

# Appendix J: Impact of Public Health Mandates on COVID-19 Case Rates + Mortality

## Literature Review

The study team conducted a literature review to inform the topic of the comparative effect of public health restrictions (such as mask mandates, stay-at-home orders, business and government closures) on COVID-19 outcomes. The study team identified two study questions for the literature review: Did COVID-19 public health restrictions work to reduce COVID-19 case counts and mortality?; and What effect did public health restrictors that were more consistently enforced have on COVID-19 cases counts and mortality?

The literature review was limited to 2020-2023, and primarily included only US studies. The study team utilized PubMed and search terms included COVID, mandates, enforcement, cases, deaths, morbidity, mortality, stay-at-home, masking mandates, and non-pharmaceutical interventions. The study team also utilized citation lists from meta-analysis articles to identify additional articles. Additionally, LitCovid, a repository of COVID-19 related literature hosted by the National Library of Medicine, National Center for Biotechnology Information was searched for articles for inclusion. Nineteen articles were identified for inclusion in this literature review; some articles included analysis of multiple public health measures.

Citation	objective	public health measure	association with reducing cases	association with reducing death	results	limitations	method
Ahlers, M. J., Aralis, H. J., Tang, W. L., Sussman, J. B., Fonarow, G. C., & Ziaeeian, B. (2021). Non-pharmaceutical interventions and COVID-19 burden in the United States. <a href="https://doi.org/10.1101/2021.09.26.21264142">https://doi.org/10.1101/2021.09.26.21264142</a>	To determine whether each of four broadly adopted NPIs (stay at home order, indoor restaurant dining ban, public mask mandate, and indoor public gathering ban) were effective in reducing the COVID-19 burden	Stay at home order	Yes	Yes	stay at home orders were effective at decreasing the rate of new diagnoses of COVID-19 the only NPI associated with decreasing COVID-19 mortality was stay at home order	This manuscript has not been published yet. The indicators it uses to present results (OR of a decrease in case/death velocity) looks confusing. Researchers did not examine compliance with government mandates	Researchers conducted a retrospective, observational cohort study to evaluate the state-specific NPI adoption or discontinuation and how it was related to COVID-19 case and mortality velocities between January 19, 2020 and March 7, 2021. Case and mortality data were obtained from The COVID Tracking Project ( <a href="https://covidtracking.com/">https://covidtracking.com/</a> ),

	among U.S. states.	Masking mandate	Yes	No	Public mask mandates were associated with over twice the likelihood of reduced COVID-19 transmission even after adjusting for other policies that may have been adopted concurrently. Public mask mandates may encourage behavioral modifications as well as directly reduce the odds of transmission by using a physical barrier.		and dates for state-specific adoption and discontinuation of NPIs were obtained from publicly available reports. The odds of a decrease in case/death velocity were used to evaluate the effectiveness of each of the NPIs. (it's a bit confusing but generally speaking, OR > 1 means the NPI was successful in reducing COVID-19 case/death velocity)
		Indoor public gatherings ban	No	No	Gathering bans with limits greater than 10 were insufficient or exacerbated COVID-19 spread		
		Indoor restaurant ban	Yes	No	Results from the mutually adjusted policy model suggested indoor restaurant dining bans and severe indoor public gathering may be associated with decreased case velocity		

