

Thesis Project Portfolio

**Developing Preliminary Point-of-Care-Ultrasound Competency Guidelines for Internal
Medicine at the UVA Hospital**

**An Exploration into the Current Obstacles in Pediatric Medicine that Impede Access to
Essential Medical Devices and Medications**

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

Developing Preliminary Point-of-Care-Ultrasound Competency Guidelines for Internal Medicine at the UVA Hospital

An Exploration into the Current Obstacles in Pediatric Medicine that Impede Access to Essential Medical Devices and Medications

Prospectus

Sociotechnical Synthesis

Upon first glance, ultrasound imaging and pediatric-specific technology are two topics that do not have any clear relationship. However, the intention behind both the technical capstone and STS, projects does have a distinct similarity. In both cases, the projects worked to find ways to make technology more accessible within medicine. Imaging technology continues to innovate and portable models are one of the newest advancements that can have immediate positive impacts. This technical project is focused on making portable ultrasounds more accessible to physicians, who can in turn provide better care to patients. Pediatrics as a whole is an area that needs new innovations in order to meet the needs of its patients. This thesis attempts to highlight the barriers that currently exist for these innovations and what can be done to help overcome the problem.

Imaging technology is an essential tool in medicine that helps with providing care for patients. It allows physicians to get visuals of internal organs and structures that can assist with the diagnostic process across a variety of specialties. Ultrasounds are an example of this technology that has continued to advance over the years. One of the most notable advancements is the development of portable models at a lower cost with equitable imaging qualities. Despite all the positives around the technology, it has failed to be officially adopted by most specialties. One of the reasons for this is that no clear certification guidelines exist for the use of the technology in practice. This leads to questions about liability as there is no acceptable standards that illustrate a physician has capable enough skills that they are not a potential danger to a patient. This technical project seeks to create certification guidelines for different usages of portable ultrasound within the Pulmonary and Critical Care Unit in the Internal Medicine Department at UVA Hospital. This includes collecting data on current training requirements for

general ultrasound usage across various departments as well as investigating various medical organization's standards. The final goal is to create a prototype of a user-friendly manual that outlines the background information of the technology, why it is useful, and make a recommendation on guidelines that can be used for physician competency.

Pediatric patients face unprecedented challenges in medicine. They lack access to essential technology that can help them treat and/or manage their needs. This problem can be clearly seen through the lack of access to medical devices (for congenital heart defects) and therapeutics (to manage Crohn's disease). This paper will examine the research question: What are the current challenges that prevent the creation of medical innovations for the pediatric population and how can these be overcome? Pinch and Bijker's Social Construction of Technology (SCOT) will guide the research to understand how the actions of various stakeholder groups contribute to the problem and the potential for a solution. Additionally, Harrison's Iterative Sociotechnical analysis (ISTA) will be used to explore how the lack of technological access has led to some unanticipated consequences. The lack of technologies is already an acknowledged problem; however, there has been very limited progress made to find a better solution. Pediatric patients are at a disadvantage as they cannot properly advocate for their own needs. It is expected that this research will help clarify how social groups (e.g., parents and insurance agencies) can create unintentional technological barriers for pediatric patients. Additionally, how the actions of certain groups (e.g., clinicians) can advocate and promote positive change. The ITSA framework will also reveal how the current solutions are far from ideal. The STS frameworks will illustrate how current healthcare needs are failing to be met and a clearer path towards a solution.

Although the projects are quite dissimilar in terms of topic, it was still valuable to complete both concurrently. The technical project resulted in a lot of highs and lows while trying to follow the engineering design process. Notably, having to be flexible and willing to adapt when encountering various obstacles. In addition, it involved learning how to take a large problem and break it down into manageable pieces, find solutions that can have a direct and meaningful impact. In regards to the thesis, this helped in shaping the direction of the project by taking a similar approach and breaking down the overarching problem of innovation in pediatrics and focus on two specific case studies. Additionally, while conducting interviews for the technical project, it became apparent that everyone had different opinions on the same problem and what the best way to proceed was. However, not everyone can be right. It was an important lesson in learning how to acknowledge people's biases and understand where they are coming from and account for that during.