Eviction Moratoria and Their Effect on Covid-19 Transmission

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LYCOMING COLLEGE ECONOMICS DEPARTMENT

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Abstract: This paper aims to analyze the relationship between state eviction moratoria and COVID-19 cases and deaths. States with active eviction moratoria are expected to experience fewer cases and deaths given the likelihood of evicted tenants moving into more dense housing with friends, family, or in a shelter. The analysis utilized daily case and death data between October 1, 2020, and March 31, 2021, from the Johns Hopkins COVID-19 Resource Center. Results from both OLS regression and lagged fixed-effects models demonstrate a statistically and practically significant negative relationship between the presence of a state eviction moratorium and COVID-19 cases and deaths. With the addition of vaccines to the lagged fixed-effects model there was no longer a significant relationship between state moratoria and COVID-19 transmission. This research adds to a body of literature which supports the public health benefits of limiting evictions during the COVID-19 pandemic and similar future crises.

Introduction:

Housing instability was not created by the current COVID-19 pandemic. Instead, the pandemic made low-income renters even more vulnerable to losing their homes. “Not everyone living in a distressed neighborhood is associated with gang members, parole officers, employers, social workers, or pastors. But nearly all of them have a landlord” (Desmond 2016). Sociologist Matthew Desmond identified what he called an eviction epidemic in 2016. In 2020 and 2021, the persistent eviction epidemic is compounded by the COVID-19 pandemic and following economic recession. Prior to 2020, housing advocates and politicians in the United States warned that increasing housing costs and stagnating wages had created a dangerous shortage of affordable housing. Affordable housing is generally classified as spending no more than 30% of one’s income on rent. Based on the 30% classification of affordability, in March of 2020, 7.3 million affordable rental homes were available for 10.6 million extremely low-income households (NLIHC 2020). That leaves an absolute affordable housing shortage of 3.6 million homes for households earning at or below 30% of the area median income (AMI). Before the pandemic, every state had a shortage of affordable housing for extremely low-income households (NLIHC 2020). Extremely low-income households face greater challenges in securing stable housing, but in 2018 nearly half of all renter households, 47.5%, paid 30% or more of their income on rent. (Benfer et al. 2020). This equates to 9.9 million households paying between 30% - 50% and another 10.9 million spending greater than 50% (JCHS 2020). The state of affordable housing prior to 2020 is key to understanding the COVID-19 eviction crisis affecting an estimated 30-40 million Americans (Benfer et al. 2020).

The percentage of renters paying more than 30% of their income on rent, known as cost-burdened renters, reached its peak in 2011 at 50.8% (Veal and Spader 2018). The 2011 peak represents a 10% increase from 2001. This increase is largely a consequence of the 2008 housing market crash. After 2011, recovery toward the 2001 level of cost-burden was slow and possibly stagnate. Between 2017 and 2018, the percentage of cost-burdened renters slightly increased from 47.4% to 47.5% (Veal and Spader 2018). Renter eviction data roughly follows the same timeline over the last two decades. In 2000, 518,000 renters were evicted. Eviction occurrences peaked in 2006 at one million and remained between 870,000 and 990,000 for every subsequent year (Princeton University 2018). The last year with available eviction data is 2016.

Evictions are difficult to study due to the lack of available data on their proceedings. However, through the work of sociologist Matthew Desmond, culminating in the Pulitzer Prize winning ethnography Evicted, and the 2008 financial collapse, eviction research has increased in popularity. Sociologists, economists, urban planners, and public health researchers have all taken interest in the often-unseen mechanism behind housing instability. Much of this new research has utilized longitudinal data and natural experiments to discover causal links between evictions and negative health outcomes (Desmond and Kimbro 2015; Sandel et al. 2018; Collinson and Reed 2018). Desmond et al. (2015) found low-income families who are evicted often must move into worse living standards in the short term. Further, the study finds the same sub-standard homes can increase the likelihood of asthma and lead poisoning in renters and their children.

In response to the pandemic, The Centers for Disease Control and Prevention issued the first ever national moratorium on evictions on September 4th, 2020. Under the moratorium, no tenant could be evicted for not paying rent if they could demonstrate income loss due to the pandemic. This could include one's hours being cut at a restaurant or work absence due to sickness. Some cities, counties, and states also instituted their own eviction moratoria throughout 2020. These localized pieces of legislation were meant to fill gaps where the national moratorium had been ineffective, whether that be for judges not abiding by it or tenants and landlords not knowing their rights under federal protection. All states were covered by the national moratorium during its coverage from September 2020 to August 2021. Therefore, the difference in state moratorium implementation has allowed researchers to analyze their effectiveness as a public health intervention. This paper will attempt to quantify state moratoria's association with COVID-19 cases and deaths.

The current research on evictions and COVID-19 provided crucial policy implications for federal, state, and local authorities in their efforts to mitigate community spread. Using state information, I will attempt to examine the association between eviction moratoriums and COVID-19 cases and mortalities. Keeping residents housed means less people in homeless shelters and fewer families doubling up in one residence. These alternative housing situations make social distancing and shelter-in-place policies nearly impossible. Informed by previous research, I hypothesize that evictions will increase the likelihood of contracting COVID-19. Therefore, I anticipate states with eviction moratoria in place will have few evictions and thus fewer COVID-19 cases and deaths compared to states without eviction moratoria.

Theoretical Framework:

COVID-19 is a respiratory illness which spreads through the transfer of droplets among persons. When persons are in closer proximity to one another, there is a greater likelihood of transmission. Benfer et al. (2020) provides a clear description of how evictions may lead to an increased number of residents living in closer proximity to one another. First, the COVID-19 pandemic creates job loss and economic recession. This job loss and recession was compounded by an affordable housing shortage that existed prior to the pandemic (NLIHC 2020). Job loss and recession thus increases rent burden on low-income renters and increases their risk of eviction. This increased risk will drive more evictions and thus a reshuffling of residents may occur. When a tenant or family is evicted, they may live with another family, friend, or check in to a shelter. Benfer et al. (2020) refers to this process as doubling-up. Prior to the eviction, two distinct household units existed. After the eviction occurred, these units were combined either in the non-evicted tenant's home, or in a shelter. When this occurs, the number of opportunities an infected person has to spread COVID-19 increases. Nande et al. (2020) graphically depicts the doubling-up process in Figure 1 below. The house outlined in red experienced an eviction. They chose to move in with the house circled in blue. The outcome of this process is a single house with more internal connections than either individual house had previously.