<p>Auger, K. A., et al. (2020). Association between statewide school closure and covid-19 incidence and mortality in the US. JAMA, 324(9), 859. <a href="https://doi.org/10.1001/jama.2020.14348">https://doi.org/10.1001/jama.2020.14348</a></p>	<p>To assess the association between school closure and its timing with incidence and mortality of COVID-19</p>	<p>Closing in-person school</p>	<p>Yes</p>	<p>Yes</p>	<p>The results of the study suggest that school closure was effective in reducing COVID-19 incidence and mortality.</p> <p>Adjusted analysis showed that school closure was associated with -62% relative change per week in COVID-19 incidence, and -58% relative change per week in COVID-19 mortality. States that closed schools earlier had a greater reduction in weekly cases compared to states that closed schools late. States that closed schools earlier had fewer estimated total deaths, while states that closed schools late had the largest absolute reduction in deaths.</p>	<p>Some of the impacts could be due to other NPIs Measuring COVID-19 incidence is limited by testing availability</p>	<p>A longitudinal collection of data was done between March 9, 2020, and May 7, 2020, allowing for at least 6 weeks after school closures in each state. School closure and its timing were examined as the independent variables, and the outcome data, daily COVID-19 incidence and mortality were estimated using data from the Johns Hopkins University School of Public Health.</p>
<p>Bendavid, E, Oh, C, Bhattacharya, J, Ioannidis, JPA. (2021) Assessing mandatory stay-at-home and business closure effects on the spread of COVID-19. European Journal of Clinical Investigation, 51:e13484. <a href="https://doi.org/10.1111/eci.13484">https://doi.org/10.1111/eci.13484</a></p>	<p>To assess the impacts of restrictive non-pharmaceutical interventions (mandatory stay-at-home orders and business closures) on the spread of COVID-19</p>	<p>NPIs</p>	<p>No</p>	<p>No</p>	<p>there is no evidence that more restrictive nonpharmaceutical interventions (such as stay-at-home orders) contributed substantially to reducing transmission of new cases in England, France, Germany, Iran, Italy, the Netherlands, Spain or the United States in early 2020 While modest decreases in daily growth (under 30%) cannot be excluded in a few</p>	<p>Cross-country comparisons are difficult: countries may have different rules, cultures and relationships between the government and the people; findings rest on the assumption that NPIs reduce transmission</p>	<p>Researchers estimated COVID-19 case growth in relation to any NPI implementation in subnational regions of 10 countries: England, France, Germany, Iran, Italy, Netherlands, Spain, South Korea, Sweden and the United States. Using first-difference models with fixed effects, they isolated the effects of more restrictive NPIs by subtracting the combined effects of less restrictive NPIs</p>

					countries, there is not evidence of large decreases in daily growth due to more restrictive NPIs		and epidemic dynamics from all NPIs. Case growth in Sweden and South Korea, two countries that did not implement mandatory stay-at-home and business closures, was utilized as comparison countries for the other 8 countries. mrNPIs = more restrictive, lrNPI=less restrictive)
Bundgaard, H., et al. (2021). Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS-CoV-2 Infection in Danish Mask Wearers : A Randomized Controlled Trial. <i>Annals of internal medicine</i> , 174(3), 335–343. <a href="https://doi.org/10.7326/M20-6817">https://doi.org/10.7326/M20-6817</a>	To determine if mask wearing by uninfected individuals would reduce infection by COVID-19.	Masking mandate	No	N/A	In a community where mask wearing was uncommon, wearing masks by non-infected individuals did not reduce COVID-19 infection by more than 50%.  42 people (1.8%) in the masked group and 53 people (2.1%) in the control group were infected with COVID-19. The difference was not statistically significant, but the 95% CIs are compatible with a 46% reduction to a 23% increase in infection among those that wore masks.	Not a US study There was no assessment of whether masks could decrease disease transmission from infected mask wearers to others	A randomized controlled study was conducted. Adults who spent 3 or more hours in public with other people and who did not wear masks were recruited. Before participating in the study, participants were required to test negative for COVID-19. Participants were provided with 50 surgical masks and instructions for use. The primary outcome was SARS-CoV-2 infection in the mask wearer at one month by antibody testing, polymerase chain reaction (PCR), or hospital diagnosis. The secondary outcome was PCR positivity for other respiratory viruses.
Chu, D. K., et al. (2020). Physical distancing, face masks, and eye protection to prevent person-to-person	To understand the effects of physical distance, face masks, and eye protection on virus transmission in	Physical distancing	Yes	N/A	Transmission of viruses was lower with physical distancing of 1 m or more, compared with a distance of less than 1 m; protection was increased as distance was	Limitations include that none of the studies were randomized, and may suffer from recall bias.	This was a systematic review of 172 observational studies in health-care and non-health-care settings across 16 countries and six continents; 44 comparative

transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. Lancet (London, England), 395(10242), 1973–1987. <a href="https://doi.org/10.1016/S0140-6736(20)31142-9">https://doi.org/10.1016/S0140-6736(20)31142-9</a>	health-care and community settings.				lengthened		studies were included in a meta-analysis, including 25697 patients with COVID-19, SARS, or MERS. Studies were all observational.
		Masking mandate	Yes	N/A	Face mask use could result in a large reduction in risk of infection, with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar.		
		Eye protection	Yes	N/A	Eye protection also was associated with less infection		
Courtemanche, C., Garuccio, J., Le, A., Pinkston, J., & Yelowitz, A. (2020). Strong Social Distancing Measures In The United States Reduced The COVID-19 Growth Rate. Health Affairs (Project Hope), 39(7), 1237–1246. <a href="https://doi.org/10.1377/hlthaff.2020.00608">https://doi.org/10.1377/hlthaff.2020.00608</a>	To determine the effectiveness of four types of social distancing measures (shelter-in-place orders, public school closures, bans on large social gatherings, and closures of entertainment-related businesses) on confirmed COVID-19 case growth rates through April 27, 2020.	shelter-in-place orders	Yes	N/A	Both shelter-in-place orders and closures of restaurants, bars, and entertainment-related businesses substantially slowed the spread of COVID-19. Shelter-in-place orders led to statistically significant reductions in the COVID-19 cases.	Some of the effects from NPIs could have been seen without these measures put into place as some populations would have voluntarily adopted protective behaviors. There may also be issues with lack of testing availability that is not accounted for in modeling.	Researchers used an event study regression with multiple policies to estimate the relationship between social distancing policies and the exponential growth rate of confirmed COVID-19 cases.
		public school closures	No	N/A	Researchers did not find evidence that closures of public schools slowed the spread of COVID-19, although the confidence intervals cannot rule out moderate-size effects.		
		bans on large social gatherings	No	N/A	Researchers did not find evidence that bans on large social gatherings slowed the spread of COVID-19, although the confidence intervals cannot rule out moderate-size effects.		

		closures of entertainment-related businesses	Yes	N/A	Closures of restaurants, bars, and entertainment-related businesses substantially slowed the spread of COVID-19.		
<p>Dreher, N., Spiera, Z., McAuley, F. M., Kuohn, L., Durbin, J. R., Marayati, N. F., Ali, M., Li, A. Y., Hannah, T. C., Gometz, A., Kostman, J. T., &amp; Choudhri, T. F. (2021). Policy interventions, social distancing, and SARS-COV-2 transmission in the United States: A retrospective state-level analysis. The American Journal of the Medical Sciences, 361(5), 575–584. <a href="https://doi.org/10.1016/j.amjms.2021.01.007">https://doi.org/10.1016/j.amjms.2021.01.007</a></p>	<p>The study was to retrospectively analyze the effectiveness of different NPIs in the early stages of the COVID-19 epidemic for every state in the U.S</p>	stay-at-home order	Yes	No	Stay-at-home order, educational facilities closure, and non-essential business closure implemented during both of the first 2 weeks following 500th cases are significantly associated with lower Rt, which mean these NPIs were effective in limiting the spread of COVID-19 at the early stage of the epidemic. No significant association was found between the implementation of these NPIs and the doubling time from 50 to 100 deaths.	<p>This study only assessed the effectiveness of NPIs at an early stage and thus is not sufficient to support the effectiveness of the long-term implementation of these interventions. This study only assessed state-level policies and mandates. County-level localized control and variation in COVID-19 cases were not accounted for.</p>	<p>COVID-19 case and death data for all 50 states and the District of Columbia were from the Coronavirus Resource Center at Johns Hopkins University. A real-time estimate of Rt, which predicted the reproduction rate of COVID-19 cases, was collected from Rt.live. The study chose the average Rt in the weeks following 500 cases and the time it took for each state to double the number of cases from 500 to 1000, and the number of deaths from 50 to 100, as the outcome indicators for the effectiveness of NPIs during the early stage of COVID-19 epidemic in the United States.</p>
		school closure	Yes	No	Stay-at-home order, educational facilities closure, and non-essential business closure implemented during both of the first 2 weeks following 500th cases are significantly associated with lower Rt, which mean these NPIs were effective in limiting the spread of COVID-19 at the early stage of the epidemic. No significant association was found		

					between the implementation of these NPIs and the doubling time from 50 to 100 deaths.		
		limitation on mass gathering	No	No	The association between the limitation on mass gatherings and Rt was not significant. No significant association was found between the implementation of these NPIs and the doubling time from 50 to 100 deaths.		
		business closure	Yes	No	Stay-at-home order, educational facilities closure, and non-essential business closure implemented during both of the first 2 weeks following 500th cases are significantly associated with lower Rt, which mean these NPIs were effective in limiting the spread of COVID-19 at the early stage of the epidemic. No significant association was found between the implementation of these NPIs and the doubling time from 50 to 100 deaths.		

