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The Differential Impact of Reopening States With and Without COVID-19 Face Mask Mandates on County-Level Consumer Spending

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Abstract

Objectives: By the end of 2020, 38 states and the District of Columbia had issued requirements that people wear face masks when in public settings to counter SARS-CoV-2 transmission. To examine the role face mask mandates played in economic recovery, we analyzed the interactive effect of having a state face mask mandate in place on county-level consumer spending after state reopening, adjusting for county rates of new COVID-19 cases and deaths, time trends, and county-specific effects.

Methods: We collected county-specific data from state executive orders, consumer spending data from the Opportunity Insights Economic Tracker, and COVID-19 case and death data from the Centers for Disease Control and Prevention COVID-19 tracker. Using an event study approach, we compared county-level changes in consumer spending before and after state-issued closure orders were lifted and assessed the interactive effect of state-issued face mask mandates.

Results: The lifting of state-issued closures was associated with an average increase in consumer spending across all counties studied within 1 month. However, the increase was 1.2-1.7 percentage points higher in counties with a state face mask mandate in place than in counties without a state face mask mandate.

Conclusions: In addition to their public health benefits, face mask mandates may have assisted economic recovery during the COVID-19 pandemic, suggesting they are a strong public health strategy for policy makers to consider now and for potential future pandemics arising from airborne viruses.

Keywords

COVID-19, face mask mandates, consumer spending, closure orders, nonpharmaceutical interventions

SARS-CoV-2, the virus that causes COVID-19, is spread predominantly by aerosol droplets from infected people.[1] To counter SARS-CoV-2 transmission, the Centers for Disease Control and Prevention (CDC) recommended a combination of evidence-based strategies for decreasing transmission of the virus, including physical distancing and wearing face masks.[2,3] By the end of 2020, 38 states and the District of Columbia had issued requirements that people wear face masks when in public settings.[4] The implementation of face mask mandates was associated with decreases in the number of COVID-19 cases and deaths, demonstrating the public health benefits of these community prevention policies.[5,6]

Despite the benefits of these prevention strategies, policy makers must weigh their impact on other important components of society. Concerns centered on the economic consequences of such strategies are at the forefront among policy makers weighing the costs and benefits of enacting or retaining community prevention strategies. Economic spending decreased during spring 2020 after states issued closure orders; however, the state-issued closure orders accounted for only a small proportion of the total economic decline.[7] The impact of COVID-19 on economic activity likely reflected a combination of factors, in addition to state closures, such as people's perceptions of risk related to

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COVID-19 incidence.[8] As such, face mask mandates may have helped economic recovery when states reopened, because people may have been more likely to reengage in economic activity when they perceived the risk of transmission to be lower when face mask mandates were in place.[9] The current literature on this topic suggests that state-issued face mask mandates may have helped economic recovery[9,10]; however, little is known about the interactive effect of state reopening policies and state-issued face mask mandates. This study sought to build upon this literature and examine the role of face mask mandates in economic recovery by analyzing the interactive effect of having a face mask mandate in place on county-level consumer spending after state reopening. We did so by estimating an event study model, adjusting for county rates of new COVID-19 cases and deaths, time trends, and county-specific effects.

Methods

We obtained county-specific data on state-issued closure orders and state-issued face mask mandates from executive and administrative orders identified on state government websites from March 1 through September 30, 2020. We analyzed and coded closure orders and face mask mandates to extract prevention strategy variables, their effective dates and expiration dates, and the counties to which the state-issued orders applied when state-issued measures varied by county.[5] We defined state-issued closure orders as the earlier of either (1) the date people were ordered to stay home or (2) the date when restaurants were ordered to cease on-premises dining and nonessential retail businesses were ordered to close. We defined the date of state-issued reopening as the earlier of either (1) the date the stay-at-home order was lifted or (2) the date restaurants were allowed to resume on-premises dining and retail businesses were permitted to reopen. We defined state-issued face mask mandates as requirements for people to wear a face mask (1) anywhere outside their home or (2) in retail businesses and restaurants. All data underwent secondary review and quality assurance checks.