The hypothesized increased risk of COVID-19 transmission after one is evicted is even more clear when the tenant or family must go to a shelter. In these severe cases, a prescient for public health concerns exists. Homeless shelters often struggle to contain transmissible illnesses. One of the most common ailments is bed-bug bites. In a 2005 study of Toronto, Canada homeless shelters, Hwang et al (2005) found 20, or 31%, had bed-bug infestations. The transient and compact nature of these shelters makes the spread of illness or beg-bugs easier compared to the broader community. The theory of increased contact due to residential doubling in homes or shelters guides this paper's analysis. When a tenant or family doubles-up with another housing unit or shelter, their risk of COVID-19 transmission is hypothesized to be higher. Therefore, in states with eviction moratoria, and fewer evictions per renter household, one expects to observe fewer COVID-19 cases and deaths.

Literature Review:

The relationship between housing and health has long been established by public health, social work, psychology, and sociology researchers. The Centers for Disease Control and

Prevention (CDC) identify housing, homes, and respiratory disease as relevant components of the built environment's role as a social determinate of health (CDC 2018). Researchers previously examined the relationship between airborne transmission and dense housing in developing areas of the globe. For example, Vino et al. (2017) examined a sample of 459 indigenous Australian residents who lived in rural areas of the country. The purpose was to analyze whether household structure influenced the spread of an influenza-like disease. Because rural indigenous Australians were found to live in more condensed housing with more family members, illnesses may spread faster in rural housing structures. With housing structure survey answers from 2013-2015, researchers used a Susceptible, Exposed, Infected, Recovered (SEIR) model to test illness transmission according to household makeup. The analysis discovered that the denser housing structures of rural indigenous communities would experience a larger magnitude of infected persons and reached peak infection levels earlier compared to less dense housing structures because "social contact between household members is typically more frequent, of greater intensity, and is more likely to involve people of different age groups than contact occurring in the general community" (Vino et al 2017). The difference in number of infected persons is as much as 13% more in dense housing. These results are especially relevant considering the 2020 COVID-19. With the relationship between housing and health established, especially considering the prominent role of respiratory diseases in housing health research, other researchers responded quickly to examine housing's role in the pandemic.

In November 2020, Leifheit et al. (2020) released the first study to examine eviction moratoria on the state level in the United States. The team of researchers utilized a difference-in-difference model to examine the effect of an active state moratorium on COVID-19 transmission and death. Their sample consisted of forty-three states who declared a state moratorium on evictions between March 13, 2020 and September 3, 2020. The dependent variable was the new daily cases and new daily deaths in each state over the same period. The majority of sampled states, twenty-seven, de-activated the state moratorium during the time period. The nature of individual policies at the state level allowed the researchers to compare new daily COVID-19 cases and deaths in states that lifted their eviction moratoria to states that maintained their moratoria. In their statistical comparison, researchers controlled for state and week fixed-effects, daily COVID-19 tests in each state, and other public health interventions including stay-at-home orders. After controlling for these variables, Leifheit et al (2020) discovered 1.6 times more COVID-19 cases in states that lifted eviction moratoria ten weeks after the lift. Seven weeks after an eviction moratorium lift, a state could expect 1.6 time more COVID-19 deaths. When researchers aggregated the increased incidence statistics to the national level, they reported 433,700 COVID-19 cases and 10,700 COVID-19 deaths "associated with eviction moratoriums lifting" (Leifheit et al. 2020, 5).

The few studies which have so far examined the relationship between evictions and COVID-19 transmission often use similar methods including difference-in-difference and state fixed-effects models. For example, Sandoval-Olascoga, Venkatarmani, and Arcaya (2021) use a difference-in-difference model to examine the association between lifting a state eviction moratorium and an individual's risk for COVID-19 transmission. The study used a similar time period to Leifheit et al. (2020), examining March 13, 2020 to September 4, 2020. The key difference between the two studies is that Sandoval-Olascoga, Venkatarmani, and Arcaya (2021) examined a sample of 509,694 individuals over that time period, whereas Leifheit et al. (2020) utilized state time series data on COVID-19 cases and deaths. With this individual level public health data, Sandoval-Olascoga and co-authors were able to calculate individual hazard ratios associated with the lifting of an eviction moratorium. These hazard ratios calculate "how often a particular event happens in one group compared to how often it happens in another group, over time" (NIH, n.d.). During the study's analysis, 43 states instituted eviction moratoria and 26 would lift their moratoria later in the examined period. The analysis found an increased hazard ratio of 1.39 five weeks after the lifting of a state eviction moratorium and 1.83 twelve weeks after a lifted state eviction moratorium.

While Leifheit et al. (2020) utilized daily data from the pandemic and Sandoval-Olascoga, Venkatarmani, and Arcaya (2021) analyzed individual public health data, Nande et al. (2020) took a more theoretical approach to calculating the effect of eviction moratoria on COVID-19 transmission. This team of researchers created a public health model to predict the spread of COVID-19 throughout different metropolitan areas in the United States. To predict virus transmission, the researchers included network contacts of individuals, level of community transmission, and public health interventions including eviction moratoria. By controlling for the population of each metro-area, researchers examined the predicted spread of COVID-19 from January 2020 to March 2021, allowing for differing levels of evictions throughout the models. They did so with hierarchical clustering of time series data. Ultimately, Nande et al. (2020) identify an association between higher eviction rates and increased community transmission across all their models. With zero evictions, or an effective eviction moratorium, the researchers' models predict 16% of any metro-area's population would catch COVID-19 sometime in 2020. With a .25% eviction rate, the number of infected residents during the year increases by half a percentage point. This change may appear small, but aggregated across the population of a major city, it can be many thousands of positive COVID-19 cases. This association only rises exponentially with a 20% yearly positivity rate being associated with a 1% eviction rate. This means moving from no evictions to a 1% eviction rate is predicted to increase the percent of the community who contracts COVID-19 by 4%. While not examining the exact same time period, the results of Nande et al. (2020) do seem to match those of Leifheit et al. (2020). Both studies found an increased risk of COVID-19 transmission following the introduction of evictions, whether through the lifting of an eviction moratoria, or statistically into a modelled city.

Researchers who used similar data to answer similar questions will also face comparable limitations. Sandoval-Olascoga, Venkatarmani, and Arcaya (2021) acknowledged the fact that many variables not included in their models could be the real reason for a positive COVID-19 cases. This omitted variable possibility holds true also for Leifheit et al. (2020) and Nande et al. (2020). Additionally, these studies do not have access to asymptomatic cases or people who were never tested. Therefore, COVID-19 case data is only available for those who were tested. Additionally, Nande et al. (2020) suggests that contracting COVID-19 could increase one's risk for housing displacement and eviction if they are already in a precarious housing position. Thus, the possibility for reverse causality in all studies on the topic must be acknowledged. Despite the difficulty in isolating eviction moratorium's effect on COVID-19 transmission and death, all previous researchers have found evidence to support the claim that lifting eviction moratoria during the pandemic included the number of cases and deaths. This research will attempt to continue work on the question, while examining a different time period than all previous studies. Like previous work, this paper asks what association state level eviction moratoria have with state COVID-19 cases and deaths. The hypothesis, in line with previous findings, is that states with eviction moratoria will have fewer COVID-19 cases and deaths than states without eviction moratoria after controlling for other relevant factors.

