Analysis of COVID-19 Case Rates in Correctional Facilities vs. State Trends

Methods of Advanced Data Engineering (MADE WS2024/25)

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Abstract

This report examines the distribution and correlation of COVID-19 case rates between inmates and officers in correctional facilities compared to broader state trends. Utilizing comprehensive datasets, we perform a series of analyses to understand the dynamics within these environments and their implications for public health policy.

1 Introduction

The study investigates COVID-19 case rates in correctional facilities versus state-level data, aiming to uncover patterns and correlations that inform strategies for managing outbreaks in high-risk settings.

2 Data Description

Data for this analysis comes from state public health databases, focusing on correctional facility and state-wide case statistics. We utilize four main datasets:

- Facilities: Detailing case rates among inmates and officers.
- Systems: Infrastructure and health measures in place.
- US Data: Broader epidemiological data.
- US States: Specific state-level case trends.

This diverse data collection enables a comprehensive comparison and deeper understanding of the pandemic's impact across different environments.

3 Methodology

Our methodology involves:

- Aggregating case data by state and facility.
- Calculating case rates per 100,000 population.
- Analyzing correlations to understand the impact of various factors on infection rates.

Data is processed using SQL queries and analyzed with statistical tools in Python, emphasizing clarity and precision in our findings.

4 Results and Analysis

4.1 Correlation Matrix and Heatmap

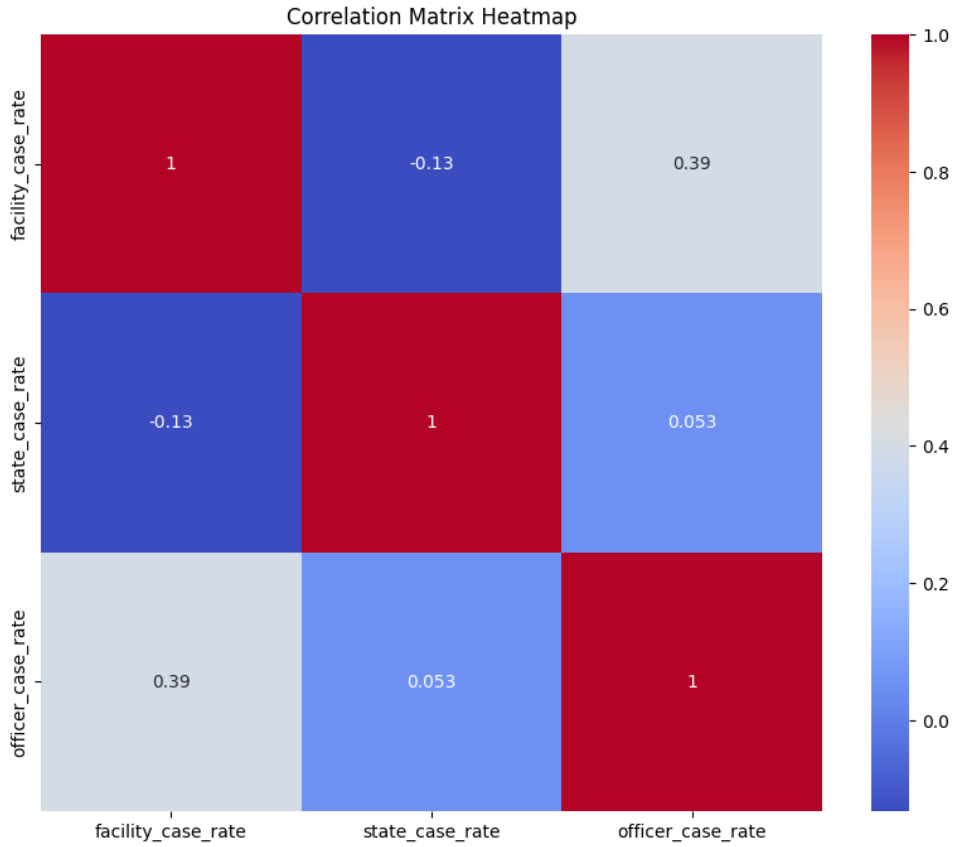

Figure 1: Heatmap illustrating the correlation between different case rates, highlighting relationships within and outside correctional facilities.

