THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF INDUSTRIAL ENGINEERING

Modeling the Spread and Impact of COVID-19 across U.S. Prisons

TATIANA KLETT
SPRING 2021

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Industrial Engineering
with honors in Industrial Engineering

Reviewed and approved* by the following:

Guodong Pang
Professor
Harold and Inge Marcus Department of
Industrial and Manufacturing Engineering
Thesis Supervisor

Sanjay Joshi
Professor
Harold and Inge Marcus Department of
Industrial and Manufacturing Engineering
Honors Advisor

* Electronic approvals are on file.

ABSTRACT

One in five prisoners in the United States has had COVID-19. Incarcerated people are infected four times more than the general population [Schwartzapfel et al., 2020]. These numbers alone prove the dire need for research focused on incarcerated people who have been impacted by the COVID-19 pandemic. This thesis investigates the action or inaction taken by various states across the United States over the course of March 2020 to February 2021 in response to COVID-19 in the prison setting. The procedure consisted of analyzing the basic reproductive number, R_0, of COVID-19 infections within numerous prison systems across the country and comparing these values to that of the general state population. R_0 is defined as the average number of infections produced by a contagious human in a population where there is no immunity. Aside from the data analysis conducted, research was carried out regarding each states policy implementation throughout 2020 and early 2021. These analyses allowed for a comprehensive examination of the reactive and preventative approaches that each state took to mitigate the spread of COVID-19 in their correctional facilities.

Out of the 6 states analyzed (California, Texas, Michigan, Oregon, Ohio, and Arkansas), the state with the highest prison infection rate was Ohio with an R_0 of 2.484. On the contrary, the state with the lowest infection rate was Oregon with an R_0 of 1.285. Both states differed greatly in their approach to managing the spread of COVID-19 and, thus, had greatly different results. The goal of this thesis is to provide stakeholders in the U.S. prison system with the proper tools and knowledge to better respond to the spread of infectious diseases in the future. This includes better testing, social distancing practices and sanitary measures, as well as de-incarceration efforts, all of which can lead to a decrease in the overall infection rate present in correctional facilities. Effective

policies against the spread of COVID-19 ultimately translate into a decrease in total loss in life of incarcerated individuals and prison staff—a heavy burden that highlights the importance of successful infectious disease mitigation policies.

As we look ahead into 2021, widespread access to the vaccine for incarcerated individuals will be a determining factor in minimizing the spread of the virus within the correctional setting. Due to each state varying in their vaccine distribution process, the virus will continue spreading in U.S. prisons and will continue to devastate an already marginalized community. If the virus is to be controlled within the prison setting, widespread vaccine distribution for incarcerated populations is a requirement. It is also paramount that each state releases transparent and comprehensive data regarding the testing and protective measures enacted throughout their prison systems. Without adequate reports concerning the status of life inside these prisons, research is hindered, making systemic change related to risk-mitigation strategies for infectious diseases nearly impossible.

A note from the author: It should be acknowledged that I use the words “prisoner” and “inmate” loosely throughout my work, despite the power that these words hold to further exacerbate the perception of those who are incarcerated or who have been incarcerated in their lifetime. These words take away the humanity of those incarcerated and that is incredibly dangerous if we are to move in a direction that views incarcerated people as more than just their offense.

"The degree of civilization in a society can be judged by entering its prisons."

\- *Fyodor Dostoevsky*

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to thank my thesis supervisor, Dr. Pang. Without his dedication and guidance over the past year, this would not have been possible. Dr. Pang supported me to pursue a thesis that reflected both my interest in Industrial Engineering and social justice. He not only allowed me to investigate an area that I am passionate about, but he shared this passion with me and we were all the more successful because of this. I cannot thank him enough for mentoring me through the daunting thesis process and coaching me through it in a sustainable manner. I would also like to thank Dr. Kreager, Director of Penn State's Criminal Justice Research Center, who willingly met with me to discuss my interest in focusing my thesis on the U.S. prison system's response to COVID-19. With his guidance, I was better able to narrow my topic and begin my research in a thoughtful and tactful manner.

I would also like to thank my parents. They have supported me throughout all of my aspirations and have challenged me to continue pushing myself outside of my comfort zone. Without them, I would have never made it through the engineering discipline, and for that, I am eternally grateful. In addition to my parents, I want to thank my sister, Katarina. As a mentor and role model, she has uplifted me in ways I cannot put into words. Listening to her experiences as a woman in engineering over the years has uplifted me to persevere. I cannot thank her enough for all that she has done for me. Lastly, I would like to thank the rest of my family and friends who have provided me with a support network that has been invaluable all of my life.

Chapter 1

Introduction

On December 31st, 2019, the Wuhan Municipal Health Commission released a statement regarding cases of a 'viral pneumonia' in Wuhan, People's Republic of China. This marked the beginning of an uphill battle towards the fight against the novel coronavirus (COVID-19). By March 11, 2020, the World Health Organization characterized the virus as a pandemic and warned that the need for detecting, testing, treating, isolating, tracing, and mobilizing healthcare officials would prove vital in mitigating the spread against COVID-19 [1]. Critical political debate regarding marginalized communities, including individuals in prison, have made headlines throughout the pandemic, forcing officials to reckon with the impact of their policies on vulnerable populations.

The United States incarcerates the most people per capita worldwide [2]. We currently house about 2.3 million people behind bars. The rise in incarceration over the last 40 years has led to a call for an end to policies leading to mass incarceration. The majority of these individuals are held in state prisons (1,291,000 people), local jails (631,000 people), and federal prisons and jails (226,000 people) [3]. Each facility operates differently due to the government bodies ruling over them. State prisons are run by the state government, whereas, federal prisons are operated by the federal government. Additionally, jails are different from prisons in that they are for individuals who are serving relatively short sentences or awaiting trial [4]. This adds a level of complexity when analyzing how facilities are run and to which standards they are held. For this reason, we chose to focus solely on State and Federal prisons across the United States.

Prisons are an especially vulnerable population for COVID-19 due to close living quarters, difficulty to socially distance, and overcrowding. Prisons across the country provide a perfect environment to exacerbate the spread of the virus. In fact, a recent study found that incarcerated people have twice the risk of dying from COVID-19 compared to a person who is free [5]. Additionally, prison populations tend to be excluded from public health discussions and overlooked when health crises arise, further aggravating the issue. Due to these factors, research regarding the treatment, and policies surrounding prison populations during the COVID-19 pandemic are crucial in ending the disparities seen across the country.

Over the past year, there has been a large push to increase the conversation surrounding the treatment of incarcerated people. The pandemic has exposed the harsh reality of what it means to be incarcerated in the United States. The question of whether or not states should work to release prisoners who committed low-risk crimes to decrease the risk of overcrowding in facilities has become commonplace. Additionally, the question of should staff be required to wear masks and receive regular testing, given the high risk of them exposing prisoners, has begun to flood the media as calls for better treatment of incarcerated people emerges.

Moreover, as the vaccine becomes widely distributed, conversations surrounding whether prisoners should be prioritized due to their heightened risk of infection have caused national division. In New York, a state that was hit especially hard at the start of the pandemic, Governor Andrew Cuomo has not listed incarcerated populations as eligible for the vaccine, despite the CDC expressing the dire need for staff and incarcerated people to become vaccinated [6]. As a result, as of February 2021, five legal-aid groups sued the governor and the state health commissioner for not allowing over 30,000 individuals incarcerated in the state of New York to be eligible for the

vaccine [7]. This is only one of many examples of pushback in response to the state and federal treatment of incarcerated populations during the pandemic.

In addition to legal-aid groups taking action against the mistreatment of incarcerated people over the last year, public outcry has resulted from stories surfacing of correctional staff who have put the lives of prisoners at risk during outside of work hours. One example of this was seen in a Maine jail where a COVID-19 outbreak resulted from a staff member attending a wedding. This one event led to at least 18 cases at the York County Jail [8]. The lack of policies in place to protect inmates as they relate to themselves and prison staff has led to great devastation across the country. For example, despite the national call for mask wearing in August of 2020, only half of all states required prison staff to wear a mask. This number is even lower for states that required incarcerated individuals to wear a mask (See Figures 1 and 2) [9].

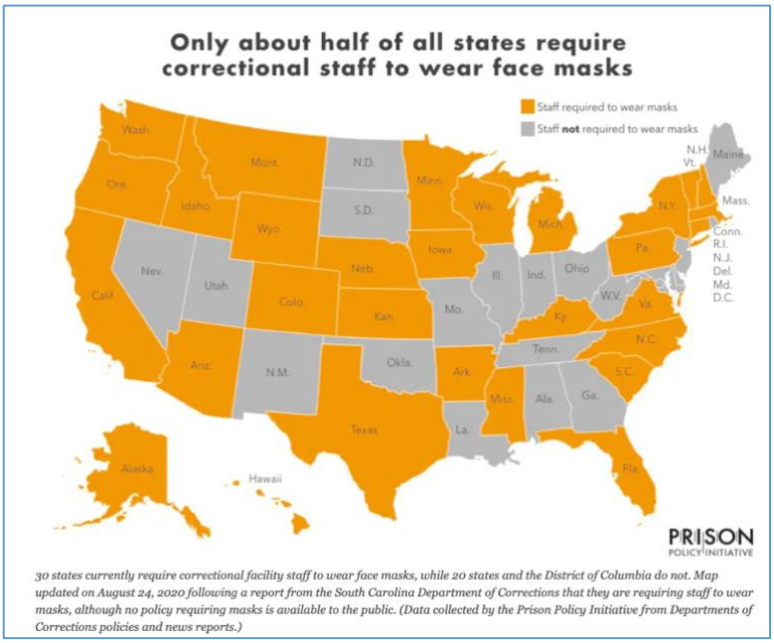


Figure 1 Prison Policy Initiative Staff Mask Use (Source: Prison Policy Initiative)

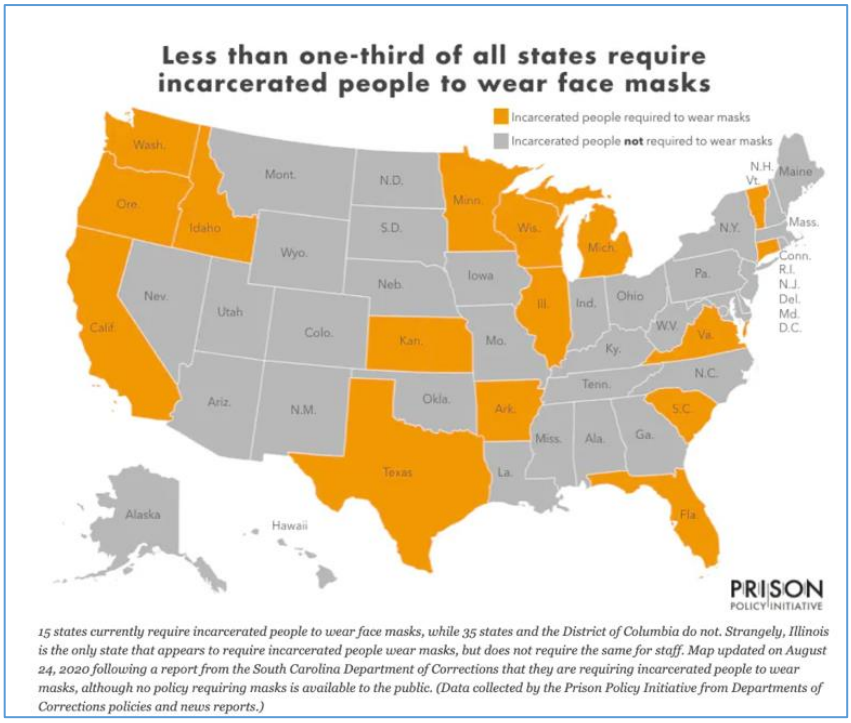


Figure 2 Prison Policy Initiative Prisoner Mask Use (Source: Prison Policy Initiative)

The year 2020 forced the United States to not only address a public health crisis due to the Coronavirus, but it also led to an increased awareness of the racial inequities flooding the country. Calls for providing equitable access to healthcare and vaccine distribution for marginalized communities were at the forefront of the fight against the Coronavirus. This was a direct result of the police killings of Breonna Taylor and George Floyd [10]. In addition to calls for systemic change in our police force, there were also demands for institutional change in our criminal justice system which disproportionately impacts people of color. This seismic shift in race relations in the United States will impact the future of many sectors of society, including the prison system.

1.1 Literature Review

Research surrounding the spread of illnesses across correctional facilities and the treatment of incarcerated people continues to be a large area of focus across many different disciplines. An example of this research includes a 2018 study done to model the spread of tuberculosis in Brazil prisons. Researchers found that annual mass TB screenings reduced the likelihood of TB in prisons by 47.4% and in the general population by 19.4% [11]. Researchers have also investigated the disproportionately high rates of infections caused by human immunodeficiency virus (HIV), hepatitis B virus (HBV), and STDs, flooding prisons and resulting in a dire need for methods to reduce the spread of these infections. Due to the fact that each U.S. State varies in their approach to limit the spread of these illnesses, including COVID-19, there are drastically different infection rates. This is reflected in Figure 3 where the varying prevalence of red dots signifies the infection rates across the United States. It is clear from these many examples that the approach in which a prison system takes to limit the spread of these infections ultimately impacts their ability to protect their inmates [12].

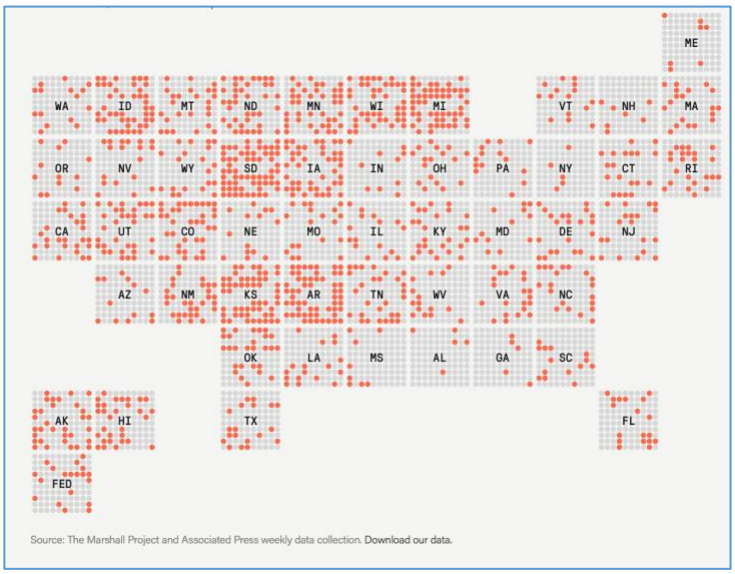


Figure 3 State by State Prison Cases (Source: The Marshall Project)

With the 2019 Coronavirus pandemic forcing the world to change as we know it, there has been a large influx of research focusing on the spread of illnesses, specifically COVID-19, in the prison and jail systems. The inspiration for focusing on the impact of Coronavirus on this specific population of people is due to the complexity of managing the spread in often overcrowded and confined spaces [13]. The added intricacy comes from the underreporting and under testing of incarcerated people and staff, leading to varying numbers depending on the source. For example, data from May 2020 provided by UCLA Law COVID-19 Behind Bars reported 36,616 cases among jail-prison residents, The Marshall Project reported 29,251 cases, and the CDC reported far less with 4,893 cases, all for the same population [13]. This difference is due to the varying methodologies and level of conservativeness in which each dataset chooses to rely on.

