How COVID-19 Influences Smoking Prevalence in the United States

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Abstract

Although the negative health consequences of tobacco use are well-informed, smokers usually do not have an incentive to quit smoking immediately as the smoking interventions are not compulsory and the illness caused by smoking is distant in time. Smoking behavior is densely studied and proved to be associated with a wide range of genetic, social, and psychological factors. This study is to learn how does COVID-19 spread influence the smoking prevalence in the United State. The results show that smoking behavior is not geographically affected by the strictness of lockdown orders and the severity of coronavirus spread. However, the cigarette consumption is associated with COVID-19 with a negative significance if people encounter depression during COVID-19. The outcome provides some important information for the cessation-related organizations: it is necessary to take care of smokers' emotion status in the process of quitting during COVID-19.

Keywords: COVID-19, smoking, cigarettes, lockdown, depression

1. Introduction

Cigarette smoking is one of the main causes of preventable disease and death worldwide. Smoking behavior is maintained largely due to nicotine dependence, which provides smokers with the positive and negative reinforcement feelings. In 1990s, the price war among cigarette companies abruptly increased the smoking initiation and consumption of cigarettes by the youth in the United States.[1] But afterwards there is a long-term trend in the reduction of adult smoking with the increasing effort of U.S. government via taxation and social organizations, where free advice and cessation services from health professionals are provided.[2] However, the smoking interventions are not compulsory and the negative health consequences are distant in time. It is barely able to motivate the smokers with an immediate concern to deter the behavior.

Soon after the first human cases of COVID-19, subsequently named SARS-CoV-2 were first reported by officials in Wuhan City, China, in December 2019, this virus has been spread rapidly around the world.[3] The U.S. state governments have responded with a wide range of extraordinary measures. Common responses include stay-at-home orders, emergency investments in healthcare facilities, income support, contact tracing and other interventions to contain the spread of the virus, and manage the economic consequences of these actions. Even though, the U.S. 2020 second quarter annualized GDP declined by 31.4% and the unemployment

[1] David R. Francis suggests that the price war is the prominent explanation in the experimental setting.
[2] This trend can be found in the article Overall Tobacco Trends. The graph Trends in Cigarette Smoking Rates depicts the smoking rate from 1965 to 2017. https://www.lung.org/research/trends-in-lung-disease/tobacco-trends-brief/overall-tobacco-trends
[3] WHO's Coronavirus disease 2019 (COVID-19) Situation Report – 94.

rate reached its peak at 14.7% in April since the World War II.[4] The lockdown orders announced by states governments also restricted people's traveling and social interactions.

This study is aimed to learn that whether COVID-19 provides people in the U.S. with incentives to start to smoke or quit smoking via its physical and cognitive influences. The data used are constructed from three sources: (1) Understanding America Study (UAS) Health and Retirement Study (HRS) survey with three waves, UAS 20, UAS 95, and UAS 185; (2) Oxford COVID-19 Government Response Tracker (OxCGRT); (3) Center for Disease Control and Prevention COVID Data Tracker. They provide information on demographic, smoking behavior, and physical and cognitive health at the individual level, as well as lockdown policy and the spread of COVID-19 evaluations at the state level. People's smoking status and cigarette consumption are investigated with different interpretations of COVID-19 influences. The results show that COVID-19 has no influence on the reduction of smoking rate, regardless of the strictness of lockdown policy, case and death rate, and mental illness caused by COVID-19. However, it is found that cigarette consumption tends to be unexpectedly lower if the individual encounters negative feelings due to COVID-19. The importance of this study is that it suggests that people tend to smoke fewer cigarettes if they are depressed or emotional during COVID-19. Thus, the health professionals should be more aware of the mental status of smokers who are trying to quit than before.

[4] Congressional Research Service reported the economy during COVID-19 in the article COVID-19 and the U.S. Economy.