Data and Methodology:

This study analyzed the new daily COVID-19 cases and new daily COVID-19 deaths in each state for everyday between October 1, 2020 to March 31, 2021. The key independent variable is the presence of a state eviction moratorium on each day in the 182-day period. COVID-19 case and death data was retrieved from Johns Hopkins University COVID Resource Center, while state moratoria dates were found through the United States COVID-19 state policy website. Johns Hopkins University records the data as time-series accumulations. To find the new daily cases and deaths, the previous day's data was subtracted from the current day for the entire period. The presence of a state moratorium was recorded as a binary variable: 1 to indicate an active state moratorium on that day and 0 to represent the lack of an active moratorium.

Data on the daily administration of tests and vaccines were also collected. Vaccine administration data only becomes available at the state level when vaccines became widely available to the public in mid-December of 2020. Therefore, vaccine data is only available for roughly half of the study's relevant time period. Additionally, other demographic and social assistance variable were included to control for differences among states. These data included a state's percentage of population over 65 years old, racial composition, and the natural log of population. A complete description of all dependent, independent, and control variables can be found in Table 1 in the appendix.

Three methods were used to analyze the effect of a state's eviction moratorium on COVID-19 cases and deaths. The first method is the multivariable OLS regressions shown below:

Model 1

$$totalcases = \beta_0 + \beta_1 totalmoratoriumdays + \beta_2 totaltests + \beta_3 rentassistance + \beta_4 nlpopulation + \beta_5 over65 + \beta_6 wohealthinsurance + \beta_7 africanamerican + \beta_8 nativeamerican + \beta_9 latino + \beta_{10} asian + u$$

Model 2

$$totaldeaths = \beta_0 + \beta_1 totalmoratoriumdays + \beta_2 totaltests + \beta_3 rentassistance + \beta_4 nlpopulation + \beta_5 over65 + \beta_6 wohealthinsurance + \beta_7 africanamerican + \beta_8 nativeamerican + \beta_9 latino + \beta_{10} asian + u$$

With both models, the 182-days between October 1, 2020 and March 31, 2021 under which a state had an active eviction moratorium were totaled. This produced a number total moratorium days for each state, which became the key independent variable. The key dependent variables are a similar summation of all cases and all deaths that occurred in each state during the 182-day period. Thus, these models attempt to quantify the association of one additional day of state moratorium on the total number of cases and deaths within each state, while holding racial demographics, population, total tests, and United States Treasury rental assistance constant.

The second model also utilized an OLS regression but this model analyzed the entire 182-day time period for each state rather than totals for state moratorium days, cases, and deaths. The models are shown below:

Model 3

$$dailycases = \beta_0 + \beta_1 statemoratorium + \beta_2 tests + \beta_3 rentassistance + \beta_4 vaccines(lagged\ 2\ weeks) + \beta_5 over65 + \beta_6 wohealthinsurance + \beta_7 africanamerican + \beta_8 nativeamerican + \beta_9 latino + \beta_{10} asian + \beta_{11} Republican + \beta_{12} EvictionLabScorecard + u$$

Model 4

$$dailydeaths = \beta_0 + \beta_1 statemoratorium + \beta_2 tests + \beta_3 rentassistance + \beta_4 vaccines(lagged\ 2\ weeks) + \beta_5 over65 + \beta_6 wohealthinsurance + \beta_7 africanamerican + \beta_8 nativeamerican + \beta_9 latino + \beta_{10} asian + \beta_{11} Republican + \beta_{12} EvictionLabScorecard + u$$

Models 3 and 4 analyzed the influence of a present state eviction moratorium on cases and deaths in the same day. Daily vaccine data was added to both models but was only available from mid-December to the end of the time period. Additionally, the presence of a republican controlled state government and the Eviction Lab Scorecard were added to these models. States received a 1 for the republican variable if the governor's office, state senate, and state house of representatives were all controlled by republicans during the time period. This allowed the model to more accurately account for policy differences among states. The Eviction Lab Scorecard is measured from 0 to 5 based on the state's renter and eviction protections. A score of 5 is the highest, indicating high renter and eviction protections during the time period.

Finally, to better account for the differences among states and to observe the lagged effects of state moratoria, a fixed effects method was also used. This method is shown below:

Model 5

$$dailycases_{i,t} = \alpha_i + \beta_1 statemoratorium(weekly\ lag)_{i,t} + \beta_2 tests_{i,t} + \beta_3 timetrend_i + \varepsilon_{i,t}$$

Model 6

$$dailydeaths_{i,t} = \alpha_i + \beta_1 statemoratorium(weekly\ lag)_{i,t} + \beta_2 tests_{i,t} + \beta_3 timetrend_i + \varepsilon_{i,t}$$

This method utilizes the entire time-series panel dataset to examine the influence of a state moratorium on a specific day, within a state, on the COVID-19 cases and deaths on a future day. Because time in-variant data cannot be used in a fixed effects model, demographics and other time-invariant data was dropped. However, the most relevant variables were measured across time and thus were retained in the fixed-effects models. Because of a hypothesized lag between the time of eviction, doubling up, infection, testing, and possible death, the key independent variable, state moratorium, was lagged in both models. For the daily cases model, the state moratorium variable was lagged for every week up to 8 weeks. For daily deaths, the model was lagged for eleven weeks to account for a lag between a positive test and fatality. Ultimately, these models allow one to observe the association between a state moratorium x-number of weeks prior and COVID-19 cases and deaths on the current day. The use of lagged state moratoria variables is grounded in previous work studying the public health interventions (Leifheit et al. 2020; Olascoga, Venkatarmani, and Arcaya 2021).

Daily vaccine data was added to the fixed-effects models. Like in models 3 and 4, the vaccine data was lagged for a two-week period to account for the time it takes one to reach full immunization after an administered shot. All else, including the lag timing, remained the same from the first use of fixed effects. The expanded fixed-effects models, including vaccine data, is shown below:

Model 7

$$dailycases_{i,t} = \alpha_i + \beta_1 statemoratorium(weekly\ lag)_{i,t} + \beta_2 tests_{i,t} + \beta_3 timetrend_i + \beta_4 vaccines(lagged\ 2\ weeks)_{i,t} + \varepsilon_{i,t}$$

Model 8

$$dailydeaths_{i,t} = \alpha_i + \beta_1 statemoratorium(weekly\ lag)_{i,t} + \beta_2 tests_{i,t} + \beta_3 timetrend_i + \beta_4 vaccines(lagged\ 2\ weeks)_{i,t} + \varepsilon_{i,t}$$

In models 1 and 2, states with more total days of state moratorium to have fewer COVID-19 cases and deaths holding other relevant variables equal. In models 3 and 4, states with more days of active eviction moratoria are expected to experience fewer cases and deaths. Finally, in the fixed effects methods, even with the two models which include vaccines, the presence of a state eviction moratorium in prior weeks is expected to be associated with fewer COVID-19 cases and deaths in the following weeks.