The issue of underreporting and poor prison conditions is not exclusive to the United States, as other areas around the world have also struggled to maintain the spread of the virus in correctional facilities. In fact, Latin America has particularly struggled. In May of 2020 Haiti's prisons were running at 450% occupancy and Brazil was following closely behind them [14]. Additionally, prisoners are especially susceptible to the virus with high rates of asthma, diabetes, and smoking habits [14]. To make matters worse, it can be incredibly challenging for incarcerated individuals to have access to proper healthcare, even outside of the pandemic. Many prisons do not have adequate healthcare within their facility, requiring the transportation of prisoners to get the care that they need. Oftentimes, prison staff are overwhelmed and unable to address every individual who needs to see a medical professional. In order to justify prisoners being transported to a healthcare facility, prisoners must usually be in critical condition. This matter has been further exacerbated throughout the pandemic where additional precautions are a necessity in order to ensure that others do not become infected from the sick individual needing transportation.

In order to address the impeding threat of overcrowding facilities, The United Nations High Commissioner for Human Rights has advocated for the release of incarcerated people who are high risk for COVID-19. Yale School of Medicine's, Frederick Altice, stresses the importance of this issue and says, "De-incarceration has to be the foremost strategy here . . . Several countries, including the USA, have extraordinarily high levels of incarceration. It will certainly be possible to release prisoners and maintain public safety . . . You can take a lot of people out of the system [by utilizing treatment programs for people incarcerated due to drug offenses], and these are people who are at increased risk of comorbidities . . . so there is an immediate public health benefit [14]." Though many talented individuals are focusing on the tools necessary to mitigate the spread of COVID-19 in prisons across the world, it is clear that this is an area that requires more focus than we see currently. The more research aimed at determining the optimal methods to reduce the spread of the virus within correctional facilities will benefit all of our communities, not just those incarcerated.

Chapter 2

Methodology

A common variable used to characterize the spread of an infectious disease, R_0, is defined as the average number of infections produced by a contagious human in a population where there is no immunity [15]. The effective reproduction number, R_E, is similar to R_0, and provides the infection rate for a population with partial immunity. Typically, R_0, needs to be greater than one in order to spread at an exponential rate and lead to an epidemic. If this value is less than one, the outbreak will most likely die out naturally. R_0 is used widely across epidemiology due to its simple model that can determine if an infection will lead to epidemic or pandemic levels of contagion. The model relies on the number of cases rising over time as well as the serial interval of a virus [16]. The serial interval of COVID-19 is estimated to be 3.96 days [17]. This is the number that is used throughout the R coding to determine the R_0 for each state and prison population. The early number of cases from COVID-19 that were analyzed resulted in R_0 estimates greater than one, which closely matched the SARS global pandemic of 2003—causing great fear over where the novel Coronavirus would leave the world if untreated.

In the prison setting, R_0 values tend to be much larger mathematically proving the need for strict rules and regulations that protect incarcerated individuals. Though the R_0 value varies from prison to prison, a study published in September 2020 found that the reproduction ratio in a large U.S. jail was 8.44 [18]. To put this value into perspective, in April 2020, German Chancellor Angela Merkel stated the severity of the R_0 value shifting from 1.0 to 1.1. She warned that this small change in numbers could lead to devastation across German hospitals by October 2020. If

this number were to increase a little more to 1.2, the German population would be expected to experience the negative effects even quicker by July 2020 [19].

Due to the versatility of R_0, the variable will be used to compare and contrast different prisons across the United States. The states will be selected based on the methods in which each state prison system used to address the spread of COVID-19 in their facilities. Different strategies were implemented surrounding security consciousness, prisoner rights, overcrowding leading to de-incarceration; all of which impacted the success or failure of states to mitigate the spread of the virus.

In his book, Ottar N. Bjornstad outlines a method to estimating R_0 from a simple epidemic [20]. The principles are applied to the early phase of the pandemic to get a rough estimate for R_0. The framework for this model is included below:

$R_0 = \exp(rG)$, where G is the generation time (average time between infection and reinfection) and r is the rate of exponential growth

$$\text{Time for a population to double} = \frac{\log(2)}{\text{r}}$$

$R_0 = Gr + 1$

Open-source data was collected from a partnership between The Marshall Project and The Associated Press [21]. The data provided chronological COVID-19 data related to prisons across the United States. The data includes numbers related to not just prisoners, but staff as well. In order to garner the data, the Marshall Project and Associated Press reporters contacted each prison organization individually and verified the information with officials. The Marshall Project and

Associated Press preface the data with the reality that many states still have yet to begin adequate testing processes, thus the number of cases within the facilities is estimated to be greater. They also share in the data overview that "sixteen prison systems, including the Federal Bureau of Prisons, would not release information about how many prisoners they are testing." Several states were chosen to be the focus of this work because of initial research done regarding the creation, or lack thereof, of policies throughout the pandemic for different prison systems. The states highlighted in this work are as follows: Arkansas, California, Michigan, Ohio, Oregon, and Texas. Additionally, open-source data was provided by The COVID Tracking Project for the general state populations for each state of interest [22].

R programming was used to determine the effective reproduction rate for each state's prison system. The Simple Epidemic model defined in Dr. Bjornstad's book was followed precisely to determine an R value that more closely relates to R_0 rather than R_E, due to the fact that at the early stages of the pandemic, there was no herd immunity or vaccinations available. Thus, the prison populations did not have substantial immunity to COVID-19. Herd immunity ($R_0 < 1$) can be achieved through vaccinations and by reaching population immunity requirements, which vary for different viruses. This value can be calculated using the equation $p_c = 1 - (\frac{1}{R_0})$ which places COVID-19 herd immunity between the values of 0.5 and 0.667. Our model analyzes prison cases between March to December 2020 when herd immunity within the prison setting and greater United States population had yet to be achieved on a major scale. The model also analyzes general population cases between March 2020 and February 2021.

2.1 Research Objectives

The objective of this thesis is to dissect the current risk-mitigation methods in place by U.S. prisons and determine the optimal system for mitigating the spread of COVID-19. Though this thesis focuses specifically on the current pandemic, the methods discussed can be applied to various infectious diseases and settings where individuals are required to live in close quarters for extended periods of time.

The overarching objectives for this thesis can be found below:

- Understand the policies that U.S. states are using to manage the spread of COVID-19 in their prisons and analyze their impact.
- Calculate the R_0 value in prisons across various states to determine those that are successfully or unsuccessfully mitigating the spread of COVID-19.
- Calculate the R_0 value in the general population across various states to compare to each states prison system.
- Provide a recommendation for prisons to mitigate the spread of COVID-19 that is rooted in restorative and equitable practices.

2.2 Procedure

The steps taken on R to conduct the analysis are highlighted below:

1. Filter and organize the COVID-19 dataset provided by the Marshall Project to conduct a state by state analysis.
2. Plot the total cases over each week for every state included in this work.
3. Calculate the R_0 for the initial spike in cases.
    a. It should be noted that this is the most dependable R_0 value as there was no herd immunity amongst the prison populations yet.
4. Determine the key trends in the graph developed in Step 2 to separate the analysis into "chunks" where the infection rates appear to be linear.
5. Once the weekly "chunks" are determined, create respective graphs for each and determine the R_0 for each time period.
    a. This particular portion of the analysis was to document the change in R_0 as the weeks progressed and the prison systems implemented policies in response to the virus.
6. Filter and organize the COVID-19 datasets provided by The COVID Tracking Project at *The Atlantic* for the general state populations to conduct a state by state analysis similar to the prison populations.
7. Plot the total cases over each week for the general population.
8. Calculate the R_0 values for each state to compare to the prison systems R_0 values.
    a. This was done to create a baseline for comparison for the rate of infection in the prison systems vs. the rate of infection in the general population of each state.

Chapter 3

State Comparisons of R_0 Values Over Time

To begin, we will discuss the R_0 values for the prison populations of each state compared to the general state population's initial R_0 value. The general state population graphs are in red and the prison population graphs are in blue. Unfortunately, due to many different reasons, the ability for wide scale testing to occur within the prison systems varied greatly depending on the state. This is important because the R_0 values within the prison system are estimated to be significantly higher than seen in Table 1. Despite this limitation, the states with effective reproductive numbers that had less R_0 values in the prisons vs. the general population did not have incredibly large differences. Thus, even with the limited testing within the prisons, the effective reproductive numbers were alarmingly high. This is not surprising, but nonetheless is important to highlight.

3.1 California

The first state under review is California with a total general population of 39.51 million people [23]. The prison data begins the week of March 26, 2020 with a total of one case and concludes with 38,398 cumulative cases by December 29th, 2020. On the other hand, the general state of California had 3,006 cumulative cases on March 26, 2020 and by December 29th, 2020 the state would have a total of 2,187,221 cumulative cases (See Figure 4). The largest initial spike in cases for the prison population occurred during weeks one to four and resulted in an R_0 value of 1.896 (See Figure 5). When comparing this value to that of the general state of California, it is smaller by 0.264. Though this is not a major difference, it is worth pointing out.

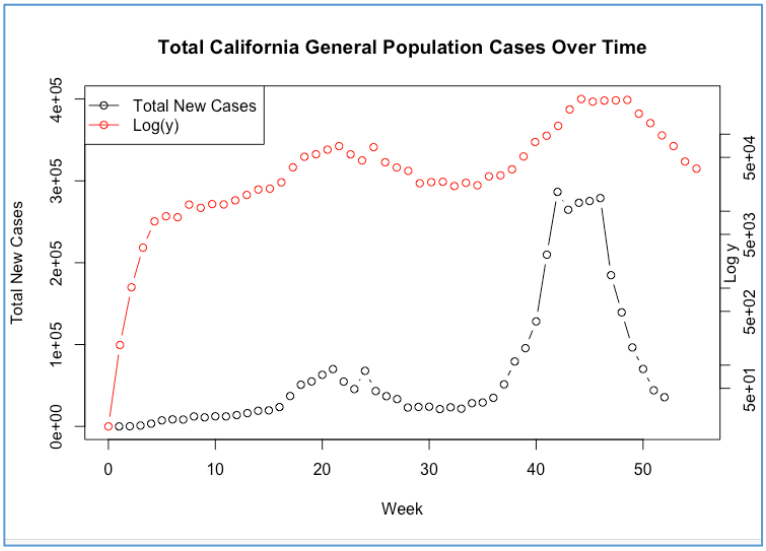


Figure 4 Total California Cases for General Population Graph

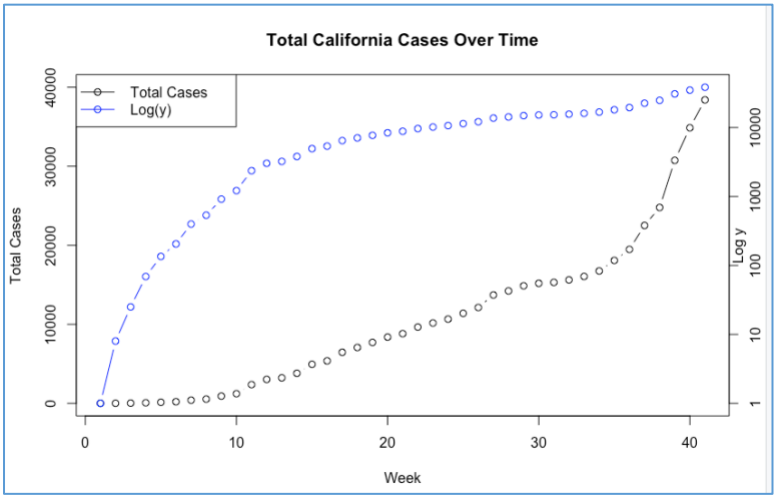


Figure 5 Total California Cases for Prison Population Graph

Figures 6 through 8 represent the portions of the total California prison cases that appeared to follow linear regression. As a result, these periods of time were further analyzed and reported in Table 1. Weeks 1 through 10 saw the biggest spike out of the three graphs. With weeks 11 through 34 and 35 through 41 decreasing significantly to almost exactly 1.0. In the next chapter,

we will dissect whether these drastic decreases in R_0 values occurred due to policy changes within the state.

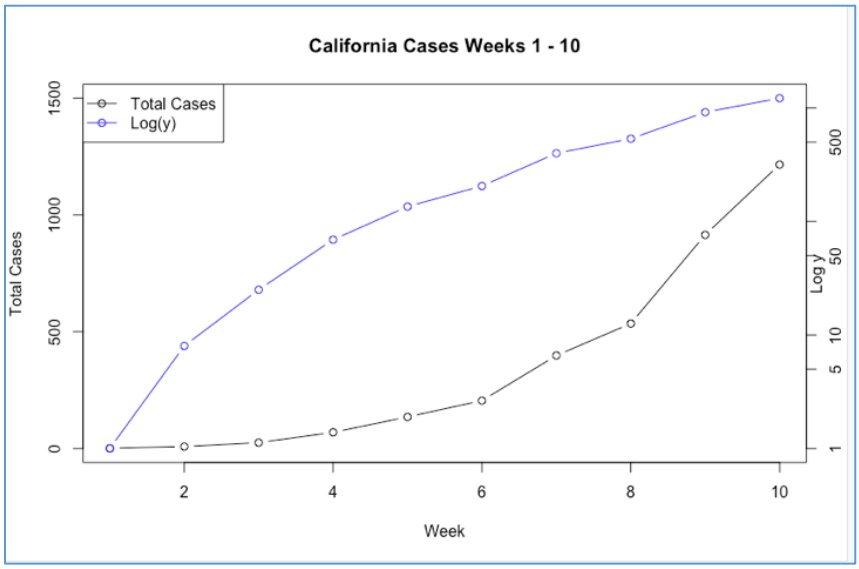


Figure 6 Total California Cases for Prison Population Graph 1

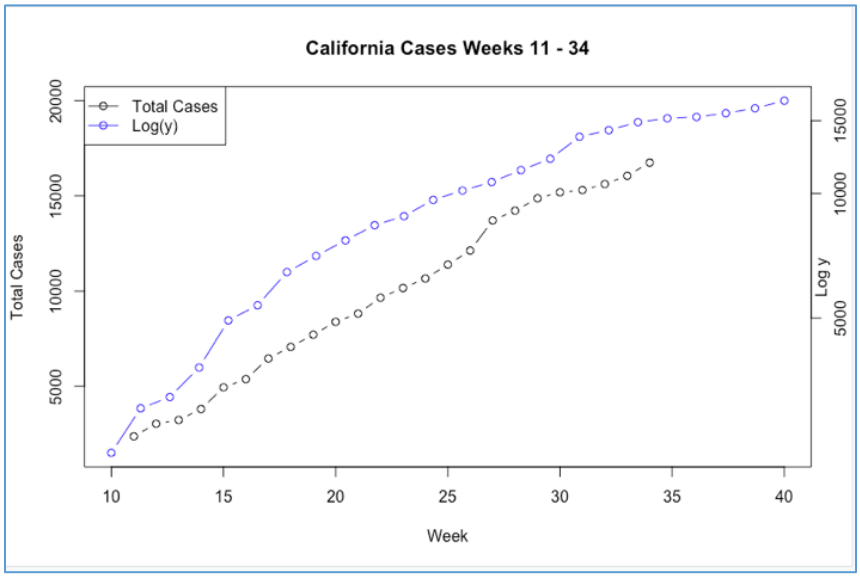


Figure 7 Total California Cases for Prison Population Graph 2

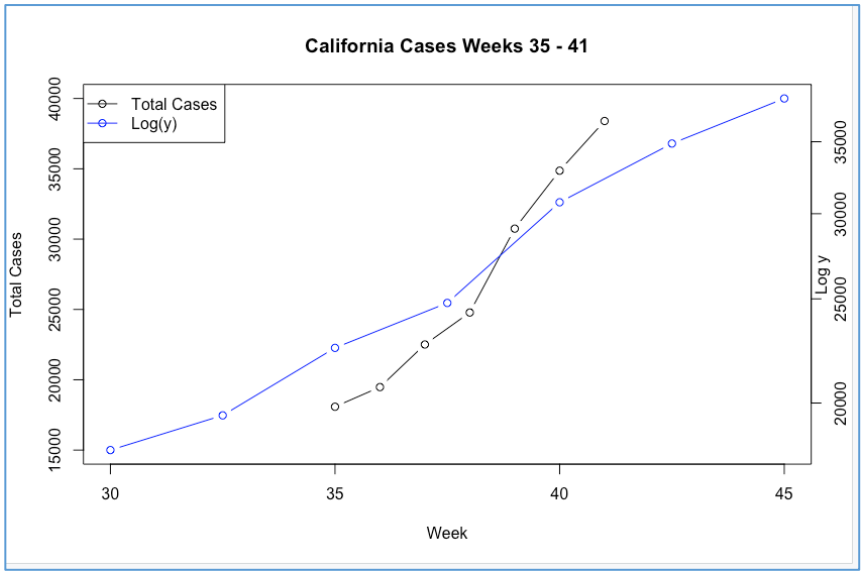


Figure 8 Total California Cases for Prison Population Graph 3

3.2 Texas

The next state that was analyzed was Texas. With a population of 29 million total, Texas is the second largest state in the country [24]. As a result, Texas saw incredibly large numbers of COVID positive individuals, both in the prison system and general population (See Figures 9 and 10). By December 29th, 2020, the prisons saw a total of 28,421 cumulative cases. The initial spike in cases equated to an R_0 value of 2.097. At the same time, the general population experienced 1,715,978 total cases, with an initial R_0 value of 2.12.

