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Smoking cessation among US adult smokers with and without COPD, 2018

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Abstract

Introduction: More than three out of five US adults who have ever smoked cigarettes have quit. This study assessed the latest estimates of smoking cessation among US adults with and without chronic obstructive pulmonary disease (COPD) who had ever smoked cigarettes (ever smokers).

Methods: Data from 161,233 ever smokers (12.8% with COPD) in the 2018 Behavioral Risk Factor Surveillance System (BRFSS) were analyzed in 2020. Weighted percentages of quit ratios (percentage of ever smokers who quit smoking), past-year quit attempts (1 day), and recent successful cessation (quit 6 months ago) by self-reported physician-diagnosed COPD status were obtained from multivariable logistic regression analyses with adjustment for sociodemographic characteristics, health-risk behaviors, depression, and asthma.

Results: Adults with COPD who smoked had greater age-adjusted past-year quit attempts (68.8% vs. 64.3%), but lower recent successful cessation (4.5% vs. 5.8%) and quit ratio (53.2% vs. 63.9%) than those without COPD. After adjusting for covariates, Adults with COPD who smoked had a significantly higher percentage of past-year quit attempts, but similar recent successful cessation and a significantly lower lifetime quit ratio compared with their counterparts without COPD.

Conclusions: Our findings suggest that individuals with COPD who try to quit smoking may be less likely to succeed than those without COPD. Evidence-based treatments for smoking cessation remains an important component of a comprehensive approach to help all adults to quit and are a particularly important element of COPD management and care.

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Keywords

cigarette smoking; smoking cessation; ever smokers; current smokers; COPD; BRFSS; population-based study; health disparity

Introduction

Chronic obstructive pulmonary disease (COPD) is a group of preventable progressive lung diseases characterized by persistent respiratory symptoms and airflow limitations due to airway obstruction. COPD includes chronic bronchitis and emphysema.¹ Physician-diagnosed COPD was reported by 6.2% of US adults in 2017 and differed by smoking status (15.2% among current smokers, 7.6% among former smokers, and 2.8% among those who had never smoked).² Cigarette smoking is the primary risk factor for COPD,³ but in 2011, two in five US adults with COPD reported current smoking.⁴ Smoking cessation is critical in the prevention and control of COPD because cessation not only reduces the risk of developing COPD, it also reduces the loss of lung function over time in those with diagnosed COPD.⁵ Growing evidence suggests that smoking cessation also diminishes the symptoms of COPD and ameliorates COPD exacerbation, hospitalization, and mortality.^{1, 3, 6, 7} Though evidence-based treatments exist to help people quit smoking, including behavioral counseling and pharmacotherapy, less than one in three adults who smoke report using these treatments in their quit attempts, and cessation rates remain quite low.⁵

Although cigarette smoking has declined and 61.7% of ever smokers have quit,⁸ about 34.1 million Americans reported current cigarette smoking in 2019.⁹ Smoking cessation varies by age, race/ethnicity, socioeconomic status, and urban-rural status.⁵ Adults with COPD were more likely to report current smoking,¹⁰ which may be associated with nicotine dependence that makes quitting smoking more difficult.¹¹ Furthermore, patients with COPD were more likely to be physically inactive, have obesity, and have depression, which could additionally influence smoking cessation behaviors.^{12–17} Few population-based studies to date have compared smoking cessation behaviors between adults with and without COPD.^{10, 11} One US telephone survey from only 5 states reported no significant difference in past-year quit attempts among adults with COPD than those without COPD in 2011, with approximately 40% of smokers with COPD reporting no quit attempts.¹⁰ A population-based study in Spain also suggested no difference in the number of quit attempts between smokers with and without COPD, with one-third of current smokers with COPD having never tried to stop smoking.¹¹ The purpose of this study is to update information on smoking cessation behaviors among US adults with and without COPD by analyzing the latest available data from the Behavioral Risk Factor Surveillance System (BRFSS) in 2018. In addition, variations of smoking cessation behaviors between adults with COPD and without COPD were assessed by age, sex, race/ethnicity, socioeconomic status such as education, employment status, and household income, urban-rural areas, risk behaviors, and chronic conditions.

Methods

Data from the 2018 BRFSS, a random-digit-dialed landline and cellular telephone survey conducted by state health departments in collaboration with the Centers for Disease Control and Prevention (CDC) in all 50 states, the District of Columbia (DC), and US territories, were analyzed ([CDC - 2018 BRFSS Survey Data and Documentation](#)). The BRFSS collected data on sociodemographic characteristics, health-related behaviors including a history of smoking and smoking cessation, and chronic conditions including COPD among US adults aged 18 years. CDC weighted each sample using methods of design weighting and “raking” weighting to obtain a study population representative of each state. The 2018 combined median response rate, which was calculated using the standard set by the American Association for Public Opinion Research (AAPOR) Response Rate Formula #4 was 49.9% (range: from 38.8% in California to 67.2% in South Dakota) from 437,436 respondents with complete information.¹⁸ All participating respondents gave informed consent and the present study is a secondary data analysis which was exempt from IRB review. The analysis of quit ratio was restricted to 161,233 adult respondents who had ever smoked cigarettes, who lived in the 50 states or DC, and who had complete information related to selected characteristics (16,886 respondents who had a missing value on any variable of interest except for federal poverty level were excluded). For past-year quit attempts and recent successful cessation, analyses were further restricted to 65,681 respondents who were either current smokers or former smokers who had quit any time in the previous year.