We obtained county-level data on daily consumer spending from Opportunity Insights Economic Tracker.[11] Opportunity Insights measures consumer spending as the seasonally adjusted credit and debit card spending in all merchant category codes and calculated as the percentage change in value compared with January 2020 (the baseline period). Opportunity Insights obtains these data from Affinity Solutions Inc, a company that aggregates consumer credit and debit card spending to support various financial service products (eg, bank loyalty programs). We obtained county-level data on COVID-19 case and death rates from CDC's COVID-19 Tracker.[12]

We measured associations among reopening, face mask mandates, and consumer spending by using an event study design, a methodology widely used to analyze policy impacts in public health.[5,6,13] For each county, we compared a reference period (1-14 days before reopening) with 7 mutually exclusive time ranges relative to the date of reopening. We examined the association during 2 pre-reopening periods (42-29 and 28-15 days before reopening) and 5 post-reopening periods (1-14, 15-28, 29-42, 43-56, and 57-70 days after reopening). We chose 14-day periods to be consistent with CDC policy evaluation tools.[14] To estimate the association between reopening, face mask mandates, and consumer spending, we used a weighted least-squares regression that included the 7 mutually exclusive period variables relative to each county's reopening date, their interaction with the county's face mask mandate status, and county and day fixed effects (ie, binary indicator variables for each county and day). Because the risk of disease transmission was likely a factor in determining the timing of reopening and implementing a face mask mandate, we included newly identified (ie, not cumulative) COVID-19 case and death rates in the model to control for potential confounding effects. A formal description of the model is provided.

To examine the potential mechanisms for the associations among reopening, face mask mandates, and consumer spending, we also estimated a model with a county-level mobility indicator (time away from home) as the dependent variable. Opportunity Insights calculates a county-level time away from home variable by multiplying the mean time spent inside the home from the American Time Use Survey by the percentage change in time spent at residential locations reported by Google (estimated using cell phone location data from Google users who have enabled the location history setting).[15]

The primary assumption of the event study research design is the parallel trend assumption, which posits that, after reopening, counties subject to a state-issued face mask mandate would have had the same trend in consumer spending as counties without a state-issued face mask mandate, in the absence of face mask mandates. We indirectly tested this assumption by examining the coefficient estimates on the pre-reopening period variables interacted with face mask mandate status.[16] A coefficient of zero for these variables would fail to reject the null hypothesis, demonstrating no differences in consumer spending trends between counties with and without state-issued face mask mandates before lifting state-issued closures, suggesting that the parallel trend assumption is met.

As a sensitivity analysis, we estimated an event study model that excluded new COVID-19 cases and death rates as control variables. As noted in previous studies, face mask mandates were associated with decreases in the number of COVID-19 cases and deaths.[5,6] In addition to face mask mandates potentially providing a sense of safety to restore consumer confidence, the reduction in COVID-19 cases resulting from face mask mandates may also drive changes in consumer behavior. By omitting data on COVID-19 cases and deaths in this sensitivity analysis, the model no longer holds those variables constant and can better account for these potential feedback loops.

Furthermore, a major assumption of the 2-way fixed-effects model, more generally, is that of strict exogeneity: that is, the error term in any given period is uncorrelated with the covariates for all past, current, and future periods. This is a rather strong assumption in this setting because shocks to consumer spending may influence future COVID-19 cases and deaths, influencing the timing of state-issued face mask mandates. A more plausible assumption is that of weak exogeneity, which assumes that the error term in any given period is uncorrelated with just past and current covariates; however, under this assumption, fixed-effects estimation may lead to bias.[17] To examine the sensitivity of our results under this less strict assumption, we estimated additional event study models, correcting for potential bias following novel methods proposed in the literature.[17]

All analyses were weighted by county population, and robust SEs were clustered at the county level to account for autocorrelation within counties. We used Stata version 16.0 (StataCorp LLC) to conduct analyses. We used *t* tests to determine *P* values, and we defined significance as $P < .05$. This activity was reviewed by CDC and conducted consistent with applicable federal law and CDC policy (eg, 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq).