2. Literature Review and Methodology

Although genetic factors, including age, gender, and race, are associated with tobacco use, the social environment and psychological factors, such as education attainment, income level, geographic location, and mental health, play a larger role in the motivation to initiate and continue smoking behavior.[5] In order to find the causality between COVID-19 and the change in smoking prevalence, the interpretations of the influences of COVID-19 should be observable and associated with smoking.

Doubeni et al. find a significant synergism between perceived accessibility and peer smoking on regular smoking among youths (2008). The perception among adolescents that tobacco products are easy to obtain is a risk factor for smoking initiation and progression. Having smoking peers increased the impact of perceived accessibility on smoking among youths even when adjusted for other factors. In addition, the lockdown orders potentially reduce the perceived accessibility of tobacco products in that they restrict travelling and lift the social barrier. Therefore, my first hypothesis is that the smoking rate and cigarette consumption would be lower in states with a stricter lockdown policy.

Being a risk factor just as cigarette smoking, researchers have found that there is an unexpected low prevalence of smoking among hospitalized patients with COVID-19 and current smokers having higher odds of COVID-19 progression than never smokers in the United States (Farsalinos et al., Patanavanich & Glantz 2020). The danger of COVID-19 infection would motivate smokers to quit or reduce the number of cigarettes used. Thus, my second hypothesis is

[5] A summary of papers concludes the determinants of tobacco use at different life stages. https://www.healthypeople.gov/2020/leading-health-indicators/2020-lhi-topics/Tobacco/determinants

that the smoking rate and cigarette consumption tend to be lower in states with higher COVID-19 case rate and death rate.

The negative consequences of COVID-19 lead to mental illness. Kujawa et al. provide empirical evidence from their longitudinal survey that emerging adults are at high risk for depression and anxiety related to the psychosocial effects of the COVID-19 pandemic (2020). Moreover, smoking is associated with people's behavioral health conditions, including greater depressive symptoms, greater likelihood of psychiatric hospitalization, etc. Prochaska et al. find that people with mental illness are disproportionately affected with high smoking prevalence, using a comprehensive HAVE (host–agent–vector–environment) framework (2017). Fluharty et al. conclude positive associations in both directions – smoking to later mental health and mental health to later smoking (2017). Combining the prerequisites that COVID-19 leads to mental illness and mental illness is associated with smoking, I propose the third hypothesis that people who are depressed due to COVID-19 tend to initiate smoking or smoke more.

Existing papers with similar topic of interests are debating about the relationship between smoking behavior and COVID-19. Two studies focused on England smokers have generated opposite results. Jackson et al. conclude that the COVID-19 lockdown in the UK is not associated with a significant change in smoking prevalence; but smokers are more likely than before lockdown to quit smoking and consult with remote cessation services (2020). Grogan et al. find that COVID-19 has different impacts on smoking prevalence based on different aspects. Two results from their paper are of similar methodology to mine. First, the increased smoking as a coping mechanism to deal with anxiety, boredom, stress, and anger in COVID-19 lockdown; second, lockdown orders enable quitting through lifting social barriers and a focus on health

benefits (2020). A recent paper published in March 2021 studies the smoking behavior after the COVID-19 California lockdown orders. Their sample focuses on the central counties in California and conclude that cigarette use, which is the smoking rate, remains unchanged; however, there is an upward shift in the cigarette consumption, which is probably resulted from the increasing time stay at home compared to protective indoor smoke-free workplace (Gonzalez et al. 2021).

Therefore, the influence of COVID-19 is broken down into three aspects: the strictness of lockdown policies across the states in the U.S., the severity of case and death rate per capita at the state level, and the mental health at the individual level. And the smoking behavior can be measured by smoking status and cigarette consumption. As all the measures are numerical and observable, I can study the relationship and causality between smoking prevalence and COVID-19.

3. Data

The data used are constructed from three sources: (1) Understanding America Study (UAS) Health and Retirement Study (HRS) survey with three waves, UAS 20, UAS 95, and UAS 185; (2) Oxford COVID-19 Government Response Tracker (OxCGRT); (3) Center for Disease Control and Prevention COVID Data Tracker.

