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ISSUE BRIEF

NO SOLUTIONS, ONLY TRADE-OFFS
An evaluation of the benefits and consequences from COVID-19 restrictions

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Introduction and Executive Summary

The state and federal governments attempted to minimize the risks from the COVID-19 pandemic through a combination of interventions including lockdowns, masking mandates, school closures, business closures, and social distancing. But did these government interventions achieve their goals? If so, at what cost? The answers to these questions matter because the threat from deadly future pandemics remains. A better understanding of the impacts from past actions can help us respond more effectively should another pandemic arise.

Toward this end, a growing body of literature has examined the impacts from COVID-19 interventions. Accounting for the costs and benefits from these policies, there is growing support for the conclusion that more invasive interventions—interventions that imposed larger impediments on people's ability to live and work as they choose—perhaps enabled small reductions in COVID-19 designated mortality and infections but undoubtedly imposed large negative impacts on employment, economic growth, and children's education outcomes.

To gain additional insight on this question, we analyzed outcomes data by state that included COVID-19 infection rates, COVID-19 mortality rates, relative economic growth, employment growth, changes in reading scores, and changes in math scores. These outcomes were compared to the restrictiveness of each state's COVID-19 policies, as assessed by McCann (2021).

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Our results support the hypothesis that public health policies that imposed more restrictive interventions did reduce the rate of COVID-19 infections and COVID-19 listed mortality, but at the expense of sizeable decreases in economic growth and education outcomes. Worsening the trade-off, the impacts from these restrictions on other health risks—such as the increased number of late cancer identifications due to delayed cancer screenings[1]—are not considered. Incorporating these impacts offset the net health benefits from the more restrictive interventions.

This implies that it is essential to consider the large costs that interventions impose upfront while devising future pandemic responses. Due to these trade-offs—the large costs that these policies impose on the young, other low-risk groups, and the broader economy—policy interventions should focus on safeguarding high-risk groups and serving as an objective information clearinghouse while avoiding restrictions on broader society.

A Brief Literature Review

The growing literature on the impact on infection rates and mortality rates from non-pharmaceutical interventions—the catchall phrase used to describe interventions such as mask mandates, business closures, school closures, and stay-at-home mandates—is mixed. Some studies have examined the data and found no impact, others have concluded that non-pharmaceutical interventions did reduce infection rates and mortality rates.

A pivotal meta-analysis by researchers at the Johns Hopkins Institute for Applied Economics examined the impact from COVID-19 lockdowns on mortality rates provides strong evidence that non-pharmaceutical interventions, other than mask mandates, had no impact on infection rates and mortality (Herby, Jonung, & Hanke, 2022).[2] The researchers identified nearly 19,000 academic articles related to both lockdowns and mortality rates, which were then systematically narrowed down based on whether the studies:

- exclusively measured the effect of lockdowns on mortality
- implemented a "difference-in-difference" statistical approach, which accounts for potential biases between treatment and control groups
- did not use measurements based on predictive modeling, focusing only on empirical *ex-post studies which use actual outcomes as the basis for the data*

This left 34 articles for their analysis, which concluded that "stay-at-home orders" failed to have any impact on COVID-19 mortality.[3] The researchers also found no noticeable effect on COVID-19 mortality from other interventions including school closures, border closures, or limiting gatherings. Mask mandates could be effective, but the researchers noted that only two studies focused on masks, so the authors concluded that more evidence is needed.

The authors conclude that while "lockdowns have had little to no public health effects, they have imposed enormous economic and social costs where they have been adopted. In consequence, lockdown policies are ill-founded and should be rejected as a pandemic policy instrument."[4]

> "The growing literature on the impact on infection rates and mortality rates from non-pharmaceutical interventions is mixed.

Bjornskov (2021) examined the impact from COVID-19 lockdown policies on mortality based on excess mortality rates in 24 European countries rather than official COVID-19 mortality rates, which accounts for the potential adverse impacts from lockdown policies on increased mortality from other causes—a core issue many studies overlook.[5] The analysis found that severe lockdown policies were not associated with lower mortality rates.

Consistent with these findings, Chaudhry et al. (2020) examined the impact from COVID-19 policies and health outcomes across the 50 countries with the largest number of cases, finding "rapid border closures, full lockdowns, and wide-spread testing were not associated with COVID-19 mortality per million people" either negatively or positively.[6] Pugh et al. (2022) examined the impacts from stay-at-home orders and excess mortalities in the United States, finding that there was no statistical relationship between excess mortality rates and the stringency of the state stay-at-home orders.[7]

Bendavid et al. (2021) examined whether countries with less restrictive government interventions (such as masking or social distancing) had similar impacts on the spread of COVID-19 as the countries with more restrictive government interventions (such as stay-at-home mandates or business closures).[8] The study found "no evidence of large and anti-contagion effects" for the more restrictive government interventions. In other words, the study did not find that there were significant benefits from a case growth perspective from more restrictive interventions.

Coccia (2021) examined the connection between infection, mortality, and economic impacts to the length of lockdowns across six European countries finding that "the policy responses of lockdown with longer duration at [the] nation[al] level seem to have a low effect in terms of significant reduction of COVID-19 infected cases and mortality rates, but a longer duration of national lockdown can slow down the dynamics of economic systems with consequential socioeconomic issues."[9]

> "While researchers have found varied impacts from non-pharmaceutical interventions on infection rates and mortality rates, studies are largely in agreement regarding the impact of these interventions on other social and economic outcomes.

While many statistical analyses found no or minimal impacts on infections and mortality, other studies found the reverse. For instance, Chernozhukov, Kasahara, and Schrimpf (2021) use a model to analyze the impacts from three counterfactual policy environments—(1) where facemasks mandates for employees in public businesses were implemented as of March 14, (2) where businesses were allowed to remain open, and (3) where stay-at-home orders were not implemented.[10] The model's results showed that the facemask counterfactual would have decreased infections and mortality, while not implementing the business closures and stay-at-home orders would have increased infections and mortality. The authors note that the facemask mandate would have reduced infections and mortality with little economic cost.