Results

Of 3143 US counties, 2803 (89%) representing 45 states had data available on consumer spending during the study period and were subject to state-issued closure orders. Of these counties, 1603 (57%) had a state-issued face mask mandate in place within 70 days of reopening. The earliest reopening date for counties that did not have a state-issued face mask mandate in place was April 24, 2020; for face mask–mandate counties, it was May 1, 2020. The latest reopening date for counties that did not have a state-issued face mask mandate in place was June 16, 2020; for face mask–mandate counties, it was July 13, 2020. The median reopening date was later for counties that had a state-issued face mask mandate in place than for non–face mask–mandate counties: May 15, 2020, versus May 1, 2020 (Figure 1).

The lifting of state-issued closure orders was associated with a 0.8 ($P < .001$), 1.4 ($P < .001$), and 1.3 ($P = .001$) percentage-point increase in consumer spending 1-14 days, 15-28 days, and 29-42 days, respectively, after the closure was lifted in counties without a state-issued face mask mandate in place for the corresponding time frame. In counties without a state-issued face mask mandate, we found nonsignificant changes in consumer spending 43-56 days and 57-70 days after the closure was lifted. The lifting of closure orders was associated with an increase in consumer spending of 2.0 ($P < .001$), 2.4 ($P < .001$), 2.2 ($P < .001$), and 2.1 ($P < .001$) percentage points 1-14 days, 15-28 days, 29-42 days, and 43-56 days, respectively, after the closure was lifted

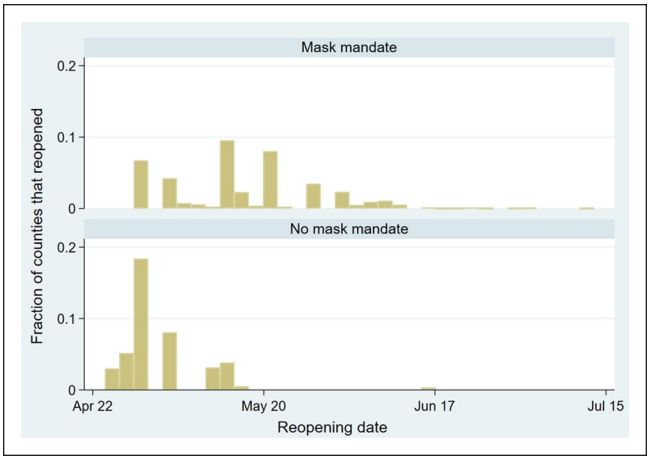

Figure 1. Distribution of county-level reopening dates by state-issued face mask mandate status, United States, 2020. Data source: Policy data were collected from state government websites containing executive or administrative orders. Notes: 2803 counties are included in the analysis. The date of reopening was defined as the earlier of either (1) the date the stay-at-home order was lifted or (2) the date both restaurants could resume on-premises dining and retail businesses were permitted to reopen. State-issued face mask mandates were defined as requirements for people to wear a face mask (1) anywhere outside their home or (2) in retail businesses and in restaurants or food establishments. For this figure, counties were stratified by whether the county was subject to a state-issued face mask mandate within 70 days after the date of reopening. Percentages across both panels sum to 100%.

when a state-issued face mask mandate was in place for the corresponding time frame (Figure 2). As such, the increase in consumer spending was 1.2 ($P = .004$) and 1.7 ($P = .02$) percentage points higher in counties with a state-issued face mask mandate in place than in counties without a state-issued face mask mandate in place 1-14 days and 43-56 days, respectively, after closures were lifted (Figure 3). Some of the pretrend coefficients of the model were significant, suggesting that the parallel trend assumption of the event study research design may not have been satisfied.