3.1 UAS Health and Retirement Survey

The UAS Health and Retirement project keeps track on approximately 20,000 Americans every two consecutive years.[6] Currently, UAS has conducted three waves of Health and Retirement surveys, initiated in 2014 (UAS 20), 2016 (UAS 95), and 2018 (UAS 185). Each of the survey is also automatically combined with UAS My Household survey, which includes a series of key demographic variables on both survey respondents and their household, including their age, ethnicity, education, marital status, work status, state of residence and family structure, among other matters.

The third wave survey, UAS 185, was still open for response and the corresponding dataset is accessed on January 6th, 2021. Although the first COVID-19 case was found in December 2019, this date is not applicable for studying how COVID-19 plays a role in smoking behavior changes in the United States. I denote March 2020 as the beginning of COVID-19 in my study, since the statistics on COVID-19 infection and death were first recorded and most lockdown polices were considered and announced by state governors in this month. So only observations after March 2020 in this dataset are kept. Panelizing with the other two waves of survey, I constructed a three-period dataset with a total of 2017 respondents and 6051 observations. The variables used include the respondent's id, age, reside state, smoking status, number of cigarettes smoked per day, and mental health status.

Denoting Period 0 for the first wave data, Period 1 for the second wave data, and Period 2 for the third wave data, I observe a decreasing trend in the number of smokers. From Period 0 to Period 1, there is a 0.58% reduction in the smoking rate. From Period 1 to Period 2, there is a

[6] the survey respondents are not just aged 50 or older. It administers web surveys that cover a wide range of ground including (but not limited to) physical health, cognitive functioning, disability, family structure, work, income, assets, pension plans, health insurance, and health care expenditures.

1.04% reduction in the smoking rate. Table 1 shows the characteristics of smokers and non-smokers in each of the period. By vertical comparison, I observe that smokers tend to be younger and less educated, in the sense of college degree attainment, than non-smokers. Also, the employment rate is lower for smokers relative to non-smokers; but smokers are more actively looking for jobs if unemployed. By horizontal comparison, there is remarkable changes in the working status after the COVID-19 spread. The Period 2 employment rate is lowest and the layoff from work is the highest among all three periods, with no regard to the smoking status of the survey respondents. As UAS 185 is the key sample that provides information after March 2020, Table 2 provides some descriptive statistics on age, education, and working status for each category of race.

3.2 Oxford COVID-19 Government Response Tracker

The Oxford COVID-19 Government Response Tracker (OxCGRT) provides a systematic measure across the 50 U.S. states, as well as District of Columbia and the US Virgin Islands, and across time to understand how government responses have evolved over the full period of the disease's spread. The Containment and Closure part can be used to evaluate the social barriers lifted by the lockdown orders of state governments. This part breaks down the lockdown orders into eight categories: school closing, workplace closing, cancel public events, restrictions on gathering size, close public transport, stay at home requirements, restrictions on interval movement, and restrictions on international travel. Based on the degree of enforcement and the wideness of implementation, it evaluates the day-by-day strictness of each category in each state. I obtained the dataset with 344 days of records, ranging from January 1st, 2020 to December 9th, 2020. The last category – restrictions on international travel – is not included since it cannot

represent geographical policy implementations. To determine whether a state has a strict lockdown policy or not, I summed the values of the first seven categories in each day of each state to get the 52 medians in each state and 1 median for the United States. Then I compared the 52 state medians of strictness with the country's median. It generated a total of 16 states that are with a higher median than the median at the country level.

One strength of this dataset is that it keeps track of the policy change over time. Governments' responses to COVID-19 exhibit significant nuance and heterogeneity as a result of limited national level coordination. The lockdown orders vary substantially in how quickly they are adopted and how long they have been kept in place. The day-to-day record can take account in the time variations and the specifications of lockdown orders can guarantee each order will not be over- or underestimated. However, measurement bias will occur if some information is left out from this composite measure and is systematically correlated with the outcomes of interest. As shown in Table 3, these 16 states are with stricter lockdown policies. Table 4 presents the number of cigarettes smoked per day in states with strict lockdown policy and in states with loose lockdown policy. The standard errors are large as the proportion of smokers is relatively small in this sample. It can be observed that, the cigarette consumption decreases in states with strict lockdown policy for every category of race after COVID-19 lockdown, while in states with loose lockdown policy the cigarette consumption decreases except for Asian.