Measures

Smoking and smoking cessation

Cigarette smoking status was defined by 2 questions: “Have you smoked at least 100 cigarettes in your entire life?” and “Do you currently smoke every day, some days, or not at all?” Current smokers were those who reported having smoked at least 100 cigarettes during their lifetime and currently smoked every day or some days; former smokers reported having smoked at least 100 cigarettes during their lifetime but did not currently smoke. Ever smokers included both current and former smokers. Quit ratio was defined as the percentage of ever smokers who had quit smoking (number of former smokers divided by number of ever smokers). Past-year quit attempts were defined as current smokers who quit for at least one day in the past year and former smokers who quit any time in the past year. Recent successful cessation was defined as former smokers who had last smoked a cigarette within the previous year, but not within the 6 months prior to the survey. The three cessation-related measures are often employed to reflect insights of short-term (<1 year for past-year quit attempts and recent successful cessation) and long-term smoking cessation (1 year, 56% had quit smoking for 10 years or more in our study sample).^{5,19}

COPD status

Respondents were defined as having COPD if they gave an affirmative response to whether they had ever been told by a doctor, nurse, or other health professional that they had COPD, emphysema, or chronic bronchitis.

Covariates

Other covariates were age group (18–44, 45–64, 65–74, and 75 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, American Indian/Alaska Native, Asian, and non-Hispanic other), education level (<high school diploma, high school diploma or GED, some college, and college graduate), employment status (employed, unemployed, retired, unable to work, and other), and federal poverty level (the ratio of total family income to federal poverty level per family size categorized as 125% federal poverty level [FPL], 126%–<200% FPL, 200%–<399% FPL, and 400 FPL, and missing).²⁰ The 2013 National Center for Health Statistic (NCHS) urban-rural classification scheme (large central metropolitan/city, large fringe metropolitan/suburb, medium metropolitan, small metropolitan, micropolitan, noncore/rural) was applied to obtain urban-rural areas.²¹ Body mass index (BMI, kg/m²) was calculated from self-reported height and weight and categorized as underweight (BMI<18.5), normal weight (BMI=18.5–24.9), overweight (BMI=25.0–29.9), or obese (BMI ≥30.0). Any leisure-time physical activity was defined based on an affirmative response to the question “During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?” Asthma shares many similarities with COPD, however, they are distinct diseases processes.²² Therefore, asthma was included as a covariate in the analysis. Current asthma was defined as an affirmative answer to 2 questions: “Have you ever been told by a doctor, nurse, or other health professional that you have asthma?” and “Do you still have asthma?” Former asthma was defined as an affirmative answer to the first question and not current asthma. Depression was defined as an affirmative response to the question: “[Ever told by a health professional] you have a depressive disorder (including depression, major depression, dysthymia, or minor depression)?”

Statistical analysis

Prevalence and 95% confidence intervals (CIs) of the three cessation measures were obtained from logistic regression models adjusting for age groups. Adjusted prevalence ratios (PRs) and 95% confidence intervals (CIs) of the three cessation measures were derived from multivariable logistic regression analyses controlling for age group, sex, race/ethnicity, education level, employment status, FPL, NCHS urban-rural county classification, BMI category, leisure-time physical activity, depression, and asthma status after no collinearity among the covariates was observed. Adjusted PRs were used to assess the association of quit attempts with COPD status after controlling for covariates. Estimates with relative standard error >30% or N <50 (unweighted sample size) were suppressed. All analyses were conducted in SAS-callable SUDAAN (version 11.0.3., Research Triangle Institute) to account for the complex sampling design. Two-tailed t-tests were applied to determine significant differences of comparison between two groups using a significance level of 0.05.

Results

The overall prevalence of COPD was 12.8% among ever smokers. Ever smokers with COPD were more likely to be women, adults aged ≥45 years, adults with high school diploma or less education level, retired or unable to work, have <200 FPL family income, live

in micropolitan or noncore (rural) counties, report no leisure-time physical activity, have current or former asthma, currently smoke, have obesity, and have depression compared with those without COPD ($p<0.01$, Table 1).

Overall, respondents with COPD reported having higher age-adjusted past-year quit attempts (68.8 vs. 64.3%) but lower age-adjusted recent successful cessation (4.5% vs. 5.8%) and quit ratio (53.2% vs. 63.9%) than those without COPD (Tables 2–4). After adjusting for covariates, adults with COPD overall or some subgroups reported higher past-year quit attempts than those without COPD, with some exceptions including those aged 18–44 years or ≥65 years, non-Hispanic Blacks, Hispanics, and Asians, and those with current or former asthma, depression, or overweight (Table 2). Recent successful cessation, however, was no different on adjusted analyses overall or among any subgroup with COPD compared to those without COPD (Table 3). Most subgroups with COPD reported a lower quit ratio than their counterparts without COPD except for minority race/ethnic groups and those who were underweight (Table 4).

Discussion

In this study, about seven in ten adults with COPD who smoked cigarettes made a past-year attempt to quit smoking, but fewer than one in twenty reported recent successful cessation. Compared to their counterparts without COPD, those with COPD who smoked were more likely to have made a quit attempt but had similar prevalence of recent cessation success in the past year; these findings were largely consistent across population sub-groups. A previous study reported a similar prevalence of past-year quit attempts among adults with COPD who smoked, but it was not significantly higher than those without COPD who smoked,¹⁰ which might be due to a limited sample size. In addition, adults with COPD in this study were found to have a significantly lower quit ratio than those without COPD among the overall population sample and across nearly all population sub-groups. These results suggest that individuals with COPD who try to quit smoking may be less likely to succeed than those who do not have COPD.

The reason that individuals with COPD who smoke are less likely to successfully quit smoking than those without COPD is unclear and is likely multifactorial. Tobacco dependence is a chronic, relapsing disorder that often requires multiple interventions and long-term support.²³ A prior study of smoking behaviors among adults with COPD found that those who smoked were more likely to smoke more heavily (>30 pack years) and have higher nicotine dependence than their counterparts without COPD.¹¹ Greater nicotine dependency can make successful cessation more difficult and could be one contributing factor to the lower quit ratio seen among those with COPD.²³ Treatment of tobacco dependence is critical for patients with COPD who smoke; smoking cessation remains the only established intervention to halt the progression of lung function loss over time.

