015, 2016, 2017).

Data Analysis

Descriptive statistics were examined for the study sample. Due to a large percentage of missing data on income (15.5%), multiple imputation was used to generate 25 imputed datasets following procedures recommended for use with BRFSS data.[12] Specifically, the fully conditional specification method was used to impute missing income data.[13] First, variables that were correlated (i.e., Cramer's V greater than 0.1) with income or missingness of income were identified as potential covariates for the imputation model.[12] Next, logistic regression with stepwise model selection was used to eliminate redundant covariates from the final imputation model. The final imputation model included all non-redundant covariates and the sampling weight.

Within each state, respondents who were in the lower 33% of all reported annual household incomes were categorized as having lower-income. Respondents who reported an annual household income within the upper-two thirds of all reported incomes in their state were categorized as having higher-income. This cut-off was selected to reflect the percentage of the population that is poor in the US; approximately one-third of the US population is considered poor or nearly poor.[14] Across states, respondents in the lower-income groups reported a maximum annual household income of less than $35,000. The majority of respondents in the higher-income groups reported an annual household income of $35,000 or higher. For descriptive purposes, smoking prevalence with 95% confidence intervals were

obtained in 2011 and 2017 for the lower- and higher-income groups. A ratio that compared smoking by income groups was calculated by dividing the smoking prevalence of the lower-income group by that of the higher-income group.

Next, state-specific linear time trends of smoking status were assessed using logistic regression models that included BRFSS data from 2011 through 2017. For each state, logistic regression models were fit to examine the relationship between year (2011–2017), income (lower-income group=1; higher-income group=0), and cigarette smoking status (current smoker=1; non-current smoker=0), adjusting for age, sex, race/ethnicity, and education level. To determine if there were differential time trends in smoking by income group, a subsequent logistic regression model included an interaction term between year and income. For statistically significant interaction terms, simple effects tests were conducted to examine the linear time trend separately in each income group. Analyses were conducted using the BRFSS sampling weights and complex survey procedures in SAS 9.4 (SAS V.9.4, SAS Institute Inc).

Results

Smoking Prevalence among Lower- and Higher-Income Groups

Table 1 provides sociodemographic characteristics of the study sample. In 2011, smoking prevalence among the lower-income groups ranged from 18.6% to 40.3% (Table 2). Among the higher-income groups, smoking prevalence ranged from 7.9% to 22.8%. The ratio of smoking rates between the lower- and higher- income groups ranged from 1.5 to 2.4. In 2017, smoking prevalence among the lower-income groups ranged from 15.1% to 38.5%. Among the higher-income groups, smoking prevalence ranged from 7.0% to 19.4%. The ratio of smoking prevalence between the lower- and higher- income groups ranged from 1.4 to 3.0. As shown in Figure 1, although smoking prevalence typically declined in both lower- and higher-income groups over the study period, income-based disparities in smoking prevalence were typically maintained.

Logistic Regression

In the majority of states, the odds of smoking decreased from 2011 to 2017 (Odds ratios [ORs]: 0.95 – 0.98), after controlling for age, sex, race/ethnicity, and education level. However, in 17 states (Alabama, Alaska, Arkansas, California, Florida, Georgia, Idaho, Iowa, Louisiana, Maine, Mississippi, Missouri, New Hampshire, Ohio, Oregon, Tennessee, Vermont), there were no significant linear trends in the odds of smoking. In each state, the odds of smoking were greater in the lower-income group as compared to the higher-income group. Odds ratios ranged from 1.37 in North Dakota to 2.11 in Arkansas (see Appendix Table 2). In each state, older age, being female, and greater education were associated with lower odds of smoking. The relationship between race/ethnicity and smoking, however, was inconsistent across states (results not shown).

There were significant interactions between year and income in four states, indicating time trends in smoking status varied by income group. In only one state (New York), smoking prevalence declined more for lower-income groups compared to higher-income groups.

