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Smoking Prevalence during the COVID-19 Pandemic in the United States

To the Editor:

External shocks can yield insight into the socioeconomic determinants of health. In the wake of some major previous social (1) and economic disruptions (2), cigarette smoking increased. The coronavirus disease (COVID-19) pandemic may have affected smoking behavior in myriad ways. Financial strain from job loss (3, 4) and pandemic-related anxiety might have increased unhealthy coping behaviors, including tobacco use. But financial strain was cushioned by trillions of dollars of federal government pandemic-relief spending, and worries about a dangerous respiratory virus might have deterred cigarette use.

We examined changes in smoking prevalence in the United States during the COVID-19 pandemic.

Methods

We analyzed data from the 2016–2020 Behavioral Risk Factor Surveillance System (BRFSS) ($N = 2{,}193{,}981$), a nationally representative telephone survey of U.S. adults conducted by the Centers for Disease Control and Prevention with U.S. states/territories.

We tabulated the prevalence of current smoking, defined as having smoked 100 or more lifetime cigarettes and to be currently smoking, each survey year and interview quarter. We considered quarter 1 (Q1)-2016 to Q4-2019 the prepandemic period and Q2-2020 to Q4-2020 the pandemic period. We excluded 95,396 subjects with missing data on smoking, and (for quarterly estimates) 11,288 subjects whose 2020 BRFSS interview occurred in early 2021.

We first examined trends according to interview quarter, both for the overall population and for age, sex, racial/ethnicity, income, and (for 2018–2020 only) urban/rural county subgroups.

To assess changes associated with the pandemic's onset, we performed an interrupted time series analysis using multivariable linear probability regression with the pre/post pandemic indicator as the predictor of interest, and with interview quarter treated as a continuous variable. To account for demographic shifts, we also included covariates for age, region, sex, education, race/ethnicity, and marital status. To evaluate whether changes in prevalence differed among aforementioned subgroups, we performed regressions that additionally included interaction terms for subgroup indicator × pre/post indicator and subgroup indicator × interview quarter.

For multivariable regressions, we excluded an additional 105,646 individuals interviewed Q1-2020, the quarter during which the pandemic unfolded, and then 82,559 individuals with missing data for one or more covariates.

Analyses were conducted with Stata 16 using BRFSS sampling weights and appropriate procedures for complex survey data. The institutional review board at the authors' institutions do not consider study of deidentified, publicly available data to be Human Subjects Research.

Results

Our study population consisted of 2,087,297 adults. Mean age was 47.5 years prepandemic and 47.6 years postpandemic; 51% of respondents were female in both periods.

Between survey years 2016 and 2019, annual smoking prevalence fell from 16.3% to 15.3%, and then more abruptly to 14.2% in 2020 (data not shown). Figure 1 provides quarterly trends in smoking prevalence overall and by subgroup. Smoking prevalence fell rapidly starting in Q1-2020 among those ages 18–54 years, while remaining