Evidence-based treatments for smoking cessation are available, including FDA-approved cessation medications and behavioral interventions; these treatments increase the likelihood of successful cessation, particularly when used in combination.⁵ One prior study using 2011 BRFSS data from 5 states noted that while individuals with COPD who smoked

and tried to quit reported higher utilization of cessation treatments than those without chronic disease, approximately half reported using no evidence-based treatment in their quit attempt¹⁰. Taken together with the finding that the majority of patients with COPD who smoke have tried to quit in the last year, this suggests there are opportunities to connect patients with evidence-based treatments to help them achieve cessation success. In addition to a potentially greater nicotine dependency, individuals with COPD may face additional barriers to quitting smoking, including lack of self-efficacy, a sense of nihilism regarding smoking cessation, and concomitant depression.^{24,25} Clinical cessation interventions which address these barriers including using individually tailored messages, use of motivation-enhancing techniques to support self-efficacy, and treatment of concomitant morbidities, may help support quit success in this population.^{24,26–29} Furthermore, evidence suggests this population may benefit most from treatment with a combination of cessation medication and behavioral interventions.^{24,26} Along with utilization of education/self-management, exercise, pulmonary rehabilitation programs, and medications, smoking cessation interventions are recognized in multiple clinical guidelines as an important part of COPD management and care.^{1, 30, 31} Hospitalization, pulmonary rehabilitation, and initial diagnosis with COPD may present particular opportunities to discuss smoking cessation and connect patients to interventions.^{5, 27, 32} Actions taken at the clinical and health system levels, including dissemination of evidence-based clinical practice guidelines regarding treatment of tobacco dependence and linkage of cessation-related clinical quality measures to payment, can also increase delivery of cessation treatment.⁵ Access to and utilization of treatment can be further increased by barrier-free insurance coverage of evidence-based cessation therapies.⁵ Additionally, population level interventions, including tobacco price increases, mass media campaigns, and smoke-free policies, increase smoking cessation in communities and are important components of a comprehensive approach to tobacco prevention and control.^{3, 5}

Although the results were obtained from a large sample of US adults from all the 50 states and DC, this study is subject to several limitations. First, BRFSS is a cross-sectional survey so that no causal inference can be made about the relationship between COPD status and smoking cessation. Furthermore, persons who made repeated smoking quit attempts over time cannot be identified before achieving sustained success.¹¹ Therefore, a longitudinal study on smoking cessation among adults with COPD may provide more insights in this population. Second, sample selection bias due to low response rates may have influenced the results. However, the effect of potential systematic bias was likely limited as the results are consistent with previous studies.^{10, 11} Third, caution should be taken in interpretation of quit ratio in this population as quitting smoking decreases the risk of COPD, potentially leading to a lower quit ratio among individuals with COPD. Finally, data from the BRFSS survey, including questions on smoking cessation and health conditions are self-reported and therefore subject to recall and social-desirability bias.

Conclusion

Most U.S. adults with COPD who smoke have attempted to quit smoking recently and are more likely than those without COPD to have made a quit attempt, but few report successful cessation. Additionally, compared to their counterparts without COPD, fewer individuals with COPD who have ever smoked have quit. Evidence-based treatments for

smoking cessation remain an important component of a comprehensive approach to help all adults to quit and are a particularly important element of COPD management and care.

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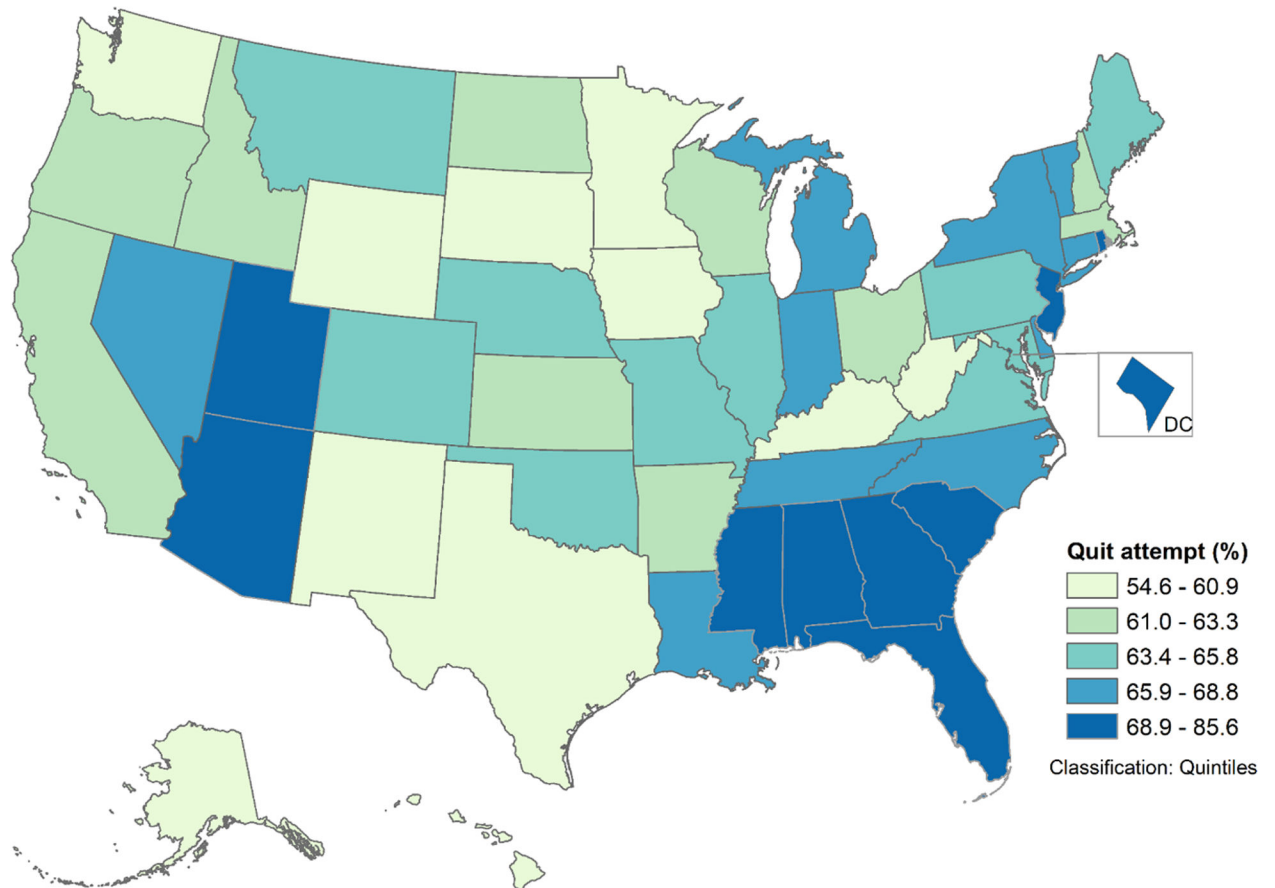


Figure 1.