Castillo, Staguhn, & Weston-Farber (2020) examined the impact from the 42 states that imposed restrictive stay-at-home orders in the United States between March 19, 2020, and April 7, 2020.[11] Their results found that restrictive interventions "may play a significant role in 'flattening the curve.'"

While researchers have found varied impacts from non-pharmaceutical interventions on infection rates and mortality rates, studies are largely in agreement regarding the impact of these interventions on other social and economic outcomes. Betthauser, Bach-Mortensen, & Engzell (2023) performed a meta-analysis examining the relationship between the COVID-19 pandemic interventions and learning loss.[12] Their analysis screened 5,153 studies, with 42 empirical analyses meeting the inclusion criteria, half of which focused on the United States. Their analysis concluded that limiting face-to-face learning causes significant learning loss, with students facing a higher level of learning loss in math than in reading.

Supporting these results, Bielinski et al. (2021) examined the impact from school closures on education outcomes for K-8 students finding that school closures negatively impacted learning in reading and, to a greater extent, math.[13] The analysis also found that losses are consistently greater for students in the later elementary and middle school grades. Donnelly & Patrinos (2021) identified eight studies that examined the relationship between learning loss and school closures, with seven finding evidence of student learning loss.[14] Learning losses were also greater for lower socioeconomic classes.

Similar to the results from Herby, Jonung, & Hanke (2022) and Coccia (2021), the evidence that business closures and stay-at-home mandates are associated with worse economic outcomes is compelling. In another literature review, Rathnayaka, Khanam, and Rahman (2022) examined the impact from business closures and stay-at-home mandates on key economic outcomes such as unemployment, GDP, household savings, and revenue.[15] The inclusion criteria screened the 1,248 articles identified to focus the analysis on 31 studies. The review concluded that lockdowns imposed economic costs including adverse impacts on inflation, employment, and consumption.

Taken as a whole, the literature on the effect of lockdowns on infection rates and mortality rates is divided, but the documented earning losses, increased unemployment rates, and lost economic opportunities is well documented. These results indicate that restrictive non-pharmaceutical interventions offer an undesirable trade-off. These conclusions are consistent with the results from our analysis as well.

“The literature on the effect of lockdowns on infection rates and mortality rates is divided, but the documented earning losses, increased unemployment rates, and lost economic opportunities is well documented.

Assessing the Tradeoffs

To gain additional insights into these important questions, we performed several analyses examining the relationship between the relative restrictiveness of each state’s non-pharmaceutical interventions and the resulting impact on healthcare outcomes, education outcomes, and economic outcomes.

To measure the relative restrictiveness of each state’s non-pharmaceutical interventions, we relied on an analysis performed by McCann (2021).[16] The study was valid as of April 6, 2021, and according to McCann

> compared the 50 states and the District of Columbia across 13 key metrics. Our data set ranges from whether restaurants are open to whether the state has required face masks in public and workplace temperature screenings.[17]

Table 1 reproduces their results, which estimated that Iowa, Florida, Wyoming, South Dakota, and Texas were imposing the least restrictive non-pharmaceutical interventions while New York, Washington, Virginia, Delaware, Washington D.C., and Vermont were imposing the most restrictive non-pharmaceutical interventions as of April 2021.

Table 1
State Rankings of COVID-19 Restrictions
As of April 5, 2021 (lower ranking, fewer restrictions)

STATE	OVERALL RANK	STATE	OVERALL RANK
Iowa	1	Maryland	26
Florida	2	Louisiana	27
Wyoming	3	North Carolina	28
South Dakota	4	Ohio	29
Texas	5	Nevada	30
Alaska	6	Kentucky	31
South Carolina	7	Colorado	32
Mississippi	8	New Mexico	33
Oklahoma	8	Illinois	34
Montana	10	Oregon	35
Idaho	11	Pennsylvania	36
Missouri	12	Hawaii	37
Arkansas	13	Massachusetts	38
Nebraska	14	Michigan	39
Arizona	15	Minnesota	40
Tennessee	16	New Jersey	41
North Dakota	17	Rhode Island	42
Utah	18	Connecticut	43
Wisconsin	19	Maine	43
West Virginia	20	California	45
Alabama	21	New York	46
New Hampshire	22	Washington	46
Indiana	23	Virginia	48
Georgia	24	Delaware	49
Kansas	25	District of Columbia	50
		Vermont	51

Source: McCann 2021

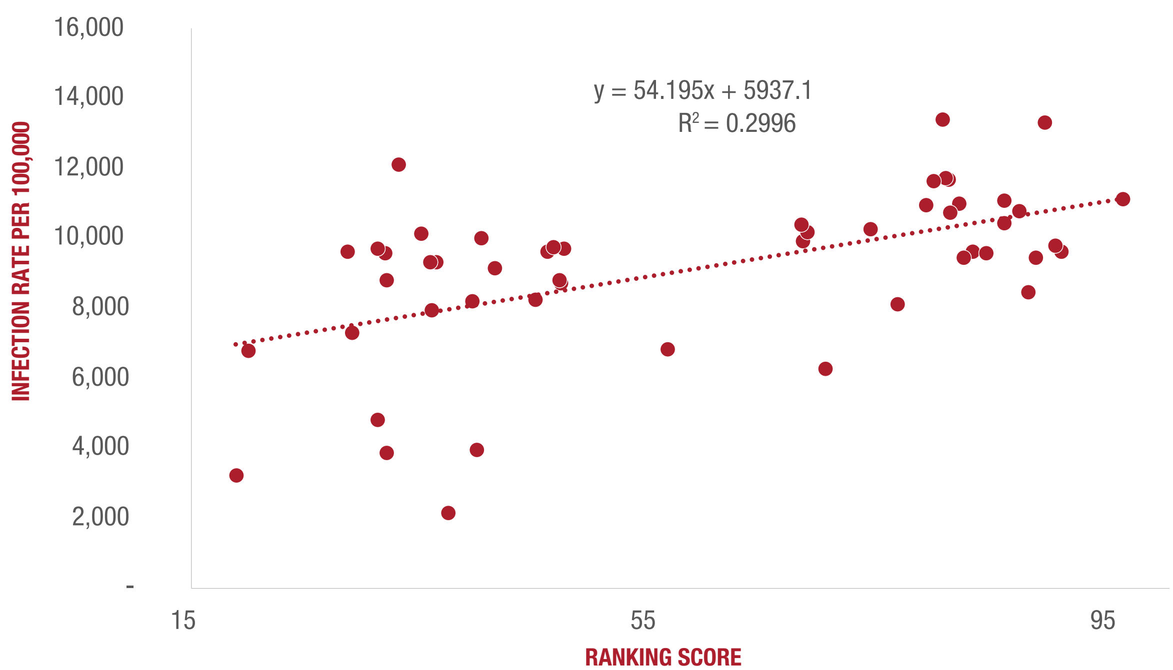
COVID-19 Restrictions, Infections, and Mortality