Simple slopes analyses revealed that in New York there was a significant, negative effect for year in the lower-income group (OR, 95% confidence interval [CI]: 0.96 [0.93, 0.98]), but not in the higher-income group (0.99 [0.97, 1.0]). However, in three states, smoking prevalence only dropped among higher-income groups, increasing income-based disparities. In West Virginia (0.96 [0.94, 0.99]), Florida (0.97 [0.95, 0.99]), and Maine (0.97 [0.95, 0.99]), there was a significant, negative effect for year in the higher-income groups, but no significant effect for year in the lower-income groups (West Virginia: 1.00 [0.98, 1.03], Florida: 1.01 [0.99, 1.03], and Maine: 1.0 [0.98, 1.03]).

Discussion

Although eliminating disparities in tobacco use is a priority for tobacco control, all states continue to exhibit income-based disparities in smoking prevalence. Between 2011 and 2017 only one state reduced disparities in smoking between lower- and higher-income groups. In three states income-based disparities in smoking actually widened. In all other states there were no differences in linear time trends between the lower- and higher-income groups, suggesting no change in income-based disparities in smoking. Smoking prevalence among the lower-income groups was often twice as high as smoking prevalence in the higher-income groups. Eliminating income-based disparities in smoking is critical to making progress in tobacco control and reducing the disproportionate burden of smoking-related disease experienced among those with lower-incomes.[15]

Findings from this study underscore the importance of identifying and implementing policies that reduce income-based disparities in smoking. Research suggests that policies that raise the prices of tobacco through tax and non-tax means have potential to reduce income-based disparities in smoking.[9,16] Although the present study is descriptive and did not evaluate the relationships between state-level tobacco control policies and smoking, a discussion of the tobacco policy environment in New York, where disparities reduced, may provide insights into effective interventions for reducing income-based disparities. New York raised its cigarette tax by $1.60 in the middle of 2010, just before the observed trends. [17] In addition, New York City, where nearly two thirds of the state's population live, implemented a $10.50 minimum price for cigarettes in 2014.[18,19]

Tobacco control programs, if they seek to reduce disparities, should consider reviewing their policies and programs to ensure they reduce, and do not maintain or exacerbate, income-based disparities in smoking. Studies suggest that population-level smoking cessation programs may increase disparities in smoking because of higher cessation rates among higher-income smokers.[9] In addition, mass media campaigns are typically less effective among lower-income smokers.[9] Hill et al.[9] state that smoking cessation programs that target support and increase recruitment among lower-income smokers can help make up for the different cessation rates. Mass media campaigns may need to be tailored to lower-income smokers to exhibit pro-equity effects. For example, studies suggest that campaigns that use personal testimony are more effective among lower-income smokers.[9]

Ideally, tobacco control programs and policies should either have a pro-equity impact (i.e., have a greater health promoting impact among more disadvantaged populations) or be

adapted specifically for lower-income smokers. A tax increase is an example of a pro-equity tobacco control policy.[9] Though a tax increase is the same for all groups, the impact is greater among those with lower-incomes. In other cases, tobacco control programs and interventions may need to deliver a greater "dose" to the priority population or be tailored to that priority population. Policies that are not specific to tobacco control may also play an important role in reducing income-based disparities in smoking. For example, Medicaid expansion may have increased access to cessation resources in certain states and have an impact on income-based disparities in smoking. More research examining the impact of tobacco control and other social policies on income-based disparities is needed.

The findings should be interpreted considering study limitations. This study was designed to document trends in income-based disparities within states; further research is required to examine the role of tobacco control, health and income-related policies in contributing to those trends. The present study is not able to make definitive conclusions about the impact of tobacco control policies on income-based disparities in smoking. In addition, this study focuses on cigarette use and does not examine trends in other tobacco product, e-cigarette, or poly-tobacco use. Trends in income-based disparities may be affected by use of other products. Also, the present study categorized respondents into two groups based on their self-reported annual household income but did not take into account the number of individuals in one's household. The BRFSS only asks participants who completed the landline survey about the number of individuals in their household. A household of two with an annual household income of $50,000, however, may be in a different economic position than a household of five with the same income. A measure of income that incorporates household size may better represent the resources available to support the household. Smoking prevalence was also not examined according to more finely-grained income levels because of sample size limitations in smaller states.[20] Classifications of participants into more income groups may provide more detailed information about income-based disparities in smoking. In addition, the present study focused only on income-based disparities in smoking. Prior research has found that educational attainment is a stronger risk factor for smoking than poverty status, an income-based measure.[21] Nevertheless, the present study provides important epidemiological findings in response to the CDC's priority of reducing income-based disparities in smoking. Also, guidelines for social policies (e.g., Medicaid) in the US are typically based on income as opposed to education, so an assessment of income-based disparities in smoking may be more useful for guiding policy.