Past-year quit attempts was defined as the percentage of current smokers who quit for 1 day or more in the past year and former smokers who quit within the past year among current smokers and former smokers who quit within the past year.

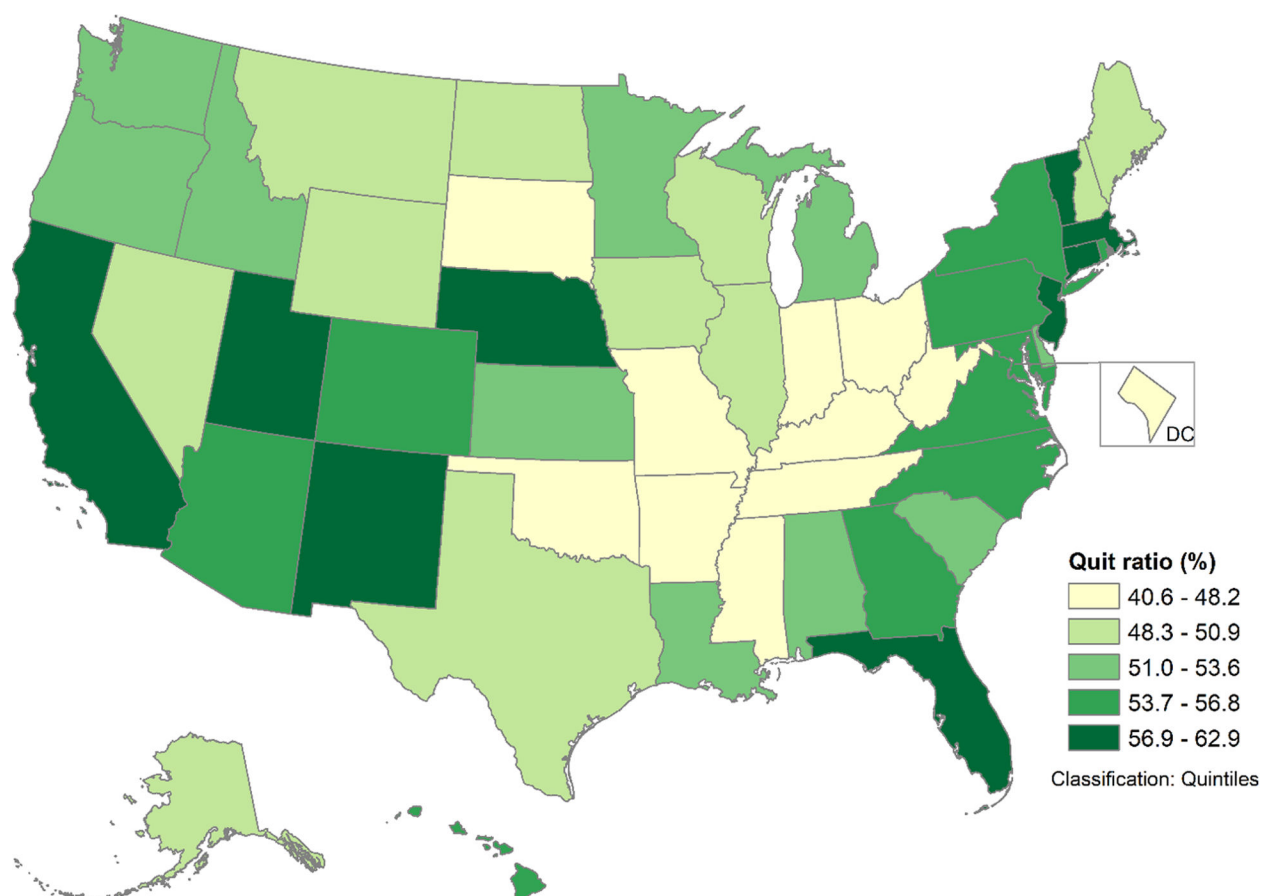


Figure 2.
Quit ratio was defined as the percentage of ever smokers who had quit smoking (former smokers divided by ever smokers).

Table 1.

Distribution of selected characteristics among 161,233 US adults who smoke by COPD status, 2018 BRFSS