Starting with the policies' designed purpose, we examined whether the states rated as having more restrictive interventions benefited by having fewer COVID-19 infections and fewer COVID-19 mortalities. COVID-19 infections and mortalities are measured as a rate per 100,000 population to account for the varied populations across the states. To align with the timing of the policy environment assessment, the cumulative infection rates and the cumulative mortality rates are as of April 7, 2021.

Infection rates and mortality rates are also potentially interrelated to when COVID-19 infections were first reported in a state, which appear to be related to a region's proximity to an international airport rather than the stringency of their interventions.[18] Those states where the virus was first reported, such as New York, amassed a large number of infections and mortalities at a time when the country was less prepared to manage the virus compared to the states where infections were first reported later. To account for the potential bias toward higher infection rates and higher mortality rates in the states where the virus appeared first, the difference between the cumulative infection rates as of April 7, 2021, and the cumulative infection rates as of the first week when a COVID-19 mortality was reported in every state (June 3, 2020) were also evaluated.

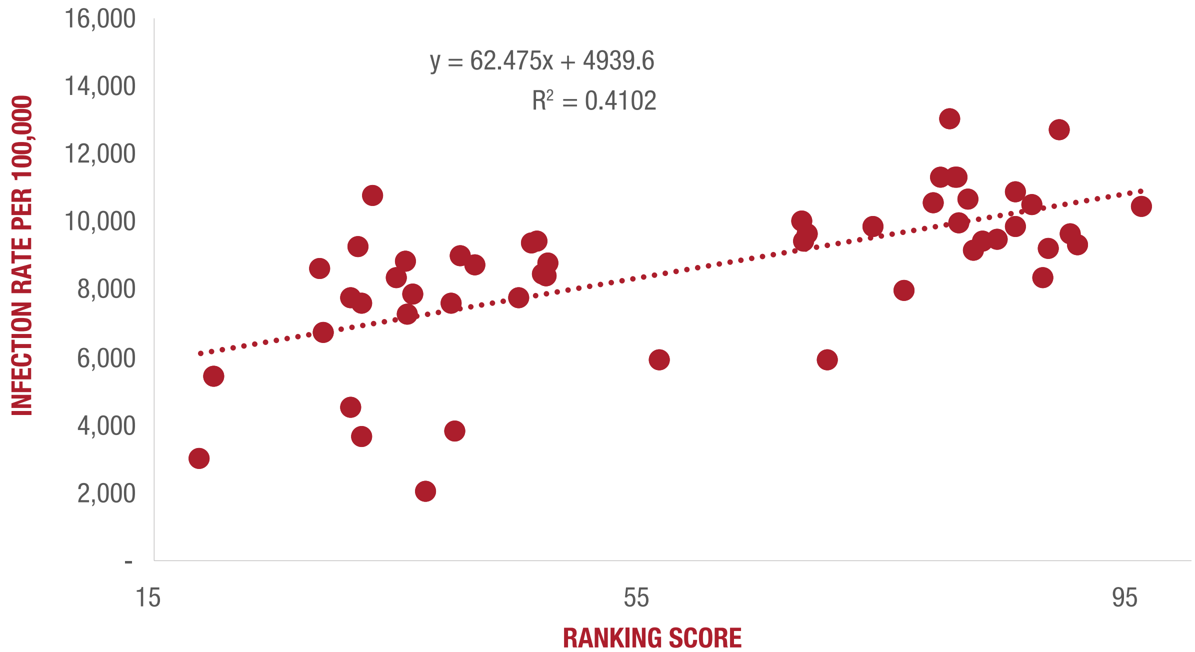
Figures 1 and 2 compare the policy intervention score from McCann 2021 (higher score indicating the state imposed fewer restrictions) and the cumulative infection rates as of April 7, 2021, and the difference in the cumulative infection rates between June 3, 2020, and April 7, 2021.

Figure 1
Cumulative Infection Rates Compared to COVID-19 Restrictiveness As of April 7, 2021 (higher score, fewer restrictions)



Source: Author calculations based on data from CDC and McCann 2021

Figure 2
Cumulative Infection Rates Compared to COVID-19 Restrictiveness Difference Between June 3, 2020 and April 7, 2021 (higher score, fewer restrictions)



Source: Author calculations based on data from CDC and McCann 2021

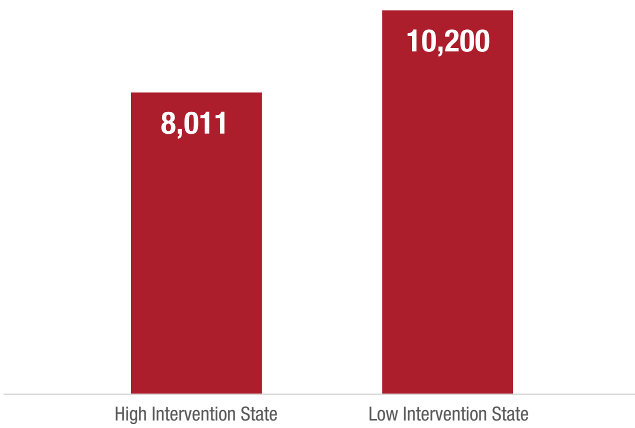
Several important trends are visible in Figures 1 and 2. First, the states with fewer restrictions (e.g., higher scores) had visibly higher COVID-19 infection rates. Second, adjusting for timing of the virus, the difference between the states with fewer restrictions and the states with more restrictions grew. Third, the groups of states generally fall into two distinct categories—high intervention states and low intervention states.