Furthermore, the present study focuses on reducing income-based disparities in smoking prevalence considering relative, as opposed to absolute, differences in smoking. For example, we would consider a scenario in which smoking prevalence dropped from 10% to 7% among higher-income groups and from 25% to 22% among lower-income groups to be an increase in disparities because the ratio of lower-to-higher smoking prevalence increases from 2.5 to 3.1. Although the absolute change for each group is the same (a drop of three percentage points), a higher proportion of the initial higher-income smoking population benefited than the initial lower-income smoking population. There is no consensus on which measure (absolute or relative) should be used to assess disparities in smoking.[22] Therefore it is critical to recognize what type of disparity is being examined and the accurate corresponding interpretation for the measure used.

A system to consistently monitor income-based disparities in smoking and disparities among other demographic groups, at both state and national levels, is needed to continue to examine progress toward reducing disparities. The present study focused on income-based disparities in smoking, but disparities exist according to groups defined by race/ethnicity, education, US census region, sexual orientation, disability, gender, and report of serious psychological distress.[1] Although not a focus of the present study, consistent with prior research at the national level,[2,23] there were significant relationships between age, sex, education and smoking in each state. Tracking smoking among these other sociodemographic groups at the state-level is a critical step in advocating and planning for effective tobacco control programs.

Conclusion

Lower-income populations have higher rates of smoking as compared to higher-income populations.[15] In addition, in most states there were no differences in linear time trends between the lower- and higher-income groups, suggesting no change in income-based disparities in smoking from 2011 to 2017. Findings from this study suggest that little progress has been made toward reducing income-based differences in smoking and additional policy and tobacco control efforts may be required to meet national disparity reduction goals.

Acknowledgments

Appendix

Appendix Table 1.

Sample size by state and year, Behavioral Risk Factor Surveillance Survey

State	2011	2012	2013	2014	2015	2016	2017
Alabama	7689	9026	6503	8652	7950	7031	6754
Alaska	3543	4345	4578	4388	3657	2914	3203
Arizona	6489	7306	4252	14867	7946	10952	15499
Arkansas	4739	5187	5268	5258	5256	5298	5322
California	18004	14574	11518	8832	12601	11393	9358
Colorado	13612	12255	13649	13399	13537	14958	9802
Connecticut	6829	8781	7710	7950	11899	11041	10588
Delaware	4777	5174	5206	4300	4070	4057	4139
District of Columbia	4560	3827	4931	4074	3994	3852	3868
Florida	12399	7624	34186	9821	9739	36955	22059
Georgia	9960	6100	8138	6351	4678	5381	6056
Hawaii	7606	7582	7858	7247	7163	8087	7754
Idaho	6077	5896	5630	5487	5802	5258	4894