Characteristic	N	COPD, % (95% CI) (n=24,491)	Non-COPD, % (95% CI) (n=136,742)
Sex			
Men	84,241	46.1 (44.8–47.5) **	58.3 (57.8–58.9)
Women	76,992	53.9 (52.5–55.2) **	41.7 (41.1–42.2)
Age group (years)			
18–44	37,502	15.4 (14.4–16.5) **	40.9 (40.3–41.5)
45–64	59,456	42.8 (41.5–44.1) **	35.4 (34.9–36.0)
65–74	38,322	25.3 (24.2–26.4) **	14.4 (14.1–14.8)
75	25,953	16.5 (15.6–17.4) **	9.3 (9.0–9.6)
Race/ethnicity			
Non-Hispanic White	130,410	79.2 (78.0–80.4) **	71.7 (71.2–72.3)
Non-Hispanic Black	11,266	9.8 (8.9–10.7)	9.6 (9.3–10.0)
Hispanic	8,532	6.0 (5.2–6.9) **	12.5 (12.0–13.0)
American Indian/Alaska Native	3,673	1.8 (1.5–2.1) **	1.1 (1.0–1.3)
Asian	1,930	0.9 (0.6–1.3) **	2.9 (2.6–3.2)
Other, Non-Hispanic	5,422	2.3 (2.0–2.6)	2.1 (2.0–2.3)
Education			
Less than high school diploma	14,563	23.6 (22.3–24.8) **	13.7 (13.3–14.2)
High school diploma or GED	51,413	34.4 (33.2–35.6) **	31.5 (31.0–32.1)
Some college or technical school	48,677	31.2 (30.0–32.4) **	33.6 (33.1–34.2)
College graduate	46,580	10.8 (10.1–11.6) **	21.1 (20.7–21.5)
Employment status			
Employed	73,852	24.9 (23.8–26.1) **	58.5 (57.9–59.0)
Unemployed	7,165	5.2 (4.6–6.0)	5.5 (5.3–5.8)
Retired	55,426	35.9 (34.7–37.1) **	21.5 (21.1–21.9)
Unable to work	17,469	28.3 (27.2–29.5) **	8.0 (7.8–8.3)
Homemaker or student	7,321	5.6 (4.9–6.5)	6.4 (6.1–6.7)
Federal poverty level (FPL)			
125% FPL	29,543	31.8 (30.6–33.1) **	19.4 (19.0–19.9)
126%–199% FPL	26,342	19.8 (18.8–20.8) **	14.2 (13.9–14.6)
200%–399% FPL	39,765	19.9 (18.9–20.9) **	22.8 (22.4–23.3)
400% FPL	45,073	13.3 (12.4–14.3) **	31.6 (31.1–32.1)
Missing	20,510	15.2 (14.3–16.2) **	11.9 (11.5–12.3)
NCHS urban-rural county scheme classification			

Characteristic	N	COPD, % (95% CI) (n=24,491)	Non-COPD, % (95% CI) (n=136,742)
Large central metropolitan	21,398	21.6 (20.3–22.8) **	27.2 (26.6–27.8)
Large fringe metropolitan	29,293	22.6 (21.4–23.8) **	24.4 (24.0–24.9)
Medium metropolitan	33,181	21.8 (20.9–22.8)	21.6 (21.1–22.0)
Small metropolitan	23,023	11.0 (10.3–11.7) **	9.7 (9.5–10.0)
Micropolitan	27,339	12.4 (11.6–13.1) **	9.6 (9.3–9.8)
Noncore (rural)	26,999	10.7 (10.0–11.4) **	7.5 (7.3–7.8)
Leisure-time physical activity			
Yes	114,400	53.6 (52.3–54.9) **	74.0 (73.5–74.5)
No	46,833	46.4 (45.1–47.7) **	26.0 (25.5–26.5)
Asthma status			
Current asthma	17,209	32.7 (31.4–33.9) **	7.2 (6.9–7.5)
Former asthma	6,775	6.1 (5.5–6.9) **	4.9 (4.6–5.1)
No	137,249	61.2 (59.9–62.5) **	88.0 (87.6–88.3)
Cigarette smoking status			
Current smoker	55,109	47.7 (46.4–49.0) **	38.1 (37.5–38.6)
Former smoker	106,124	52.3 (51.0–53.6) **	61.9 (61.4–62.5)
Body mass index (BMI, kg/m²)			
Underweight (<18.5)	2,904	3.3 (2.9–3.7) **	1.5 (1.4–1.6)
Normal weight (18.5–24.9)	46,985	28.0 (26.8–29.2) **	29.8 (29.3–30.3)
Overweight (25.0–29.9)	58,743	30.2 (29.0–31.4) **	37.0 (36.5–37.6)
Obese (≥30.0)	52,601	38.5 (37.2–39.8) **	31.7 (31.1–32.2)
Depression			
Yes	38,726	40.4 (39.1–41.7) **	22.2 (21.7–22.6)
No	122,507	59.6 (58.3–60.9) **	77.8 (77.4–78.3)

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; COPD, chronic obstructive pulmonary disease; CI, confidence interval; GED, General Educational Development; NCHS, National Center for Health Statistics.

** P<0.01 for the comparison between COPD and non-COPD; otherwise p>0.05.

Table 2.

Prevalence^a and adjusted prevalence ratio of past year quit attempts^b among 65,681 adults who smoke, 2018 BRFSS

	Past-year quit attempts ^b , % (95% CI)		Adjusted prevalence ratio (95% CI) ^c
Characteristic	COPD	Non-COPD	
Crude prevalence	64.9 (63.1–66.6)	64.7 (63.9–65.6)	
Age-adjusted prevalence	68.8 (67.0–70.5)	64.3 (63.5–65.1)	1.07 (1.04–1.11) *
Sex^a			
Men	68.5 (65.8–71.3)	64.6 (63.5–65.7)	1.07 (1.02–1.12) *
Women	68.7 (66.4–71.0)	63.9 (62.7–65.2)	1.07 (1.03–1.11) *
Age group (years)			
18–44	69.8 (65.8–73.8)	69.9 (68.8–70.9)	1.01 (0.95–1.08)
45–64	64.8 (62.3–67.3)	58.5 (57.0–60.0)	1.09 (1.04–1.15) *
65–74	62.8 (59.5–66.2)	56.6 (54.0–59.2)	1.07 (0.99–1.15)
75	54.3 (47.8–60.8)	47.6 (42.7–52.5)	1.16 (0.99–1.36)
Race/ethnicity^a			
Non-Hispanic White	66.8 (64.9–68.7)	61.7 (60.7–62.6)	1.07 (1.04–1.11) *
Non-Hispanic Black	76.0 (69.1–82.9)	71.9 (69.5–74.3)	1.05 (0.96–1.14)
Hispanic	74.6 (64.8–84.4)	68.7 (65.7–71.6)	1.08 (0.94–1.25)
American Indian/Alaska Native	69.3 (59.6–78.9)	53.3 (46.8–59.8)	1.26 (1.04–1.52) *
Asian	85.4 (70.1–101.2)	74.9 (69.5–80.3)	1.08 (0.84–1.38)
Other, Non-Hispanic	74.6 (67.7–81.6)	64.4 (60.7–68.0)	1.13 (1.01–1.27) *
Education^a			
Less than high school diploma	66.4 (62.3–70.4)	61.8 (59.3–64.2)	1.08 (1.00–1.17)
High school diploma or GED	67.8 (65.0–70.6)	62.7 (61.3–64.0)	1.07 (1.02–1.13) *
Some college or technical school	72.2 (69.4–74.9)	65.4 (63.9–66.9)	1.10 (1.05–1.15) *
College graduate	67.3 (61.1–73.5)	69.1 (67.4–70.8)	0.97 (0.88–1.07)
Employment status^a			
Employed	67.0 (63.6–70.4)	65.5 (64.4–66.5)	1.04 (0.99–1.10)
Unemployed	73.3 (67.3–79.3)	67.0 (64.3–69.7)	1.11 (1.02–1.21) *
Retired	60.2 (57.2–63.3)	54.2 (51.6–56.7)	1.14 (1.06–1.23) *
Unable to work	68.7 (65.7–71.6)	65.9 (63.4–68.3)	1.03 (0.97–1.09)
Homemaker or student	67.4 (58.2–76.6)	66.6 (63.1–70.1)	1.03 (0.90–1.19)
Federal poverty level (FPL)			
125% FPL	69.9 (67.1–72.7)	66.1 (64.5–67.7)	1.08 (1.02–1.13) *