The lifting of closure orders was associated with a 0.5 ($P < .001$), 0.9 ($P < .001$), 1.0 ($P < .001$), and 0.4 ($P = .03$) percentage-point increase in time spent away from home 1-14 days, 15-28 days, 29-42 days, and 43-56 days, respectively, after the closure was lifted in counties without a state-issued face mask mandate in place for the corresponding time frame (Table). The lifting of closure orders was associated with an increase in time spent away from home of 1.1 ($P < .001$), 1.7 ($P < .001$), 1.5 ($P < .001$), and 1.1 ($P < .001$) percentage points 1-14 days, 15-28 days, 29-42 days, and 43-56 days after the closure was lifted if a state-issued face mask mandate was in place for the corresponding time frame. As such, the increase in time spent away from home was 0.7 ($P < .001$), 0.7 ($P = .001$), 0.6 ($P = .01$), 0.7 ($P = .001$), and 0.8 ($P < .001$) percentage points higher in counties with a

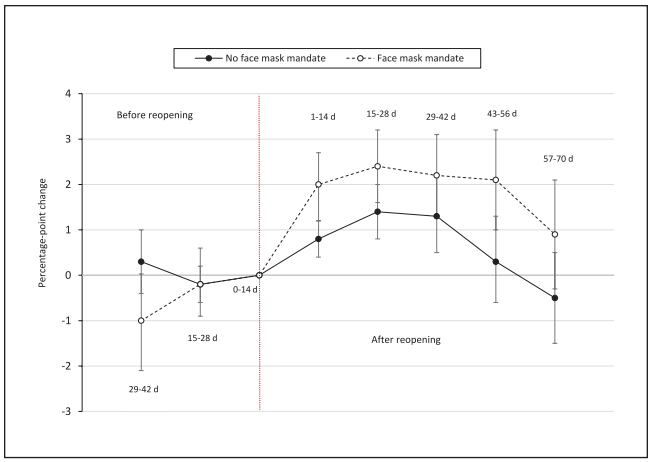

Figure 2. Percentage-point change in consumer spending in the United States from January 2020, by face mask mandate status: event study results. The dotted vertical line indicates reopening date. Consumer spending data are from Opportunity Insights Economic Tracker and are measured as the seasonally adjusted credit/debit card spending in all merchant category codes and calculated as the percentage change in value compared with January 2020 (the baseline period). The model controlled for COVID-19 case rates and death rates and included county and day fixed effects (ie, binary indicator variables for each county and day of the year). All analyses were weighted by county population and estimated with robust SEs clustered at the county level.

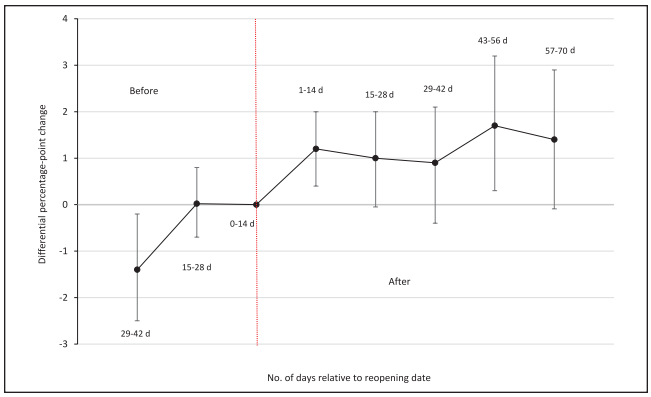

Figure 3. Differential percentage-point change in consumer spending in the United States from January 2020 between counties with and without state-issued face mask mandates: event study results. The dotted vertical line indicates the reopening date. Consumer spending data are from Opportunity Insights Economic Tracker and are measured as the seasonally adjusted credit/debit card spending in all merchant category codes and calculated as the percentage change in value compared with January 2020 (the baseline period). The model controlled for COVID-19 case rates and death rates and included county and day fixed effects (ie, binary indicator variables for each county and day of the year). All analyses were weighted by county population and estimated with robust SEs clustered at the county level.