Dividing the states into these two categories, Figure 3 compares the average cumulative infections per 100,000 as of April 7, 2021, for the high intervention states to the average cumulative infections per 100,000 as of April 7, 2021, for the low intervention states.

Figure 3 illustrates that the average infections per 100,000 people through April 7, 2021, were in fact higher in those states that were imposing less restrictions compared to the average infections per 100,000 people through April 7, 2021, in the states that were imposing more restrictions.

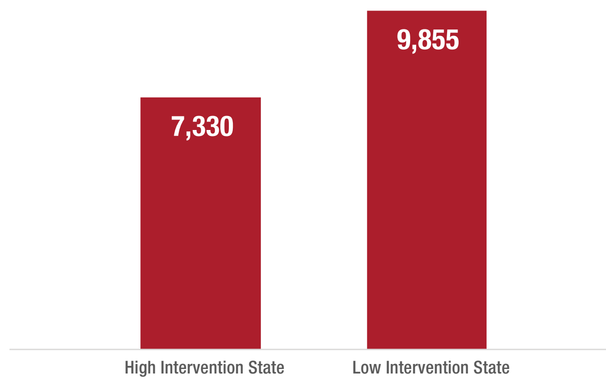
Figure 4 illustrates that this same pattern holds when measuring infections by the difference in the cumulative infection rates between June 3, 2020, and April 7, 2021.

Figure 3
Cumulative Infection Rates Compared to COVID-19 Restrictiveness
Average High Intervention States Compared to Average Low Intervention States, as of April 7, 2021



Source: Author calculations based on data from CDC and McCann 2021

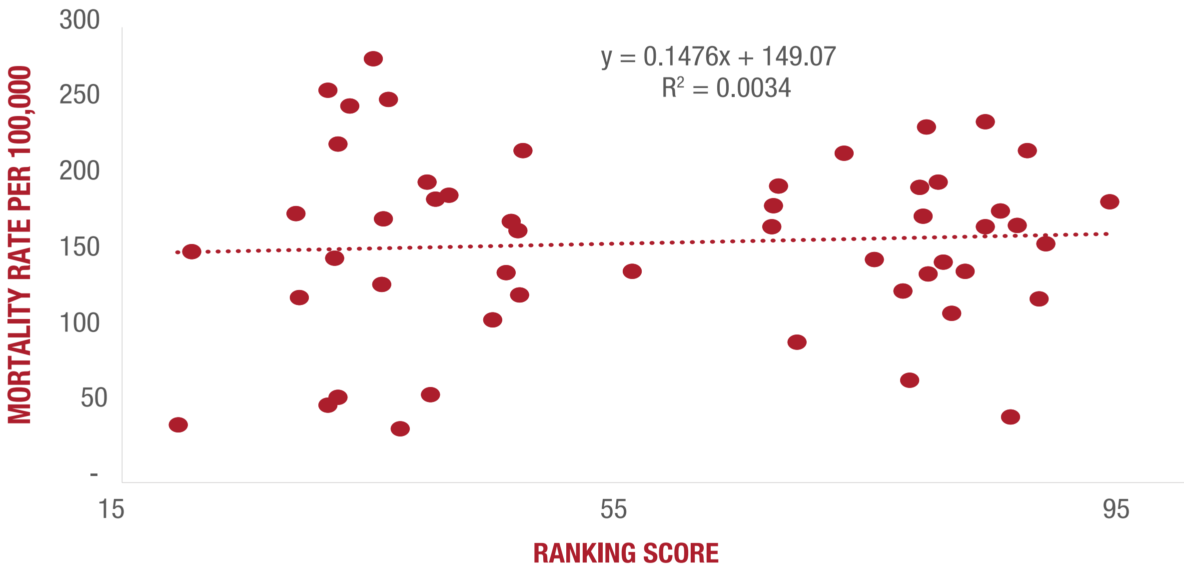
Figure 4
Cumulative Infection Rates Compared to COVID-19 Restrictiveness
Average High Intervention States Compared to Average Low Intervention States
Difference Between June 3, 2020, and April 7, 2021



Source: Author calculations based on data from CDC and McCann 2021

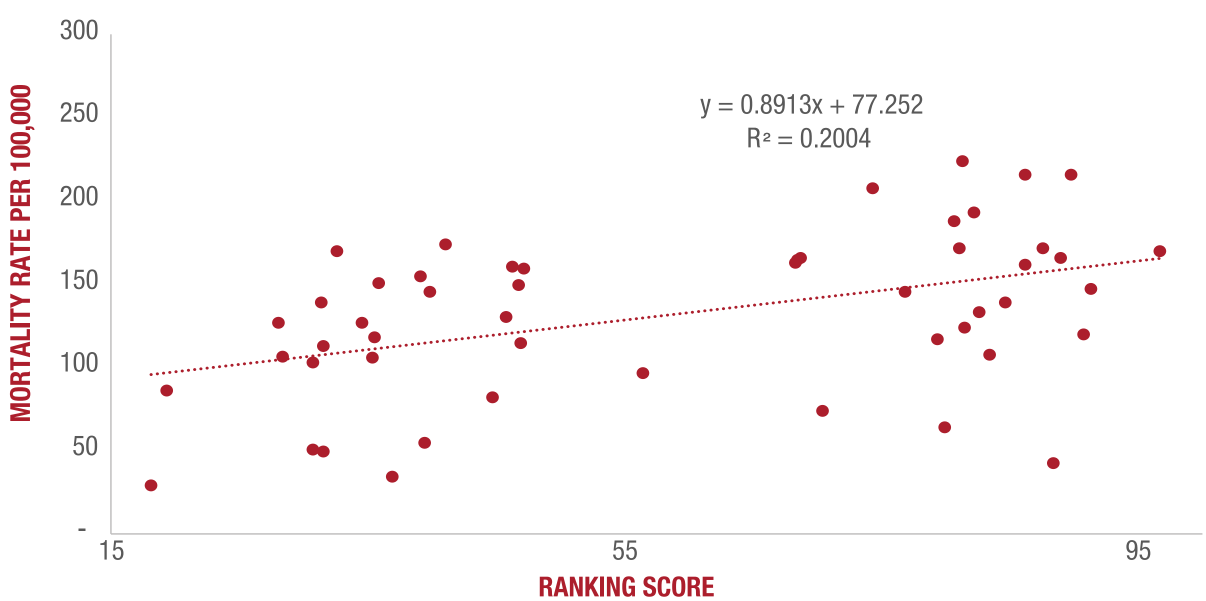
Comparing the states based on the cumulative mortality rates illustrates a slightly different pattern. While the cumulative mortality rates as of April 7, 2021, were unrelated to the restrictiveness of the non-pharmaceutical interventions, see Figure 5, comparing the states based on the difference between the cumulative mortality rates as of April 7, 2021, and the cumulative mortality rates as of June 3, 2020, reveals a similar pattern to the infection rates, see Figure 6. Put differently, ***only when the timing adjustment is included, does the COVID-19 mortality rates appear to be higher in the states imposing fewer non-pharmaceutical interventions compared to the states imposing more interventions.***