3.3 Center for Disease Control and Prevention COVID Data Tracker

Center for Disease Control and Prevention (CDC) takes record of COVID-19 case and death reported by state and territorial jurisdictions since January 21st in 2020. The COVID Data Tracker provides the linear cumulative case and death rate per 100,000 across the 50 states,

District of Columbia, and the U.S. Virgin Islands.[7] It is used to determine the severity of COVID-19 spread in each state. Comparing the state level case and death rates with their median respectively, I assigned a total of 26 states are with severe COVID-19 spread due to their higher than median case rates and lightly different 26 states with severe COVID-19 spread due to their higher than median death rates. One limitation of this data is that the case rate and death rate are not recorded in each day but are aggregated. The other limitation is that the span of aggregation is almost one year and the COVID-19 spread has reached to a saturated level as I accessed this data on January 6th, 2021. Thus, I could barely observe any huge differences in the severity among the states. These two limitations would reduce the reliability of the determination of COVID-19 severity based on case rate and death rate across the states. The states with high case and death rates are also shown in Table 3.

4. Empirical Strategy

I study the causality between COVID-19 and the reduction in smoking prevalence through three interpretations of COVID-19 influences – the strictness of state level lockdown policy, the severity of COVID-19 spread measured by the case and death rates in each state, and the individual mental problems due to COVID-19. A series of models rely on difference-in-difference regression, controlling on age and age square. There are two dependent variables: smoking status and cigarette consumption in Period 1 and Period 2, namely pre-COVID and post-COVID. To test the parallel trend assumption, the same regressions are run again for Period 0 and Period 1, namely one period before pre-COVID and pre-COVID, and the graphs are generated to see the number of cigarettes consumed per day across the three periods.

[7] The data information page: https://covid.cdc.gov/covid-data-tracker/#cases_totalcases

4.1 Strictness of Lockdown Policies at the State Level

To examine the first hypothesis that the smoking rate and cigarette consumption would be lower in states with a stricter lockdown policy, two models regress the smoking status and cigarette consumption respectively and the treatment group is states with strict lockdown policy. The regression specifications are as follows:

$$SmokeNow_{i,t} = \beta_0 + \beta_1 * age_{i,t} + \beta_2 * age_{i,t}^2 + \beta_3 * post_{i,t} + \beta_4 * policy_{i,t} + \beta_5 * post_{i,t} * policy_{i,t} + \epsilon_{i,t} \quad (1)$$

$$NumCig_{i,t} = \beta_0 + \beta_1 * age_{i,t} + \beta_2 * age_{i,t}^2 + \beta_3 * post_{i,t} + \beta_4 * policy_{i,t} + \beta_5 * post_{i,t} * policy_{i,t} + \epsilon_{i,t} \quad (2)$$

where *i* indexes the individual and *t* indexes the period. *Age* and *age square* are controlled as they are time-variant. *Post* is a dummy variable, equals to one for post-COVID period, and zero for pre-COVID period. *Policy* is the treatment variable, equals to one if the state that individual *i* resides in has a strict lockdown policy, and zero otherwise. The interaction term, *post* * *policy*, is equivalent to a dummy variable, equals to one for observations in the treatment group in post-COVID period, and zero otherwise. Note that β_5 no longer equals to the difference-in-difference estimator in mean since I am controlling on *age* and *age square*. The standard errors are clustered at the state level. I expected β_5 to be negative so that the effect of lockdown policy in each state, which restricts people's access for travelling and makes them stay at home longer than before, would reduce the smoking rate or number of cigarettes consumed.