state-issued face mask mandate in place than in counties without a state-issued face mask mandate in place 1-14 days, 15-28 days, 29-42 days, 43-56 days, and 57-70 days, respectively, after closures were lifted. In general, the mobility models produced significant coefficient estimates on the pretrend variables, suggesting that the parallel trend assumption for these specifications may not have been satisfied.

The main results of the event study models were robust to the exclusion of the COVID-19 case and death covariates (Figure 4). These models suggest that the increase in consumer spending was 1.2 ($P = .002$), 1.1 ($P = .04$), 1.9 ($P = .01$), and 1.7 ($P = .03$) percentage points higher in counties with a state-issued face mask mandate in place than in counties without a state-issued face mask mandate in place 1-14 days, 15-28 days, 43-56 days, and 57-70 days, respectively, after closures were lifted. The main results were robust to bias corrections conducted under the weak exogeneity assumption.

Discussion

The results of our study suggest that the lifting of state closure orders was associated with an average increase in consumer spending across all counties within approximately 1 month of the lifting of orders. However, consumer spending increased at a higher rate after the closure was lifted in counties where a state-issued face mask mandate was in place than in counties without the mandate. These findings suggest that jurisdictions with state-issued face mask mandates in place experienced significantly swifter economic recovery than jurisdictions without state-issued face mask mandates in place within 70 days of reopening. In addition, the estimated differential effect between face mask and non–face mask counties was slightly larger when the model did not hold constant new COVID-19 cases and deaths, suggesting that the epidemiologic impact of face mask mandates may have also contributed to changes in consumer spending. Furthermore, because face mask–mandate and non–face mask–mandate counties experienced similar initial economic decline at the start of the pandemic, this observed spending effect was likely not the result of counties subject to a state-issued face mask mandate "catching up" to counties that were not subject to a state-issued face mask mandate.

Previous research showed that face mask mandates were associated with a significant decrease in the growth rates of COVID-19 incidence, death, and hospitalization.[5,13] Because COVID-19 can lead to prolonged illness and require long-term treatment,[18] face mask mandates may have resulted in a decrease in COVID-19–associated health care costs.[13] In addition, research showed that extended state closures and reopening with a statewide face mask mandate in place helped slow rapid increases in cases of COVID-19.[19] Our study demonstrates that state-issued face mask mandates may have also encouraged economic recovery after state reopening, suggesting they are a strong public health policy for decision makers to consider.

Table. Results of an event study on the differential impact of reopening states on time spent away from home between US counties with and without state-issued face mask mandates (N = 2803) during the COVID-19 pandemic, March 25–September 21, 2020[a]

Time relative to day state-issued closure was lifted	Percentage-point change in time away from home (95% CI)		
	No face mask mandate	Face mask mandate	Differential effect
29-42 Days before	0.4[b] (0.1 to 0.7)	−0.7[b] (−1.1 to −0.4)	−1.1[b] (−1.5 to −0.7)
15-28 Days before	0.2[b] (0.1 to 0.4)	−0.4[b] (−0.7 to −0.2)	−0.6[b] (−0.9 to −0.4)
0-14 Days before	[Reference]	[Reference]	[Reference]
1-14 Days after	0.5[b] (0.3 to 0.7)	1.1[b] (0.9 to 1.3)	0.7[b] (0.4 to 1.0)
15-28 Days after	0.9[b] (0.7 to 1.2)	1.7[b] (1.3 to 2.0)	0.7[b] (0.3 to 1.1)
29-42 Days after	1.0[b] (0.7 to 1.3)	1.5[b] (1.1 to 1.9)	0.6[b] (0.1 to 1.0)
43-56 Days after	0.4[b] (0.1 to 0.7)	1.1[b] (0.7 to 1.5)	0.7[b] (0.3 to 1.2)
57-70 Days after	−0.4[b] (−0.8 to −0.1)	0.4 (−0.1 to 0.8)	0.8[b] (0.4 to 1.2)