Figure 5
Mortality Rates Compared to COVID-19 Restrictiveness
As of April 7, 2021
(higher score, fewer restrictions)



Source: Author calculations based on data from CDC and McCann 2021

Figure 6
Mortality Rates Compared to COVID-19 Restrictiveness
Difference Between June 3, 2020 and April 7, 2021
(higher score, fewer restrictions)



Source: Author calculations based on data from CDC and McCann 2021

Significant differences are clearly seen by comparing the average cumulative mortality rates as of April 7, 2021, in the highly restrictive states compared to the less restrictive states. As Figure 7 illustrates, the cumulative mortality rates of the high intervention states and low intervention states are nearly the same. In contrast, Figure 8 compares the restrictive states to the less restrictive states based on the difference in the average cumulative mortality rate between June 3, 2020, and April 7, 2021. Based on this comparison, the average mortality rates have a much larger difference.

Figure 7
Cumulative Mortality Rates
As of April 7, 2021
Average High Intervention States Compared to Average Low Intervention States

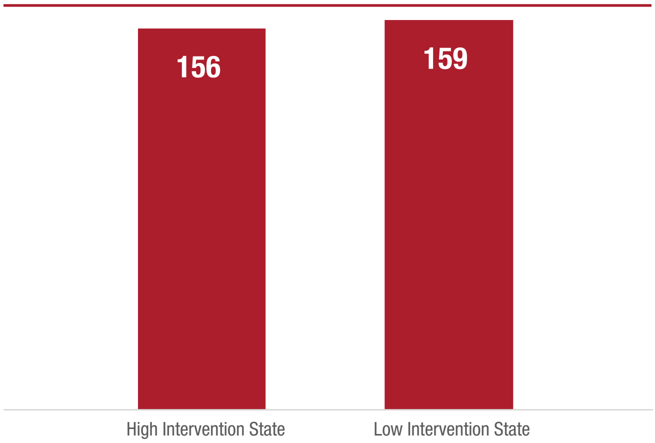
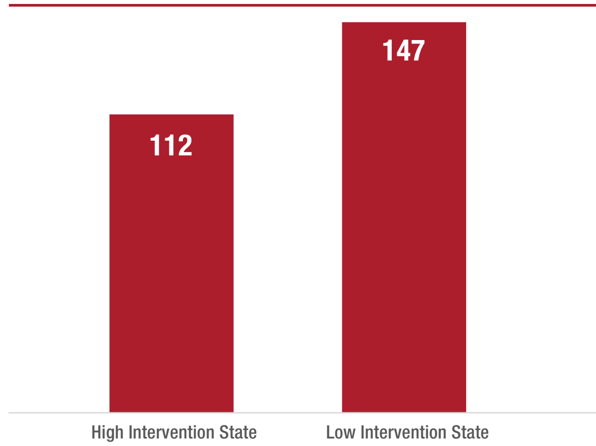


Figure 8
Cumulative Mortality Rates
Difference Between June 3, 2020, and April 7, 2021
Average High Intervention States Compared to Average Low Intervention States



Source: Author calculations based on data from CDC and McCann 2021

To confirm whether these differences are statistically relevant, statistical analyses were performed, which are summarized in Tables A1—A3 of the Appendix. Given the bimodal distribution of the restrictiveness scores evident in Figures 1, 2, 5, and 6, the data naturally falls into two distinct categories. Consequently, we categorized 26 states as the "low intervention group" and 25 states as the "high intervention group" (Washington D.C. is included as a state in the analysis). Using this categorization, we performed t-tests across the variables of interest. T-tests are statistical analyses that determine whether the average outcomes across two groups differ from one another.

The results of the t-tests are consistent with the above figures. Compared to the low intervention states, the high intervention states tended to experience:

- moderately lower rates of cumulative COVID-19 infections as of April 7, 2021,
- moderately lower rates in the difference in cumulative COVID-19 infections between June 3, 2020, and April 7, 2021,

- no difference in the rates of cumulative COVID-19 mortality as of April 7, 2021,
- moderately lower rates of COVID-19 linked mortality based on the difference in cumulative infections between June 3, 2020, and April 7, 2021.

In addition, when examining the impact of non-pharmaceutical interventions on infections and mortality, we performed several multi-variable regressions to account for the reality that other variables could influence state-level infections and mortality, which included population density, the percentage of elderly individuals, the share of the population that is obese, and the poverty rate. The regression results confirm the results from the t-tests (see the Appendix for more details).

It is important to note that the mortality impacts should be viewed as a best-case outcome because mortality is measured as COVID-19 listed mortality rates rather than excess mortality rates. Non-pharmaceutical interventions (e.g., stay-at-home orders and business closures) can have adverse impacts on other causes of mortality, and these impacts are not captured in the COVID-19 mortality data. Chaudhry et al. (2020), Bjornskov (2021), and Pugh et al. (2022) all demonstrated that the benefits that stringent non-pharmaceutical interventions enable (e.g., reduced COVID-19 mortality rates) are typically offset (often completely) by increases in other causes of mortality.