State	2011	2012	2013	2014	2015	2016	2017
Illinois	5475	5579	5608	5052	5289	4764	5545
Indiana	8495	8645	10338	11530	6067	11066	13829
Iowa	7354	7166	8157	8130	6227	7257	7699
Kansas	20712	11801	23282	13743	23236	12188	21843
Kentucky	10894	11223	11013	11197	8806	10265	8642
Louisiana	10926	9068	5251	6781	4716	5256	4809
Maine	13243	9921	8097	9137	9063	10019	9692
Maryland	10117	12812	13011	12569	12598	18473	13588
Massachusetts	22328	21723	15071	15654	9294	8415	6912
Michigan	11049	10499	12759	8466	8935	12024	10889
Minnesota	15401	12246	14340	16419	16761	16831	17095
Mississippi	8907	7788	7453	4205	6035	5135	5076
Missouri	6405	6754	7118	7081	7307	7126	7601
Montana	10265	8679	9693	7502	6051	5971	5915
Nebraska	25416	19173	17139	22420	17561	15183	15350
Nevada	5493	4846	5101	3763	2926	4344	3764
New Hampshire	6362	7530	6463	6192	7022	6420	5751
New Jersey	15383	15761	13386	13045	11465	7652	11719
New Mexico	9417	8776	9316	8937	6734	6024	6538
New York	7735	6060	8979	6865	12357	34190	12249
North Carolina	11550	11898	8860	7289	6698	6536	4916
North Dakota	5306	4879	7806	7786	4972	5742	6992
Ohio	9948	13026	11971	10933	11929	12389	12289
Oklahoma	8523	8015	8244	8448	6943	6925	6638
Oregon	6247	5302	5949	5227	5359	5439	5370
Pennsylvania	11509	19958	11429	11000	5740	6810	6542
Rhode Island	6533	5480	6531	6450	6206	5457	5632
South Carolina	12948	12795	10717	11027	11607	11236	11311
South Dakota	8259	7878	6895	7401	7221	5767	7012
Tennessee	5914	7056	5815	5142	5979	6167	5843
Texas	14973	9129	10917	15436	14697	11709	12255
Utah	12669	12436	12769	15006	11401	10988	10251
Vermont	7096	6056	6392	6475	6489	6540	6516
Virginia	6605	7398	8464	9472	8646	9002	9630
Washington	14772	15319	11162	10092	16116	14259	13279
West Virginia	5282	5409	5899	6199	5957	7151	5472
Wisconsin	5302	5299	6589	7045	6188	5271	5810
Wyoming	6870	6273	6454	6416	5492	4497	4463

Note. Sample size is unweighted.

Appendix Table 2.

Odds ratios of the income and year terms in the logistic regression models

State	Odds Ratio (95% Confidence Interval)	
	Income	**Year**
Alabama	1.8 (1.6, 1.9)	0.99 (0.97, 1.00)
Alaska	1.8 (1.6, 2.0)	0.99 (0.96, 1.02)
Arizona	1.7 (1.6, 1.9)	0.97 (0.95, 0.99)
Arkansas	2.1 (1.9, 2.4)	0.98 (0.96, 1.01)
California	1.6 (1.5, 1.7)	1.00 (0.98, 1.01)
Colorado	1.8 (1.7, 1.9)	0.98 (0.97, 1.00)
Connecticut	1.7 (1.6, 1.9)	0.96 (0.95, 0.98)
Delaware	1.6 (1.4, 1.7)	0.97 (0.95, 0.99)
District of Columbia	1.8 (1.6, 2.1)	0.95 (0.93, 0.97)
Florida	1.7 (1.6, 1.8)	0.99 (0.97, 1.00)
Georgia	1.7 (1.6, 1.9)	0.98 (0.97, 1.00)
Hawaii	1.5 (1.4, 1.7)	0.98 (0.96, 1.00)
Idaho	2.0 (1.8, 2.2)	0.98 (0.96, 1.01)
Illinois	1.7 (1.5, 1.8)	0.96 (0.94, 0.98)
Indiana	1.8 (1.7, 2.0)	0.98 (0.97, 1.00)
Iowa	1.9 (1.8, 2.0)	0.99 (0.97, 1.00)
Kansas	1.8 (1.7, 1.9)	0.97 (0.96, 0.98)
Kentucky	1.8 (1.7, 2.0)	0.98 (0.96, 0.99)
Louisiana	1.6 (1.5, 1.8)	0.99 (0.97, 1.01)
Maine	2.0 (1.8, 2.1)	0.99 (0.97, 1.00)
Maryland	1.6 (1.5, 1.7)	0.96 (0.95, 0.98)
Massachusetts	1.8 (1.6, 1.9)	0.97 (0.95, 0.98)
Michigan	1.8 (1.7, 1.9)	0.98 (0.96, 0.99)
Minnesota	1.8 (1.7, 1.9)	0.96 (0.95, 0.97)
Mississippi	1.8 (1.6, 1.9)	0.99 (0.97, 1.01)
Missouri	1.9 (1.7, 2.0)	0.99 (0.97, 1.00)
Montana	2.0 (1.8, 2.1)	0.98 (0.96, 1.00)
Nebraska	1.7 (1.6, 1.8)	0.97 (0.95, 0.98)
Nevada	1.8 (1.6, 2.0)	0.97 (0.94, 0.99)
New Hampshire	2.0 (1.8, 2.2)	1.00 (0.98, 1.02)
New Jersey	1.4 (1.3, 1.6)	0.97 (0.95, 0.99)
New Mexico	1.7 (1.6, 1.9)	0.97 (0.95, 0.99)
New York	1.6 (1.5, 1.7)	0.98 (0.96, 0.99)
North Carolina	1.8 (1.7, 1.9)	0.97 (0.96, 0.99)
North Dakota	1.4 (1.3, 1.5)	0.98 (0.96, 0.99)
Ohio	2.0 (1.8, 2.1)	0.99 (0.97, 1.00)
Oklahoma	1.8 (1.7, 2.0)	0.96 (0.95, 0.98)
Oregon	2.0 (1.9, 2.2)	0.99 (0.97, 1.01)