[a]Data source: Data on time away from home are from Opportunity Insights Economic Tracker and calculate time away from home by multiplying the mean time spent inside the home from the American Time Use Survey by the percentage change in time spent at residential locations reported by Google county level. The model controlled for COVID-19 case rates and death rates and included county and day fixed effects (ie, binary indicator variables for each county and day of the year). All analyses were weighted by county population and estimated with robust SE clustered at the county level.

[b]*t* tests were used to estimate *P* values. Significantly different from referent at $P < .05$.

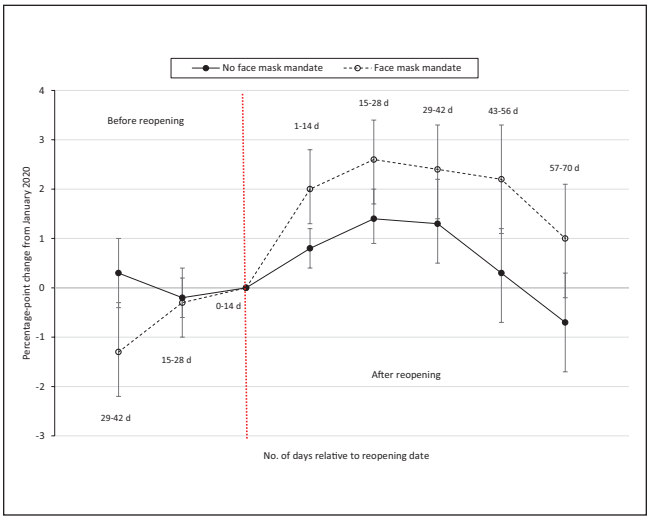

Figure 4. Percentage-point change in consumer spending in the United States in 2020 between counties with and without state-issued face mask mandates, excluding COVID-19 cases and deaths as control variables: event study results. Dotted vertical line indicates reopening date. Consumer spending data are from Opportunity Insights Economic Tracker and are measured as the seasonally adjusted credit/debit card spending in all merchant category codes and calculated as the percentage change in value compared with January 2020 (the baseline period). The model included county and day fixed effects (ie, binary indicator variables for each county and day of the year). All analyses were weighted by county population and estimated with robust SEs clustered at the county level.

To illustrate the comparative impact of state-issued face mask mandates on county-level spending, consider the following example based on average consumer spending. In 2019, total average consumer spending was estimated to be approximately $63 000 per consumer ($5250 per month),[20] and the average county population was estimated to be approximately 100 000. These spending and population estimates suggest that a county's average 2-week consumer spending was roughly $262.5 million. Assuming this 2-week average as a county's baseline consumer spending, we estimated that the average increase in biweekly consumer spending was $3.15-$4.46 million more in counties with state-issued face mask mandates than in counties without state-issued face mask mandates after state-issued closure orders were lifted.

This difference in economic recovery between face mask and non–face mask counties may be explained by a greater likelihood for people to have reengaged in economic activity when preventive measures, such as face mask mandates, were in place. Survey data from Utah support this hypothesis: people in Utah reported being more likely to enter stores when others were required to wear a face mask than when such requirements were not in place.[9] Our results also demonstrated that consumer spending was indistinguishable from pre-reopening levels in counties without state-issued face mask mandates in place after 43 days of reopening, but spending maintained higher levels in counties with state-issued face mask mandates in place than in counties without these mandates. This finding suggests that state-issued face mask mandates may have been associated with sustained consumer spending after pent-up demand (ie, rapid increases in demand after a period of low or no spending) was exhausted.