4.2 The Severity of COVID-19 Spread

To examine the second hypothesis that the smoking rate and cigarette consumption tend to be lower in states with higher COVID-19 case rate and death rate, another two models regress only current smoking rate. The treatment group is states with severe of COVID-19 spread, which

is determined by case rate and high death rate per 100,000. The regression specifications are as follows:

$$SmokeNow_{i,t} = \beta_0 + \beta_1 * age_{i,t} + \beta_2 * age_{i,t}^2 + \beta_3 * post_{i,t} + \beta_4 * case_{i,t} + \beta_5 * post_{i,t} * case_{i,t} + \epsilon_{i,t} \quad (3)$$

$$SmokeNow_{i,t} = \beta_0 + \beta_1 * age_{i,t} + \beta_2 * age_{i,t}^2 + \beta_3 * post_{i,t} + \beta_4 * death_{i,t} + \beta_5 * post_{i,t} * death_{i,t} + \epsilon_{i,t} \quad (4)$$

where *case* and *death* are the treatment variables, equals to one if the state that individual *i* resides in has a higher than median case rate or death rate, and zero otherwise. The interaction terms, *post* * *case* and *post* * *death*, are equivalent to a dummy variable, equals to one for observations in the treatment group in post-COVID period, and zero otherwise. The standard errors are clustered at the state level. I expect β_5 to be negative in both regressions so that the smoking rate or cigarette consumption are negatively correlated with the severity of COVID-19 spread.

4.3 Mental Health

The mental health interpretation focuses on two negative feelings: depressed and emotional. Model (5) and model (6) regress smoking rate while model (7) and (8) regress number of cigarettes.

$$SmokeNow_{i,t} = \beta_0 + \beta_1 * age_{i,t} + \beta_2 * age_{i,t}^2 + \beta_3 * post_{i,t} + \beta_4 * DepStable_{i,t} + \beta_5 * post_{i,t} * DepStable_{i,t} + \epsilon_{i,t} \quad (5)$$

$$SmokeNow_{i,t} = \beta_0 + \beta_1 * age_{i,t} + \beta_2 * age_{i,t}^2 + \beta_3 * post_{i,t} + \beta_4 * EmotStable_{i,t} + \beta_5 * post_{i,t} * EmotStable_{i,t} + \epsilon_{i,t} \quad (6)$$

$$NumCig_{i,t} = \beta_0 + \beta_1 * age_{i,t} + \beta_2 * age_{i,t}^2 + \beta_3 * post_{i,t} + \beta_4 * DepStable_{i,t} + \beta_5 * post_{i,t} * DepStable_{i,t} + \epsilon_{i,t} \quad (7)$$

$$NumCig_{i,t} = \beta_0 + \beta_1 * age_{i,t} + \beta_2 * age_{i,t}^2 + \beta_3 * post_{i,t} + \beta_4 * EmotStable_{i,t} + \beta_5 * post_{i,t} * EmotStable_{i,t} + \epsilon_{i,t} \quad (8)$$

where *DepStable* and *EmotStable* are the treatment variables. *DepStable* equals to one if individual *i* was depressed in pre-COVID period and is depressed during the post-COVID period, and zero otherwise. Similarly, *EmotStable* equals to one if individual *i* was emotional in pre-COVID period and is emotional during the post-COVID period, and zero otherwise. The interaction term, *post * DepStable* and *post * EmotStable*, are equivalent to dummy variables, equal to one for observations in the treatment group in post-COVID period, and zero otherwise. The standard errors are clustered at the individual level. I expect β_5 to be positive so that if individual *i* encounters any negative feelings due to COVID-19 would initiate smoking or increase the number of cigarettes smoked per day.

4.4 Parallel Trend Assumption Test

As with the differences-in-differences specification, the approach requires that pre-treatment trends in the five treatments were the same for the treatment and control groups (the parallel trends assumption). To test this assumption, I run the same regressions for Period 0 and Period 1, which are the one period before the pre-treatment period and the pre-treatment period.

5. Results

The regression outcomes suggest that neither the strictness of lockdown policy nor the severity of COVID-19 spread are associated with the smoking status and cigarette consumption. As shown in Table 5 and Table 6, statistical significance does not exist for any of the difference-in-difference estimators.