State	Odds Ratio (95% Confidence Interval)	
	Income	Year
Pennsylvania	1.8 (1.7, 1.9)	0.97 (0.96, 0.99)
Rhode Island	1.8 (1.7, 2.0)	0.96 (0.94, 0.98)
South Carolina	1.8 (1.7, 1.9)	0.98 (0.97, 0.99)
South Dakota	1.6 (1.5, 1.8)	0.97 (0.95, 0.99)
Tennessee	2.0 (1.8, 2.2)	1.00 (0.99, 1.03)
Texas	1.5 (1.4, 1.7)	0.97 (0.95, 0.99)
Utah	1.8 (1.6, 1.9)	0.97 (0.96, 0.99)
Vermont	2.0 (1.8, 2.2)	1.00 (0.98, 1.02)
Virginia	1.7 (1.6, 1.8)	0.96 (0.95, 0.98)
Washington	1.9 (1.8, 2.1)	0.97 (0.96, 0.99)
West Virginia	1.9 (1.8, 2.0)	0.98 (0.97, 1.00)
Wisconsin	1.9 (1.7, 2.1)	0.97 (0.95, 0.99)
Wyoming	1.8 (1.6, 2.0)	0.97 (0.95, 0.99)

Notes. Logistic regression models were adjusted for age, sex, education, and race/ethnicity. The income term was coded where 1 = lower-income group and 0 = higher-income group. Models were run separately for each state.

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Highlights

- In each state, the odds of smoking were 1.4 to 3.0 times greater in the lower-income group as compared to the higher-income group

- Between 2011 and 2017 only one state reduced disparities in smoking between lower-and higher-income groups

- Pro-equity strategies are needed because current tobacco control efforts are maintaining or widening income-based disparities
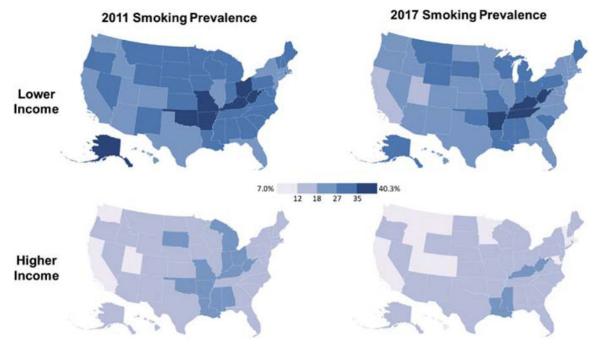
2011 Smoking Prevalence

2017 Smoking Prevalence

Lower Income

Higher Income

7.0% ▬▬▬ 40.3%
12 18 27 35

Fig. 1.
Smoking prevalence by lower and higher income groups in the United States.

Table 1.

Demographic characteristics of sample ($N = 1,716,224,520$), BRFSS Survey 2011–2017