Characteristic	Past-year quit attempts ^b , % (95% CI)		Adjusted prevalence ratio (95% CI) ^c
	COPD	Non-COPD	
126%–199% FPL	67.0 (63.0–70.9)	62.9 (60.9–64.9)	1.04 (0.97–1.12)
200%–399% FPL	68.1 (64.0–72.3)	61.9 (60.0–63.8)	1.08 (1.00–1.15)
400% FPL	69.2 (63.1–75.2)	65.7 (64.0–67.4)	1.09 (0.99–1.19)
Missing	65.9 (60.8–71.0)	64.2 (61.8–66.6)	1.04 (0.95–1.14)
NCHS urban-rural county scheme classification^a			
Large central metropolitan	71.3 (66.6–76.0)	67.9 (66.0–69.8)	1.07 (1.00–1.15)
Large fringe metropolitan	72.1 (68.4–75.9)	64.6 (62.7–66.4)	1.13 (1.06–1.20) *
Medium metropolitan	68.0 (64.5–71.6)	64.3 (62.6–65.9)	1.02 (0.95–1.10)
Small metropolitan	65.6 (61.5–69.8)	63.8 (61.7–65.9)	1.03 (0.95–1.11)
Micropolitan	66.6 (62.1–71.1)	58.5 (56.6–60.5)	1.11 (1.02–1.20) *
Noncore (rural)	64.9 (60.0–69.7)	59.1 (56.8–61.4)	1.08 (0.98–1.18)
Leisure-time physical activity^a			
Yes	71.1 (68.7–73.5)	67.3 (66.4–68.3)	1.05 (1.01–1.09) *
No	64.7 (62.0–67.4)	57.2 (55.5–58.9)	1.11 (1.05–1.17) *
Asthma status^a			
Current asthma	68.6 (65.3–71.9)	69.2 (66.2–72.3)	1.01 (0.95–1.08)
Former asthma	69.8 (60.7–78.9)	71.1 (67.6–74.5)	0.99 (0.86–1.12)
No	68.0 (65.9–70.2)	63.5 (62.6–64.4)	1.10 (1.06–1.13) *
Body mass index (BMI, kg/m²)^a			
Underweight (<18.5)	72.3 (65.5–79.0)	57.3 (52.5–62.2)	1.29 (1.13–1.46) **
Normal weight (18.5–24.9)	69.1 (66.2–72.0)	63.5 (62.1–64.8)	1.09 (1.04–1.15) *
Overweight (25.0–29.9)	66.6 (62.8–70.3)	65.8 (64.4–67.1)	1.01 (0.95–1.08)
Obesity (≥30.0)	69.8 (67.0–72.7)	64.1 (62.4–65.7)	1.07 (1.02–1.13) *
Depression^a			
Yes	68.5 (65.9–71.1)	66.9 (65.5–68.4)	1.03 (0.99–1.08)
No	68.7 (66.3–71.2)	63.3 (62.3–64.3)	1.09 (1.05–1.14) *

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; COPD, chronic obstructive pulmonary disease; CI, confidence interval; GED, General Educational Development; NCHS, National Center for Health Statistics.

^a Age-adjusted prevalence and 95% CI were derived from a logistic regression model including age.

^b Past-year quit attempts was defined as the percentage of current smokers who quit for 1 day or more in the past year and former smokers who quit any time in the past year among current smokers and former smokers who quit within the past year.

^c Adjusted prevalence ratio and 95% CI were derived from a logistic regression model including all other selected characteristics.

* P<0.05,

** P<0.01; otherwise p>0.05.

Table 3.

Prevalence^a and adjusted prevalence ratio of recent successful cessation^b among 65,681 US adults who smoke, 2018 BRFSS