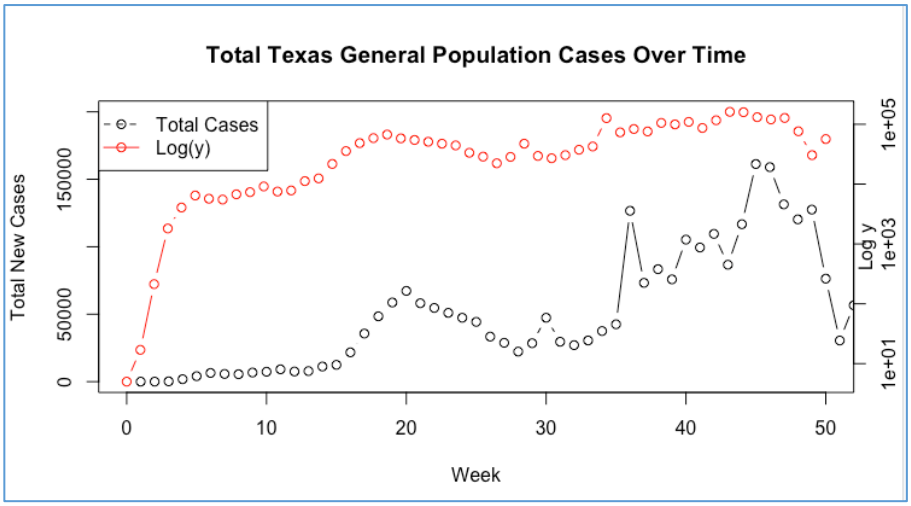


Figure 9 Total Texas Cases for General Population Graph

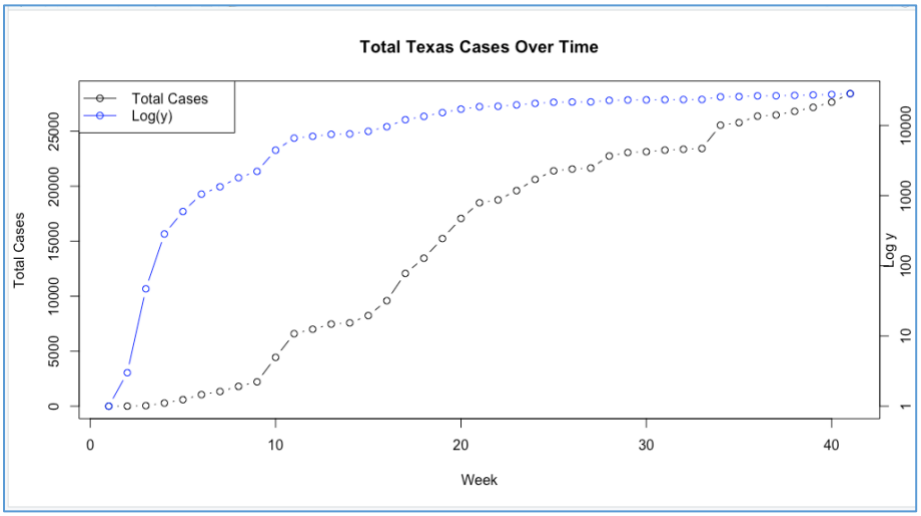


Figure 10 Total Texas Cases for Prison Population Graph

The primary weeks of interest were determined from Figure 10. Weeks 1 through 9 appear to be increasing linearly, as well as 10 through 33 and 34 through 41 (See Figures 11 – 13). Out of these three segments of time, the largest R_0 value occurred during weeks 1 through 9 at a value of 1.538. For the next segment of time, the R_0 value decreased to 1.038. This is a notable decrease and could be linked perhaps to effective policy implementation. However, the value is still greater than 1, meaning that the spread will continue to infect people exponentially if not properly

addressed. For the final weeks, the R_0 value increased a small amount, consequentially ending with a value of 1.07.

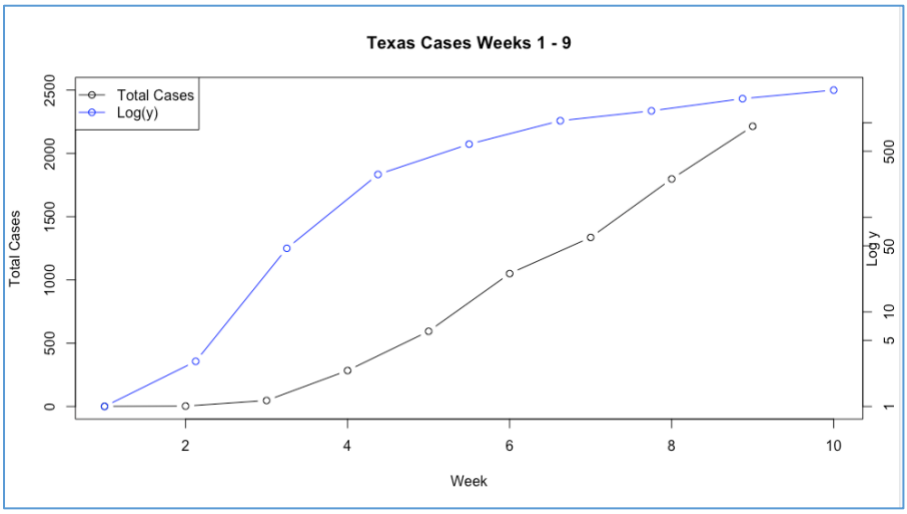


Figure 11 Total Texas Cases for Prison Population Graph 1

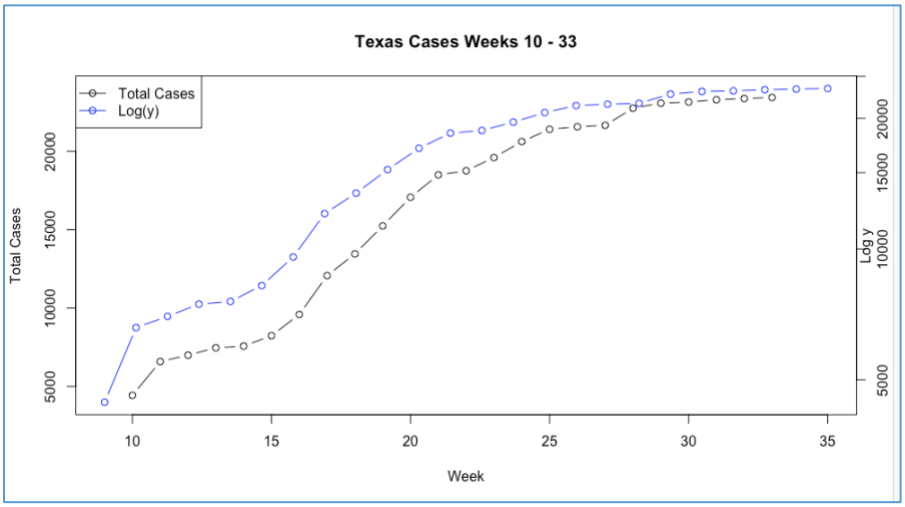


Figure 12 Total Texas Cases for Prison Population Graph 2

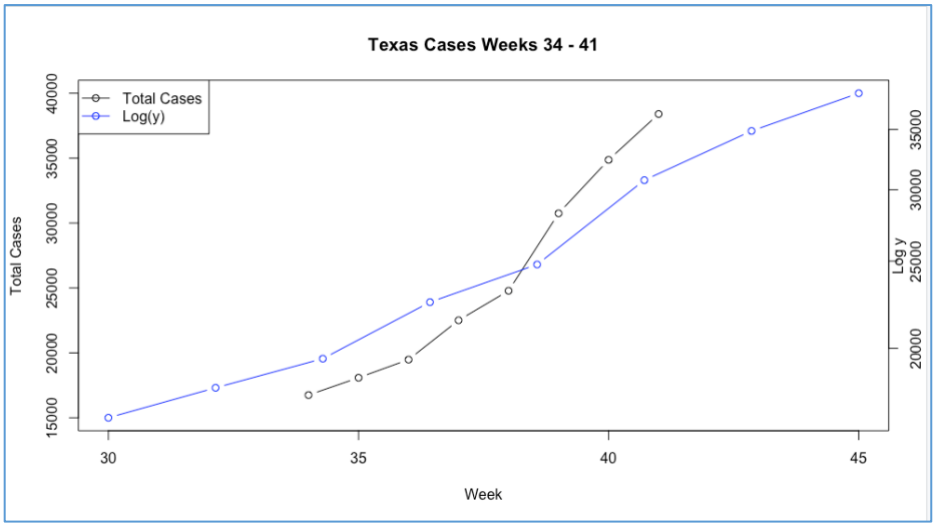


Figure 13 Total Texas Cases for Prison Population Graph 3

3.3 Oregon

The following state under analysis is Oregon. Oregon is substantially smaller than the previous states discussed with a total population of 4.218 million [25]. Oregon was decided upon due to their rigorous efforts to mitigate the spread within their prison system. The first data entry occurred on the week of April 8th, 2020, and reported that the total number of cases within the Oregon prisons was only 3. However, by December 29th, 2020, the total cases had increased to 2,196. This is the smallest increase in cases out of all of the states included in this study. Though this is not a concrete finding to rely on due to the varying state prison populations, it is notable when comparing Arkansas and Oregon who have similar prison populations, but saw drastically different numbers of total prison cases. The data reflects the success of these policies with an initial R_0 value of 1.285. This is substantially lower than other states and proves the necessity of spread mitigation policies, especially early on in the discovery of an outbreak. The general population

also experienced lower rates of infection with an R_0 value of 1.7 (See Figures 14 and 15). This is the second lowest R_0 value for the general populations following Arkansas.

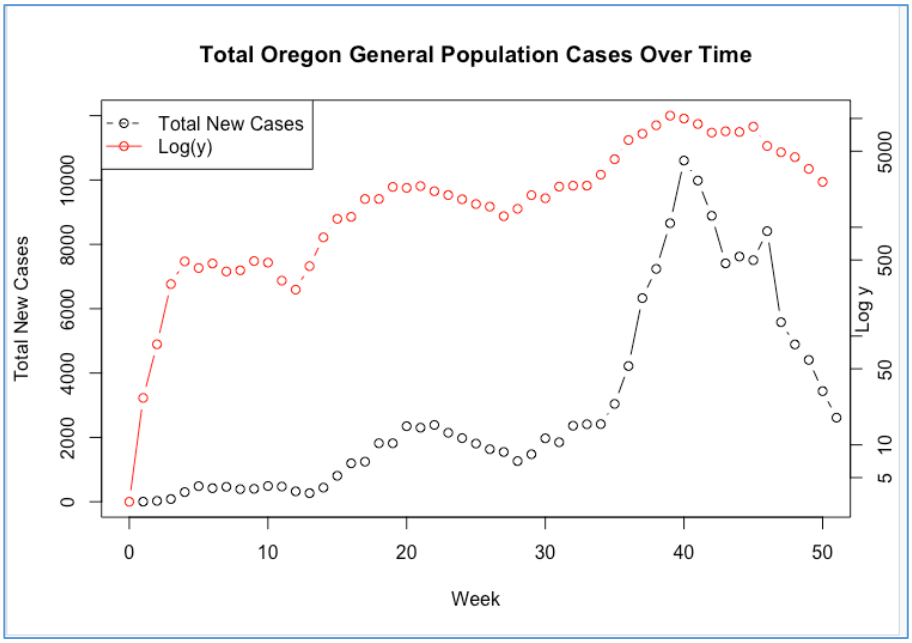


Figure 14 Total Oregon Cases for General Population Graph

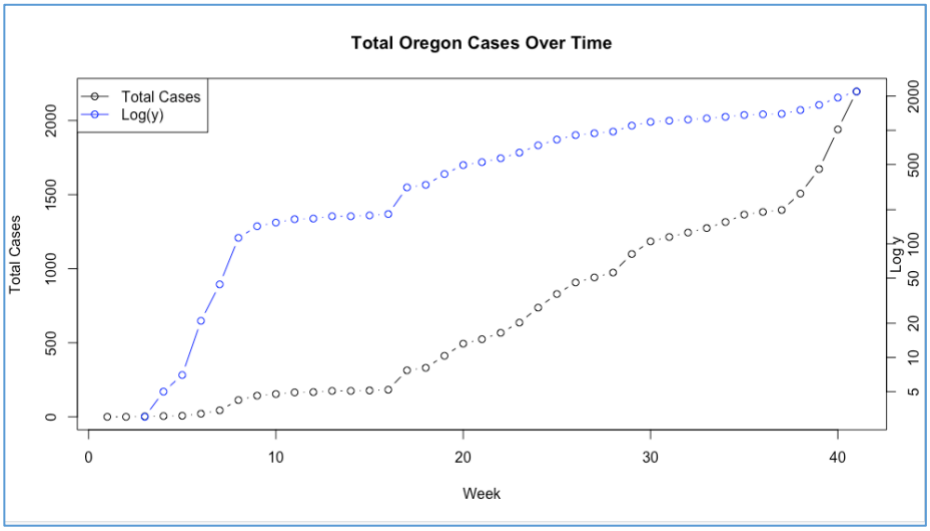


Figure 15 Total Oregon Cases for Prison Population Graph

Similar to the states discussed in sections 3.1 and 3.2, the timeperiods of interest were determined from the total prison population graph. The spread within the prison system was

analyzed over time for weeks 3 through 16, 17 through 36, and 37 through 41 (See Figures 16 – 18). The largest R_0 value occured over the course of weeks 3 through 16 at a rate of 1.197. The spread was then decreased to a rate of 1.044 for weeks 17 through 36 and then proceeded to increase again for the last 5 weeks at a rate of 1.065.

