

## **Thesis Project Portfolio**

### **Redesign of the University of Virginia's Emergency Department Waiting Room Layout to Optimize Patient Flow and Increase Satisfaction**

(Technical Report)

### **Using Actor Network Theory to Analyze the Federal Emergency Management Agency's Failure after Hurricane Katrina in 2005**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science  
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree  
Bachelor of Science, School of Engineering

**Adalyn Grace Mall**

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Department of Systems and Information Engineering

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## **Sociotechnical Synthesis**

My technical paper optimizes the wait time within the University of Virginia Emergency Department through a simulation study. My science, technology, and society (STS) research analyzes the actors of the medical facilities in New Orleans after Hurricane Katrina. Since the optimization focused on triage within the ED, I researched triage processes during natural disasters. I chose the most extreme hurricane of the twenty-first century, Katrina, in New Orleans in August 2005. My research changed into how the different facilities handled the natural disaster rather than their patients. To broaden my understanding of the medical facilities' reaction to Katrina, the Oschner Center Hospital and the Charity Hospital, I also researched the U.S. political connection to the Federal Emergency Management Agency.

The technical portion of my thesis in Systems Engineering entailed me working in a team of five other Systems Engineering students with advisors from the University of Virginia Hospital Emergency Department (ED) and the Systems and Information Engineering Department. We observed the ED looking for areas of improvement. We were also given historical data from Epic on the times a patient received room assignments, total time triaged, waiting room times, and overall time within the ED. We ran statistical tests, such as the t-test and the f-test, to see which data was statistically significant. We also followed the movement of patients through spaghetti diagrams within the ED. We observed an accumulation of 66 hours within the ED in various sections and under various providers. We talked to all personnel to get the most accurate picture of room placement, staff placement, and general flow in the ED. After the observations, we decided to simulate the present flow of the ED through FlexSim HC. We verified the interarrival times from the Epic data provided with the data outputted from the simulation. We ended with a Poisson distribution among the interarrival times. We also

remodeled the UVA ED waiting room through simulation to improve patient satisfaction. We reallocated hospital space for the ED in the new model. We met with facilities that said if the remodel were to occur, there would need to be additional funding for electrical. For future projects, we offered the model to upper leadership within the ED, explaining the significance of the remodel.

In my STS research, I looked at the role of the Federal Emergency Management Agency (FEMA) in healthcare after Hurricane Katrina hit New Orleans in August of 2005. I analyzed the actors of the politics associated with FEMA, Ochsner Center Hospital, and Charity Hospital through actor-network theory with FEMA as the network builder. Actor-network theory explains the opening of a “black box” of science and technology by outlining the complex relationships between governments, technologies, knowledge, texts, money, and people (Cressman, 2009, p. 3). I analyzed non-human actors within my network because I believe that there was no one individual person responsible for FEMA’s failure but rather multiple large entities. Also, Actor-Network theory helps explain the interaction of humans with non-humans; i.e., government organizations, medical facilities, etc. Using actor-network theory, I analyzed how FEMA's hub within New Orleans was at the Ochsner Center Hospital. Charity Hospital became a famously damaged facility. LSU reported that the hospital needed \$25 million in repairs; however, by 2008, the cost would escalate to \$475 million (Gratz, 2015). The damage was reported as high because the higher the damage, the more funds the facility would receive from FEMA. From the political perspective, FEMA conducted a study stating that New Orleans was the most at-risk city in the country of getting hit by a hurricane, so they created a simulated hurricane called “Pam.” “Pam” was meant to help the federal and local government create documentation for the areas in the most significant risk and what would be the solution if the damage occurred. Unfortunately,

all the information recorded for “Pam” was not effectively used since it took the city ten years to return to its pre-Katrina state.

Through both my STS and technical thesis, I learned about trauma 1 healthcare facilities within the US. I learned about the best operations to be triaged as a patient and the best methods of moving through a system. Healthcare is a giant ecosystem of processes and they are all interconnected. I also learned the importance of FEMA since each community suffers after a natural disaster- which is still true in 2025. I also learned the proper research methods through STS 4500 and 4600 courses.