<p>Fowler JH, Hill SJ, Levin R, Obradovich N (2021) Stay-at-home orders associate with subsequent decreases in COVID-19 cases and fatalities in the United States. PLoS ONE 16(6): e0248849. <a href="https://doi.org/10.1371/journal.pone.0248849">https://doi.org/10.1371/journal.pone.0248849</a></p>	<p>To understand the impact of stay-at-home orders on cases and deaths</p>	<p>stay-at-home order</p>	<p>Yes</p>	<p>Yes</p>	<p>Stay-at-home orders are associated with a 30.2 percent (11.0 to 45.2) average reduction in weekly incident cases after one week, a 40.0 percent (23.4 to 53.0) reduction after two weeks, and a 48.6 percent (31.1 to 61.7) reduction after three weeks. Stay-at-home orders are also associated with a 59.8 percent (18.3 to 80.2) average reduction in weekly fatalities after three weeks. These results suggest that stay-at-home orders might have reduced confirmed cases by 390,000 (170,000 to 680,000) and fatalities by 41,000 (27,000 to 59,000) within the first three weeks in localities that implemented stay-at-home orders.</p>	<p>as with any observational study, the associations cannot be assumed casual cases and fatalities are based on incomplete data cannot separate out impact of other local interventions</p>	<p>Researchers combined the data on the timing of stay-at-home orders with daily confirmed COVID-19 cases and deaths at the county level during the first seven weeks of the outbreak in the United States. They estimated the association between stay-at-home orders and changes in COVID-19 cases and deaths using a difference-in-differences design to account for unmeasured local variation in factors like health systems and demographics and for differences in factors like national mitigation actions and access to tests.</p>
<p>Hansen, N-J.H., Mano,R.C. (2023) Mask mandates save lives, Journal of Health Economics. 88. <a href="https://doi.org/10.1016/j.jhealeco.2022.102721">https://doi.org/10.1016/j.jhealeco.2022.102721</a></p>	<p>To answer the question: Did statewide mask mandates save lives?</p>	<p>Masking mandate</p>	<p>Yes</p>	<p>Yes</p>	<p>statewide mask mandates reduced new weekly COVID-19 cases by 54.95 cases per 100,000 inhabitants, COVID-19 hospital admissions by 11.44 persons per 100,000 inhabitants, and new COVID-19 deaths by 0.73 by 100,000 inhabitants. impact of mask mandates on outcomes varies depending on political leaning, with higher reductions in cases</p>	<p>Estimates may be low potential sources of bias: other ph mandates, spillover effect (travel between states due to policies)</p>	<p>Researchers used a regression discontinuity design to examine the variation between counties across state mask borders, that is a state border that separates two counties, in which one county is in a state with a mask mandate at a given time and the other county is in a state without a mask mandate at the same time. The study period was between January 20, 2020 and December 20, 2020,</p>