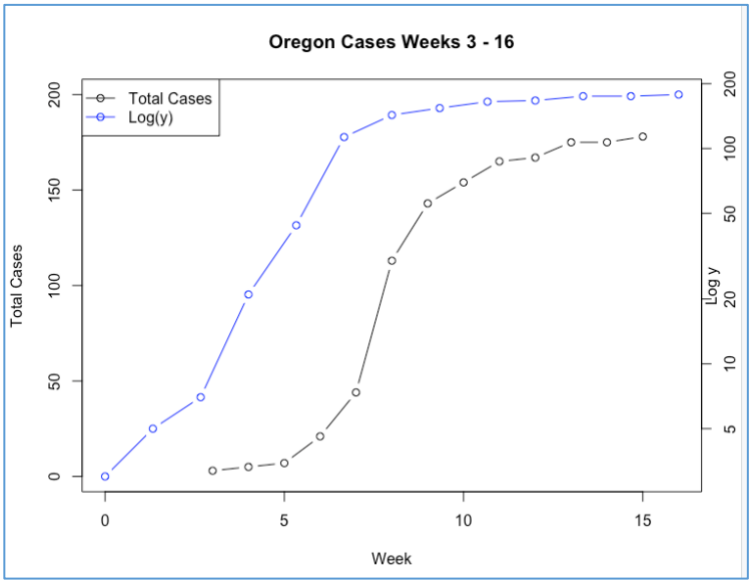


Figure 16 Total Oregon Cases for Prison Population Graph 1

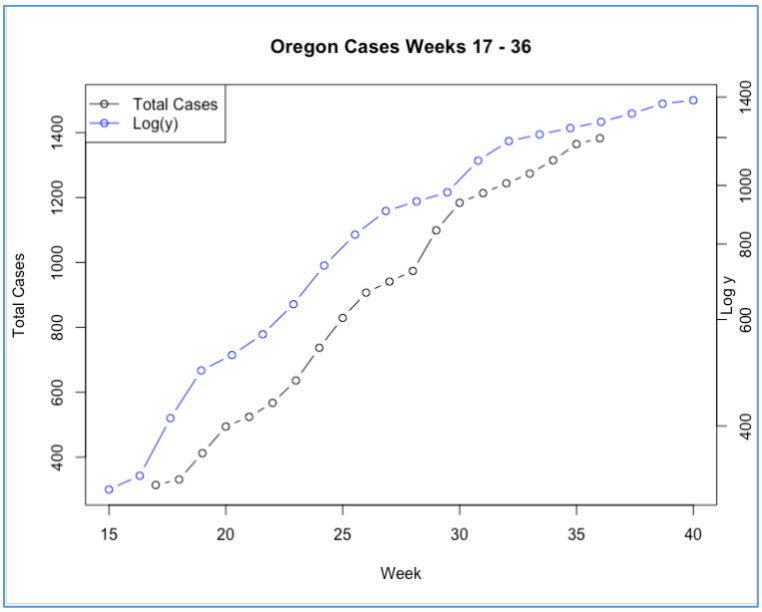


Figure 17 Total Oregon Cases for Prison Population Graph 2

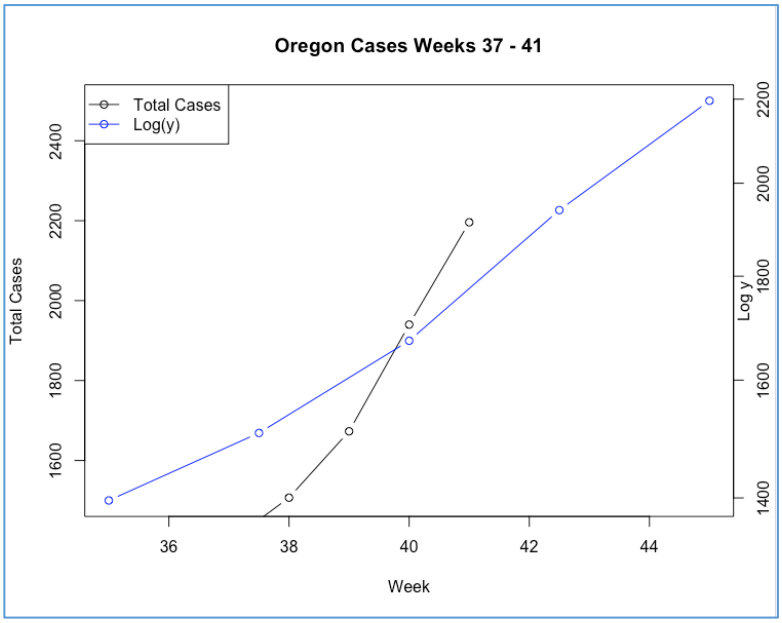


Figure 18 Total Oregon Cases for Prison Population Graph 3

3.4 Ohio

The next state under review is Ohio. Ohio has a total population of 11.69 million people [26]. The first data entry for the state of Ohio's prison cases was for the week of April 8th, 2020. The total cases for this week was equal to 19. By December 29th, 2020, the cases had increased to 8,750 total cases. For the general state population, the total cases by this time in December were 682,570. Ohio is one of the states that had an R_0 value in the prisons that was greater than the general population (See Figures 19 and 20). This is critical in understanding the severity of the spread of the virus within Ohio prisons. The potential reasoning behind why Ohio saw such shattering numbers will be discussed in the following chapter. The R_0 value within the prison system during the initial spike in cases was 2.484, whereas this number was 1.956 for the general population of Ohio. Additionally, Ohio experienced the largest R_0 value for all of the prisons that were reviewed in this study.

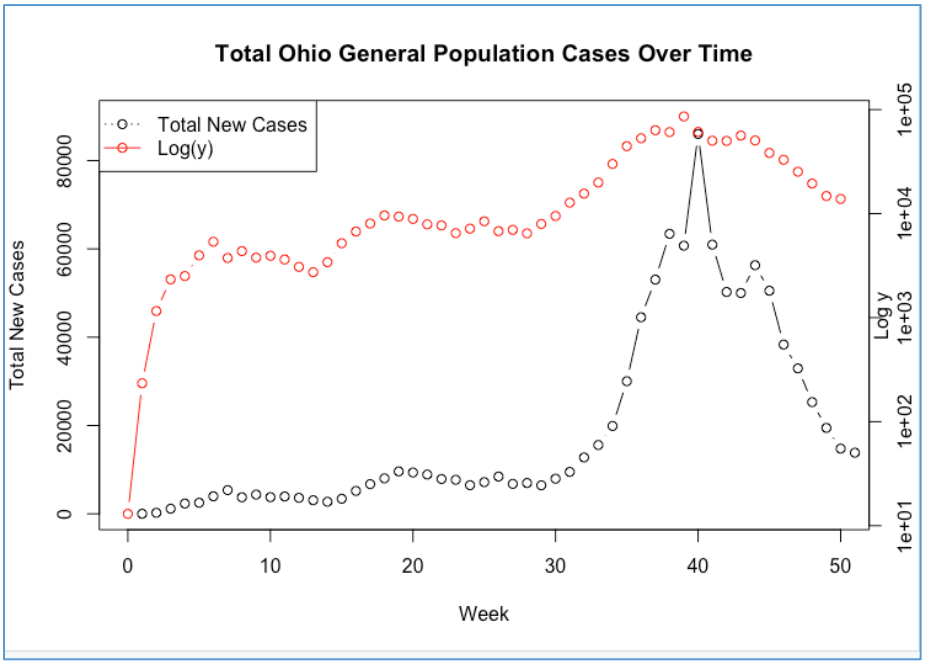


Figure 19 Total Ohio Cases for General Population Graph

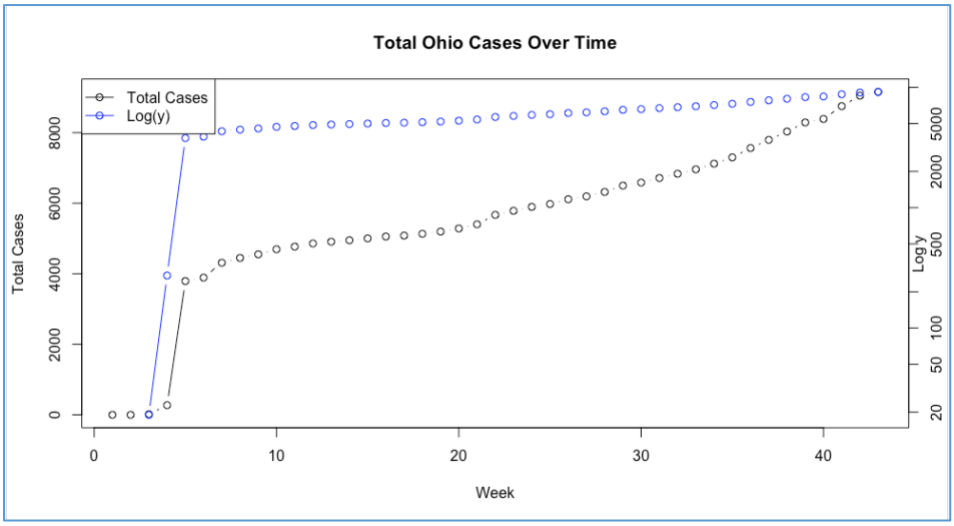


Figure 20 Total Ohio Cases for Prison Population Graph

The graph of the total Ohio cases within the prison system was utilized in order to determine the linear segments of the cases over time. These segments of time included weeks 4 through 5 and 6 through 43 (See Figures 21 and 22). For weeks 5 through 6, the R_0 value was

2.466. For the following weeks, the R_0 value decreased significantly to 1.011. This decrease in cases could be linked to policy implementation or partial herd immunity being reached amongst the prison population. This will be discussed further in the following chapter.

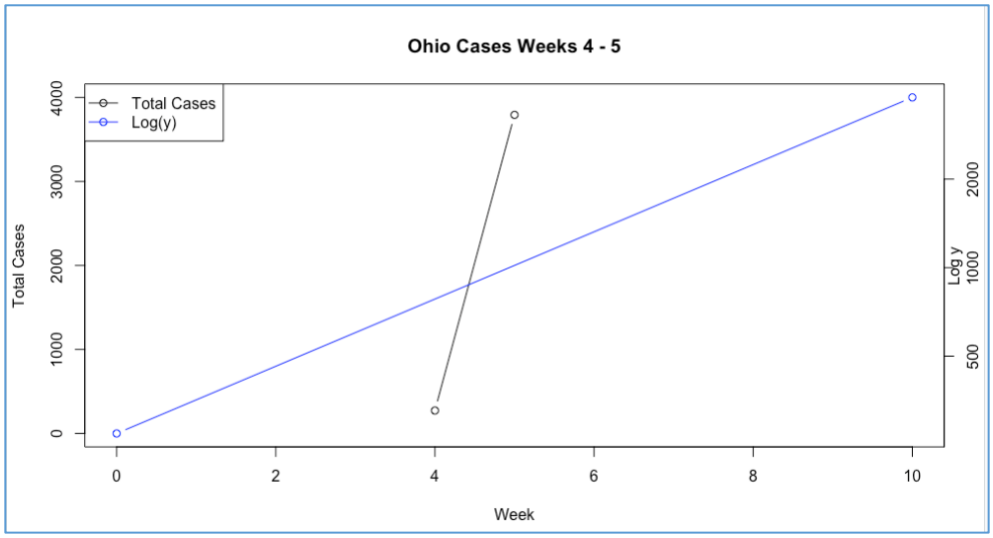


Figure 21 Total Ohio Cases for Prison Population Graph 1

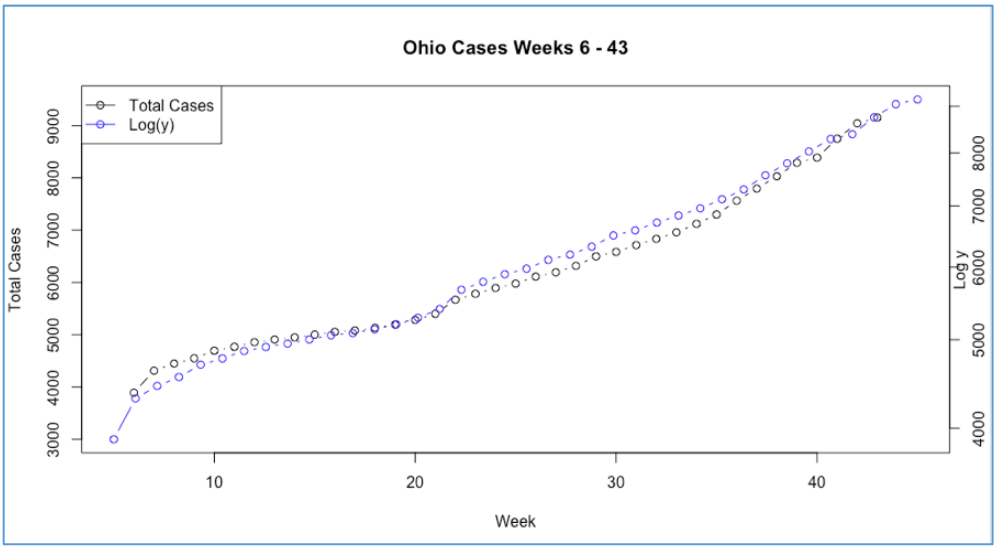


Figure 22 Total Ohio Cases for Prison Population Graph 2

3.5 Michigan

The second to last state under consideration was Michigan. The population of Michigan is close to 10 million people [27]. On March 26th, 2020, the first week of reported data, the total prison cases were 24. By December 29th, 2020, this number had risen to 21,622 inmates. The initial spike in cases for the prison population caused an R_0 value of 1.906 compared to a value of 2.215 for the general population (See Figures 23 and 24). Though these numbers are different, the R_0 value for the prison population is very high—almost two prisoners were infected for every one case in the Michigan prison system at the early phases of the pandemic. It is important to also keep in mind that these alarming numbers were occurring despite the severe underreporting and under testing in these facilities.

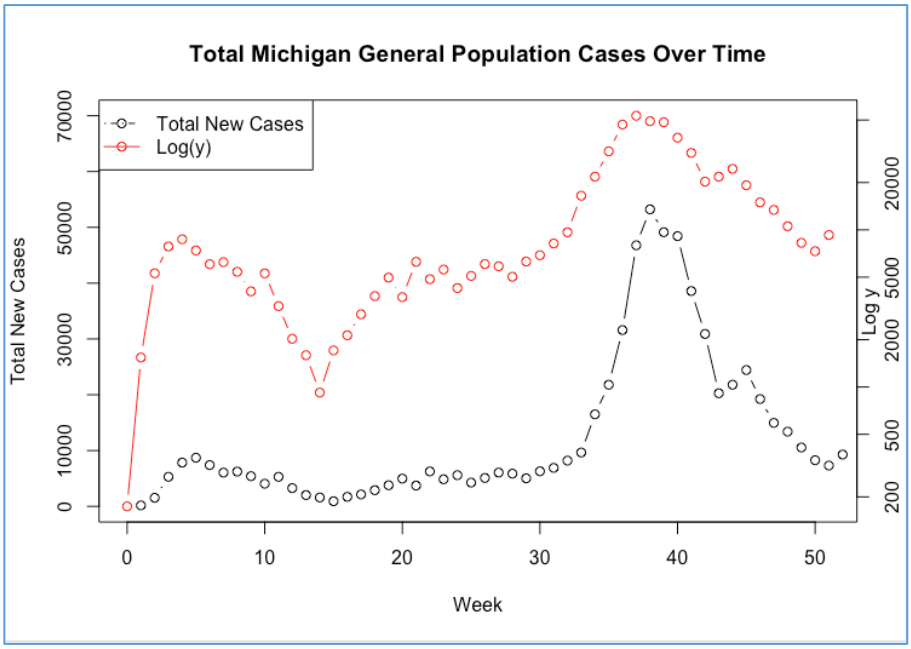


Figure 23 Total Michigan Cases for General Population Graph

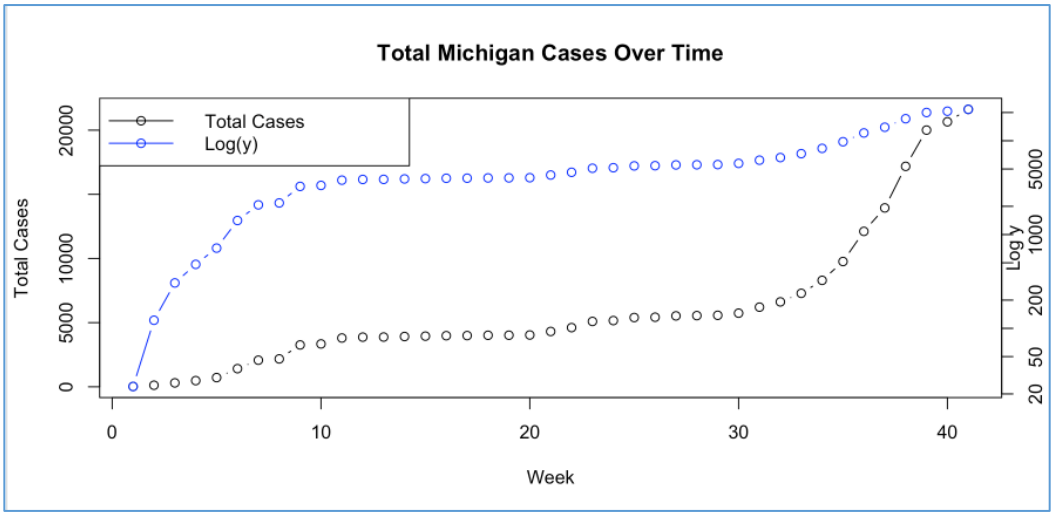


Figure 24 Total Michigan Cases for Prison Population Graph

The total Michigan cases over time graph was utilized to determine the linear portions of the graph to include for further analysis. These linear portions were weeks 1 through 8, 9 through 35, and 36 through 41 (See Figures 25 – 27). The R_0 values were as follows, 1.336 for the first eight weeks, 1.018 for the next several weeks, and 1.067 for the final 6 weeks. This is a rather steady decline in rate of infection over time which is a positive sign.

