Thesis Project Portfolio

Designing a Mechanical Housing Component for Neonatal Pulse Oximetry

(Technical Report)

Exploring Purdue Pharma's Role within the Opioid Crisis Through the Lens of Care Ethics

(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

Jayeesh Chennupati

Spring, 2024

Department of Biomedical Engineering

Table of Contents

Sociotechnical Synthesis

My technical work and STS research paper are connected through the application of care ethics to determine optimal actions or engineering design to address vulnerable populations. However, the two works differ in the vulnerabilities of each population and how actors are able to address the vulnerabilities for each population. Within the STS research paper, there is an exploration of how Purdue Pharmaceuticals preyed on doctors and patients, exhibiting a lack of care, that fueled the opioid crisis within the United States continuing to have severe ramifications within the United States. Within the technical work, there is an application of care ethics as design criteria since the technical solution is prompted by a lack of functionality for neonates creating negative clinical outcomes. While my technical work and STS research paper focus on completely two different situations, one where a company did a wrong doing while the other is more focused on creating an engineering solution, both have care ethics incorporated within the design or discussion of the projects.

The industry standard for a pulse oximeter is inadequate for diagnosing infants in lower income countries, which inhibits the correct treatment with oxygen saturation in resource constrained settings. Thus, a new pulse oximeter was created that would more adequately address the unique design constraints that neonates pose. This project was executed by creating a pulse oximeter that could change its ring diameter based on the user's finger. It was tested by replicating a similar movement neonates had and measuring the rotational and vertical movement of the pulse oximeter. The final interaction had minimal vertical movement but had some rotational movement. Future work would consist of creating fully functional prototypes tested on neonates that would meet FDA standards.

Within the STS research paper, I explored how Purdue Pharma did not act morally within the marketing of OxyContin by downplaying negative consequences and using doctors for its marketing efforts. To support the idea, I used the ethical framework known as care ethics where the main tenant of care as a virtue was explored within the various ways care could have or was not implemented by Purdue Pharma. The goal of the paper was to highlight how Purdue Pharma did not practice care and create a standard for actors to act with care in systems, like healthcare, that might not necessitate care for actors to function. Otherwise, if we continue to fail to consider how actors should care in systems that don't necessitate care, we create a world where the tragedy of the commons and negative externalities will be more present.

Though the two projects were different in examining a technological product vs examining an actor, the tenants of care are extremely important to consider in both projects. Care is essential within device development to first understand how to care for your patient by being attentive towards issues that they face and then recognizing how to act on that care. By learning how the healthcare system might not always necessitate care and understanding the disastrous consequences of care being sidelined for profits, my motivation has increased to act with care in situations that might not mandate doing so. In conclusion, by both working on my STS research paper and technical project this past year, I have advanced my ability to understand how to create devices that have care principles imbued with them and also act as an actor that displays care for everyone and everything I work with.