However, the causality exists between smoking and COVID in the breakdown of mental health. Table 7 tells that the coefficients of the difference-in-difference estimators are statistically significant when the dependent variable is the number of cigarettes smoked per day. But the negative sign of those coefficients implies a contradiction to the third hypothesis. Thus, the initiation of smoking, or the smoking rate, is not associated mental problems due to COVID-19, while the number of cigarettes consumed per day is smaller for people who are persistently depressed or emotional during the pre- and post-COVID periods.

Table 8 and Table 9 show the outcomes of regression the two pre-treatment periods. The coefficients of all difference-in-difference estimators are not statistically significant. Moreover, in Graph 1, four trends in the average of cigarette consumption across time are drawn. Parallel Trend 2, which sets the treatment group as states with higher than median case and death rates, violated the parallel trend assumption most. The difference between the control group and the treatment group is not consistent in periods before COVID-19. There exist some other factors that accounts for the reduction in the smoking prevalence. As shown in Parallel Trend 4, where the treatment is depression, the trends before COVID-19 are almost strictly parallel and the assumption is satisfied.

6. Conclusion

In this study, I break down the influence of COVID-19 into three parts and investigate the causality between each part and smoking behavior, which is defined by smoking status and cigarette consumption. Since the first three treatment groups are clustered at the state level, I

conclude that smoking behavior is not geographically affected by U.S. lockdown orders and the infections and deaths caused by COVID-19.

One possible reason for rejecting the first hypothesis might be that the degree of lockdown policy in each state are not sufficiently enough to prevent people from accessing tobacco products. Compared to the lockdown of Wuhan when COVID-19 was first discovered, the state level travel restriction in the U.S. is aimed to reduce social interactions and residents are still able to access basic living materials by themselves, while the whole city of Wuhan was isolated and all the public institutions, besides hospitals, and private firms were not running. Therefore, it does not make such a huge difference even the lockdown policy is recorded dynamically and evaluated for strictness.

The case and death rate are also not related to the reduction in smoking prevalence. One reason lies in the reliability of CDC COVID Tracker data. As discussed, the limitation of is that the rates are cumulative and, by the time of my access to the data, the case and death rate has almost reached the peak of the speed of COVID-19 spread. Therefore, there is not much difference among the states with high rates and states with low rates. Moreover, the sample is selected by UAS, where the infection rates among the survey respondents are pretty low, based on the UAS COVID longitudinal survey. By following the government guidance, those respondents may not have little intention to change their smoking behavior.

As people tend to smoke fewer cigarettes if they are depressed or emotional during COVID-19, the health professionals should be more aware of the mental status of smokers who are trying to quit than before. Further studies are needed with a more comprehensive interpretation of COVID-19, since the coronavirus spread impacts many aspects of our life.

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Appendix

Table 1. Characteristics of Smokers and Non-smokers

	Period 0	*Period 1*	*Period 2*
Non-smoker			
Percent Gender - Male	41.3	41.5	40.9
Mean Age	49.067	50.990	53.166
Percent Completed College	54.6	54.4	55.2
Currently working	0.622	0.623	0.577
Unemployed - on layoff	0.011	0.010	0.035
Unemployed - looking	0.060	0.053	0.045
Smoker			
Percent Gender - Male	36.7	35.5	37.8
Mean Age	46.746	49.391	50.442
Percent Completed College	28.9	33.8	30.2
Currently working	0.543	0.515	0.511
Unemployed - on layoff	0.026	0.023	0.040
Unemployed - looking	0.129	0.117	0.112
Total			
Percent Gender - Male	40.6	40.6	40.5
Mean Age	48.709	50.753	52.791
Percent Completed College	50.6	51.4	51.7
Currently working	0.610	0.607	0.568
Unemployed - on layoff	0.013	0.012	0.036
Unemployed - looking	0.070	0.063	0.054