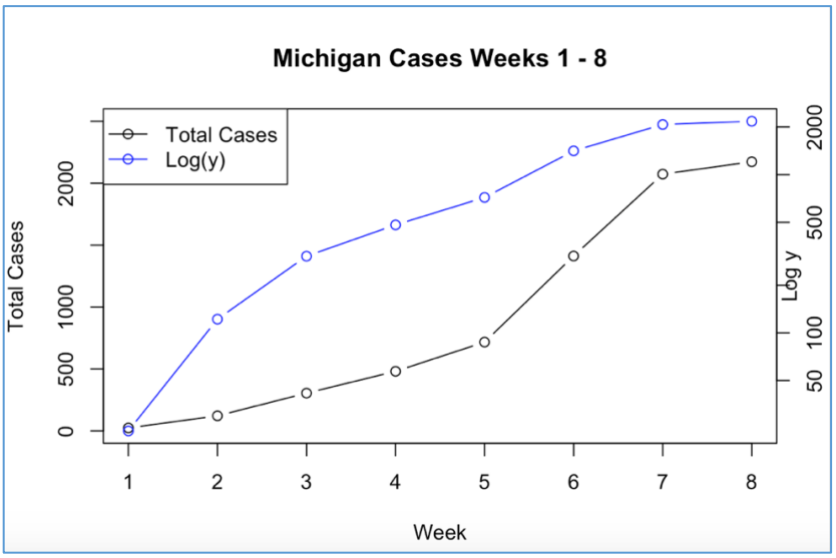


Figure 25 Total Michigan Cases for Prison Population Graph 1

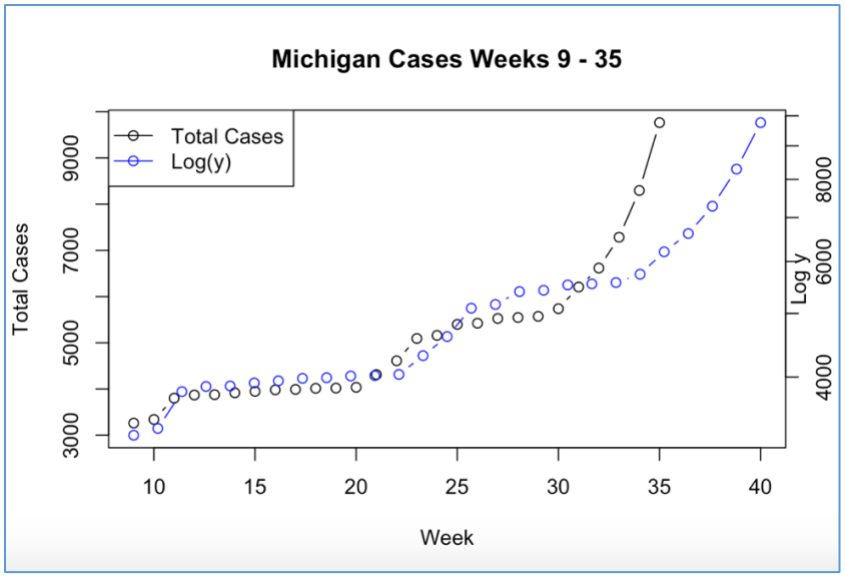


Figure 26 Total Michigan Cases for Prison Population Graph 2

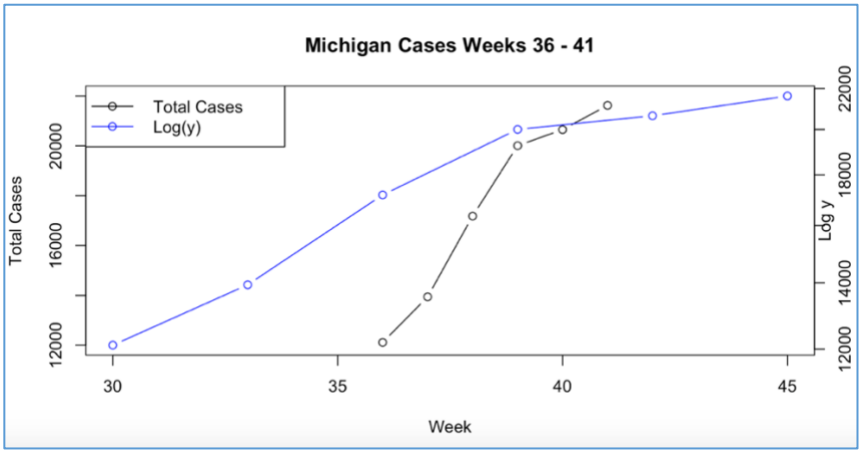


Figure 27 Total Michigan Cases for Prison Population Graph 3

3.6 Arkansas

The final state under consideration is Arkansas. Arkansas has a total population of 3.018 million [28]. Arkansas was chosen for analysis because of the incredibly high number of infections that occurred in their prison system. These quantities were much greater than the general

population experienced, highlighting their ineffective approach to mitigating the spread. The first data input for the dataset was on April 14th, 2020, which had a total number of cases equal to 61 inmates. By December 29th, 2020 this number had increased to 10,579 inmates. This is an incredibly high number of cases considering that the total prison population is only 16,070 prisoners [29]. The general population had an initial spike leading to an R_0 value of 1.553. This was significantly lower than the prison population's initial rate of 2.383 (See Figures 28 and 29).

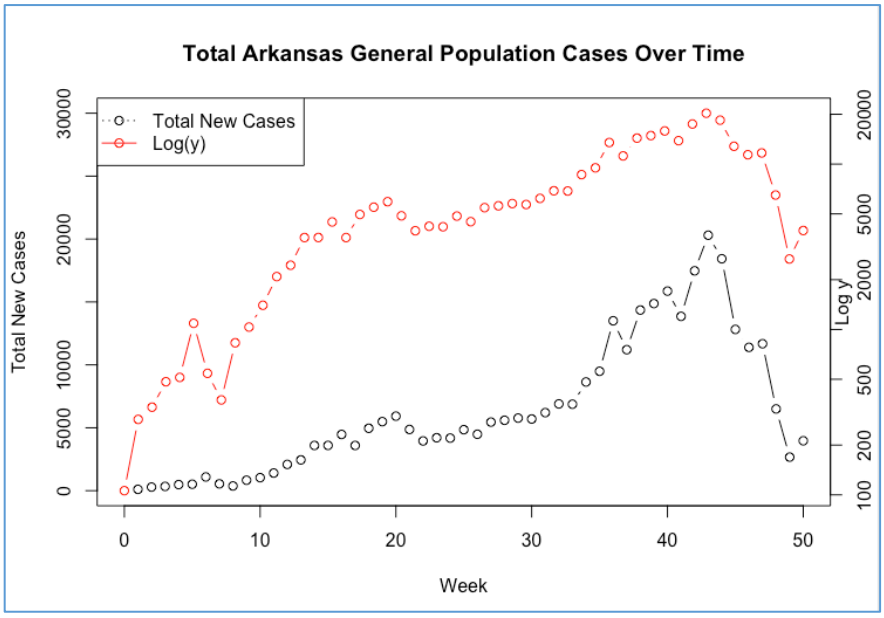


Figure 28 Total Arkansas Cases for General Population Graph

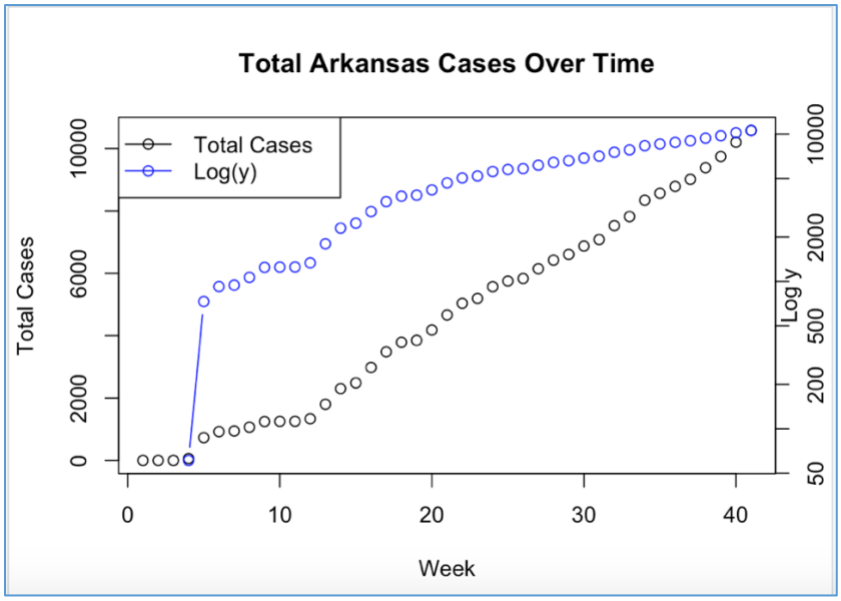


Figure 29 Total Arkansas Cases for Prison Population Graph

The graph of total Arkansas prisoner cases was used to determine the linear portions of infection over time. These portions of linear growth occurred over weeks 1 through 5 and 6 through 41 (See Figures 29 and 30). The R_0 value for weeks 6 through 41 was 1.039 which is a noteworthy decrease in the initial rate of infections over the first five weeks. However, once again this value is greater than 1 meaning that the incarcerated people still experienced exponential rates of infection within the prison system.

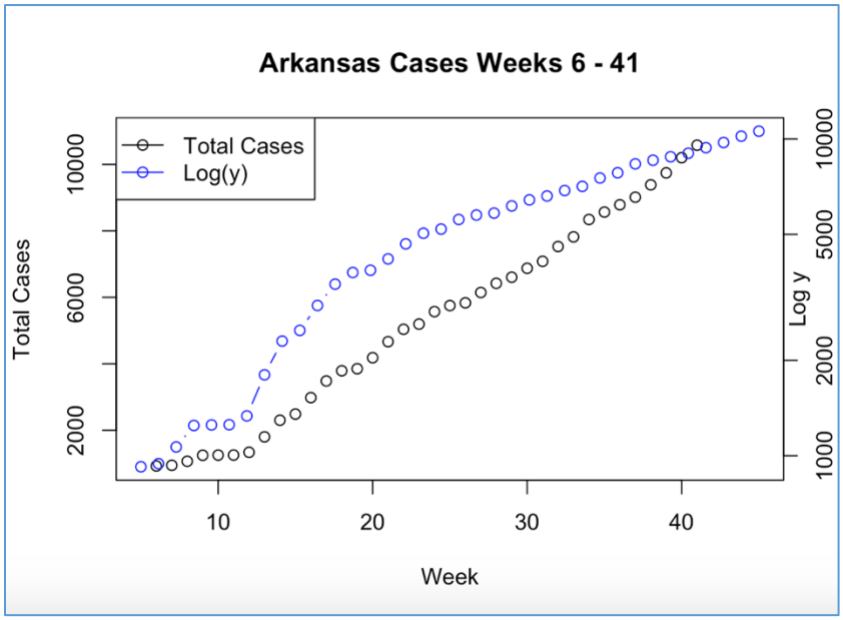


Figure 30 Total Arkansas Cases for Prison Population Graph 1

3.7 U.S. State Comparisons

It is clear from the previous sections that each state had varying levels of infection within both their general and prison populations. Table 1 expresses the R_0 values over time across the 6 states, separating each into the linear and initial portion of infection. The order of initial R_0 values within the prison system from smallest to largest is as follows—Oregon, California, Michigan, Texas, Arkansas, and Ohio. However, the order of initial R_0 values within the general population from smallest to largest is as follows—Arkansas, Oregon, Ohio, Texas, California, and Michigan (See Table 2). This is assumed to be different for many reasons including, but not limited to, testing capacities, statewide mask mandates and shutdowns, and less dense populations of people. Additionally, it is worth mentioning again that some states may have had greater rates of infection within their prisons, but due to limited testing, as well as limited reporting done by the prisons, the number of reported infected individuals is severely limited. Regardless of these limitations, the

infection rate inside the prisons closely matches that of the general state populations, meaning that with adequate testing it is estimated that the rate of infection is much larger.

A common trend throughout all of the 6 states is that there was a general reduction in R_0 values as time went on. This could be for various reasons, one of which is the creation of policies to mitigate the spread of the virus within the facilities. These policies will be discussed in the next chapter.

Table 1. R_0 Values for each State's Prison Population with Varying Timelines

State	R0	Weeks	Average
CA	1.399	1 - 10	
CA	1.045	11 - 34	
CA	1.074	35 - 41	
CA	1.896	Weeks < 4	AVG = 1.354
TX	1.538	1 - 9	
TX	1.038	10 - 33	
TX	1.07	34 - 41	
TX	2.097	Weeks < 5	AVG=1.436
OR	1.197	3 - 16	
OR	1.044	17 - 36	
OR	1.065	37 - 41	
OR	1.285	Weeks < 5	AVG= 1.148
OH	2.466	4 - 5	
OH	1.011	6 - 43	
OH	2.484	Weeks < 5	AVG=1.987
MI	1.336	1 - 8	
MI	1.018	9 - 35	
MI	1.067	36 - 41	
MI	1.906	Weeks < 3	AVG = 1.332
AR	1.039	6 - 41	
AR	2.383	Weeks < 6	AVG = 1.711

Table 2. R_0 Value for each State's General Population with Varying Timelines

State	R0	Weeks	Less than Prison R0?
CA	2.160	Weeks < 4	No
TX	2.120	Weeks < 5	~Equal
OR	1.70	Weeks < 6	No
OH	1.956	Weeks < 5	Yes
MI	2.215	Weeks < 3	No
AR	1.553	Weeks < 6	Yes

When comparing the rate of infection within each states prison system versus their general population, it is evident that each state saw varying levels of infections within the two settings. Out of all of the states, the state with the highest R_0 for the general population is Michigan, whereas, the state with the lowest R_0 for the general population is Arkansas. The states that had greater rates of infection inside their prison systems compared to their general population were Ohio and Arkansas, with Texas having an R_0 value practically equal for both. Ohio will be a focal point throughout the next chapter, along with Oregon who had low levels of infection throughout 2020. It is necessary to compare the difference in policies that all 6 states took to have drastically different outcomes in their infection rates in order to better understand the best policies to enact moving forward.