					and deaths in democratic-leaning counties.  estimates imply that statewide mask mandates saved 87,000 lives and could have potentially saved 57,000 additional lives up to December 19, 2020		when the COVID-19 pandemic hit the U.S. and mask mandates were being implemented and vaccines were not yet widely available.
McGrail, D. J., Dai, J., McAndrews, K. M., & Kalluri, R. (2020). Enacting national social distancing policies corresponds with dramatic reduction in COVID19 infection rates. PloS one, 15(7), e0236619. <a href="https://doi.org/10.1371/journal.pone.0236619">https://doi.org/10.1371/journal.pone.0236619</a>	To determine efficacy of social distancing policies on slowing the spread of COVID-19.	Social distancing policies, including closure of non-essential workplaces and schools, as well as policies on physical spacing when in public	Yes	N/A	Social distancing is an effective measure to reduce the spread of COVID-19. In the US, there was a strong reduction observed in average mobility following implementation of social distancing policies in the 47 states with social distancing policies; changes in average mobility were significantly correlated with decreases in COVID19 spread rate. Globally, nations with regional or national social distancing policies had a significantly larger reduction in mobility than those without policies, and nations with national policies exhibited a significantly larger reduction than those with regional policies.	Reliance on COVID-19 testing is most likely an undercount of cases Study did not control for variables such as population density, healthcare infrastructure, testing rates, climate, population characteristics	Researchers determined the spread of COVID-19 both before and after implementation of social distancing policies, using daily case numbers for COVID-19 and population numbers acquired from the COVID-19 Data Repository by the Center for Systems Science and Engineering at Johns Hopkins University. Based on the 95% confidence interval for time from exposure to exhibiting symptoms of 8.2 to 15.6 days, they included cases a maximum of 7 days post implementation of social distancing policies to still be considered pre-social distancing. Researchers also looked at the impact of social distancing policies on community mobility, utilizing data from Google mobility reports. Average mobility was taken as the average reduction in mobility across the 5 Google mobility metrics (retail and

							recreation, grocery and pharmacy, parks, transit stations, and workplace).
Nguyen M. (2021) Mask Mandates and COVID-19 Related Symptoms in the US. ClinicoEconomics and Outcomes Research, 13:757-766 <a href="https://doi.org/10.2147/CEOR.S326728">https://doi.org/10.2147/CEOR.S326728</a>	This study investigates the extent to which the Public Mask Mandate, a policy that requires the use of face masks in public, can protect people from developing COVID-19 symptoms during the initial stage of the pandemic from mid-April to early June 2020 in the United States (US).	Masking mandate	Yes	N/A	Public Mask Mandate significantly lowers the incidence of developing all COVID-19 symptoms by 0.29 percentage points. The estimate implies an average reduction of 290%, compared to the proportion of the mandate-unaffected individuals who display all symptoms (0.1%).	other policies at the beginning of the pandemic such as lockdowns and eviction moratorium are not accounted for in the model does not account for subsets of population already required to wear masks examines likelihood of symptoms, not infection	Researchers employed a difference-in-differences model to exploit the differential timing of the mask mandate implementation across states. Data on symptoms were pulled from the COVID Impact Survey (CIS). Implementation dates of public mask mandates were pulled from government websites.
Rader, B., White, L. F., Burns, M. R., Chen, J., Brilliant, J., Cohen, J., Shaman, J., Brilliant, L., Kraemer, M. U., Hawkins, J. B., Scarpino, S. V., Astley, C. M., & Brownstein, J. S. (2021). Mask-wearing and control of SARS-COV-2 transmission in the USA: A cross-sectional study.	The study was to assess mask compliance across the USA, and evaluate the association of a change in self-reported mask-wearing with the timing of mask mandates. The purpose of the study was to examine the effect of face masks on the transmission of COVID-19 in the	Masking mandate	Yes	N/A	The results suggested that mask-wearing reduced transmission of COVID-19 across all levels of physical distancing. A 10% increase in reported mask-wearing was associated with an increase of more than three-fold in odds of transmission control.	Self-reported mask wearing data	Self-reported mask-wearing data were collected through a web survey hosted on SurveyMonkey, together with a random-selected invitation to participate in the COVIDNearYou survey. Transmission data were estimated based on the case data from The COVID Tracking Project and the open COVID-19 data working group. A daily Rt number was used to estimate the number of secondary cases arising from a single case for a given day to measure state-specific