Discussion on Correlation Matrix: The analysis of the correlation matrix provides insights into how different COVID-19 case rates are interrelated within the state:

- **Facility Case Rate and Officer Case Rate**: There is a moderate positive correlation of 0.39, suggesting shared risk factors or similar exposure levels within correctional facilities.
- **Facility Case Rate and State Case Rate**: A slight negative correlation of -0.13 indicates that outbreaks in facilities may not mirror broader state infection patterns.
- **Officer Case Rate and State Case Rate**: A very weak correlation of 0.05 suggests that the spread among correctional officers is relatively independent of state trends.

4.2 Time Series Analysis of Top 10 States

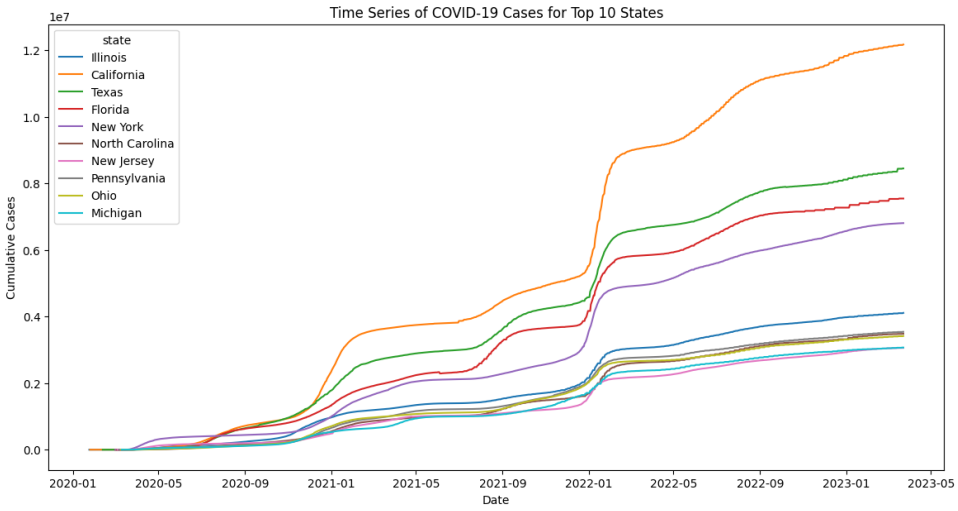

Figure 2: Time series analysis of COVID-19 cases for the states most affected by the pandemic, displaying trends over time.

Discussion on Time Series Analysis: This analysis tracks the cumulative number of confirmed COVID-19 cases from early 2020 to mid-2023, showing how the virus spread differently across various highly affected states, such as California, Texas, Florida, and New York.