Chapter 4

The Impact of Policy Responses to COVID-19 across U.S. States

4.1 General U.S. Prison Response Timeline

Through the analysis conducted and evidence provided in chapter 3, it is apparent that there is an extreme difference in the effective reproductive number across the various prison systems. In order to understand the meaning behind these differences in total COVID-19 cases, it is important to deconstruct the policies enforced throughout the months of March to December 2020. By gaining a greater understanding of the action taken by each state, one can better reflect upon the policies that made a positive or negative impact on the total number of infected individuals over the last year.

First, we will start with the general timeline of policies throughout the country that many states took in order to combat the spread of the Coronavirus. The primary concern for prisons is the overcrowding prevalent in many facilities. Thus, many states took to de-incarceration efforts to limit the overcrowding commonly seen before the pandemic. According to the Marshall Project and the Associated Press, between the months of March and June 2020, over 100,000 incarcerated people were released from prisons and jails [30]. This number is close to a reduction in ten percent of the total incarcerated population in the country. Additionally, on April 6th, a memo sent to federal prosecutors by Attorney General Barr pressed them to consider the need for reducing the number of prisoners in their custody when considering bail decisions. At this same time, starting April 1st, 2020, the Federal Bureau of Prisons enforced a two-week quarantine for all people

incarcerated. This quarantine required all incarcerated individuals to remain within their cells [31]. Though this effort was progressive in thought, the actual implementation proved challenging.

By early April 2020, the CDC recommended that all individuals who leave their house should wear masks [32]. This announcement came as an attempt to limit the ability for people who may not know that they are carriers to spread the virus within their community. As it was stated earlier in the introduction, though mask wearing became commonplace across the world, this was not the case within various prison systems in the United States. In fact, out of all of the states of interest in this study, the state with the latest announcement that they would provide masks to staff and inmates was Ohio. Ohio was also the only state out of the 6 (as of August 24th, 2020) that had not yet made an announcement mandating masks being required for both staff and incarcerated people [33]. This single act could have had an incredibly negative impact on Ohio's prison system's R_0 value. Moreover, this solitary mask policy could have had an influence on why Ohio had the largest R_0 value out of the 6 included in this study.

By Summer 2020, additional efforts were implemented to allow incarcerated individuals to apply for home confinement. In California, the US District Court Judge ruled that medically vulnerable individuals should be transferred from a California prison complex to home confinement. This was a result of an influx in Coronavirus cases in the prison system that led to the death of four incarcerated people and infected an additional 1,000. Unfortunately, out of the over 700,000 federal prisoners that applied to be released early, as of October of 2020, only 156 were approved. Despite the efforts to de-incarcerate federal facilities, those in power continued in their traditional ways and denied to set incarcerated individuals free, jeopardizing the health of incarcerated people and outside communities [31].

The Prison Policy Initiative collected data in December of 2020 to determine the severity of crowding in prisons after large strides were taken towards de-incarceration by various states. Though states like California made efforts to release incarcerated individuals earlier than their original sentences, they still have alarming rates of capacity—based on the lowest reported capacity, the state of California is operating at 110% capacity. Similarly, the other four states are operating at worrisome capacities—Arkansas (103%), Texas (101%), Oregon (95%), and Michigan (94%). Unfortunately, Ohio did not report capacity data to the Bureau of Justice Statistics [34]. These findings parallel the R_0 values seen in Chapter 3, with Arkansas surpassing a capacity of 100% and having the second highest R_0 value out of all of the other states. The danger of correctional facilities operating at such high capacities has been proven to lead to greater risks of infection and death due to COVID-19. In fact, research done around the Texas state prison system reflected that facility capacities should be reduced to at least 85% in order to minimize the risks of the spread of COVID-19 [35].

Several senators including Senator Elizabeth Warren and Senator Richard Durbin pushed for improvement in the treatment of incarcerated people throughout the pandemic. Their asks included requiring weekly testing in federal prisons and lessening the reliance on solitary confinement as quarantine rather than allowing for compassionate release. Senator Warren also released an op-ed urging for additional data collection and transparency related to the spread of the virus in prisons across the U.S. [31].

In the winter months of 2020, the virus did not slow down and it continued to spread across prison populations. In fact, in December, out of the 50 men on death row at a federal penitentiary in Indiana, 14 had tested positive for the virus simultaneously. This negative attention to the facility caused great public outcry and led to their lawyers to call for the postponement of their death [31].

Many prisons experienced outbreaks with terrifying rates of infection similar to that of the federal penitentiary in Indiana leading to calls for institutional change across the U.S. prison system.

4.2 Stakeholder Analysis and Support

In June of 2020, the Prison Policy Initiative conducted a comprehensive analysis comparing states for their approaches to mitigating the spread of the virus within their prisons (See Figure 31). This analysis focused on several metrics that they believed to be crucial in the fight against the Coronavirus. These metrics included states providing adequate testing and personal protective equipment (PPE) to staff and incarcerated people, de-incarceration efforts, governor-issued executive orders to accelerate the release of high-risk populations and those nearing the end of their sentence, and lastly, transparency related to state-level COVID-19 data and efforts to mitigate the spread. Out of the 6 states of interest, Ohio scored the lowest, on the other hand, Michigan scored the highest with Oregon closely behind. This parallels our findings with regards to Ohio, however, it was surprising to find Michigan score higher than California. This had to do with Michigan receiving many points for executive orders that encourage the early release of certain incarcerated individuals. Oregon also received several points for their efforts to de-incarcerate their prison population [36].

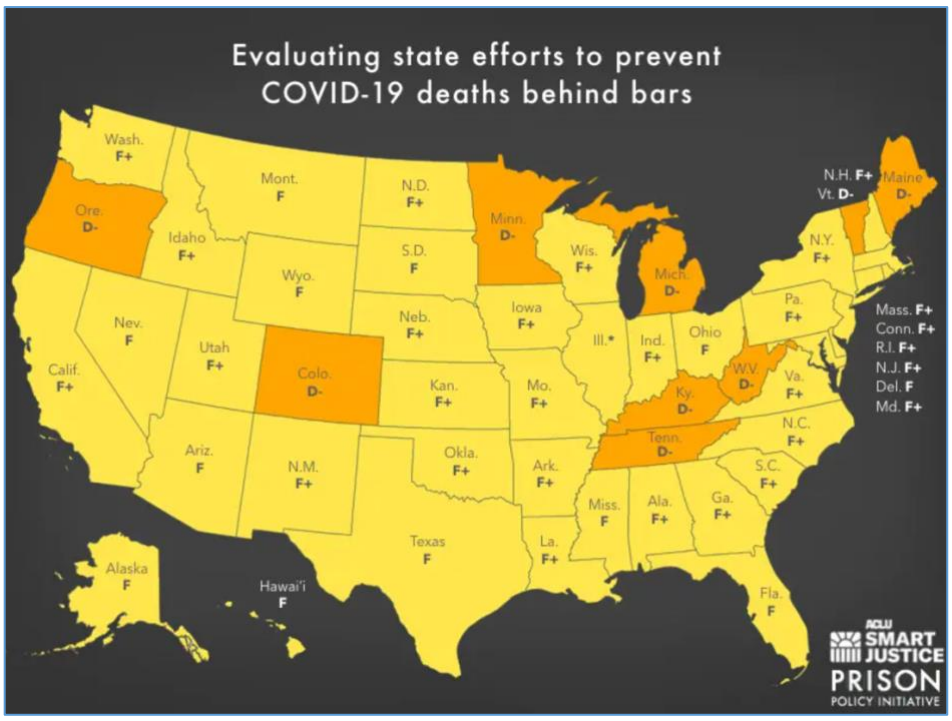


Figure 31 Prison Policy Initiative COVID-19 State Analysis (Source: ACLU & Prison Policy Initiative)

The Center for Disease Control and Prevention (CDC) released an interim guide on managing COVID-19 in correctional and detention facilities. The guide continues to be updated as new information is published regarding the transmission of the virus. The guide is organized into three sections (Operational Preparedness, Prevention, and Management of COVID-19) [37]. Operational preparedness focuses on the need for administrators to plan in an effort to best prepare for reducing the spread of the virus within their facilities. The first area of concern within the section of preparedness relates to communication and coordination. This includes developing relationships with health departments and other correctional facilities who can best advise and direct the facilities on how to hinder outbreaks from occurring. This section also includes becoming informed on existing influenza, other hazards, and COVID-19 plans. Lastly, the CDC urges administrators to consider alternative options to incarceration in order to prevent overcrowding. This includes diverting new incarcerated individuals and utilizing alternate options

to incarceration. The second area of concern within the section of preparedness is personnel practices such as sick leave, remote work options, and planning for staff absences. The last area of focus within the section of preparedness relates to operations, supplies, and PPE preparations. This includes providing medical supplies, tissues, soap, face masks, hand sanitizer, etc. at low or no cost to incarcerated individuals.

The next section within the guide is geared towards prevention. This is a comprehensive section that covers many areas where prevention may be possible within the prisons. The first major area within this section is operations. The CDC recommends limiting transferring incarcerated people to other facilities unless it is for medical needs or to reduce overcrowding. Additionally, they recommend suspending co-pays for incarcerated people receiving medical care. The second pivotal area surrounds the cleaning and disinfecting of the facilities, as well as adequate testing measures. This section also covers social distancing measures throughout the prisons. The CDC recommends implementing social distancing measures throughout common areas, recreation, meals, group activities, housing, work assignments, and medical treatments However, it was shocking to find that the CDC allows for critical infrastructure workers such as correctional officers, law enforcement officers, and healthcare staff to continue working following exposure to COVID-19. This policy is contingent on them remaining asymptomatic and that additional measures are put into place for them to protect everyone. This allowance in workers to return to work after potential exposure with the virus puts the lives of incarcerated people and the greater community at risk. If it is recommended that general members of the community remain at home who have been exposed, this recommendation should also be upheld for those working within the correctional setting.

The last section within the guide is aimed at management. This section focuses specifically on strategies to handle individuals who are suspected to be COVID positive. The major areas include ensuring logistically that hygiene supplies and disinfecting practices are occurring regularly and reliably. This section also includes how to manage incarcerated individuals who are symptomatic or confirmed to have COVID-19. Many of the CDC's recommendations are contingent on having extra space for quarantine which is challenging when these facilities are operating close to or above capacity. For example, the CDC recommends ensuring the medical isolation of these individuals is different from solitary confinement in an effort to reduce the number of individuals who are hesitant to self-isolate. However, if the prisons are overwhelmed by an outbreak and simply trying to separate individuals who are suspected of having COVID, will they have the bandwidth and physical space to be able to actually carry this out? The answer is most likely no, which will translate into a lower number of inmates who opt into quarantining, ultimately increasing the chances of a greater R_0.

Though the CDC offered valuable recommendations for the prison systems to utilize, it is clear from our research that all of the 6 states did not take the necessary precautions to allow for these policies to come to fruition. There are many factors that contributed to these facilities being unable to effectively minimize the spread of the virus including a lack of resources, limited staff members caring or being knowledgeable about the virus, and above all, limited enforcement of such policies by the federal government.

4.3 Policies Enacted by Oregon and Ohio

Due to the fact that Oregon saw the lowest rate of infections within their prison system, we will dissect the various policies that they enacted that may have contributed positively to limiting the spread. Outside of the pandemic, the state of Oregon has been known to be progressive in their incarceration efforts. An example of this is their supportive housing program that works to support those transitioning to life post-incarceration while still under active supervision. With housing being particularly expensive in Oregon, recidivism is a direct result of an inability to afford housing. Thus, this program works to support those at a high-risk of reoffending. In response to the COVID-19 pandemic, the program provided 10 of their newly built tiny homes to support incarcerated individuals who had tested positive for the virus or were released early under the Governor's order. Another risk-mitigation tool was the use of virtual platforms to minimize any non-essential face to face interactions with prison staff [38].

Oregon took drastic steps to reducing their prison population. The criteria for commutation established on December 2nd, 2020 by Governor Kate Brown focused on two groups—those who were medically vulnerable or had projected release dates within 6 months. The early release was contingent upon those incarcerated having a suitable housing plan, not presenting an unacceptable safety, security, or compliance risk to the community, had a record of good conduct for the last 12 months, among many other criteria [39]. Oregon also provides thorough updates regarding the policies in place to mitigate the spread of the virus across their various facilities. They have provided these reports to the public since the start of the pandemic in March of 2020. An example of these updates can be seen in Figure 32 which was the first update that the Department of Corrections released on March 12, 2020.