Descriptive statistics for both the OLS regressions and fixed-effects data is shown in Table 2 in the appendix. Given the high variance in state populations, the standard deviation for new daily COVID-19 cases and deaths is higher than the mean values. The average state had roughly 2507 cases and 37 deaths from COVID-19 on any given day between October 1st, 2020 and March 31st, 2021. California had the highest single day totals for both new daily COVID-19 cases and deaths. On December 31, 2020, California recorded 57,406 cases. On February 24, 2021, the state experienced 1,093 deaths due to COVID-19. California also has the highest population of any state, so these statistics are not solely indicative of the state's pandemic policies. The differences in state minimum and maximum tests were also large among vaccines, tests, and rental assistance. States with the most vaccines and tests administered by March 31st, 2021 had 1,251,750 and 3,133,845 respectively. The most rental assistance allotted by the time period's end was $58.5 million will the state with the least money allocated had $0.

Finally, variance inflation factor (VIF) tests were run to check for multicollinearity in all the variables included in models 1 through 8. No variable had a VIF greater than ten. The ‘republican’ variable has the highest VIF with a 2.69. All other variables had VIFs below 2.5 with the means in models 3 and 4 being 1.94. Given all model variables have VIFs below the traditional threshold of 10, and all but one VIF is below the more conservative threshold of 2.5, the risk of coefficient inflation due to multicollinearity is relatively minimal.

Findings and Discussion:

Results from the models 1 and 2 are presented in Table 3 of the appendix. As hypothesized, there is a statistically significant relationship between one additional day of state eviction moratorium and fewer COVID-19 cases and deaths. One additionally day of state moratorium was associated with roughly 821 fewer COVID-19 cases and 18 fewer deaths. These results were significant at the .05 level. Considering the entire time period, these results suggest, a state with an eviction moratorium during the entire 182-day time period might expect 149,422 fewer COVID-19 cases and 3,276 fewer deaths. These estimates, while not of the same time period, are smaller than those put forward by Leifheit et al. (2020) who predicted 433,700 fewer cases and 10,700 fewer deaths with the same measure. However, the OLS regression estimates are larger than those of Nande et al. (2020) who discovered anywhere from 1,000 to 100,000 additional cases associated with the presence of evictions. As one may expect, more tests and a larger population were also statistically significant in their association with more COVID-19 cases and deaths. Somewhat surprisingly however, the demographic make-up of each state did not appear to play a significant role in the number of cases and deaths within each state. These results may be because the demographic information collected was aggregated percentages, rather than more precise individual level data.

Models 3 and 4 are displayed in table 4 in the appendix. Like models 1 and 2, these results demonstrate a statistically and practically significant negative relationship, at the .01

level, between the presence of a state eviction moratorium and COVID-19 cases and deaths. In looking at the entire 182-day time period, models 3 and 4 predict roughly 969 fewer cases and 18 fewer deaths if the state has an active eviction moratorium on that day after relevant variables are controlled. Both models reported fewer observations than models 5 and 6 because of the addition of vaccine data. Vaccines are only available for half of the relevant time period, so the days prior to vaccine availability were dropped from the analysis. The same effect is seen when vaccine data is again added in models 7 and 8. To account for the lagged period between vaccine administration and the medicine taking full effect, daily vaccine administration was lagged by two weeks in models 3 and 4.

Two relevant variables included in models 3 and 4 but not 1 and 2 are the 'Republican' and 'Eviction Lab Scorecard' variables. Both measures account for differences in politics and thus COVID-19 policies that likely influence the number of COVID-19 cases and deaths within a state. The coefficient on a republican controlled state government is positive, but not statistically significant in either model. However, the Eviction Lab Scorecard is statistically significant at the .01 level in its negative association with both cases and deaths. One addition point on the scorecard's 0-5 scale, indicating an increase in renter protections during the pandemic, is associated with 239 fewer cases and 4 fewer deaths. Models 3 and 4 predict states with a greater number of Native American residents or those over the age of 65 will record both more cases and deaths. Fewer cases and deaths were associated with states that reported a larger Asian American population.

Unlike models 5 and 6, coefficients for a lagged state moratorium variables are not included in the results for models 3 and 4. However, the state moratorium variable was lagged in both models. The results are not reported because the coefficients and statistical significance of the state moratorium variable in both models remained largely unchanged. The state moratorium variable was lagged for each week up to ten weeks in the explanatory models for cases and deaths. In model 3, the cases model, the coefficient was as large as 1,038 fewer cases in week three and as low as 632 fewer cases in week ten. The eviction moratorium variable was statistically significant at the .01 level in every week. For model 4, the deaths model, the state moratorium coefficient was even more stable and similarly statistically significant at every level. The coefficient reached peak size in week seven at 19 fewer cases and dropped to 16 fewer cases in week ten.

The results for models 5 and 6 on COVID-19 cases and deaths without vaccine data can be found in Tables 5 and 6 in the appendix. Model 5 shows a statistically significant relationship appears three weeks after an active state moratorium and increases in size and significance until weeks four and five. The association diminishes after seven weeks. The relationship is strongest in week four, where the model predicts that the presence of a state eviction moratorium four weeks prior is associated with 613 fewer cases. A similar pattern is observed in the fixed-effects model predicting COVID-19 deaths. A statistically significant relationship appears at five weeks, increases in size and significance until week eight, and diminishes after week nine. At week eight, the model predicts the presence of a state eviction moratorium eight weeks prior is associated with 16 fewer deaths. The fact that this relationship shows up later in weeks, five compared to four, for deaths compared to cases is what one would expect given a lag between a positive tests and possible mortality. Previous studies had found increased COVID-19 cases 5-12 weeks after a state moratorium was lifted (Sandoval-Olascoga, Venkatarmani, and Arcaya 2021). The timing of this paper's results suggest that an equal but opposite effect may occur after the activation of a state moratorium on evictions. Graphical representations of the downward trends of both COVID-19 cases and deaths over time can be found in Figures 2 and 3 in the appendix.