Group	Sample size	Percentage of the Total Sample	Smoking Prevalence
Age			
18–24	220, 158,839	12.8%	16.3%
25–34	297,604,815	17.3%	22.0%
35–44	285,708,821	16.6%	19.1%
45–54	303513191	17.7%	19.9%
55–64	281,321,111	16.4%	17.2%
65 or older	327,917,743	19.1%	8.5%
Sex			
Female	880,865,485	51.3%	19.3%
Male	835,180,909	48.7%	14.9%
Missing	178,126	<1%	22.9%
Income			
Less than $10,000	92,626,842	5.4%	29.4%
$10,000 to less than $15,000	82,701,729	4.8%	26.9%
$15,000 to less than $20,000	118,285,358	6.9%	25.5%
$20,000 to less than $25,000	137, 721,331	8.0%	23.1%
$25,000 to less than $35,000	157,355,655	9.2%	20.3%
$35,000 to less than $50,000	199700002	11.6%	18.1%
$50,000 to less than $75,000	217,493,157	12.7%	15.1%
$75,000 or more	445,191,716	25.9%	9.6%
Missing	265,148,729	15.4%	14.0%
Education			
Did not graduate high school	246,667,136	14.4%	26.5%
Graduated high school	486,573,230	28.4%	21.6%
Attended college or technical school	526,324,450	30.7%	17.0%
Graduated from college or technical school	447,269,335	26.1%	7.0%
Missing	9,390,368	<1%	7.2%
Race/ethnicity			

Group	Sample size	Percentage of the Total Sample	Smoking Prevalence
White only, non-Hispanic	1,093,518, 887	63.7%	18.0%
Black only, non-Hispanic	198,950,812	11.6%	19.1%
Other race only, non-Hispanic or Multiracial, non-Hispanic	133,637,273	7.8%	14.4%
Hispanic	261,325,378	15.2%	13.1%
Missing	28,792,170	1.7%	15.1%
Year			
2011	235,054,070	13.7%	19.8%
2012	240,130,580	14.0%	18.4%
2013	243,095,138	14.2%	17.4%
2014	245,561,099	14.3%	16.4%
2015	248,437,417	14.5%	15.8%
2016	251,162,036	14.6%	15.5%
2017	252,784,180	14.7%	15.5%

Notes. BRFSS = Behavioral Risk Factor Surveillance System. The table presents descriptive statistics for combined BRFSS data from 2011 to 2017. The Other race only, non-Hispanic group includes persons who are American Indian or Alaskan Native only, non-Hispanic, Asian only, non-Hispanic, Native Hawaiian or other Pacific Islander only, non-Hispanic, and Other race only, non-Hispanic.

Table 2.