COVID-19 Restrictions Unintended Consequences

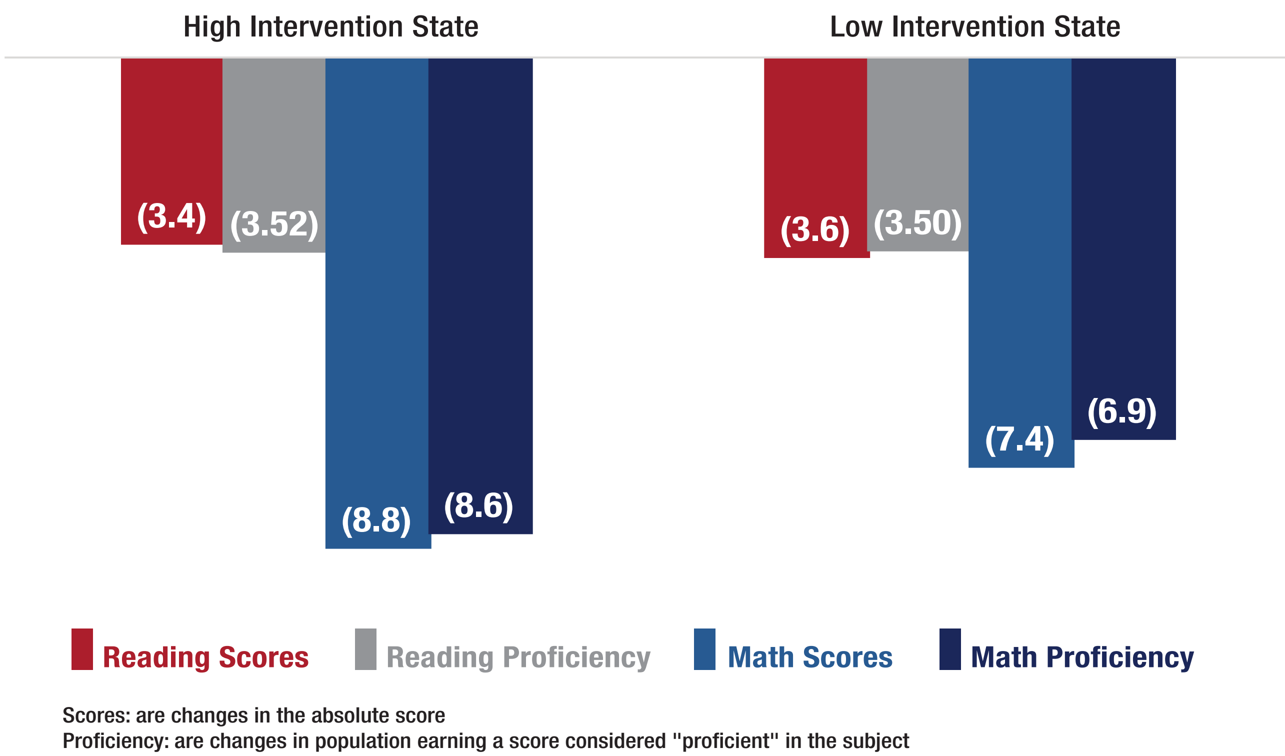
While the intentions of the non-pharmaceutical interventions are to reduce the COVID-19 infection rates and COVID-19 mortality rates, the impacts from these policies are not confined to these areas. Many other impacts, most of which are adverse but unintended, occur. In this analysis, we focused on just two unintended consequences—the unintended impacts on education outcomes and the unintended impacts on economic outcomes.

To examine whether there are adverse impacts on education outcomes, the results of the National Assessment of Educational Progress (NAEP) were analyzed. [19] In total four measures were evaluated across the states:

- The average reading scores
- The average math scores
- The percentage of students who scored above proficient in reading and,
- The percentage of students who scored above proficient in math.

Figure 9 graphically presents the results. Based on the graphical presentation, it appears that declines in reading outcomes were universal across the country. Given the long-term consequences from these results, it is important to emphasize the unprecedented decline in reading scores that occurred across all states. These declines indicate that the school closures, which all states implemented, were extremely detrimental. However, the similar size of the reading declines across the two categories of states indicates that the restrictive states did not impose additional harm compared to the non-restrictive states. This cannot be said with respect to math scores. With respect to math scores there is a universal and disconcerting decline in student performance that is much worse than the declines in reading scores. The states that imposed more restrictive non-pharmaceutical innovations (e.g., high-intervention states) experienced even larger declines in math, indicating that the more restrictive interventions imposed additional harms compared to the less restrictive interventions.

Figure 9
NAEP Reading and Math Scores and Percentage Above Proficiency Change Between 2019 and 2022
Average High Intervention States Compared to Average Low Intervention States



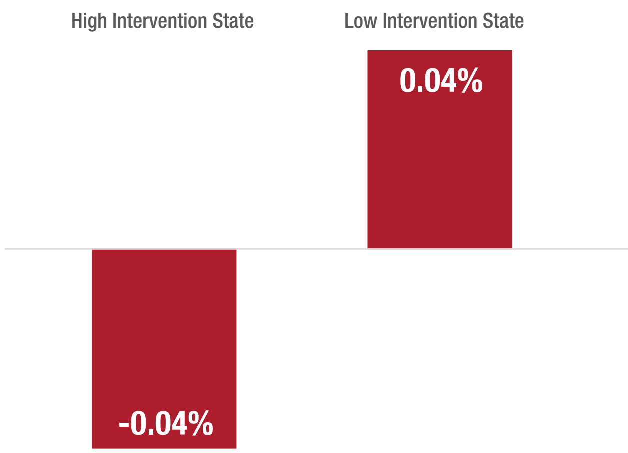
Source: Author calculations based on data from U.S. Department of Education and McCann 2021

The trends visualized in Figure 9 were confirmed by the t-tests, see Appendix Table A4. As the broad declines in total NAEP performance illustrated, overall education outcomes declined during the COVID-19 period—a universally disconcerting outcome. However, the states that imposed more stringent interventions did not experience larger declines in reading performance. These states did see a statistically significant larger decline in math outcomes relative to the states that imposed less burdensome restrictions. Therefore, an important cost of implementing the high intervention policies appears to be reduced math performance compared to the states that implemented low intervention policies.