Results from the final fixed-effects models, 7 and 8, can be found in Tables 7 and 8 in the appendix. These models included data on the daily administered vaccines. When vaccine data is added to the models, only a minimal statistically relationship remains between a lagged state eviction moratorium and COVID-19 cases and deaths. In model 7, the cases model, a statistically significant negative relationship exists only in weeks two, three, and four. Notably, the coefficient on week two predicts 1175 few cases two weeks after an active state eviction moratorium. That is the largest coefficient among any of the fixed effects models. At no lag in model 8, the deaths model, was the presence of a state eviction moratorium statistically significant. Vaccines, however, are statistically significant throughout both models. As one may expect, more administered vaccines is associated with few COVID-19 cases and deaths. These results leads one to believe vaccines are a more influential public health intervention when compared to eviction moratoria. Because previous research had examined a time period before vaccines were available, this data was not available to include in other models. Without vaccine data included, the OLS regression and fixed-effects models do align with other research in supporting state eviction moratoria as an effective means to mitigate the transmission of COVID-19.

However, adding vaccine data suggests that eviction moratoria may be a short-term solution as a longer-term solution, like preventative medicine, is developed. The framing of eviction moratoria as a short-term solution seems to be in line with what federal policy makers initially thought when instituting the CDC's national moratorium on evictions. The policy was enacted on September 4th of 2020 and was originally set to expire on December 31st of the same year (NLIHC 2021). However, with extensions, the policy remained active until August of 2021. Additionally, some states like Colorado and Massachusetts activated, de-activated, and re-activated state eviction moratoria as the pandemic dragged on. Another example is shown through state policies in September of 2021. On September 1, 2021, the United States recorded 210,995 new COVID-19 cases (The New York Times 2022). The summer period has been the largest increase in cases since the winter surge of 2020. Despite the spike in cases, only 15 of the original 44 states who implemented eviction moratoria still had one in place. The remaining 29 states had deactivated their moratoria. This too suggests policy makers at the state level viewed eviction moratoria as a short-term public health solution. Evidence presented in this paper and others support this view. However, a more economically and socially sustainable solution, like a vaccine, must also be a part of policy makers efforts to combat future pandemics.

Similar to other studies attempting to quantify the effect of eviction moratoria on COVID-19 cases and deaths, this study has significant limitations. Firstly, even with a fixed-effects model, there are many unaccounted-for variables which influence the COVID-19 cases and deaths within each state. Additionally, the data collected was at the population level of each state. For more precise analyses, individual level data would be useful. Therefore, this study was not able to track if the tenants being evicted were the same citizens counted in case and mortality data. Finally, eviction legislation at the state level was not created equally. In some states, evictions were blocked at the level of filing. In others, evictions were blocked at the enforcement stage. The variance in eviction moratoria legislation may contribute to the effectiveness of each policy. These policies are also ineffective at combatting informal evictions in which a tenant is forced to leave by a landlord who by-passes the legal system. Informal evictions are not systematical collected and thus don't lend themselves easily to analysis.

Conclusion:

Before the COVID-19 pandemic, housing had been established by experts as an important determinate of public health. Armed with this information, researchers studied various public health interventions while the pandemic continued. One such intervention was federal and state eviction moratoriums. According to the theory of doubling-up, when an evicted tenant moves in with a family, friend, or shelter after an eviction, researchers hypothesized eviction moratoria could reduce the number of COVID-19 cases and death within a state. This hypothesis was promptly supported with research as Leifheit et al. (2020) discovered more COVID-19 cases and death in states that had lifted an eviction moratorium during the first six months of the pandemic. The current paper aimed to analyze the time period after Leifheit et al. (2020) in order to establish if this relationship remained over time. An additional benefit to this paper's timeframe is that vaccines became widely available in mid-December of 2020. Previous papers did not have the ability to include daily vaccine administration data in their analyses.

In both the totals and daily OLS regression and fixed effects model, the study finds an association between the presence of a state eviction moratorium and fewer COVID-19 cases and deaths. The negative relationship between a state moratorium and COVID-19 cases is strongest following 4 to 7 weeks of an active state moratorium. The same relationship is true between a state moratorium and COVID-19 deaths between 5 and 9 weeks. However, when daily vaccine administration data is added to the fixed effects models, there is a minimal significantly relationship between the presence of a state moratorium and COVID-19 cases and deaths. Instead, vaccines have the strongest negative association with both cases and deaths. This leads to a possible frame of eviction moratoria as an important short-term public health intervention, while a more effective, long-term solution is developed. In this case, vaccines represent a long-term solution that may effectively replace eviction moratoria when widely available.

This relationship between short-term and long-term public health interventions may lead to questions on how best to time the implementation of certain policies. For example, when does it become ineffective to continue an eviction moratorium when a long-term solution like vaccines is widely available? This question is especially relevant considering a recent paper which found neighborhoods in major metro-areas with the highest eviction rates also had the lowest vaccination rates in the same cities. (Jin et al. 2021). If there are specific areas or populations within a city where residents are hesitant to take a vaccine, or do not have access, policy makers must take that population into account when making public health decisions. This added nuance is especially important if the same population is more vulnerable to housing instability as demonstrated in the Jin et al. (2021) results. Finally, this paper, like previous work, analyzed eviction moratoria at the state level. Many counties and even some cities also instituted their own eviction moratoria during the pandemic. Future researcher should compare the effectiveness of eviction moratoria at different levels of governance. If policy makers can know whether federal, state, or local moratoria are most effective, there may be a clearer and more uniform effect to keep citizens housed and healthy in future crises.

Policy debates regarding eviction moratoria throughout the pandemic have often focused on the financial hardship placed on landlords, especially those with few properties. Research from JPMorgan and Chase revealed 7% of landlords missed a mortgage payment during the pandemic due to lost rental revenue (Greig, Zhao, and Lefevre 2021). The economic instability of landlords should not be minimized in policy discussions regarding eviction moratoria, but evidence from this paper and others provides credit to the thought that preventing evictions can be lifesaving. The three model types used in this paper all find statistically and practically significant evidence that fewer people died in states which kept active moratoria on evictions. While individually, all three models have limitations, together they all reach the same conclusion: efforts to keep vulnerable populations housed during a pandemic is an effective public health tool.