<p>The Lancet Digital Health, 3(3).  <a href="https://doi.org/10.1016/s2589-7500(20)30293-4">https://doi.org/10.1016/s2589-7500(20)30293-4</a></p>	<p>US.</p>						<p>community transmission control.  Mask mandate information for each state was from the masks4all database.</p>
<p>Siedner MJ, Harling G, Reynolds Z, Gilbert RF, Haneuse S, Venkataramani AS, et al. (2020) Correction: Social distancing to slow the US COVID-19 epidemic: Longitudinal pretest–posttest comparison group study. PLoS Med 17(10): e1003376.  <a href="https://doi.org/10.1371/journal.pmed.1003376">https://doi.org/10.1371/journal.pmed.1003376</a></p>	<p>To determine if social distancing measures to address the US COVID-19 epidemic had health and social impacts.</p>	<p>Social distancing measures, included closures of schools, closures of workplaces, cancellations of public events, restrictions on internal movement (stay-at-home orders), and closures of state borders.</p>	<p>Yes</p>	<p>Yes</p>	<p>Social distancing rules did appear to slow the transmission of COVID-19 and reduce mortality from COVID-19. There was a statistically significant reduction in COVID-19 case rates growth with statewide social distancing requirements. There was also a statistically significant reduction in COVID-19-attributed mortality growth rate in social distancing requirements seven days after implementation, but the effect was gone after ten days.</p>	<p>This study did not determine which types of social distancing requirements (closures of schools, closures of workplaces, cancellations of public events, restrictions on internal movement (stay-at-home orders), and closures of state borders) were most effective at reducing COVID-19. Researchers did not control for potential confounding factors such as underestimating strength of social distancing policies due to neighboring states or increased testing.</p>	<p>Researchers conducted a longitudinal pretest–posttest comparison group study to estimate the change in COVID-19 case growth before versus after implementation of statewide social distancing measures in the US. The primary outcome examined was the COVID-19 case growth rate and the secondary outcome was the COVID-19-attributed mortality growth rate.</p>

<p>Singh, S., Shaikh, M., Hauck, K., &amp; Miraldo, M. (2021). Impacts of introducing and lifting nonpharmaceutical interventions on COVID-19 daily growth rate and compliance in the United States. Proceedings of the National Academy of Sciences, 118(12). <a href="https://doi.org/10.1073/pnas.2021359118">https://doi.org/10.1073/pnas.2021359118</a></p>	<p>To evaluate the heterogeneous impacts of introducing and lifting non-pharmaceutical interventions on COVID-19 with regards to population characteristics.</p>	<p>non-pharmaceutical interventions</p>	<p>Yes</p>	<p>N/A</p>	<p>Introducing NPIs led to significant increase in compliance and a reduction in COVID-19 cases, and lifting NPIs led to an increase in COVID-19 cases. The impact was stronger in counties with non-White populations above the county-wide median. However, only the implementation of “stronger” NPIs targeting the general population and businesses have a statistically significant impact.</p>	<p>This study did not determine which types of social distancing requirements (closures of schools, closures of workplaces, cancellations of public events, restrictions on internal movement (stay-at-home orders), and closures of state borders) were most effective at reducing COVID-19. Researchers controlled for testing at the state level not count level. Counties were included in the tx group if they had an official mandate, but some businesses may have closed without a policy implemented in their jurisdiction.</p>	<p>This study assessed the impacts of both introducing and lifting of NPIs on COVID-19 daily growth and compliance, and also evaluated the heterogeneous impacts of NPIs across counties’ sociodemographic and economic characteristics. The study assessed NPIs that selectively targeted population groups by allocating measures into four categories as suggested by the Trump administration - NPIs targeting vulnerable populations, businesses, and the general population through “weaker” and “stronger” measures. Data on COVID-19 cases were from publicly available COVID-19 databases through John Hopkins University and USAFacts. Data on COVID-19 tests were from the COVID-19 Tracking Project; data on mobility was acquired through SafeGraph.</p>
<p>Spira B. (2022). Correlation Between Mask Compliance and COVID-19 Outcomes in Europe. Cureus, 14(4), e24268. <a href="https://doi.org/10.7759/cureus.24268">https://doi.org/10.7759/cureus.24268</a></p>	<p>To determine if mask wearing was correlated with COVID-19 morbidity and mortality.</p>	<p>Masking mandate</p>	<p>No</p>	<p>No</p>	<p>The positive correlation between mask usage and cases was not statistically significant (p = 0.436), but the correlation between mask usage and deaths was positive and significant (p = 0.039)</p>	<p>Differences in vaccination rates in different countries may impact transmission, but study was early in vaccine rollout that it would probably have limited impact (only three countries in study had vaccination rates over 30%). Another potential confounding effect could have been that</p>	<p>Data was collected from 35 Western and Eastern European countries who had a population of at least one million people. Data on morbidity, mortality, and mask usage during a six-month period were collected and analyzed. Spearman’s correlation analyses and</p>