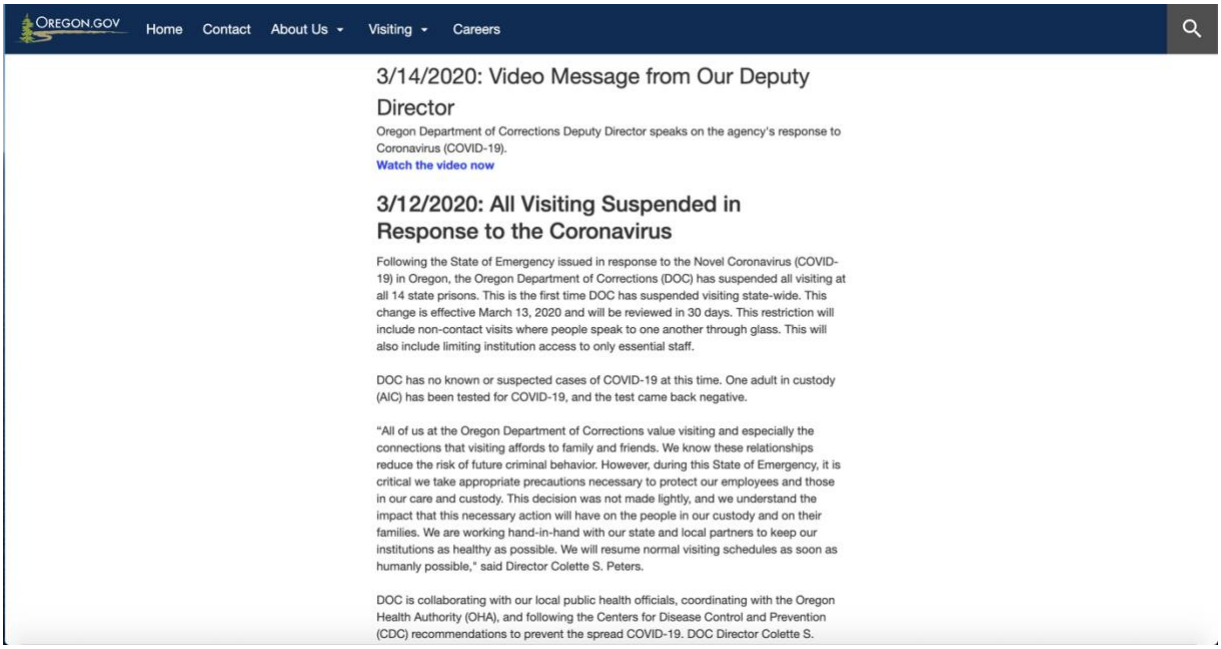
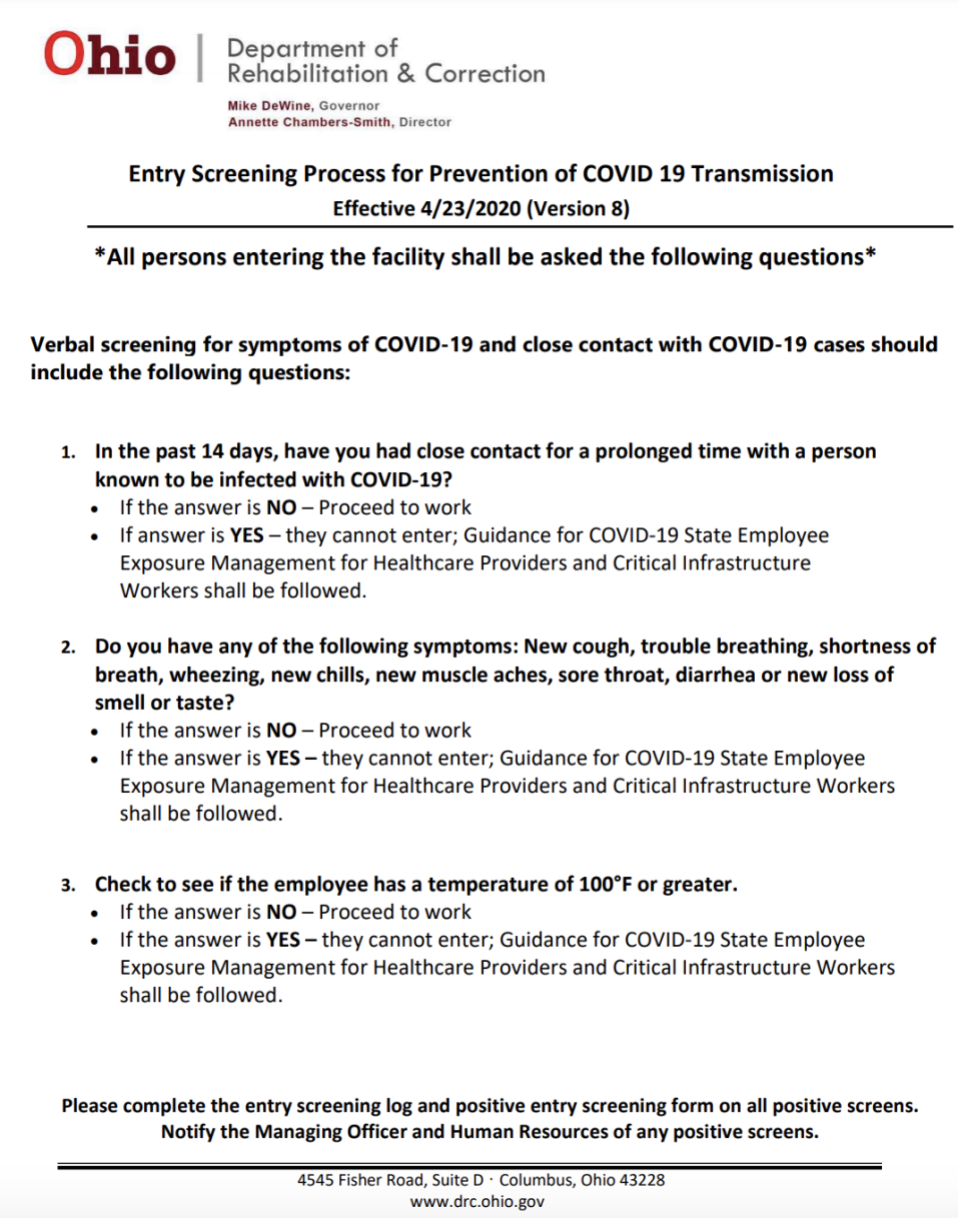


Figure 32 Oregon COVID-19 Updates (Source: Oregon.gov)

When comparing the Oregon state webpages dedicated to COVID-19 information to that of other states, like Ohio, it is clear that Oregon Department of Corrections is far more committed to transparency surrounding the state of the virus within their facilities than other agencies. Ohio, the state with the highest R_0 value out of the 6 analyzed, has incredibly little information regarding the policies in place to address the spread of COVID-19 within their prisons. Besides having a one-page document that identifies the total tests administered to inmates which is updated regularly and an additional screening document used for those entering the prisons, there is little information provided concerning what exactly each facility is doing outside of their normal operations to protect those incarcerated (See Figure 33) [40]. As a result, it is difficult to analyze the policies that are leading to such devastating rates of infection across their correctional facilities. Regardless of the limited information provided to the public, it is clear that there has been inadequate action

taken by the Ohio authorities. This was especially clear by May 27, 2020 when all 28 of their facilities were under quarantine due to high rates of COVID-19 [41].



Ohio | Department of Rehabilitation & Correction

Mike DeWine, Governor
Annette Chambers-Smith, Director

Entry Screening Process for Prevention of COVID 19 Transmission

Effective 4/23/2020 (Version 8)

All persons entering the facility shall be asked the following questions

Verbal screening for symptoms of COVID-19 and close contact with COVID-19 cases should include the following questions:

1. **In the past 14 days, have you had close contact for a prolonged time with a person known to be infected with COVID-19?**
   - If the answer is **NO** – Proceed to work
   - If answer is **YES** – they cannot enter; Guidance for COVID-19 State Employee Exposure Management for Healthcare Providers and Critical Infrastructure Workers shall be followed.
2. **Do you have any of the following symptoms: New cough, trouble breathing, shortness of breath, wheezing, new chills, new muscle aches, sore throat, diarrhea or new loss of smell or taste?**
   - If the answer is **NO** – Proceed to work
   - If the answer is **YES –** they cannot enter; Guidance for COVID-19 State Employee Exposure Management for Healthcare Providers and Critical Infrastructure Workers shall be followed.
3. **Check to see if the employee has a temperature of 100°F or greater.**
   - If the answer is **NO** – Proceed to work
   - If the answer is **YES –** they cannot enter; Guidance for COVID-19 State Employee Exposure Management for Healthcare Providers and Critical Infrastructure Workers shall be followed.

Please complete the entry screening log and positive entry screening form on all positive screens. Notify the Managing Officer and Human Resources of any positive screens.

4545 Fisher Road, Suite D · Columbus, Ohio 43228
www.drc.ohio.gov

Figure 33 Ohio Prison Screening Document (Source: drc.ohio.gov)

The ACLU of Ohio has been a major advocate for those incarcerated throughout the pandemic. They called upon the Ohio Department of Rehabilitation and Correction (ODRC) on

March 24th, 2020 to release a daily report of the COVID-19 situation across Ohio facilities. Soon after, the ODRC committed to a regular release of testing statistics and the overall positivity rate within their facilities. In addition to the calls for such government transparency, in early April 2020, the ACLU sent several requests for a release of the policies in place to mitigate the spread within the facilities. Despite these requests, as of December 2020, they had yet to receive a response from the Governor's office directly. Over the entire course of 2020, the ACLU advocated directly to the Governor's office for policy implementation to reduce the effects of the virus across incarcerated populations. This included calls for the de-incarceration of Ohio inmates to which the Governor did eventually resort. In fact, over the course of March to November 2020, the state of Ohio released over 4,000 people. Though this may seem like a substantial reduction, the state is still operating greatly over capacity with over 44,000 people incarcerated in a system designed to hold 38,000 [41]. This information alone points to why Ohio experienced such large rates of infection despite de-incarceration efforts.

4.4 Vaccine Distribution

Looking ahead, in order to gain herd immunity, widespread distribution amongst prison populations is a necessity. Despite being incredibly important in the fight against the COVID-19 pandemic, many states have differed in their approach to distributing the vaccine to those incarcerated. Below is the vaccine response by the 6 states of interest [31]:

- Arkansas (as of January 6th, 2021): The state began vaccinating all prison staff, starting with those who had never contracted the virus. However, there are no plans to vaccinate incarcerated people.

- California (as of January 25th, 2021): Vaccinations have been offered to some incarcerated individuals, but it has been extremely limited. The vaccines offered to those incarcerated have been restricted to only those who are at high-risk of becoming very ill from the virus [42].
- Michigan (as of December 30th, 2020): The state has begun vaccinating prison medical staff and in their next phase will begin vaccinating the remaining prison staff. On the other hand, incarcerated individuals will not be eligible for the vaccine until the general population is also eligible sometime later in 2021.
- Ohio (as of December 23rd, 2020): The state did not have any plans to vaccinate incarcerated individuals or prison staff. Once staff are eligible, there will be prioritization of them over the majority of incarcerated people. However, a small fraction of incredibly vulnerable incarcerated individuals were eligible for the vaccine.
- Oregon (as of February 2021): Due to a judge order, all incarcerated individuals in the Oregon prison system will be given priority to receive the vaccine. Currently, out of the total adults incarcerated in the state, 69% have acquiesced to receiving the vaccine. Unfortunately, it is estimated that only 55% of prison staff will actually sign up to receive the vaccine.
- Texas (as of February 2021): Despite the Texas Department of Criminal Justice having distributed over 5,000 does of the vaccine, none were given to those incarcerated in the state's prisons. This is true even though many incarcerated individuals are eligible for the vaccine under the general population's vaccine guidelines.

When it comes to incarcerated individuals receiving the vaccine, it is clear that they are at an incredible disadvantage. Unfortunately, the only state that took a progressive approach in

vaccine distribution for vulnerable populations was Oregon. It is worth mentioning that Oregon also had the lowest R_0 value out of any other state under review. This is because they have taken the necessary strides towards prioritizing their prison system's populations. Though the R_0 value cannot be linked to the vaccine distribution since the data analysis ended before wide spread vaccination occurred, it is still important to note because Oregon's approach to vaccinating their prison systems emphasizes other tactics they have taken to limit the spread of COVID-19.

4.5 Firsthand Accounts of Incarceration during the Pandemic

In addition to discussing the policies that each state has enacted in an effort to curb the spread of the virus within the prison system, it is just as important to listen to firsthand accounts of the impact that being incarcerated during a pandemic has had on incarcerated people and their families. To begin, on May 6th, 2020, Mrs. Lamar contacted an Arkansas prison where her husband had been living for the last thirty years. She called to put money into her husband's books for him to use for purchasing food. Instead of obliging, the prison staff informed her that her husband had died from virus earlier that morning. To make matters worse, when she called back the next day to inform them of her decision of what to do with his body, they let her know that they had already cremated him [43]. Mrs. Lamar's story is a horrifying example of the autonomy that has been taken from incarcerated individuals and their families during this pandemic. It is also an example of the neglect that incarcerated people have had to endure in the midst of an already trying time.

Unfortunately, Mrs. Lamar is not the only person negatively impacted by the inaction of the Arkansas prison system. The mistreatment of incarcerated individuals in the state of Arkansas

led to a federal lawsuit. A group of plaintiffs filed the lawsuit in an effort "to seek immediate relief against the substantial risk of COVID-19 infection, illness, and death while incarcerated in facilities operated by the Arkansas Department of Corrections [44]." The lawsuit includes plaintiff testimonies of unsafe conditions such as interacting with over a hundred individuals daily and the limited correct use of PPE. These testimonies also included that the sleeping quarters are overcrowded and do not allow for the six feet of recommended distance. The testing capacities are also reported to be limited and individuals who are symptomatic often do not receive tests right away. Many incarcerated individuals are also at high-risk if they were to become exposed to the virus due to underlying health conditions such as cancer, asthma, and heart disease [44].

These testimonies are not unique to Arkansas and similar experiences of incarcerated people can be found in each and every of the 6 states highlighted in this study. A similar lawsuit was filed by incarcerated individuals in April of 2020 against Oregon Governor Kate Brown and the Department of Corrections for exposing them to unnecessary risks associated with the virus. The incarcerated individuals ask for social distancing mandates within the facilities, as well as a reduction in the number of prisoners housed in the facilities [45].

Ohio prisons have seen devastating numbers of infection as a result of overcrowding and inadequate virus mitigation policies over the past year. Aside from this being apparent from Ohio having the largest R_0 value out of all of the 6 states, this is also clear from incarcerated people's testimonies inside Ohio prisons. In Toledo Ohio, as of December 27th, 2020, the correctional institution has had at least 172 staff and 87 incarcerated people test positive. This is significant enough of a number that the National Guard was summoned to aid in running the facility. This example alone proves that the CDC guide was either not followed well by this facility or did not provide practical enough knowledge and resources to effectively mitigate the spread. Conflicting

reports regarding the situation within the prison have been released by both the ODRC and incarcerated people in Ohio. The ODRC stated, “All applicable CDC guidelines have been implemented inside our prisons . . . [46].” However, David Easley (located in the Toledo facility) and other incarcerated individuals across the state have reported limited testing and social distancing measures including the requirement to share communal showers and rooms [46]. There is a major discrepancy in the reported implementation of policies and the experience of these policies from within the prison walls.

Texas prisons are not exempt from the mistreatment of incarcerated people over the past year. Under normal circumstances, a lack of transparency and follow through of risk-mitigation policies has become commonplace. However, in February of 2021, Governor Abbott issued a disaster declaration as Texas saw record breaking low temperatures. With the cold weather, the entire state experienced power outages and water shortages that lasted for days [47]. The impact of this was devastating for the free population in Texas, as well as for those incarcerated. For a population that was already experiencing deadly conditions, the cold weather pushed the prisons even more. With no water, many incarcerated people were forced to go to the bathroom in paper bags or use snow from outside to flush their toilets. Additionally, due to limited blankets, inmates struggled to keep warm. Not only were incarcerated people experiencing the adverse effects of the freezing temperatures, but the prisons also faced low levels of staff attendance, leaving many staff members overwhelmed and alone. The director of the non-profit Texas Inmates Families Association voiced well the reality of living as an incarcerated person in Texas, “The Texas prison system is in the category of infrastructure that the Legislature doesn’t give a flip about . . . It’s just punishing these people on all sides: COVID, heat, cold, food, understaffing, broken prisons [48].”

It is especially upsetting that all of this occurred in the midst of an already challenging fight against the Coronavirus, only further exacerbating the spread and leading to a greater loss in life.

The many examples shared in this section prove the dire need for the United States to dedicate more time, resources, and emotion into the prison system's infrastructure. Without adequate policies, even outside of the pandemic, we will continue to see the marginalization and exploitation of incarcerated people.

Chapter 5

Conclusion and Recommendations

It is clear from the previous chapters that no state has had a perfect response to combatting the spread of COVID-19 within their prison systems. Unfortunately, this is apparent from each prison system having an R_0 value greater than one. This indicator was chosen because of its versatility and applicability. When the R_0 value is greater than one, the COVID-19 virus is expected to spread exponentially, putting not only incarcerated individuals at risk, but the surrounding communities as well. Despite having access to an exceptionally limited dataset due to the lack of testing and transparency across various prison systems, the R_0 values were alarmingly high. This proves the need for more adequate testing and risk-mitigation processes within the prisons.

It is critical to analyze the approaches that have worked and those that have not throughout the COVID-19 pandemic. There is no excuse for the devastation that resulted from the inadequate policies that were implemented throughout 2020 and early 2021 to address the virus within the prisons. However, a great deal can be learned from the mistakes and the loss that transpired. If we learn from the faults made over the past year, we will be equipped to properly address other infectious diseases in the prison setting moving forward.

Of the utmost importance should be the safety and welfare of prison staff and those incarcerated. There should be a federal mandate that requires the testing of all incarcerated individuals and staff regularly to ensure that the true number of COVID positive individuals are known. This is especially important for staff. Any member of staff who is suspected of being infected should stay home and follow the CDC guidelines to determine when they can return. It is

also imperative that facilities provide quarantine and isolation options for incarcerated individuals that is different from simply placing them in solitary confinement. Infected incarcerated people should not be punished for practicing safe COVID-19 protocol. Additionally, there is a dire need for transparency with outside communities to ensure that all are aware and prepared to protect themselves and their loved ones. This transparency is also critical for researchers who rely on adequate data and information to properly assess the severity of the situation.

