Thesis Project Portfolio

Deploying Vaccine Distribution Sites for Improved Accessibility and Equity to Support Pandemic Response

(Technical Report)

Thematic Analysis of the Integration of Community-Specific Conventions in COVID-19 Vaccine Distribution Policies to Enhance Vaccine Accessibility and Equity

(STS Research Paper)

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Sociotechnical Synthesis

Four years after the first identified case, COVID-19 remains a global health crisis. Although vaccines have become widely available in Virginia, the overall vaccination rate remains below the threshold predicted for herd immunity. Extending upon traditional vaccination efforts, Virginia has deployed mobile vaccination clinics that travel from location to location to reach populations with weaker local health infrastructure. Virginia's data-driven approaches have also yielded increased infrastructure support for integration with SafeGraph, a data analytics provider that tracks mobility location data for individuals based on anonymized cell phone data.

To facilitate equitable vaccine uptake, this technical project focuses on developing computational algorithms that utilize these two aspects of Virginia's data-driven infrastructure to improve the accessibility of vaccine distribution sites across marginalized demographic groups. In doing so, it is critical to consider the social and human dimensions to effectively incorporate the conventions of minorities and underserved populations.

I used Star's infrastructure framework to analyze the extent to which vaccine distribution infrastructure successfully engaged under-vaccinated communities. Examining the themes of demographic groups, human conventions, and policies, I conducted thematic coding on 27 monthly Department of Health Plan for Equitable Distribution of COVID-19 Vaccine reports to the Virginia General Assembly from January 2021 to March 2023. The three themes capture how Virginia's COVID-19 responses align with Star's infrastructure framework, highlighting the role of pandemic response infrastructure in executing human conventions, and depicting the extent to which policymakers were constrained by the sociopolitical base.

The thematic coding results emphasized the success of policymakers in integrating mobility conventions with the vaccine distribution infrastructure but also depicted the shortcomings of the infrastructural base in detecting marginalized demographic groups and establishing sustainable policies to improve vaccine equity. Vaccine infrastructure development was greatly constrained by an unstable social and policy base: changes in political leadership, public opinion, and social values led to volatile policies that were under-enforced and eventually overturned.

The sociopolitical debates surrounding vaccine equity have illustrated the importance of establishing a robust pandemic response infrastructure to manage COVID-19 and future epidemics. The directions determined by big-picture policymaking drive technical research, motivating the development of computation algorithms that target mobility conventions. These algorithms must be embedded into both the local and broader health infrastructural base to have a sustained impact.

Additionally, technical research inherits the limitations and constrained infrastructural base from state/federal policymakers. It is critical for research to mitigate these limitations by improving the data collection infrastructure for the age, sex, and gender demographics that have a low presence in health reports. Only by understanding pandemic response infrastructure in the context of human organizations can we hope to construct sustainable health infrastructure to prepare for future crises.