

**Development of an Optimization Framework for the Reallocation of
Air Ambulance Base Locations in the United States**
(Technical Report)

**Impact of Scientific Advancement and Politics on Healthcare
Outcomes and Cost**
(STS Research Paper)

An Undergraduate Thesis Portfolio
Presented to the Faculty of the
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Bachelor of Science in Biomedical Engineering

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Socio-Technical Synthesis

The problem that my research is attempting to tackle revolves around the air ambulance industry. Based on the current allocation of air ambulance bases in 2019, measuring for a 20-minute response time, which is imperative in some emergency cases, air ambulances could not be achieved for 42.5 million people in the US. In addition, the average price of an air ambulance trip increased substantially over a 10-year period from 2008 to 2017, rising 144% for helicopters and 166% for fixed wing aircraft. With a current median price of \$36,400 for helicopter air ambulances, these costs are often too high for patients to bear. The solution to this problem is to reallocate the air ambulance bases across the country through an optimization model. In order to do so, we are utilizing population density and disease incidence rates across the country to create a framework for where air ambulance bases should be located to serve the highest number of patients possible. Based on our reallocation, more patients would be able to reach a hospital within an hour of injury or illness and the air ambulances would have to travel a shorter distance, decreasing the variable costs associated with the ambulances.

It is essential to consider both the human and social dimensions of this technology due to the importance of healthcare on people's lives. It is an improvement in healthcare because it analytically determines the best location to serve those with injuries or illnesses. Our biggest target is the human and social dimension of the system and that is where the focus lies. To determine how science and politics impact healthcare outcomes, I will be taking a deep dive into the air ambulance industry utilizing the framework of co-production and the meta-learning theory. Through the use of the co-production framework, I will conduct research on the healthcare industry by examining historical case studies and engaging in policy analysis. I will analyze the air ambulance industry over a finite period of time and conduct both the historical

case studies and policy analysis to illustrate the impact of technological innovation and politics on health outcomes. This allows me to see where and how the healthcare industry has improved and why there has been a decrease in morbidity and mortality rates over time. I expect there to be a strong correlation between technological innovation and an improvement in patient's health outcomes. With better technology comes an improved way to diagnose and treat patients, thus leading to a better outcome. In regards to politics, I expect there to be less of an impact on healthcare outcomes of patients, but a significant impact on things such as cost and resources allocated to people. Considering my technology and STS research in concert, I believe it will allow for a direct improvement in the morbidity and mortality rates for air ambulance patients. Through the STS research, I will be able to show how the healthcare industry has morphed overtime to better treat patients and will illustrate how the current air ambulance industry was established.