

**Thesis Portfolio**

**Structural Racism as a Barrier to Influenza Vaccination Uptake during Pregnancy in the Americas**  
(Technical Report)

**The Extent to which Physician Mistrust caused by the US Healthcare System and held by Minority Patients Exacerbates Racial Health Disparities**  
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science  
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Bachelor of Science, School of Engineering

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## **Sociotechnical Synthesis**

This portfolio's technical and sociotechnical topics analyze factors perpetuating and symptoms resulting from racial health disparities in both the United States and Brazil. The overarching goal of both projects was to elucidate new investigative avenues for solutions that can effectively address these concerning inequities.

Almost two centuries have elapsed since the 13<sup>th</sup> amendment was ratified to abolish slavery in the United States, yet the effects of this ancient history of institutional racism continue to permeate the nation. The South American country of Brazil shares a similar history of systemic discrimination and the longstanding eugenic belief that non-whites are inferior as human beings. The healthcare systems of both countries are not immune to these practices, and racial disparities disproportionately and negatively affect the clinical outcomes of minorities relative to those of whites within each nation.

The aim of this portfolio's technical project was two-fold: 1) to elucidate the effects of racial health disparities pertaining to inactivated influenza vaccination (IIV) uptake during pregnancy in Brazil on adverse birth outcomes, and 2) to construct an effective IIV schedule that can mitigate the spatiotemporal spread of influenza in Brazil's semi-arid state of Ceará. Physiological changes during pregnancy place pregnant women at a higher risk for infection, morbidity, and mortality from influenza relative to other nonpregnant adults. However, current IIV campaigns are largely ineffective due to not only the lack of vaccination coverage among the pregnant population, but also the racial health disparities permeating these campaigns. The technical team hypothesized that racial health disparities pertaining to IIV coverage during pregnancy in Brazil result in a higher quantity of adverse birth outcomes for minority patients. The

team also hypothesized that an experimental metapopulation-based IIV schedule for the semi-arid state of Ceará will effectively limit the spatiotemporal spread of the virus. The notion that influenza infection during pregnancy may lead to a higher quantity of adverse birth outcomes due to racial health disparities that continue to ravage Brazil's healthcare system is alarming. Thus, a timely IIV schedule that effectively addresses these shortcomings and disparities may prove invaluable for public health campaigns in reducing the morbidity associated with the viral disease.

The aim of the sociotechnical paper is to not only explain the origins of minority medical mistrust of physicians in the United States, but also elucidate this population-level mistrust's exacerbating effects on the nation's racial health disparities. Through application of the Wicked Problem Framing methodology, it was determined that the nation's longstanding and ongoing history of unethical medical investigations and clinical atrocities formed the origins of minority medical mistrust, and the lack of diversity and inclusion within the nation's physician workforce continually perpetuates it. Furthermore, through leveraging a combined Historical Case Studies and Documentary Research Analysis methodology, it was found that mistrust of physicians held by minorities exacerbates the nation's racial health disparities primarily via deteriorating the patient-provider relationship. Overall, the sociotechnical project elucidated the need for further analysis to be conducted in this area. Racial health disparities pervade the United States healthcare system at every level; ignoring these disparities—as well as the factors that perpetuate and exacerbate them—may leave the system vulnerable to continue straying further and further away from the key tenets of medicine.

As an aspiring physician, working on the technical and sociotechnical projects outlined above has been truly rewarding. Due to my biomedical engineering undergraduate experience, I feel that I had gained a solid grasp on the scientific and technical intricacies of the human body.

However, it was not until my participation in both these projects this past year that I exposed myself to the humanity behind medicine—the idea that every patient who steps foot in the clinical setting brings a unique set of experiences which must be understood in order for comprehensive care to be provided. In conducting statistical analysis and constructing a vaccination schedule for the technical project, I gained a richer understanding of how scientific techniques can be utilized to address disparities in healthcare. While performing the sociotechnical analysis, the intricacies behind these racial health disparities were elucidated to me, and I began understanding the breadth and depth of the detrimental experiences that minorities have historically experienced within the nation’s healthcare system. Both projects also made me realize how extensive analysis is necessary to be further conducted on the topic of racial health disparities at the global scale. Medicine is largely dependent on the equity that is present in each physician’s care. The fact that there continues to be bias and discrimination permeating modern-day healthcare systems is alarming, and solutions must be urgently implemented such that the questions raised in both the technical and sociotechnical topics of this portfolio may be comprehensively addressed.