Cigarette use prevalence in 2011 and 2017 by income group

State	2011			2017			Change in ratio
	Lower income	Higher income	Ratio[a]	Lower income	Higher income	Ratio[a]	
Alabama	33.4 (30.7, 36.0)	18.4 (16.6, 20.2)	1.8	32.2 (29.4, 35.0)	15.7 (14.0, 17.3)	2.1	−0.3
Alaska	35.1 (31.1, 39.2)	16.3 (14.1, 18.6)	2.2	33.0 (27.1, 38.9)	16.1 (13.3, 19.0)	2.0	0.2
Arizona	27.0 (22.9, 31.1)	15.1 (12.9, 17.3)	1.8	24.0 (22.2, 25.8)	13.0 (12.0, 13.9)	1.8	0.0
Arkansas	38.2 (34.3, 42.0)	18.3 (15.9, 20.6)	2.1	35.3 (31.1, 39.6)	15.6 (13.0, 18.2)	2.3	−0.2
California	18.6 (17.1, 20.1)	11.1 (10.3, 11.9)	1.7	17.2 (15.1, 19.2)	10.5 (9.3, 11.7)	1.6	0.1
Colorado	26.4 (24.3, 28.6)	13.1 (12.0, 14.3)	2.0	24.2 (22.0, 26.3)	11.5 (10.4, 12.5)	2.1	−0.1
Connecticut	23.4 (20.7, 26.1)	13.5 (12.0, 15.2)	1.7	21.0 (18.7, 23.3)	10.3 (9.1, 11.6)	2.0	−0.3
Delaware	32.0 (27.8, 36.2)	17.7 (15.7, 19.8)	1.8	26.0 (22.1, 29.8)	14.4 (12.5, 16.4)	1.8	0.0
District of Columbia	31.6 (27.8, 35.5)	13.4 (11.2, 15.6)	2.4	26.8 (23.4, 30.3)	9.0 (7.4, 10.7)	3.0	−0.6
Florida	24.7 (22.6, 26.7)	16.1 (14.7, 17.5)	1.5	24.3 (21.9, 26.7)	12.7 (11.4, 14.0)	1.9	−0.4
Georgia	30.7 (28.0, 33.4)	15.4 (13.9, 16.9)	2.0	25.8 (23.1, 28.5)	14.7 (13.1, 16.3)	1.8	0.2
Hawaii	24.5 (21.8, 27.2)	12.4 (10.9, 14.0)	2.0	18.3 (16.1, 20.6)	11.3 (9.9, 12.6)	1.6	0.4
Idaho	26.2 (22.6, 29.7)	13.0 (11.3, 14.8)	2.0	24.9 (21.2, 28.6)	11.2 (9.6, 12.8)	2.2	−0.2
Illinois	27.0 (23.8, 30.1)	17.0 (14.9, 19.1)	1.6	22.7 (20.1, 25.4)	12.3 (10.8, 13.7)	1.8	−0.2
Indiana	34.4 (31.8, 37.0)	21.0 (19.4, 22.6)	1.6	33.3 (31.2, 35.5)	17.8 (16.7, 18.9)	1.9	−0.3
Iowa	28.9 (26.6, 31.2)	14.7 (13.3, 16.1)	2.0	26.1 (23.8, 28.3)	13.0 (11.9, 14.2)	2.0	0.0
Kansas	31.2 (29.8, 32.7)	15.1 (14.2, 16.0)	2.1	27.0 (25.5, 28.5)	13.2 (12.4, 14.0)	2.0	0.1
Kentucky	40.3 (37.4, 43.3)	22.7 (21.0, 24.5)	1.8	37.1 (33.6, 40.6)	19.4 (17.6, 21.2)	1.9	−0.1
Louisiana	32.6 (30.1, 35.1)	21.2 (19.5, 22.9)	1.5	32.8 (29.6, 36.0)	18.3 (16.4, 20.2)	1.8	−0.3
Maine	34.0 (31.8, 36.3)	17.0 (15.8, 18.1)	2.0	30.4 (27.2, 33.6)	13.8 (12.5, 15.2)	2.2	−0.2
Maryland	28.2 (25.4, 31.0)	14.4 (13.0, 15.9)	2.0	23.3 (20.7, 25.9)	10.9 (9.8, 12.0)	2.1	−0.1
Massachusetts	25.6 (23.9, 27.4)	13.9 (12.8, 15.0)	1.8	22.9 (19.7, 26.0)	10.4 (8.9, 11.9)	2.2	−0.4
Michigan	33.6 (31.0, 36.3)	18.4 (17.0, 19.9)	1.8	31.4 (29.0, 33.8)	15.4 (14.3, 16.6)	2.0	−0.2
Minnesota	27.6 (25.7, 29.5)	14.1 (13.0, 15.2)	2.0	23.2 (21.5, 24.8)	11.3 (10.5, 12.1)	2.1	−0.1
Mississippi	34.6 (32.0, 37.2)	21.6 (20.0, 23.3)	1.6	33.1 (29.0, 37.1)	18.9 (16.8, 20.9)	1.8	−0.2
Missouri	37.1 (34.1, 40.1)	18.8 (17.0, 20.6)	2.0	34.3 (31.1, 37.5)	16.1 (14.6, 17.6)	2.1	−0.1
Montana	33.2 (30.7, 35.7)	15.6 (14.1, 17.0)	2.1	31.3 (27.9, 34.6)	11.8 (10.3, 13.3)	2.7	−0.6
Nebraska	28.5 (26.9, 30.1)	16.5 (15.6, 17.3)	1.7	25.7 (23.3, 28.2)	12.6 (11.6, 13.6)	2.0	−0.3
Nevada	32.0 (28.0, 36.0)	17.9 (15.7, 20.1)	1.8	24.1 (20.2, 28.1)	15.2 (12.9, 17.4)	1.6	0.2
New Hampshire	29.7 (26.9, 32.6)	13.9 (12.2, 15.5)	2.1	26.2 (22.6, 29.8)	12.5 (10.6, 14.4)	2.1	0.0
New Jersey	21.6 (19.9, 23.4)	14.0 (12.9, 15.1)	1.5	18.4 (16.2, 20.6)	12.3 (10.9, 13.7)	1.5	0.0
New Mexico	28.9 (26.8, 31.1)	16.2 (14.8, 17.6)	1.8	26.4 (23.6, 29.1)	13.0 (11.4, 14.6)	2.0	−0.2
New York	26.7 (24.1, 29.4)	13.8 (12.4, 15.1)	1.9	20.6 (18.5, 22.6)	12.7 (11.6, 13.8)	1.6	0.3
North Carolina	30.9 (28.4, 33.3)	16.5 (15.0, 18.0)	1.9	25.9 (22.8, 29.0)	14.0 (12.3, 15.7)	1.9	0.0
North Dakota	27.7 (24.8, 30.6)	17.7 (15.8, 19.6)	1.6	26.9 (24.2, 29.7)	15.0 (13.5, 16.4)	1.8	−0.2
Ohio	38.0 (35.3, 40.7)	18.6 (17.1, 20.0)	2.0	34.2 (31.6, 36.9)	16.7 (15.4, 17.9)	2.0	0.0
Oklahoma	38.1 (35.3, 40.8)	19.6 (18.0, 21.1)	1.9	29.7 (26.8, 32.6)	16.3 (14.8, 17.9)	1.8	0.1
Oregon	32.0 (29.0, 35.1)	13.4 (11.9, 15.0)	2.4	26.3 (23.7, 29.2)	13.0 (11.5, 14.4)	2.0	0.4

