

Thesis Portfolio

Engineering a Resilient Regional Healthcare System: Improving Stroke Care in
Shelby County, TN
(Technical Report)

Childhood Obesity: Teaching Children Healthy Habits in Rural Communities
(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

Cardiovascular disease is an overarching category of disease that includes stroke, hypertension, heart failure, and other conditions. Cardiovascular disease is the leading cause of death in the United States, amongst all racial and ethnic groups (CDC, 2021). An individual's risk of cardiovascular disease can be influenced by genetic factors; however, environmental factors are often more important. These factors can range from a person's diet and lifestyle to the healthcare system they have access to. The wide range of possible conditions and its high prevalence make cardiovascular disease a necessary but difficult problem to address.

In an attempt to address this problem from the healthcare system point of view, this technical paper will focus on an approach to improving and modelling stroke care in Shelby County, Tennessee. Of all cardiovascular conditions, strokes are the leading cause of death in the United States (CDC, 2021). Our current health care system is reliant on fixed facilities, which are not flexible under high strain scenarios, like a pandemic. These facilities often experience bottlenecks and are unable to deliver adequate healthcare to all portions of their population. The survival and recovery of patients following a stroke is highly dependent on the quality and speed of the healthcare they receive. It has been proven that patients experience fewer lasting affects three months after a stroke if they arrive at an emergency room within three hours of the onset of symptoms (CDC, 2021). This capstone project will work in accordance with The MITRE Corporation to create a model that accurately examines healthcare delivery resources and their degree of resiliency in high strain scenarios. The model utilizes Geographic Information System (GIS) mapping software to spatially represent Shelby County by zip code. By creating an accurate representation of the healthcare system and patient population of Shelby County, this

project provides recommendation to reconfigure resources to better improve stroke care under both normal and high strain scenarios.

The STS paper portion of this thesis attempts to address cardiovascular disease from the perspective of environmental factors, like childhood obesity, which can affect an individual's risk of a future cardiovascular condition. Childhood obesity greatly increases a person's risk for stroke, heart attack, high blood pressure, and a variety of other conditions later in life. This issue is specifically of importance to the rural United States as rural children are 26% more likely to be obese than urban children (Robinson et al., 2019). For this reason, this paper focuses on childhood obesity in rural areas and how schools play a role in this statistic. Nutrition in schools has become a more prominent issue in the last 20 years. However, for a variety of reasons, rural schools have struggled to keep up with changing legislation and regulations. They also experience a variety of issues related to setting up an adequate nutritional program. Issues like staff shortages, lack of funding, and lack of food availability are all contributing factors to a higher obesity rate in rural children. The motivations behind this paper are to suggest recommendations for how local and federal officials can better address and accommodate the unique difficulties faced by rural schools in creating nutritional programs.