Figures 10—12 illustrate that there appear to be important differences with respect to economic outcomes between the high intervention states and low intervention states.

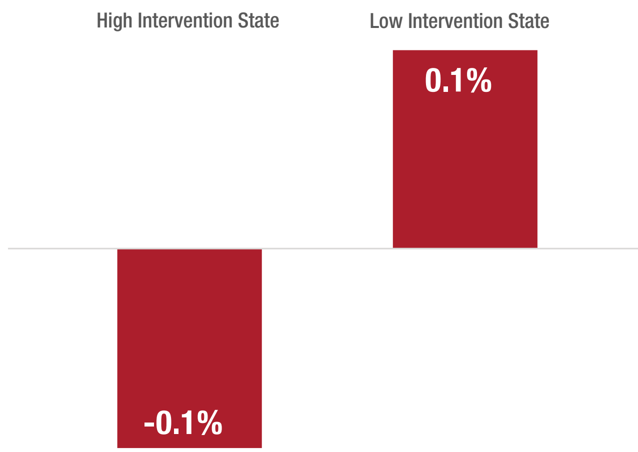
Figure 10 illustrates that the economy of the average high intervention state grew slower than the economy of the average low intervention state such that the state's share of the national economy declined by 0.04 percent. By definition, the average low intervention state's share of the national economy increased by this amount. A more pronounced impact was seen with the food and accommodation sector where the average high intervention state's share of this industry declined by 0.10 percent, see Figure 11. Table A5 in the Appendix reports the results from the t-tests that demonstrate these differences are statistically significant.

Figure 10
Change in State Share of National GDP Between 2019 and 2022 Average High Intervention States Compared to Average Low Intervention States



Source: Author calculations based on data from U.S. Bureau of Economic Analysis and McCann 2021

Figure 11
Change in State Share of National Accommodation Sector GDP Between 2019 and 2022 Average High Intervention States Compared to Average Low Intervention States



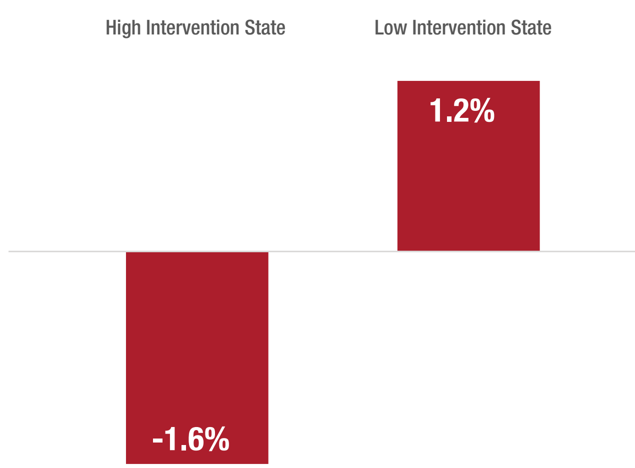
Source: Author calculations based on data from U.S. Bureau of Economic Analysis and McCann 2021

With respect to the labor market, between December 2019 and November 2022, employment in the high intervention states declined, on average, by 1.6 percent compared to growth of 1.2 percent in the low intervention states. As Table A5 in the Appendix illustrates, based on the t-tests, these results are also statistically significant.

Putting the trends together, the high intervention states suffered larger economic consequences compared to the low intervention states. The high intervention states' share of the national economy declined, particularly in the food and accommodation sectors. Further, even accounting for the economic recovery through the end of 2022, employment in the high intervention states was still below the pre-pandemic levels whereas employment in the low intervention states was growing once again.

The different education and economic outcomes for the high intervention states compared to the low intervention states clearly illustrate that the stringent non-pharmaceutical interventions impose large unintended consequences on the people living in the states where they are imposed. These support the hypothesis that there are important trade-offs incurred when imposing stringent non-pharmaceutical interventions.

Figure 12
Change in Employment December 2019 and November 2022 Average High Intervention States Compared to Average Low Intervention States



Source: Author calculations based on data from U.S. Bureau of Labor Statistics and McCann 2021

Conclusion

The ability of the states to implement different approaches when it comes to school closings, business closings, and stay at home orders provides important case studies to glean insights regarding the costs and benefits associated with the non-pharmaceutical intervention policies that were implemented in response to the COVID-19 pandemic. The states that implemented policies categorized as more stringent tended to have fewer COVID-19 infections and fewer COVID-19 mortalities per 100,000 people. These states have also experienced increases in other causes of mortality that may fully offset the reduction in COVID-19 mortalities, larger economic consequences, and larger education losses for children.

The existence of these costly unintended consequences from stringent non-pharmaceutical interventions argues for caution should states consider imposing these policies in the future. As Thomas Sowell might say, "there are no solutions, only tradeoffs".

Recognizing this reality argues for extreme caution when considering stringent non-pharmaceutical interventions in response to future threats. High risk individuals, particularly those over 65 years of age, tend to face the highest risks from infections yet often bear the lowest costs from the unintended consequences. In contrast, students and working age adults tend to face lower costs from infections yet bear much higher burdens from the unintended consequences from these policies. The existence of these trade-offs argues for tailoring policies to tightly target the most vulnerable populations while minimizing the costs students and working adults must bear.

Appendix

To examine the relationship between the restrictiveness of the non-pharmaceutical interventions on the change in the number of infections per 100,000 and mortalities per 100,000, t-tests were examined by dividing the 50 states plus Washington D.C. into two groups—the high intervention states and the low intervention states.

The t-tests examining the impact of interventions on infections and mortality, as Table A1 illustrates, revealed

- A statistically significant relationship between the low intervention states and higher cumulative infections per 100,000 as of April 7, 2021
- A statistically significant relationship between the low intervention states and higher infections per 100,000 as measured by the difference in the cumulative infections between June 3, 2020, and April 7, 2021
- A statistically insignificant relationship between the low intervention states and higher cumulative mortality per 100,000 as of April 7, 2021
- A statistically significant relationship between the low intervention states and higher mortality per 100,000 as measured by the difference in the cumulative mortalities between June 3, 2020, and April 7, 2021.