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Appendix: Figures

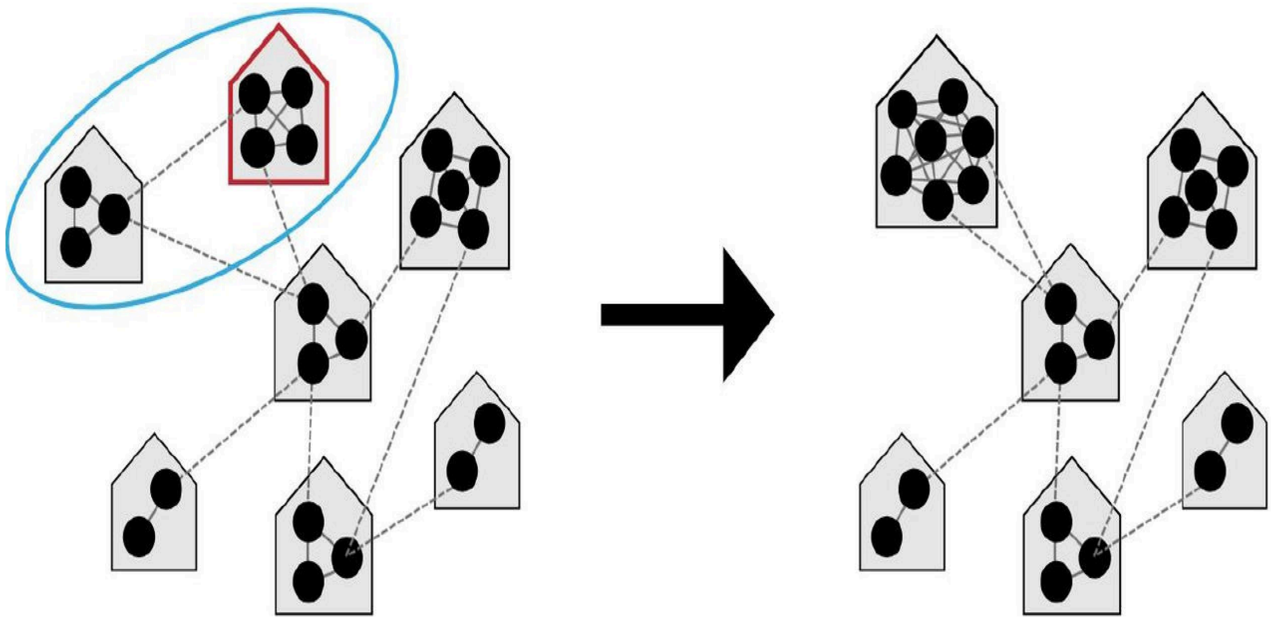


Figure 1: Nande et al. (2020)

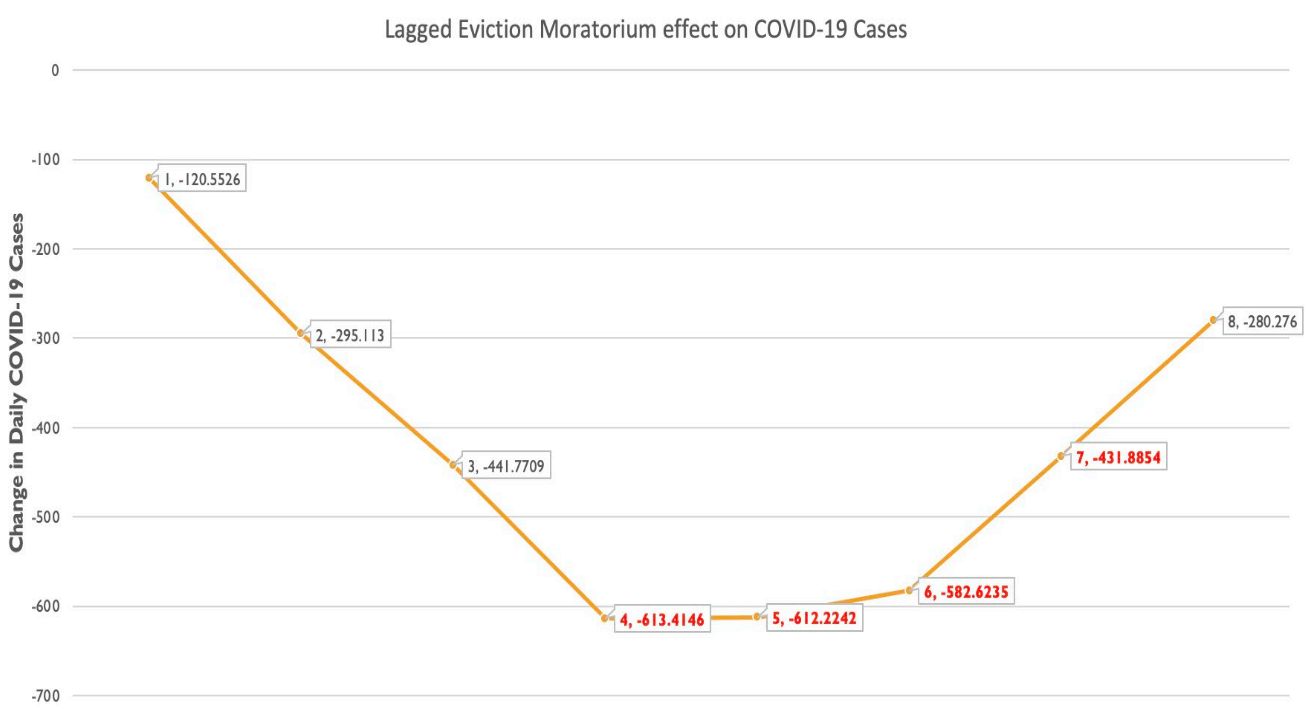
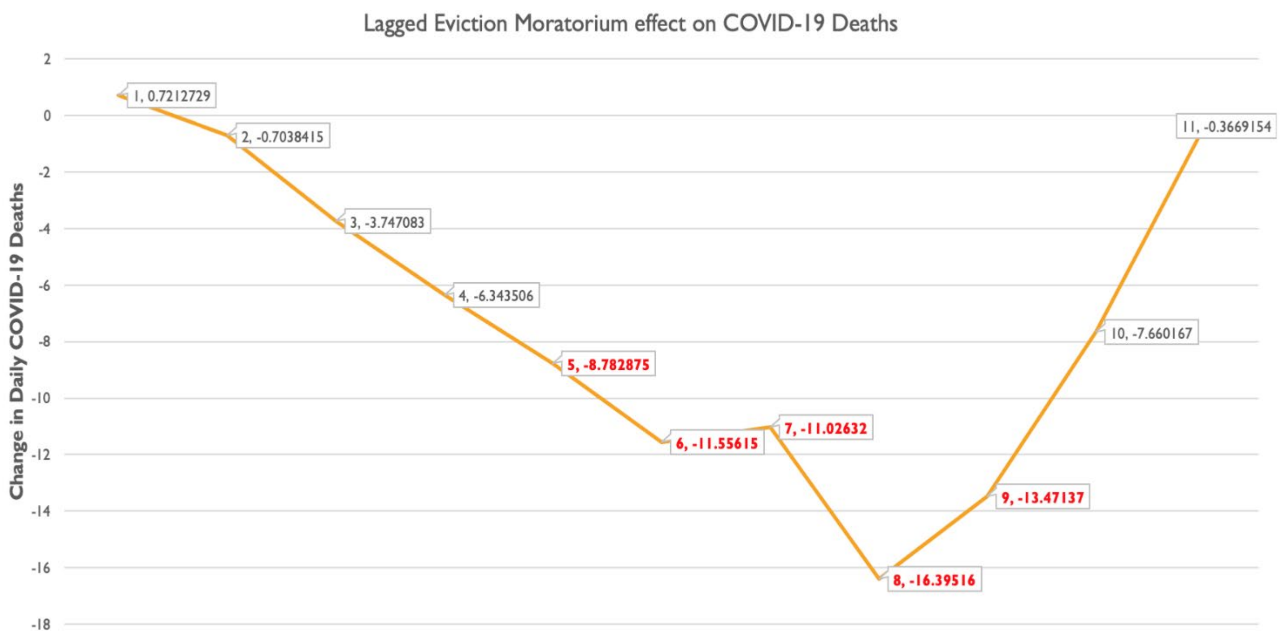