Table 2. Characteristics of Sample, post COVID

	Spanish/Hispanic/Latino	White	Black	*American Indian or Alaska Native*	Asian	*Hawaiian/Pacific Islander*	*Total*
Characteristics of Population							
Percent Gender - Male	41.1	31.4	47.6	53.3	80.0	41.7	40.6
Mean Age	53.422	49.420	47.619	48.733	40.800	51.060	52.824
Mean Education	11.138	10.686	9.762	11.900	10.400	11.488	11.110
Working status							
Currently working	0.558	0.613	0.571	0.767	0.600	0.583	0.567
On sick or other leave	0.009	0.018	0.000	0.000	0.000	0.036	0.010
Unemployed - on layoff	0.034	0.036	0.095	0.033	0.000	0.060	0.036
Unemployed - looking	0.051	0.071	0.095	0.033	0.000	0.071	0.054
Retired	0.245	0.125	0.190	0.133	0.200	0.167	0.229
Hours of work per week	21.970	24.456	22.048	30.733	26.000	25.119	22.453
Household income	11.539	9.107	8.714	11.200	11.600	11.274	11.289
Characteristics of Those in Labor Force							
Percent Gender - Male	42.5	34.5	42.9	58.3	66.7	45.5	42.3
Mean Age	47.935	46.000	46.357	43.708	35.333	47.364	47.603
Mean Education	11.374	10.885	9.786	12.583	10.333	12.109	11.365
Hours of work per week	35.994	35.690	33.071	38.417	43.333	38.182	36.095
Household income	12.313	9.956	8.500	11.750	12.000	12.400	12.047

Note: Labor force is currently working + unemployment looking. Education and household income are two categorical variables in the dataset.

Table 3. States in Treatment Group

	Strict Lockdown Policy	Higher Case Rate	Higher Death Rate
Alaska	Yes	Yes	
Alabama	Yes	Yes	Yes
Arkansas		Yes	Yes
Arizona		Yes	Yes
California	Yes		
Colorado	Yes		
Connecticut	Yes		Yes
Delaware	Yes		
District of Columbia			Yes
Florida	Yes		Yes
Georgia		Yes	Yes
Hawaii	Yes		
Iowa		Yes	Yes
Idaho		Yes	
Illinois		Yes	Yes
Indiana		Yes	Yes
Kansas		Yes	Yes
Louisiana		Yes	Yes
Maine	Yes		
Massachusetts	Yes		Yes
Maryland	Yes		Yes
Michigan			Yes
Minnesota	Yes	Yes	Yes
Missouri		Yes	
Mississippi		Yes	Yes
Montana		Yes	
North Dakota		Yes	Yes
Nebraska		Yes	
New Jersey			Yes
New Mexico	Yes	Yes	Yes
Nevada		Yes	Yes
New York	Yes		Yes
Ohio	Yes		
Oklahoma		Yes	
Pennsylvania			Yes
South Carolina		Yes	Yes
South Dakota		Yes	Yes
Tennessee		Yes	Yes
Texas	Yes		
Utah		Yes	
Washington	Yes		
Wisconsin		Yes	
Wyoming		Yes	

Note: State is not included in this table if it does not obtain any of the three characteristics.

Table 4. Number of Cigarettes of Residents in States with Loose vs. Strict Lockdown Policy

	Period 0	*Period 1*	*Period 2*
Loose Lockdown Policy:			
Spanish/Hispanic/Latino	0.915	1.047	0.667
	(1.188)	(1.010)	(.941)
White	2.754	2.480	2.332
	(.241)	(.197)	(.187)
Black	2.378	1.637	0.870
	(.723)	(.595)	(.569)
American Indian or Alaska	1.182	3.021	2.436
Native	(1.228)	(.968)	(.912)
Asian	2.333	1.500	2.857
	(2.717)	(2.098)	(2.389)
Hawaiian/Pacific Islander	40	2.000	1.333
	(8.086)	(2.967)	(2.581)
Strict Lockdown Policy:			
Spanish/Hispanic/Latino	0.637	0.923	0.761
	(.533)	(.504)	(.444)
White	1.979	1.819	1.516
	(.228)	(.217)	(.191)
Black	2.338	1.838	1.368
	(.677)	(.663)	(.585)
American Indian or Alaska	1.148	1.480	1.333
Native	(1.097)	(1.094)	(.984)
Asian	0.444	0.444	0.297
	(.949)	(.911)	(.791)
Hawaiian/Pacific Islander	2.167	2.250	2.143
	(1.646)	(1.579)	(1.288)