	Recent successful cessation ^b , % (95% CI)		Adjusted prevalence ratio (95% CI) ^c
Characteristic	COPD	Non-COPD	
Crude prevalence	4.5 (3.8– 5.4)	5.9 (5.5– 6.3)	
Age-adjusted prevalence	4.5 (3.8– 5.3)	5.8 (5.4– 6.2)	1.10 (0.91–1.35)
Sex^a			
Men	4.7 (3.6– 5.9)	6.1 (5.6– 6.7)	1.09 (0.83–1.42)
Women	4.4 (3.3– 5.4)	5.3 (4.7– 5.9)	1.10 (0.84–1.46)
Age group (years)			
18–44	4.6 (2.9– 7.2)	6.7 (6.2– 7.4)	0.98 (0.62–1.57)
45–64	4.3 (3.5– 5.3)	4.6 (4.1– 5.3)	1.00 (0.77–1.29)
65–74	5.0 (3.4– 7.3)	4.8 (3.7– 6.2)	1.29 (0.85–1.97)
75	4.7 (3.0– 7.3)	4.9 (2.9– 8.3)	1.02 (0.60–1.73)
Race/ethnicity^a			
Non-Hispanic White	3.9 (3.3– 4.5)	6.0 (5.5– 6.4)	0.97 (0.81–1.18)
Non-Hispanic Black	4.2 (2.2– 6.3)	3.6 (2.8– 4.5)	1.16 (0.71–1.89)
Hispanic	_d	6.3 (4.8– 7.8)	_d
American Indian/Alaska Native	_d	3.9 (2.3– 5.5)	_d
Asian	_d	9.3 (4.7–13.8)	_d
Other, Non-Hispanic	_d	5.2 (3.5– 6.9)	_d
Education^a			
Less than high school diploma	4.1 (2.6– 5.6)	3.2 (2.4– 4.0)	1.00 (0.81–1.23)
High school diploma or GED	4.0 (2.8– 5.2)	4.7 (4.1– 5.4)	1.09 (0.77–1.53)
Some college or technical school	5.1 (3.6– 6.6)	6.3 (5.6– 7.1)	1.12 (0.77–1.61)
College graduate	_d	10.0 (8.9–11.2)	_d
Employment status^a			
Employed	4.5 (3.0– 6.0)	6.3 (5.7– 6.8)	0.84 (0.59–1.20)
Unemployed	_d	5.4 (3.8– 6.9)	_d
Retired	3.7 (2.4– 5.0)	5.1 (2.8– 7.4)	1.07 (0.73–1.56)
Unable to work	4.8 (3.7– 5.9)	3.1 (2.4– 3.8)	1.47 (1.00–2.18)
Homemaker or student	_d	6.7 (4.9– 8.4)	_d
Federal poverty level (FPL)			
125% FPL	4.4 (3.1– 5.7)	3.8 (3.1– 4.5)	1.39 (0.98–1.96)
126%–199% FPL	5.1 (3.1– 7.1)	4.7 (4.0– 5.5)	1.35 (0.84–2.15)

	Recent successful cessation ^b , % (95% CI)		Adjusted prevalence ratio (95% CI) ^c
Characteristic	COPD	Non-COPD	
200%–399% FPL	4.2 (2.7– 5.6)	5.5 (4.7– 6.3)	1.00 (0.67–1.49)
400% FPL	5.6 (2.3– 8.8)	9.5 (8.4–10.6)	0.74 (0.43–1.28)
Missing	3.8 (2.4– 5.3)	4.7 (3.7– 5.7)	0.78 (0.51–1.20)
NCHS urban-rural county scheme classification^a			
Large central metropolitan	5.5 (3.2– 7.8)	6.9 (5.9– 7.9)	1.14 (0.72–1.79)
Large fringe metropolitan	5.8 (3.7– 7.9)	6.0 (5.1– 7.0)	1.24 (0.84–1.85)
Medium metropolitan	4.8 (3.1– 6.5)	5.3 (4.6– 5.9)	1.30 (0.84–2.02)
Small metropolitan	3.2 (2.1– 4.4)	5.2 (4.4– 6.1)	0.74 (0.48–1.14)
Micropolitan	3.3 (2.2– 4.4)	5.3 (4.2– 6.3)	0.88 (0.58–1.35)
Noncore (rural)	2.7 (1.8– 3.6)	4.0 (3.2– 4.7)	0.84 (0.56–1.28)
Leisure-time physical activity^a			
Yes	4.7 (3.7– 5.8)	6.5 (6.0– 7.0)	0.98 (0.75–1.28)
No	4.3 (3.3– 5.3)	4.1 (3.4– 4.7)	1.32 (1.00–1.75)
Asthma status^a			
Current asthma	5.1 (3.5– 6.7)	5.2 (4.1– 6.3)	1.01 (0.68–1.52)
Former asthma	_d	6.2 (4.6– 7.8)	_d
No	3.8 (3.1– 4.6)	5.8 (5.4– 6.2)	0.99 (0.79–1.24)
Body mass index (BMI, kg/m²)^a			
Underweight (<18.5)	_d	2.7 (1.3– 4.1)	_d
Normal weight (18.5–24.9)	3.7 (2.5– 5.0)	5.1 (4.4– 5.8)	1.05 (0.69–1.58)
Overweight (25.0–29.9)	3.8 (2.8– 4.8)	6.2 (5.4– 7.0)	0.89 (0.66–1.20)
Obese (≥ 30.0)	6.1 (4.4– 7.7)	6.3 (5.6– 7.0)	1.26 (0.94–1.70)
Depression^a			
Yes	4.0 (2.8– 5.2)	5.1 (4.4– 5.7)	0.92 (0.67–1.26)
No	5.0 (3.9– 6.1)	6.0 (5.5– 6.6)	1.18 (0.93–1.50)

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; COPD, chronic obstructive pulmonary disease; CI, confidence interval; GED, General Educational Development; NCHS, National Center for Health Statistics.

^a Age-adjusted prevalence and 95% CI were derived from a logistic regression model including age.

^b Recent successful cessation was defined as the percentage of former smokers who had last smoked a cigarette within the previous year, but not within the 6 months prior to the survey among current smokers and former smokers who quit within the past year.

^c Adjusted prevalence ratio and 95% CI were derived from a logistic regression model including all other selected characteristics.

^d Unreliable estimates when relative standard error > 0.30 or N < 50.

Table 4.