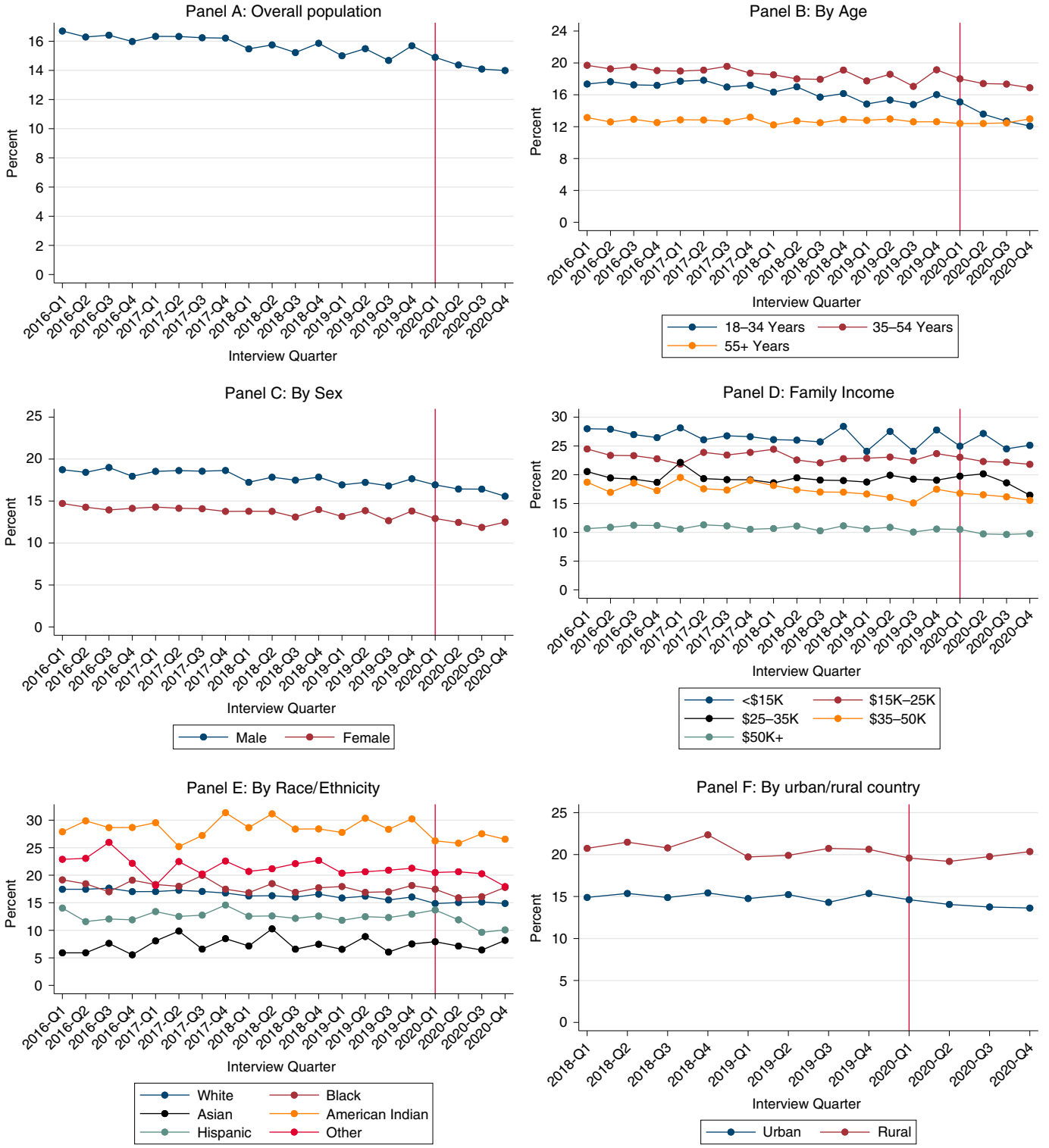

Figure 1. Current smoking prevalence by interview quarter, Behavioral Risk Factor Surveillance System (BRFSS) 2016–2020. The red line demarcates the beginning of the coronavirus disease (COVID-19) pandemic in the United States. Quarter 1 (Q1) = January–March; Q2 = April–June; Q3 = July–September; Q4 = October–December. Quarters refer to time when interview was conducted and do not necessarily correspond with survey year, as a small number of individuals in each BRFSS survey year are not interviewed until early in the following calendar year; here, they are presented at the time of interview, although the annual estimates reported in the main text refer to survey year. Study population: (*A*) Overall: *N* = 2,087,297; (*B*) Age: *N* = 2,087,297; (*C*) Sex: *N* = 2,086,076; (*D*) Income: *N* = 1,747,808; (*E*) Race: *N* = 2,048,779; and (*F*) Urban/rural: *N* = 1,169,146. The BRFSS imputed age for those with missing data for all years. The BRFSS also imputed race/ethnicity for those with missing data for 2017–2020 based on most common race/ethnicity in the region. All race/ethnicities except "Hispanic" are non-Hispanic; Hispanic individuals can be of any race. Other race includes Native Hawaiian or Pacific Islander, other, and those of multiple races. American Indian includes Alaskan Native.

Table 1. Adjusted change in smoking prevalence pre- (Q1-2016 to Q4-2019) to post (Q2-2020 to Q4-2020) COVID-19 pandemic among U.S. adults

Characteristic	Unweighted *N* for Analysis*	Percentage Point Change (95% CI)	*P* Value
Overall population	1,899,092	−0.59 (−0.99 to −0.19)	0.004
Age, yr	1,899,092		
18–34		−1.66 (−2.62 to −0.70)	0.001
35–54		−0.28 (−1.22 to 0.66)	0.56
⩾55		Reference	
Sex	1,899,092		
Male		Reference	
Female		−0.44 (−1.24 to 0.36)	0.28
Race/ethnicity†	1,899,092		
White		Reference	
Black		0.07 (−1.34 to 1.49)	0.92
Asian		0.15 (−1.81 to 2.10)	0.88
American Indian/Alaskan Native		−1.79 (−5.82 to 2.25)	0.39
Hispanic		−1.45 (−2.79 to −0.12)	0.03
Other		−0.54 (−3.00 to 1.92)	0.67
Family income‡	1,603,982		
<$15K		0.78 (−1.14 to 2.71)	0.43
$15–25K		−0.27 (−1.67 to 1.13)	0.70
$25–35K		0.21 (−1.46 to 1.87)	0.81
$35–50K		0.96 (−0.36 to 2.27)	0.15
⩾$50K		Reference	
Urban/rural county§	1,036,995		
Urban		Reference	
Rural		0.31 (−1.51 to 2.13)	0.74