Note: I stick to use regressions to obtain this table. Both summarize and regress commands generate high standard errors, due to the large proportion of the sample are non-smokers and thus number of cigarettes consumed is 0 for those respondents.

Table 5. Regressions for Lockdown Policy

	Smoke Cigarette Now	Number of Cigarettes Per Day
	(1)	(2)
age	0.014***	0.253***
	(0.002)	(0.041)
age square	-0.000***	-0.003***
	(0.000)	(0.000)
post	-0.003	-0.179
	(0.006)	(0.109)
policy	-0.017	-0.599
	(0.021)	(0.467)
D-in-D policy	-0.015*	-0.121
	(0.009)	(0.175)
Observations	4030	4023

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Table 6. Regression for Severity of COVID-19 Spread

	Smoke Cigarette Now	Smoke Cigarette Now
	(3)	(4)
age	0.014***	0.014***
	(0.002)	(0.002)
age square	-0.000***	-0.000***
	(0.000)	(0.000)
post	-0.008	-0.007
	(0.006)	(0.007)
case	0.016	
	(0.018)	
D-in-D case	-0.000	
	(0.010)	
death		0.022
		(0.019)
D-in-D death		-0.001
		(0.010)
Observations	4030	4030

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Table 7. Regressions for Mental Issues

	Smoke Cigarette Now		Number of Cigarettes Per Day	
	(5)	(6)	(7)	(8)
age	0.014***	0.014***	0.253***	0.254***
	(0.002)	(0.002)	(0.039)	(0.039)
age square	-0.000***	-0.000***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
post	-0.003	-0.008	-0.040	-0.110
	(0.005)	(0.005)	(0.082)	(0.085)
depress stable	0.133***		2.375***	
	(0.020)		(0.377)	
D-in-D depress stable	-0.020		-0.744***	
	(0.013)		(0.248)	
emotional stable		0.138***		2.548***
		(0.024)		(0.463)
D-in-D emotional stable		-0.005		-0.668**
		(0.016)		(0.306)
Observations	4024	4028	4018	4021

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Table 8. Parallel Trend Regressions, Smoke Now

	Smoke Cigarette Now				
	(1)	(3)	(4)	(5)	(6)
age	0.013***	0.013***	0.013***	0.012***	0.013***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
age square	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
post	-0.003	-0.005	0.001	-0.003	0.000
	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)
policy	-0.018				
	(0.023)				
D-in-D policy	-0.000				
	(0.010)				
case		0.014			
		(0.019)			
D-in-D case		0.002			
		(0.009)			
death			0.031		
			(0.020)		
D-in-D death			-0.007		
			(0.008)		
depress stable				0.145***	
				(0.022)	
D-in-D depress stable				-0.006	
				(0.014)	
emotional stable					0.150***
					(0.025)
D-in-D emotional stable					-0.025
					(0.017)
Observations	4032	4032	4032	4030	4030

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Table 9. Parallel Trend Regression, Number of Cig

	Number of Cigarettes Per Day		
	(2)	(7)	(8)
age	0.198***	0.179***	0.190***
	(0.064)	(0.056)	(0.056)
age square	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)
post	-0.303**	-0.186*	-0.161
	(0.121)	(0.105)	(0.115)
policy	-0.796		
	(0.531)		
D-in-D policy	0.180		
	(0.174)		
depress stable		2.864***	
		(0.478)	
D-in-D depress stable		-0.285	
		(0.348)	
emotional stable			2.921***
			(0.521)
D-in-D emotional stable			-0.537
			(0.354)
Observations	4027	4025	4025

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Graph 1. Parallel Trends Test