4.3 Comparative Case Rates Between Inmates and Officers

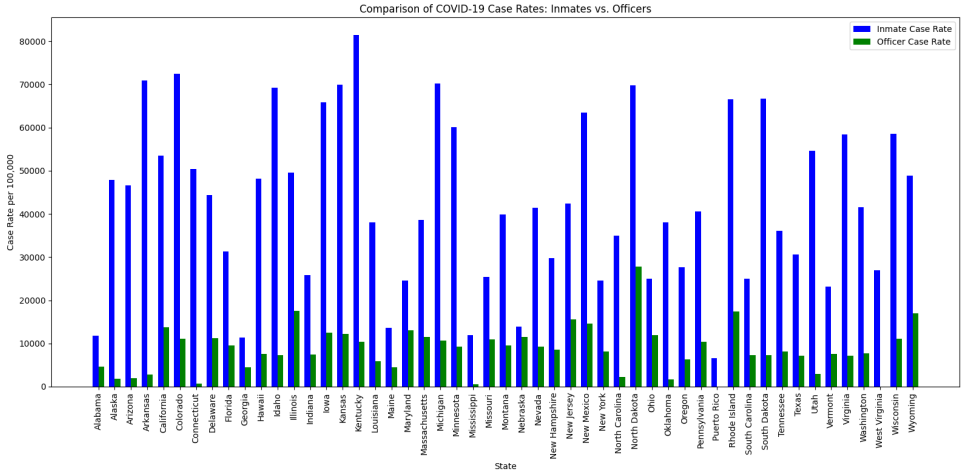

Figure 3: Comparison of COVID-19 case rates: Inmates vs. Officers, highlighting the disparities and potential risk factors in correctional settings.

Discussion on Comparative Case Rates: The bar chart compares COVID-19 case rates per 100,000 population between inmates and correctional officers, underscoring significant disparities and higher risks faced by inmates due to environmental conditions like overcrowding.

4.4 Facility to State Case Ratio Analysis

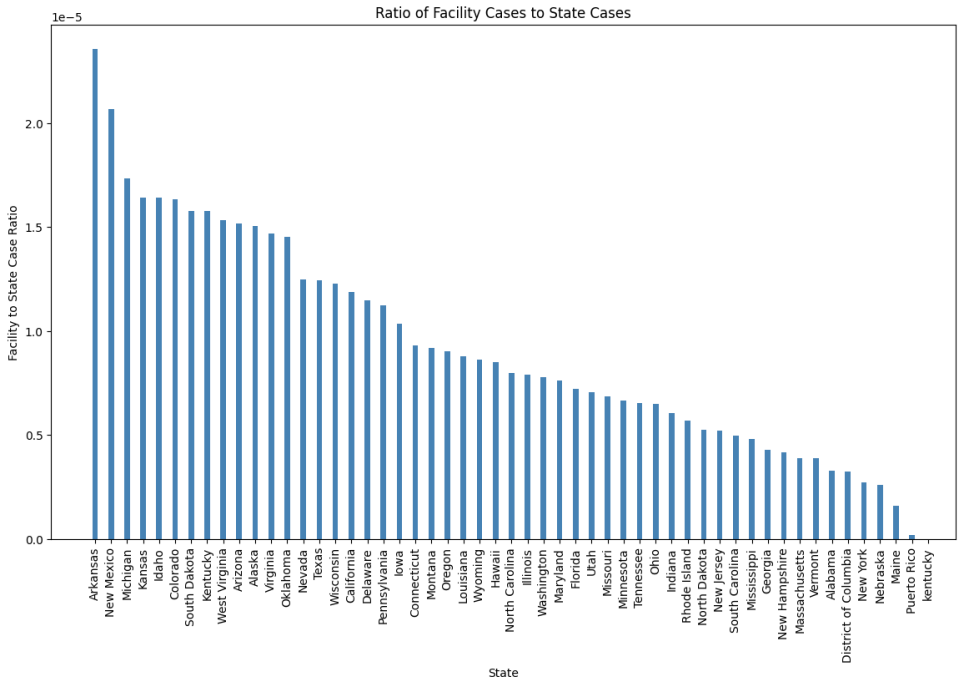

Figure 4: Graph showing the ratio of cases within facilities compared to total state cases, indicating the concentration of outbreaks within correctional facilities.

Discussion on Facility to State Case Ratio: This analysis highlights the ratio of COVID-19 cases found within correctional facilities relative to the total cases in each state, showing significant variations and the localized nature of outbreaks within facilities.

5 Conclusions

The study highlights significant disparities in COVID-19 impact within correctional facilities compared to state-wide data, underscoring the need for targeted health interventions and informed public health strategies to manage and mitigate outbreaks in high-risk settings effectively.

References

- NY Times Data on Correctional Facilities
- NY Times Data on Correctional Systems
- NY Times Data on US States
- NY Times Data on US