An Executive Summary and Sociotechnical Synthesis

A Paper submitted to the Department of Engineering and Society

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Best Serving the Medical Public

"Wherever the art of Medicine is loved, there is also a love of Humanity." - Hippocrates

The motivation that drove both my technical portion of my thesis and my STS research paper boils down to the complicated initiative of improving the current medical system in America. When looking at modeling an individual anesthesia induction procedure at the UVA hospital and taking a broader glance at the laws that govern our healthcare system and the data that we keep it was apparent that there was room for improvement on both fronts. Americans feel the same way as only 4% of those polled believed that the healthcare system should be kept as is. With such low faith in the system it raises the question as to how the healthcare system can best protect the interests of the people it serves considering healthcare spending in 2019 reached approximately 17.3% of US's GDP (CMS, 2020).

The technical portion of my thesis produced a model that best represents the operating room environment for analyzing the anesthesia induction procedure at the UVA hospital to determine critical points for cross contamination and potentially change procedures. This model was then tweaked in order to account for unforeseen occurrences in the induction procedure such as accidentally skipping a step, touching doctor hands together, and forgetting to sterilize equipment after an operation. The findings of this modeling indicated that, contrary to previous opinion, loose adherence to the strict induction procedure was not the cause for the most significant contamination of the patient as the procedure itself prevented slight errors from propagating contamination. The most critical step in mitigating contamination in the operating

room is thoroughly sanitizing all of the objects in the room before the next procedure (most specifically the pixxis drawer and the tray). This discovery is highly applicable in the anesthesia fields and of special importance to be taught at training hospitals (such as UVA) and undergraduate nursing classrooms.

In my STS research I looked at the use of the electronic healthcare record (EHR) system in America specifically in regard to the current state of the system, arguing the ethicality of the system, and the legislation in place in order to provide recommendations that would shore up any potential shortcomings. I argued from a utilitarian perspective that for the greatest amount of good for the largest number of people that the use of the EHR system was both necessary and ethical in today's world because of the accountability, speed of care, and accessibility that it provides to both the patients and the healthcare professionals. However, changes will need to be made to legislation in order to better mitigate the technical and privacy risks associated with the expansion of the EHR system given the advancements in data analytics and technology as a whole.

STS perspectives support ethical responsibility in engineering by forcing engineers to consider the contextual situation of a problem, by considering the stakeholders and providing empathy when needed for them, and by applying ethical frameworks in order to deal with dilemmas intertwined with the technology we all deal with. These two parts of my thesis are key examples of the benefits of applying STS perspectives into real life situations. For my capstone project at the hospital, we observed numerous anesthesia induction processes in the operating rooms in order to get a better understanding of the model that we would need to build and then ultimately validate. Additionally, we needed to have empathy for the anesthesia providers in order to know what kind of errors they were likely to make in the heat of the moment and then

test our model against these wrinkles. Regarding the STS research portion of my thesis, it was critical to understand the importance of different ethical frameworks to be able to apply them to the current state of the EHR system and see how different parties were able to look at it. It was also crucial to understand the historical relevance of the EHR system and how it came about in the early 2000's to be able to compare what role it plays today intertwined with the technological advancements we have made.