Figure 2



Lagged Eviction Moratorium effect on COVID-19 Deaths
Change in Daily COVID-19 Deaths
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
1, 0.7212729
2, -0.7038415
3, -3.747083
4, -6.343506
5, -8.782875
6, -11.55615
7, -11.02632
8, -16.39516
9, -13.47137
10, -7.660167
11, -0.3669154

Figure 3

Appendix: Tables

Variable Descriptions		
Variable Name	**Description**	**Source**
Time Variable	Days numbered 1-182 between Oct 1, 2020 & March 31, 2021	N/A
COVID-19 Cases	New daily cases of COVID-19 within the state	Johns Hopkins University
COVID-19 Deaths	New daily deaths due to COVID-19 within the state	Johns Hopkins University
State Moratorium	Binary: 1 for presense of moratorium on that day - 0 for no moratorium	COVID-19 US State Policies
Total Moratorium	Number of days with a moratorium in place between Oct 1, 2020 & March 31, 2021	COVID-19 US State Policies
Total Cases	Summation of cases between Oct 1, 2020 & March 31, 2021	Johns Hopkins University
Total Deaths	Summation of deaths between Oct 1, 2020 & March 31, 2022	Johns Hopkins University
Vaccines	New daily vaccines administered	Centers for Disease Control
Tests	New daily tests administered	COVID Tracking Project
Total Tests	Summation of test between Oct 1, 2020 & March 7, 2021 divided by 10,000	COVID Tracking Project
Utility Moratorium	Binary: 1 for presence of a utility moratorium on that day - 0 for no moratorium	COVID-19 US State Policies
Rental Assistance	Emergency Rental Assistance 1 allocated by March 31, 2021 (Millions)	United States Treasury
N.L. Population	Natural log of state population as of April 1, 2020	US Census Bureau
% over 65	Percentage of state over the age of 65	US Census Bureau
% w/o Health Insurance	Percentage of state population without health insurance	US Census Bureau
% African American	Percentage of state population self-identified as African American	US Census Bureau
%Latino/a	Percentage of state population self-identified as Latino/a	US Census Bureau
%Native American	Percentage of state population self-identified as Native American	US Census Bureau
%Asian	Percentage of state population self-identified as Asian	US Census Bureau
Republican	Binary: 1 for Republican control of state government - 0 for democrat or mixed control	National Conference of State Legislatures
ELS Scorecard	0 to 5 based on measures implemented by state governments to limit residential housing displacement	Princeton University Eviction Lab

Table 1

Summary Statistics				
Variable	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
COVID-19 Cases	2507.6	4140.9	0	57406
COVID-19 Deaths	37.2	65.3	0	1093
Total Moratorium	59.6	82.4	0	182
Total Cases	453877	524128.9	17520	2894726
Total Deaths	6724.6	7957.8	169	43018
Vaccines	34926	83728	0	1251750
Tests	31079	67774	0	3133845
Total Tests	487.9	654.5	36.6	3487.4
Rental Assistance	3	9.1	0	58.5
N.L. Population	15.2	1.04	13.3	17.5
% over 65	16.9	2	11.4	21.2
% w/o Health Insurance	9.95	3.6	3.5	20.8
% African American	11.9	10.7	0.6	46
%Latino/a	12.2	10.3	1.7	49.3
%Native American	2	3.1	0.3	15.6
%Asian	4.6	5.5	0.8	37.6
Eviction Lab Scorecard	1.8	1.4	0	4.4

Table 2

Totals Regression Results		
Regression Model:	**Cases**	**Deaths**
Independent Variable:		
totalmoratoriumdays	-821.15**	-18.67**
	(382.2)	(7.667)
totaltests10,000	575.43***	7.63***
	(58.13)	(1.166)
rentalassistance	-946.51	-28.81
	(2650.28)	(53.17)
nlpopulation	105991.7***	2030.68**
	(38456.4)	(771.49)
over65	-19433.6	-135.32
	(12630.2)	(253.38)
wohealthinsurance	24512.85**	302.2
	(9195.7)	(184.48)
africanamerican	-2254.19	-.651
	(2528.35)	(50.72)
latinoa	4701.26	105.5886
	(3198.17)	(64.16)
nativeamerican	-17350.74*	-219.69
	(9886.28)	(198.33)
asian	3725.94	74.78
	(4835.81)	(97.01)
Constant	-1313393**	-28569.59**
	607612.7	(12189.57)
Observations	51	51
R Square	.9249	.8689
Note: Standard Errors in parentheses		
Significance levels denoted by * p ≤ .10; ** p ≤ .05; *** p ≤ .01		

Table 3

Daily Regression Results		
Regression Model:	**Cases**	**Deaths**
Independent Variables		
StateMoratorium	-969.10***	-18.17***
	(167.39)	(3.18)
Tests	.048***	.0006***
	(.00129)	(.00002)
Rental Assistance	468.28***	10.26***
	(156.6)	(2.98)
Vaccines (lagged 2 weeks)	-.00048	.00027***
	(.00109)	(.00002)
Over65	713.49***	20.08***
	(74.07)	(1.408)
AfricanAmerican	86.44***	1.107***
	(18.65)	(.354)
Latino	16.07***	.038
	(5.26)	(.10)
NativeAmerican	81.75***	1.687***
	(6.43)	(.122)
Asian	-108.33***	-1.63***
	(21.61)	(.41)
Republican	293.76*	1.003
	(168.25)	(3.19)
ELScorecard	-155.61***	-4.55***
	(53.04)	(1.008)
Constant	-11154.52***	-296.12***
	(1064.04)	(20.22)
Observations	3519	3519
R Square	.5878	.5713
Note: Standard Errors in parentheses		
Significance levels denoted by * p ≤ .10; ** p ≤ .05; *** p ≤ .01		

