Thesis Project Portfolio

Life Cycle Assessment of Stainless-Steel Surgical Tools at UVA Hospital

(Technical Report)

The Impact of Single-Use Hospital Plastic Medical Devices on the U.S. Healthcare Landscape

(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

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Spring, 2024

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Sociotechnical Synthesis

Introduction

When looking at the world of healthcare from different angles, many sociotechnical dynamics begin to come to light. Today, the problem of medical waste encompasses various sociotechnical factors throughout the life cycle of each piece of medical waste. Both the technical capstone project and the STS research paper aim to explore these connections by highlighting the issues related to hospital waste and their effects on waste management, environmental sustainability, and healthcare practices. The technical project serves as a comprehensive UVA Health System waste analysis. On the other hand, the STS research paper explores the broader sociotechnical dynamics that cause and result from the growing medical waste crisis in the United States. Although each project has a different approach, they both follow the similar goal of mitigating the impact of hospital waste on the environment by promoting more sustainable healthcare practices. This understanding, in turn, offers hope for change, highlighting the need for different approaches to tackle the increasing problem of healthcare waste in hospitals around the country.

Technical Project

The primary goal of the capstone project is to conduct a waste stream analysis on stainless steel surgical tools used in the UVA hospital operating rooms. With this goal in mind, the project aims to provide results to the hospital regarding its waste generation. These findings show the increasing scale of the medical waste problem since the COVID-19 pandemic and hope to encourage policy changes that promote more sustainable practices. The project includes two primary specific aims. The first aim is a comprehensive waste stream analysis of UVA Health to

find areas of increased waste output and build a list of all possible hospital waste sources. Using the initial analysis results, the project's second aim is a complete Life Cycle Analysis (LCA) of a selected medical device or tool creating increased waste in the hospital. In the case of UVA Health, the tools chosen for the LCA are stainless-steel surgical tools used throughout the hospital system. The LCA begins with an audit of stainless-steel surgical tools in UVA Health to determine the types of tools used along with the quantity of waste they produce. Additionally, the LCA includes an in-depth comparison between UVA Health's reusable stainless-steel tools and their respective disposable counterparts. These comparing factors outline each tool's cost and environmental impact throughout its lifespan. The results of the LCA underscore opportunities for UVA Health to advance sustainable practices by promoting increased use of reusable tools, thereby reducing its waste output and environmental impact.

STS Research Paper

Similar to the stainless steel-surgical tools in UVA Health, single-use plastic medical devices have significant environmental ramifications, which are a critical concern for the whole industry. The research of the STS paper explores this prevalent issue under the guiding question: What are the sociotechnical barriers to hospitals implementing systems to reduce hospital plastic waste? Research is conducted through the broad lens of the Social Construction of Technology (SCOT) framework. This framework highlights various levels of interpretive flexibility among different stakeholders. Additionally, the research uses a mixed-methods approach that integrates a comprehensive literature review, interviews with stakeholders within the sustainability industry, and case studies from around the world. The research hopes to bring a broader perspective on the decision-making behind the continued use of single-use plastics in healthcare.

Anticipated findings include diverse perspectives from varying stakeholders, which can reveal the complex interplay of policy decisions, regulatory dynamics, and economic considerations that go into the use of single-use plastics. By highlighting the many sociotechnical factors leading to the current medical waste practices, the research provides a significant potential for changes in the healthcare landscape by driving policy changes and promoting more sustainable and environmentally friendly practices within the fields of STS and engineering.

Conclusion

Completing both the technical capstone project and the STS research paper concurrently provided an opportunity to see the significant issues surrounding hospital waste through a more holistic lens. Each project influenced the other by using the technical factors outlined in the LCA on stainless-steel tools to understand the policy decisions that allow for single-use plastic medical devices to dominate the current healthcare landscape around the country. Moreover, the distinct connections between each project fostered a broader perspective, highlighting the importance of collaboration from each stakeholder to improve the healthcare industry's environmental sustainability. Collaboration between each stakeholder is a practical necessity in addressing sociotechnical and environmental needs throughout the entire life cycle of hospital waste. Thus, the value of completing both projects concurrently lies in having a more integral understanding of the medical industry and its connections to politics, technology, society, and the environment.