Table A1
T-test Results
Low Intervention States Compared to High Intervention States
Infection Rates and Mortality Rates

	Cumulative As of April 7, 2021		Change in Cumulative Between June 3, 2020, and April 7, 2021	
	Infections per 100k	Mortality per 100k	Infections per 100k	Mortality per 100k
P-value	0.0001	0.7749	0.0	0.0031
T score	-4.119	-0.2875	-5.1747	-3.1145

Due to the potential impact from other variables that could impact the infection rates in a state, several multiple regression analyses were run in addition to the t-tests to control for these additional factors. These variables included: population density, the percentage of elderly individuals, the share of the population that is obese, and the poverty rate. Since only the difference between the cumulative mortality between June 3, 2020, and April 7, 2021, were significant based on the t-tests, the regression analyses only examined this dependent variable.

The regression analyses examining the difference in the cumulative infections per 100,000 between June 3, 2020, and April 7, 2021, found a statistically significant relationship between fewer non-pharmaceutical restrictions and higher infections ($\beta = 52.22$, $p < 0.001$), see Table A2.

Table A2
Regression Results
Independent Variable: Change in Cumulative Infections per 100,000 Between June 3, 2020 and April 7, 2021

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
Regulatory Restriction	62.47***	67.59***	63.96***	52.13***	61.14***	52.22***
	(10.85)	(13.77)	(11.60)	(11.05)	(11.15)	(11.05)
Pop. Density (log)		144.6	121.0	147.3	81.55	142.4
		(208.4)	(228.2)	(213.1)	(228.2)	(223.7)
% Age Over 65			-269.8*	-288.9**	-273.9*	-288.7**
			(137.0)	(129.5)	(141.8)	(131.3)
Obesity				148.3**		143.5*
				(58.61)		(79.85)
Poverty					118.4	12.29
					(80.41)	(107.5)
Constant	4,940***	3,966**	8,982***	4,941	7,916***	4,961
	(779.3)	(1,708)	(2,714)	(3,000)	(2,632)	(3,091)
Observations	51	51	51	51	51	51
R-squared	0.410	0.417	0.471	0.522	0.488	0.523

ROBUST STANDARD ERRORS IN PARENTHESES
***** P<0.01, ** P<0.05, * P<0.1**

Similar to infections, the regression analysis examining the difference in the cumulative mortality per 100,000 between June 3, 2020, and April 7, 2021, revealed a statistically significant relationship between fewer non-pharmaceutical restrictions and higher mortality ($\beta = .85$, $p < 0.001$), see Table A3.

Table A3
Regression Results
Independent Variable: Change in Cumulative Mortality per 100,000 Between June 3, 2020 and April 7, 2021

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
Regulatory Restriction	0.891***	1.226***	1.242***	0.808***	1.049***	0.850***
	(0.259)	(0.294)	(0.304)	(0.279)	(0.240)	(0.237)
Pop. Density (log)		9.465	9.567*	10.54**	6.875	8.238*
		(5.650)	(5.677)	(4.845)	(5.219)	(4.806)
% Age Over 65			1.173	0.472	0.891	0.560
			(3.665)	(2.922)	(3.241)	(2.865)
Obesity				5.447***		3.214*
				(1.339)		(1.685)
Poverty					8.083***	5.707**
					(1.681)	(2.159)
Constant	77.25***	13.49	-8.329	-156.8*	-81.13	-147.3*
	(15.60)	(41.01)	(82.85)	(80.59)	(71.88)	(78.86)
Observations	51	51	51	51	51	51
R-squared	0.200	0.266	0.268	0.436	0.464	0.505

ROBUST STANDARD ERRORS IN PARENTHESES
***** P<0.01, ** P<0.05, * P<0.1**

T-tests were run to evaluate whether there were statistically significant differences between the change in reading and math outcomes in low intervention states and high intervention states. As illustrated in Table A4, there are no statistically significant differences between the declines in the reading outcomes in the low intervention states compared to the high intervention states. There are statistically significant differences in the outcomes between low intervention states and high intervention states with respect to math outcomes, however. The low intervention states had small declines in their math scores and saw a smaller decline in the percentage of students rated as proficient or higher.

Table A4
T-test Results
Low Intervention States Compared to High Intervention States
Reading and Math Scores

	READING SCORE	READING PROFICIENCY	MATH SCORE	MATH PROFICIENCY
P-value	0.8412	0.9765	0.0089	0.011
T score	0.2015	0.0296	-2.724	-2.6434

T-tests were run to evaluate whether there were statistically significant differences between key economic outcomes in low intervention states and high intervention states. As illustrated in Table A5, the high intervention states experienced statistically significant declines in their share of the national GDP and their share of the accommodation and food services GDP. Additionally, from the end of 2019 through the end of 2022, the high intervention states experienced statistically significant weaker employment markets.

Table A5
T-test Results
Low Intervention States Compared to High Intervention States
GDP and Employment Impacts

	CHANGE IN STATE SHARE OF NATIONAL GDP 2019 Q4—2022 Q2	CHANGE IN STATE SHARE OF ACCOMMODATION AND FOOD SERVICES GDP 2019 Q4—2022 Q2	CHANGE IN EMPLOYMENT 12/2019—11/2022
P-value	0.0044	0.0704	0.0002
T score	-2.9874	-1.8498	-4.099

Endnotes

1 For example, see: Alkatout I, Biebl M, Momenimovahed Z, Giovannucci E, Hadavandsiri F, Salehiniya H and Allahqoli L (2021) "Has COVID-19 Affected Cancer Screening Programs? A Systematic Review" Front. Oncol. 11:675038. doi: 10.3389/fonc.2021.675038; and Zhang X, Elsaid MI, DeGraffinreid C, Champion VL, Paskett ED, Brock G, Washington C, Ferketich AK, Hampel H, Aker H (2023) "Impact of the COVID-19 Pandemic on Cancer Screening Delays" *Journal of Clinical Oncology,* Volume 41, Number 17, 10 June pp. 3194-3202(9).

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