Table 4

Fixed Effects Regression Results: Excess Daily Cases								
Independent Variables								
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
StateMoratorium	-120.55	-295.113	-441.77*	-613.41**	-612.22**	-582.62**	-431.885*	-280.27
	(-233.75)	(-237.093)	(239.72)	(242.92)	(243.8)	(247.578)	(254.787)	(266.65)
Tests	0.012***	0.011***	.0102***	.0093***	.008***	.0075***	.0067***	.006***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
TimeTrend	-0.4	-3.935***	-8.228***	-13.32***	-18.79***	-24.189***	-28.95***	-33.85***
	(-0.77)	(.826)	(.8839)	(.9484)	(1.008)	(1.086)	(1.183)	(1.309)
Constant	2484.09***	2955.05***	3513.27***	4179.92***	4845.7***	5503.3***	6055.24***	6622.87***
	-104.82	110.4699	116.56	(123.88)	(130.94)	(140.569)	(153.24)	(170.12)
Observations	7701	7344	6,987	6,630	6273	5916	5559	5202
R Square	0.2651	0.2553	0.2312	0.1954	0.1757	0.1609	0.1545	0.1541
Note: Standard Errors in parentheses								
Significance levels denoted by * p ≤ .10; ** p ≤ .05; *** p ≤ .01								

Table 5

Fixed Effects Regression Results: Excess Daily Deaths											
Independent Variables											
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**	**Week 9**	**Week 10**	**Week 11**
StateMoratorium	.721	-.7038	-3.747	-6.3435	-8.782**	-11.556***	-11.026**	-16.395***	-13.47***	-7.66	-.3669
	(3.90)	(4.004)	(4.119)	(4.241)	(4.3475)	(4.49)	(4.6462)	(4.8529)	(5.049)	(5.257)	(5.35)
Tests	.000096***	.00008***	.00007***	.00006***	.00005***	.00004***	.00003***	.00002***	.00001***	.00004	.00003***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
TimeTrend	.25018***	.23517***	.21239***	.1783***	.1350***	.0796***	.0104***	-.05461**	-.1552***	-.2209***	-.2791***
	(.0128)	(.01396)	(.01519)	(.0165)	(.01798)	(.01969)	(.02159)	(.0238)	(.0260)	(.0292)	(.0326)
Constant	16.67***	19.094***	22.958***	28.051***	34.288***	42.145***	50.694***	60.64***	72.69***	78.25***	83.691***
	(1.748)	(1.865)	(2.003)	(2.1629)	(2.3349)	(2.549)	(2.794)	(3.096)	(3.417)	(4.049)	(4.516)
Observations	7701	7344	6987	6630	6273	5916	5,559	5202	4845	4488	4131
R Squared	0.1217	0.1121	0.0993	0.0827	0.0592	0.0282	0.0142	0.0015	0.0004	0.0502	0.0640
Note: Standard Errors in parentheses											
Significance levels denoted by * p ≤ .10; ** p ≤ .05; *** p ≤ .01											

Table 6

Fixed Effects Regression Results: Excess Daily Cases including Vaccines								
Independent Variables								
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
StateMoratorium	-819.52	-1175.67**	-863.19**	-769.849**	-577.324	-403.75	-248.74	-196.94
	(608.89)	(496.94)	(410.44)	(374.08)	(360.9)	(364.262)	(377.21)	(385.527)
Tests	.0276***	.0277***	.0277***	.0277***	.0276***	.0276***	.0276***	.0276***
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
TimeTrend	-59.06***	-59.05***	-58.909***	-58.82***	-58.827***	-58.869***	-58.933***	-58.95***
	(2.147)	(2.14)	(2.147)	(2.149)	(2.15)	(2.15)	(2.15)	(2.154)
Vaccines	-.0045***	-.0045***	-.00449***	-.0045***	-.0044***	-.0045***	-.0045***	-.0045***
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Constant	9524.86***	9641.789**	9517.20***	9475.04***	9412.13***	9360.31***	9317.99***	9303.70***
	(345.22)	(324.117)	(306.307)	(299.44)	(296.629)	(295.93)	(296.86)	(297.34)
Observations	3519	3519	3519	3519	3519	3519	3519	3519
R Square	.4605	.4467	.4596	.4620	.4656	.4674	.4678	.4677
Note: Standard Errors in parentheses								
Significance levels denoted by * p ≤ .10; ** p ≤ .05; *** p ≤ .0								

Table 7

Fixed Effects Regression Results: Excess Daily Deaths including Vaccines											
Independent Variables											
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**	**Week 9**	**Week 10**	**Week 11**
StateMoratorium	12.83	11.14	8.54	6.10	4.63	1.62	.1316	-5.87	-6.72	-4.65	-.249
	(7.52)	(6.74)	(6.35)	(6.19)	(6.24)	(6.48)	(6.59)	(6.51)	(6.12)	(5.56)	(5.26)
Tests	.000062**	.000062**	.000063**	.000063**	.000064**	.000064**	.000064**	.000064**	.000064**	.000064**	.000065**
	(.000028)	(.000028)	(.000029)	(.000029)	(.000029)	(.000029)	(.000029)	(.000029)	(.000029)	(.000029)	(.000029)
TimeTrend	.00015***	.00015***	.00015***	.00015***	.00015***	.00015***	.00015***	.00015***	.00015***	.00015***	.00015***
	(.000013)	(.000013)	(.000013)	(.000013)	(.000013)	(.000013)	(.000013)	(.000013)	(.000013)	(.000013)	(.000013)
Vaccines	-.3524***	-.3533***	-.3534***	-.3531***	-.3527***	-.3516***	-.3510***	-.3492***	-.3494***	-.3509***	-.3480***
	(.031)	(.031)	(.031)	(.031)	(.031)	(.031)	(.031)	(.031)	(.031)	(.031)	(.031)
Constant	82.98***	83.66***	84.53***	85.29***	85.72***	86.57***	86.97***	88.68***	88.98***	88.49***	86.63***
	(4.56)	(4.39)	(4.32)	(4.28)	(4.28)	(4.29)	(4.33)	(4.32)	(4.29)	(4.28)	(4.44)
Observations	3519	3519	3519	3519	3519	3519	3519	3519	3519	3519	3519
R Squared	.2532	.2621	.2739	.2835	.2881	.2933	.2938	.2796	.2752	.2832	.2989
Note: Standard Errors in parentheses											
Significance levels denoted by * p ≤ .10; ** p ≤ .05; *** p ≤ .0											

Table 8