Definition of abbreviations: BRFSS = Behavioral Risk Factor Surveillance System; CI = confidence interval; COVID-19 = coronavirus disease; Q = quarter. All models adjusted for age (18–34, 35–54, ⩾55 yr); region (Northeast, Midwest, South, West); sex (male/female); education (less than high school, high school graduate, some college/technical school, college/technical school graduate); marital status (married vs. unmarried, which includes: divorced, widowed, separated, never married, unmarried couple); race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, non-Hispanic American Indian/Alaskan Native, Hispanic, non-Hispanic other); an indicator of interview quarter (treated continuously); and a pandemic onset indicator (pre- [Q1-2016 to Q4-2019] vs. post- [Q2-2020 to Q4-2020]). Models examining differences among subgroups were additionally adjusted for subgroup indicator × pandemic onset indicator and subgroup indicator × interview quarter interaction terms. Percentage point change estimates for the overall population are the coefficient for the pandemic onset indicator multiplied by 100; for subgroups, estimates are the coefficient for the pandemic onset indicator × subgroup interaction term multiplied by 100.
*All analyses exclude individuals with missing smoking data (n = 95,396 of total BRFSS population of N = 2,193,981), followed by those interviewed Q1-2021 (n = 11,288), followed by those interviewed in Q1-2020 (n = 105,646), followed by those with missing data on one or more covariate (total n = 82,559, including those in U.S. territories who could were not assigned a census region), leaving a final population of 1,899,092 for adjusted analyses.
†All race/ethnicities except Hispanic are non-Hispanic; Hispanic individuals can be of any race. Other race includes Native Hawaiian or Pacific Islander, other, and those of multiple races. The BRFSS imputed race for individuals with missing data for all years except 2016.
‡Family income missing for 295,110 of 1,899,092 individuals.
§Includes survey years 2018–2020 only.

stable among persons ages 55 years or older. In all years, smoking rates were higher among men than women and among lower-income versus higher-income individuals. Smoking prevalence was highest among American Indians/Alaskan Natives and lowest among Asians, with a substantial decrease among Hispanics after Q1-2020. After pandemic onset, smoking prevalence appeared to decrease in urban counties (which began the period with lower smoking rates) but changed little in rural counties.

Table 1 provides results adjusted for demographic factors and linear smoking trends, both for the overall population and among subgroups. Smoking prevalence in the overall population fell by an adjusted 0.59 percentage points (95% confidence interval [CI], −0.99 to −0.19) after pandemic onset. After pandemic onset, individuals ages 18–34 years experienced an adjusted 1.66 percentage point reduction (95% CI, −2.62 to −0.70) in smoking prevalence relative to individuals ages 55 years or older. Relative to non-Hispanic White individuals, Hispanic individuals had a 1.45 percentage point decrease (−2.79 to −0.12) in smoking prevalence after onset of the pandemic. Differential changes between other subgroups did not reach statistical significance.

Discussion

Smoking prevalence fell during the COVID-19 pandemic in the United States, particularly among younger and Hispanic individuals, a trend that runs counter to those observed in some past social upheavals.

The causes of this salutary behavioral change are uncertain. In the past, increasing unemployment has sometimes been associated with increases in unhealthy coping behaviors, including cigarette smoking (3, 4) (e.g., a 600,000-person increase in the number of smokers in the United States [2] [although not in Iceland (5)] during the Great Recession). Dislocation, social isolation, and anxiety (6) might also be expected to increase psychosocial strain

and promote tobacco use, an effect that may, in part, explain increased smoking among those exposed to Hurricane Katrina (1) and terrorist attacks (7).

However, during COVID-19, the untoward effect of unemployment may have been blunted by the infusion of government relief funds, causing the poverty rate to paradoxically fall in 2020 despite economic contraction. Moreover, specific worries about lung health occasioned by the epidemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) respiratory illness may have deterred smoking uptake. School closures could also have reduced smoking behaviors among parents seeking to avoid smoking around children; in addition, for some, work- or commuting-related stress was potentially alleviated.

A few studies have examined the impact of COVID-19 on smoking. For instance, a survey conducted in Italy found that smoking prevalence decreased, although cigarette consumption increased among those who continued to smoke (8). However, previous analyses have had major limitations, including a lack of prepandemic sampling or limited generalizability (9, 10).

Although our study avoids these limitations, selection bias caused by the disruption of data collection because of the pandemic could raise concern about the comparability of the samples. However, the BRFSS was conducted by telephone both before and during the pandemic, and the 2020 response rate (47.9%) was, reassuringly, similar to that of the 2019 survey (49.4%). Unfortunately, we had no information on the quantity of cigarettes consumed by smokers.

Our findings suggest that increases in tobacco uptake may be avoidable during a period of pandemic-induced economic and social disruption. Public health agencies and clinicians should seek to consolidate these gains, and policymakers should assist such efforts by assuring adequate financial supports for disadvantaged Americans. ■

Author disclosures are available with the text of this letter at www.atsjournals.org.

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