Furthermore, if a county's state-issued face mask mandate status influenced the likelihood of people to reengage in economic activity, it follows that face mask mandates should also lead people to spend more time outside the home relative to people living in counties not subject to a state-issued face mask mandate. Although the event study models did not satisfy the parallel trend assumption when analyzing the mobility indicator, our analysis did not rule out this hypothesis, because time

spent away from home increased at a higher rate 1-70 days after the closure was lifted in counties under state-issued face mask mandates relative to counties without a face mask mandate, suggesting a potential association. These findings together suggest that face masks proved to be beneficial economically during the COVID-19 pandemic. In addition, our findings suggest potential benefits outside the context of COVID-19 and into the future; they can be applied to other respiratory illnesses (eg, influenza). Research on the 1918 influenza pandemic found that nonpharmaceutical interventions flattened the disease transmission curve while not hindering economic recovery.[21] Similar to previous COVID-19 research,[7] Correia et al[21] found that the 1918 influenza pandemic disrupted the economy but that consumer responses to the pandemic itself, rather than prevention strategies, had the biggest impact.

We also considered whether the timing of state-issued reopening, rather than state-issued face mask mandate status exclusively, contributed to changes in consumer spending. Although we observed differences in the distribution of reopening dates by state-issued face mask mandate status, most reopening dates occurred in May 2020, suggesting that differences in reopening timing were likely not the primary mechanism for the observed association between state-issued reopening, state-issued face mask mandates, and consumer spending. In addition, our model used day fixed effects, which are meant to capture unobserved temporal variation in consumer spending that affects all counties. However, we cannot explicitly rule out pent-up demand in counties that reopened later as a contributing factor to the observed changes in consumer spending.

Limitations

This study had several potential limitations. First, data on consumer spending were not available for every county in the United States, which restricted the sample used for our analysis. Second, although the analysis demonstrated that mobility also increased because of state-issued face mask mandates, we could not determine whether spending occurred online or in person. Third, our study was limited to state-issued policies and did not account for mitigation policies issued by local governments or businesses. Fourth, our study was ecological. The research design was constructed to overcome unmeasured confounding arising from the nonrandom implementation of policy; however, we cannot, with certainty, rule out other potential confounders that may have influenced both the timing of state-issued face mask mandates and changes in consumer spending, such as local perceptions of face mask mandates.

Conclusion

In addition to reducing the transmission of SARS-CoV-2,[5,19] face mask mandates are associated with swifter economic recovery. This study demonstrated that counties with face mask mandates in place experienced an increase in consumer spending 1.2-1.7 percentage points higher than counties that were not subject to a state-issued face mask mandate after states lifted closure orders.

In future pandemics, policy makers will again be faced with difficult decisions, weighing the costs and benefits of both public health and economic outcomes when deciding what prevention strategies to implement and for what duration. Face mask mandates can slow the spread of airborne viruses without adversely affecting the economy. Our study suggests that face mask mandates may even help the economy recover from negative demand shocks (ie, a reduction in demand arising from unforeseen events) that result from airborne viruses and that face mask mandates are a strong public health policy for decision makers to consider.

Authors' Note

The following supplementary materials are available upon request from the author: (1) text describing the details of the event study design; (2) a table showing the differential impact of reopening states on consumer spending between counties with and without state-issued face mask mandates (excluding COVID-19 cases and deaths as control variables): (3) a table showing the differential impact of reopening states on time spent away from home between counties with and without state-issued face mask mandates (excluding COVID-19 cases and deaths as control variables); (4) a table showing the differential impact of reopening states on consumer spending between counties with and without state-issued face mask mandates (bias-corrected event study results); (5) a table showing the differential impact of reopening states on time spent away from home between counties with and without state-issued face mask mandates (bias-corrected event study results); and (6) a graph showing daily county-level consumer spending by whether the county was ever subject to a state-issued face mask mandate, 2020.

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Declaration of Conflicting Interests

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