Prevalence^a and adjusted prevalence ratio of smoking quit ratio^b among 161,233 US adults who smoke, 2018 BRFSS

	Quit ratio ^b , % (95% CI)		Adjusted prevalence ratio (95% CI) ^c
Characteristic	COPD	Non-COPD	
Crude prevalence	52.3 (51.0–53.6)	61.9 (61.4–62.5)	
Age-adjusted prevalence	53.2 (51.7–54.6)	63.9 (63.3–64.4)	0.81 (0.78–0.84) **
Sex ^a			
Men	55.8 (53.8–57.9)	64.6 (63.8–65.4)	0.83 (0.79–0.87) **
Women	50.9 (48.9–52.8)	62.8 (61.9–63.7)	0.80 (0.77–0.84) **
Age group (years)			
18–44	31.3 (27.7–35.1)	48.7 (47.7–49.6)	0.84 (0.75–0.94) *
45–64	41.2 (39.2–43.2)	62.3 (61.3–63.2)	0.79 (0.75–0.83) **
65–74	64.7 (62.4–67.0)	80.0 (79.0–81.0)	0.87 (0.84–0.90) **
75	81.6 (79.2–83.8)	90.8 (89.9–91.7)	0.91 (0.89–0.94) *
Race/ethnicity ^a			
Non-Hispanic White	52.9 (51.4–54.4)	66.0 (65.4–66.6)	0.80 (0.78–0.83) **
Non-Hispanic Black	49.0 (43.7–54.2)	48.5 (46.5–50.4)	0.92 (0.80–1.05)
Hispanic	64.6 (57.6–71.5)	64.7 (62.4–67.1)	0.97 (0.84–1.12)
American Indian/Alaska Native	40.6 (31.0–50.1)	52.0 (47.0–57.0)	0.83 (0.61–1.12)
Asian	66.9 (50.7–83.0)	67.8 (63.4–72.2)	0.84 (0.56–1.28)
Other, Non-Hispanic	51.7 (43.5–60.0)	55.7 (52.9–58.6)	0.92 (0.76–1.12)
Education ^a			
Less than high school diploma	41.6 (38.4–44.8)	49.5 (47.4–51.6)	0.81 (0.73–0.90) **
High school diploma or GED	53.0 (50.7–55.3)	58.9 (57.9–60.0)	0.81 (0.76–0.85) **
Some college or technical school	57.6 (55.2–59.9)	64.9 (63.9–65.9)	0.82 (0.78–0.87) **
College graduate	66.0 (62.5–69.5)	78.7 (77.8–79.5)	0.83 (0.78–0.88) **
Employment status ^a			
Employed	56.1 (53.2–59.0)	66.6 (65.7–67.4)	0.78 (0.73–0.83) **
Unemployed	39.5 (33.1–45.9)	48.0 (45.4–50.6)	0.68 (0.55–0.85) **
Retired	57.0 (54.4–59.6)	66.5 (64.7–68.2)	0.87 (0.85–0.89) **
Unable to work	48.3 (45.4–51.1)	48.1 (46.1–50.0)	0.85 (0.78–0.92) *
Homemaker or student	51.8 (43.7–59.8)	62.8 (60.3–65.3)	0.80 (0.65–0.97) *
Federal poverty level (FPL) ^a			
125% FPL	43.2 (40.8–45.5)	49.9 (48.3–51.4)	0.78 (0.72–0.85) **

	Quit ratio ^b , % (95% CI)		Adjusted prevalence ratio (95% CI) ^c
Characteristic	COPD	Non-COPD	
126%–199% FPL	53.0 (49.9–56.1)	56.2 (54.6–57.7)	0.82 (0.76–0.89) **
200%–399% FPL	58.7 (55.6–61.8)	64.5 (63.2–65.7)	0.81 (0.76–0.86) **
400% FPL	69.5 (65.9–73.1)	76.7 (75.8–77.6)	0.82 (0.76–0.88) **
Missing	52.0 (48.2–55.8)	59.1 (57.3–60.8)	0.84 (0.77–0.92) *
NCHS urban-rural county scheme classification^a			
Large central metropolitan	56.0 (52.3–59.6)	65.6 (64.3–67.0)	0.83 (0.77–0.90) **
Large fringe metropolitan	57.7 (54.4–61.1)	66.9 (65.7–68.1)	0.85 (0.79–0.91) *
Medium metropolitan	53.6 (50.9–56.3)	63.7 (62.6–64.9)	0.80 (0.75–0.86) **
Small metropolitan	50.8 (47.3–54.2)	61.4 (60.0–62.9)	0.81 (0.74–0.89) **
Micropolitan	44.5 (41.4–47.5)	59.4 (58.0–60.7)	0.73 (0.67–0.79) **
Noncore (rural)	49.3 (45.8–52.8)	56.5 (54.9–58.2)	0.80 (0.73–0.88) **
Leisure-time physical activity^a			
Yes	57.1 (55.2–59.0)	67.3 (66.7–67.9)	0.81 (0.77–0.84) **
No	48.6 (46.5–50.7)	54.0 (52.7–55.3)	0.82 (0.77–0.87) **
Asthma status^a			
Current asthma	55.4 (53.0–57.8)	60.8 (58.7–62.9)	0.83 (0.77–0.89) **
Former asthma	57.1 (51.1–63.1)	66.6 (64.0–69.2)	0.74 (0.63–0.88) **
No	51.5 (49.7–53.4)	63.9 (63.3–64.6)	0.80 (0.77–0.83) **
Body mass index (BMI, kg/m²)^a			
Underweight (<18.5)	35.4 (28.1–42.7)	42.1 (37.8–46.4)	0.87 (0.67–1.13)
Normal weight (18.5–24.9)	42.3 (39.6–45.0)	58.3 (57.2–59.3)	0.76 (0.70–0.81) **
Overweight (25.0–29.9)	54.0 (51.4–56.7)	65.8 (64.9–66.8)	0.83 (0.78–0.87) **
Obese (≥30.0)	61.8 (59.6–63.9)	67.8 (66.8–68.8)	0.84 (0.80–0.88) **
Depression^a			
Yes	50.0 (47.7–52.2)	56.6 (55.5–57.8)	0.81 (0.76–0.87) **
No	55.3 (53.4–57.1)	65.9 (65.2–66.5)	0.80 (0.77–0.83) **

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; COPD, chronic obstructive pulmonary disease; CI, confidence interval; GED, General Educational Development; NCHS, National Center for Health Statistics.

^a Age-adjusted prevalence and 95% CI were derived from a logistic regression model including age.

^b Quit ratio was defined as the percentage of ever smokers who had quit smoking (former smokers divided by ever smokers).

^c Adjusted prevalence ratio and 95% CI were derived from a logistic regression model including all other selected characteristics.

* P<0.05,

^{**}
P<0.01; otherwise p>0.05.

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