						countries with already higher rates of cases may have been more likely to implement mask mandates, so they would then have higher rates of infection with mask wearing mandates in place.	Shapiro-Wilk normality checks were in JASP and linear regressions in Wolfram Mathematica 13.0.
Stype, A.C., Yaya, M.E. & Osika, J. Non-pharmaceutical Interventions and COVID-19: Do County- and State-Level Policies Predict the Spread of COVID-19?. J Econ Race Policy (2023). <a href="https://doi.org/10.1007/s41996-022-00112-w">https://doi.org/10.1007/s41996-022-00112-w</a>	Examine the overall impact of state and local government response to the initial stages of the COVID-19 pandemic in the USA through the end of Labor Day weekend 2020 (September 7, 2020)	non-pharmaceutical interventions (aggregated measures of mask mandates, daycare closures, stay-at-home orders, and restaurant and bar closures)	Yes	Yes	NPIs, early intervention, longer implementation of NPIs, and instituting a variety of NPIs, were effective in reducing deaths and cases during the first wave of the COVID-19 pandemic.	One weakness of this study is using the data as a cross-section instead of as a time series	Researchers conducted two-stage least square estimations for general NPI measure, which includes mask mandates, daycare closures, restaurant and bar closures, and stay-at-home orders at county and state levels. Four outcomes are examined: total deaths, total cases, cumulative deaths at peak, and cumulative cases at peak.
Xu, J., Hussain, S., Lu, G., Zheng, K., Wei, S., Bao, W., & Zhang, L. (2020). Associations of stay-at-home order and face-masking recommendation with trends in daily new cases and deaths of laboratory-confirmed	To understand the associations of stay-at-home orders and face-masking recommendations on trends in daily new cases and deaths of laboratory-confirmed COVID-19 cases.	stay-at-home order	Yes	Yes	Modeling of data shows that early implementation of stay-at-home orders could reduce daily new cases and deaths Modeling also shows that premature lifting of stay-at-home orders would be associated with a significant increase in daily new cases and deaths	A limitation in utilizing laboratory confirmed cases is that it was most likely an undercount of cases	Researchers conducted a quasi-experimental interrupted time series study to compare the changes in COVID-19 epidemics before and after stay-at-home orders and face-masking recommendations. They utilized national and state level daily case and death data from the COVID-19 Tracking

COVID-19 in the United States. medRxiv : the preprint server for health sciences, 2020.05.01.20088237. <a href="https://doi.org/10.1101/2020.05.01.20088237">https://doi.org/10.1101/2020.05.01.20088237</a>							Project. They only included cases and deaths that occurred from March 1 to April 20, 2020 in the 50 states and DC.
Zhang, R., Wang, Y., Lv, Z. et al. (2022) Evaluating the impact of stay-at-home and quarantine measures on COVID-19 spread. BMC Infectious Diseases 22, 648 <a href="https://doi.org/10.1186/s12879-022-07636-4">https://doi.org/10.1186/s12879-022-07636-4</a>	To evaluate impact of stay-at-home orders and quarantine measures on COVID-19 spread	stay-at-home order	Yes	N/A	Results indicate that self-isolation of the susceptible population is necessary to contain the outbreak. At a given rate, self-isolation of susceptible population induced by stay-at-home orders is more effective than quarantine of SARS-CoV-2 contacts in reducing effective reproductive numbers $R_e$ .	Researchers neglected the effect of quarantine of SARS-CoV-2 contacts on the susceptible population, did not explicitly consider contact tracing efforts implemented after lockdown, they assume model parameters in counterfactual simulations such as the transmission rate and ascertainment rate remain the same as estimated using real-world data, and human behaviors and cultures vary in different counties and could impact the compliance with control measures	Researchers developed a mathematical model to estimate the effect of stay-at-home and quarantine on suppressing COVID-19 spread in four cities: Wuhan in China, New York City in the US, Milan in Italy, and London in the UK.