State	2011			2017			Change in ratio
	Lower income	Higher income	Ratio[a]	Lower income	Higher income	Ratio[a]	
Pennsylvania	32.5 (30.2, 34.8)	17.8 (16.5, 19.1)	1.8	28.9 (25.9, 32.0)	15.8 (14.3, 17.2)	1.8	0.0
Rhode Island	28.7 (25.7, 31.7)	15.7 (14.1, 17.4)	1.8	23.1 (19.6, 26.6)	12.8 (11.1, 14.6)	1.8	0.0
South Carolina	31.8 (29.6, 34.0)	17.9 (16.4, 19.5)	1.8	29.0 (26.7, 31.3)	14.7 (13.5, 16.0)	2.0	−0.2
South Dakota	31.9 (28.1, 35.8)	18.7 (16.4, 21.0)	1.7	28.8 (23.9, 33.6)	16.4 (14.3, 18.6)	1.8	−0.1
Tennessee	31.8 (27.4, 36.3)	17.2 (14.4, 20.0)	1.8	35.7 (32.5, 39.0)	16.9 (15.1, 18.8)	2.1	−0.3
Texas	25.8 (23.5, 28.1)	15.4 (14.0, 16.8)	1.7	20.0 (17.3, 22.7)	14.5 (12.7, 16.3)	1.4	0.3
Utah	18.6 (16.9, 20.3)	7.9 (7.0, 8.8)	2.4	15.1 (13.4, 16.8)	7.0 (6.2, 7.9)	2.2	0.2
Vermont	28.7 (26.0, 31.3)	12.5 (11.0, 14.0)	2.3	25.3 (22.5, 28.1)	11.6 (10.1, 13.2)	2.2	0.1
Virginia	30.6 (27.7, 33.6)	14.9 (13.1, 16.7)	2.1	25.4 (23.2, 27.7)	12.5 (11.3, 13.7)	2.0	0.1
Washington	26.6 (24.4, 28.8)	11.4 (10.2, 12.6)	2.3	21.5 (19.6, 23.3)	10.7 (9.7, 11.6)	2.0	0.3
West Virginia	38.0 (35.2, 40.8)	22.8 (20.7, 24.8)	1.7	38.5 (35.5, 41.4)	19.0 (17.2, 20.9)	2.0	−0.3
Wisconsin	34.2 (29.9, 38.5)	15.5 (13.8, 17.2)	2.2	27.6 (23.9, 31.3)	13.3 (11.7, 14.8)	2.1	0.1
Wyoming	32.3 (29.4, 35.1)	16.4 (14.7, 18.1)	2.0	27.8 (24.7, 30.9)	14.0 (12.3, 15.7)	2.0	0.0

Note. The value is the ratio of smoking prevalence in the lower-income group to that in the higher-income group.