Aside from these paramount measures, a mask mandate for everyone in these facilities is a necessity to limit the spread. Additionally, PPE, soap, alcohol-based hand sanitizer, access to healthcare and comprehensive cleaning supplies should be provided free of cost to all incarcerated people. De-incarceration efforts for those at a high risk should also be prioritized to limit the chance of mortality. This policy will aid in the goal of operating at no more than 85% capacity to allow for proper social distancing procedures. Lastly, all incarcerated people and prison staff should be eligible for the vaccine in the first phase of distribution [49]. Ultimately, the safety of every community is connected to the safety of incarcerated communities. Thus, it is in the best interest of everyone to vaccinate our prison populations.

An additional recommendation is to institute an unbiased outside entity to assess the situations within the facilities. If there are not systems in place to protect incarcerated populations, we will never see change related to spread mitigation policies. Aside from adequate policies enacted across U.S. states, it is critical that the prisons are being held accountable and properly penalized if they are not following the policies that they ratify.

Appendix A

R Code

Link to GitHub with R code: https://github.com/tmklett/Thesis.git

BIBLIOGRAPHY
(In order of first citation)

1. Schwartzapfel, B., Park, K., & Demillo, A. (2020, December 18). 1 in 5 prisoners in the u.s. has had COVID-19. Retrieved March 20, 2021, from https://www.themarshallproject.org/2020/12/18/1-in-5-prisoners-in-the-u-s-has-had-covid-19
2. Timeline: Who's Covid-19 response. (2021). Retrieved March 20, 2021, from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline?gclid=Cj0KCQiA0rSABhDlARIsAJtjfCe7d2nIQSRcEx33Y4YEQunUoNqB2Why1pVjp79-BbRv-R7LxMeL-XIaAtRMEALw_wcB#event-71
3. Sawyer, W., & Wagner, P. (2020, March 24). Mass incarceration: The whole pie 2020. Retrieved March 20, 2021, from https://www.prisonpolicy.org/reports/pie2020.html
4. Kramer, L. (2018, November 28). What are the main differences between state and federal corrections? Retrieved March 20, 2021, from https://legalbeagle.com/8214304-main-between-state-federal-corrections.html
5. Levenson, E. (2020, September 03). Prison inmates are twice as likely to die of Covid-19 than those on the outside, new report finds. Retrieved March 20, 2021, from https://www.cnn.com/2020/09/02/us/prison-coronavirus-clusters-report/index.html
6. Goldensohn, R. (2021, January 18). State prison covid-19 wave grows as inmates wait for vaccines. Retrieved March 20, 2021, from https://www.thecity.nyc/2021/1/18/22237488/new-york-prison-covid-cases-grow-inmates-vaccines-cuomo

7. Lach, E. (2021, February 13). Andrew Cuomo's refusal to vaccinate inmates is indefensible. Retrieved from https://www.newyorker.com/news/our-local-correspondents/andrew-cuomos-refusal-to-vaccinate-inmates-is-indefensible
8. Lewis, S. (2020, August 26). Huge coronavirus outbreak at maine jail linked to Indoor wedding reception. Retrieved March 20, 2021, from https://www.cbsnews.com/news/coronavirus-maine-wedding-covid-outbreak-jail-indoor-reception-millinocket/
9. Widra, E., & Herring, T. (2020, August 14). Half of states fail to require mask use by correctional staff. Retrieved March 20, 2021, from https://www.prisonpolicy.org/blog/2020/08/14/masks-in-prisons/
10. Torres-Springer, M. (2020, June 09). The fight for equality at the center of the George Floyd case. Retrieved March 20, 2021, from https://www.fordfoundation.org/just-matters/just-matters/posts/the-fight-for-equality-at-the-center-of-the-george-floyd-case/
11. Mabud, T. S., De Lourdes Delgado Alves, M., Ko, A. I., Basu, S., Walter, K. S., Cohen, T., . . . Andrews, J. R. (2019). Correction: Evaluating strategies for control of tuberculosis in prisons and prevention of spillover INTO COMMUNITIES: An observational and modeling study from Brazil. *PLOS Medicine, 16*(3). doi:10.1371/journal.pmed.1002764
12. White, M. C. (n.d.). Identifying Infectious Diseases in Prisons: Surveillance, Protection, and Intervention [Editorial]. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1305539/pdf/westjmed00318-0051.pdf
13. Franco-Paredes, C., Jankousky, K., Schultz, J., Bernfeld, J., Cullen, K., Quan, N. G., . . . Krsak, M. (2020). COVID-19 in jails and PRISONS: A neglected infection in a

marginalized population. *PLOS Neglected Tropical Diseases, 14*(6). doi:10.1371/journal.pntd.0008409

14. Burki, T. (2020). Prisons are “in no way equipped” to deal with covid-19. *The Lancet, 395*(10234), 1411-1412. doi:10.1016/s0140-6736(20)30984-3
15. Bauch, C. T. (2021). Estimating the Covid-19 R number: A bargain with the devil? *The Lancet Infectious Diseases, 21*(2), 151-153. doi:10.1016/s1473-3099(20)30840-9
16. Zimmer, K. (2020, July 13). Why r0 is problematic for predicting covid-19 spread. Retrieved March 20, 2021, from https://www.the-scientist.com/features/why-r0-is-problematic-for-predicting-covid-19-spread-67690
17. Du, Z., Xu, X., Wu, Y., Wang, L., Cowling, B. J., & Meyers, L. (2020). Serial Interval of COVID-19 among Publicly Reported Confirmed Cases. *Emerging Infectious Diseases*, *26*(6), 1341-1343. https://dx.doi.org/10.3201/eid2606.200357.
18. Puglisi, L. B., Malloy, G. S., Harvey, T. D., Brandeau, M. L., & Wang, E. A. (2021). Estimation of COVID-19 basic reproduction ratio in a large urban jail in the United States. *Annals of Epidemiology, 53*, 103-105. doi:10.1016/j.annepidem.2020.09.002
19. Bhalla, J. (2020, April 17). This viral Angela Merkel clip explains the risks of loosening social distancing too fast. Retrieved March 20, 2021, from https://www.vox.com/2020/4/17/21225916/coronavirus-in-germany-angela-merkel-lifting-lockdown
20. Bjørnstad, O. N. (2018). *Epidemics: Models and data using R*. Cham, Switzerland: Springer.

21. The Marshall Project: COVID cases in prisons - dataset by associatedpress. (2020, March). Retrieved February, 2021, from https://data.world/associatedpress/marshall-project-covid-cases-in-prisons
22. The COVID tracking project. (2021). Retrieved from https://covidtracking.com/
23. Data Commons. (2019). California. Retrieved March 21, 2021, from https://datacommons.org/place/geoId/06?utm_medium=explore&mprop=count&popt=Person&hl=en
24. Data Commons. (2019). Texas. Retrieved March 21, 2021, from https://datacommons.org/place/geoId/48
25. Data Commons. (2019). Oregon. Retrieved March 21, 2021, from https://datacommons.org/place/geoId/41
26. Data Commons. (2019). Ohio. Retrieved March 21, 2021, from https://datacommons.org/place/geoId/39
27. Data Commons. (2019). Michigan. Retrieved March 21, 2021, from https://datacommons.org/place/geoId/26
28. Data Commons. (2019). Arkansas. Retrieved March 21, 2021, from https://datacommons.org/place/geoId/05
29. VeraInstitute. (2019). *Incarceration Trends in Arkansas* [PDF]. https://www.vera.org/downloads/pdfdownloads/state-incarceration-trends-arkansas.pdf
30. Sharma, D., Li, W., Lavoie, D., & Lauer, C. (2020, July 16). Prison populations drop by 100,000 During pandemic. Retrieved from https://www.themarshallproject.org/2020/07/16/prison-populations-drop-by-100-000-during-pandemic

31. B. (2020, March 27). Reducing jail and prison populations during the covid-19 pandemic. Retrieved March 21, 2021, from https://www.brennancenter.org/our-work/research-reports/reducing-jail-and-prison-populations-during-covid-19-pandemic
32. Dwyer, C., & Aubrey, A. (2020, April 03). CDC now RECOMMENDS Americans consider Wearing Cloth face coverings in public. Retrieved March 21, 2021, from https://www.npr.org/sections/coronavirus-live-updates/2020/04/03/826219824/president-trump-says-cdc-now-recommends-americans-wear-cloth-masks-in-public
33. Widra, E., & Herring, T. (2020, August 14). Half of states fail to require mask use by correctional staff. Retrieved March 20, 2021, from https://www.prisonpolicy.org/blog/2020/08/14/masks-in-prisons/
34. Widra, E. (2020, December 21). Since you asked: Just how overcrowded were prisons before the pandemic, and at this time of social distancing, how overcrowded are they now? Retrieved March 21, 2021, from https://www.prisonpolicy.org/blog/2020/12/21/overcrowding/
35. Vest, N., Johnson, O., Nowotny, K., & Brinkley-Rubinstein, L. (2020). Prison population reductions and covid-19: A latent profile analysis synthesizing recent evidence from the Texas state prison system. *Urban Health, 98*, 53-58. doi:https://doi.org/10.1007/s11524-020-00504-z
36. Widra, E., & Hayre, D. (2020, June 25). Failing grades: States' responses To COVID-19 in jails & prisons. Retrieved March 21, 2021, from https://www.prisonpolicy.org/reports/failing_grades.html
37. CDC. (2020). Guidance on management of Coronavirus Disease 2019 (COVID-19) in correctional and detention facilities. Retrieved March 21, 2021, from

https://www.cdc.gov/coronavirus/2019-ncov/community/correction-detention/guidance-correctional-detention.html

38. Oregon Department of Corrections. (2021). *Evaluating Oregon's Community Corrections Act 2019–21* (Rep.). https://www.oregon.gov/doc/Documents/community-corrections-act-report-2019-21.pdf
39. Governor Kate Brown. (n.d.). *AIC Newsletter* [PDF]. https://www.oregon.gov/doc/covid19/Documents/aic-newsletter-spot-governors-commutation-criteria.pdf
40. Ohio DRC. (2021). COVID-19 updates. Retrieved from https://www.drc.ohio.gov/Family/COVID-19-UPDATES
41. A. (2021, January). *THE IMPACT OF COVID-19 ON INCARCERATED OHIOANS IN 2020* [PDF]. https://www.acluohio.org/wp-content/uploads/2021/01/COVID-19LookBack_2021-0125.pdf
42. California begins Vaccinating inmates, but not at its Hardest-hit Prisons. (2021, January 25). Retrieved April 03, 2021, from https://www.nytimes.com/live/2021/01/02/world/covid-19-coronavirus
43. Gill, L. (2020, June 15). Grim stories from inside an Arkansas prison capture the toll of covid-19. Retrieved March 21, 2021, from https://theappeal.org/grim-stories-from-inside-an-arkansas-prison-capture-the-toll-of-covid-19/
44. Frazier v. Kelley, ACLU (United States District Court Eastern District of Arkansas Central Division April 21, 2020).

45. Wilson, C. (2020, April 06). Oregon inmates sue Department of corrections Over COVID Response. Retrieved March 21, 2021, from https://www.opb.org/news/article/oregon-inmates-sue-department-of-corrections-over-covid-response/

46. Carlisle, M., & Bates, J. (2020, December 28). With Over 275,000 Infections and 1,700 Deaths, Covid-19 has devastated the U.S. prison and jail population. Retrieved March 21, 2021, from https://time.com/5924211/coronavirus-outbreaks-prisons-jails-vaccines/

47. Salam, E. (2021, February 14). Texas sees one of its coldest winters in decades as temperatures drop. Retrieved April 03, 2021, from https://www.theguardian.com/us-news/2021/feb/14/texas-weather-latest-freezing-ice-winter

48. Blakinger, K. (2021, February 19). Inside frigid Texas prisons: Broken toilets, disgusting food, few blankets. Retrieved from https://www.themarshallproject.org/2021/02/19/inside-frigid-texas-prisons-broken-toilets-disgusting-food-few-blankets

49. https://thejusticecollaborative.com/wp-content/uploads/2020/03/TJC-Fact-Sheet-COVID19-Practices-for-Jails-and-Prisons.pdf

ACADEMIC VITA

TATIANA M. KLETT

tmk5570@psu.edu

High-achieving, dedicated college Senior, pursuing a degree in Industrial Engineering at The Pennsylvania State University Schreyer Honors College. Extremely motivated with a passion for work in risk-mitigation, optimization, and corporate social responsibility.

EDUCATION

The Pennsylvania State University | Schreyer Honors College — **University Park, PA**
Bachelor of Science in Industrial Engineering
Minor in African American Studies — Graduation: May 2021

PROFESSIONAL EXPERIENCE

ExxonMobil, *Houston, TX* – Operations Excellence Sustainability Organization Engineering Intern — **2020**
- Oversaw the research-based data analysis platform to strengthen above ground risk management strategies using an internal Excel tool
- Researched the trending human rights concerns in Papua New Guinea, Ghana, and Colombia to assess the initial risks on these countries and communities where EM is involved in project exploration
- Interviewed various Socioeconomic Management practitioners to strengthen cross-collaboration across the organization
- Led a Socioeconomic Management educational forum with 60 attendees across multiple EM business lines

Morgan Academic Center, *Penn State University* – STEM Tutor — **2019 - Present**
- Tutor Penn State students in Calculus 1/2/3, Differential Equations, Linear Algebra, and College Algebra
- Mentored students to develop academic goals to ensure long term success

Polsinelli Public Policy Department, *Washington, D.C.* – Intern — **2019**
- Contributed to developing an enhanced amendment tracking and distribution system for the House Rules Committee Labor-HHS-Education Bills, supporting timely updates for internal and external stakeholders
- Assisted with multiple Client Hill Days which included the development and dissemination of necessary marketing, education, and lobbying materials
- Actively attended congressional meetings and fundraisers on behalf of external clients
- Attended congressional hearings and provided timely reports to support client business needs

D.C. Social Justice Fellowship, *Penn State University & Washington, D.C.* – Fellow & Teaching Assistant — **2019 - 2020**
- Created lesson plans and taught D.C. public high school students about opportunities to positively impact change
- Met with D.C. social justice stakeholders to develop impactful curriculum
- Developed a Civic Action Plan to address educational equity in Pittsburgh, PA
- Selected to return for an additional year as a Fellowship Cohort Teaching Assistant

LEADERSHIP & INVOLVEMENT

Schreyer Honors College Diversity Task Force (DTF) – Founding Member — **2018 - Present**
- Actively serves the Schreyer community by advancing the Honors College DTF, whose mission is to increase the recruitment and retention of underrepresented scholars
- Participated in the hiring of the new Schreyer Associate Dean of Equity and Inclusion position

Penn State Engineering Design Research — **2018 - 2020**
- Investigated implicit gender bias in the engineering design classroom
- Awarded the competitive title of College of Engineering Research Initiative Scholar

Nittany Greyhounds, *Port Matilda, PA* – Volunteer — **2019 - Present**

Penn State F.O.R.M. Club – Secretary — **2019 - 2020**
- Executive member of the Penn State Future Opportunities Reached through Mentorship club helping underrepresented high school students apply to higher education

CORE SKILLS & HONORS

Technical Skills: MATLAB, R Programming, SolidWorks, Microsoft Office: Excel, Word, PowerPoint, Access
Relevant Honors: Lockheed Martin Design Showcase Winner, Dean's List, Academic Excellence Award
Scholarships: African American Studies, Anna N. Dosen, Pittsburgh Promise Executive Scholar