

Thesis Project Portfolio

Recycling of Single-Use Metal Instruments at the UVA Health Emergency Department

(Technical Report)

Sterility, Sustainability, and Justice: Rethinking Healthcare Waste at UVA

(STS Research Paper)

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Executive Summary

Hospitals generate immense amounts of waste, yet much of it is invisible to the patients they serve. In a field built around healing, the environmental harm caused by single-use medical instruments often goes unaddressed. My capstone project and STS research both explore how to close this gap—technically, operationally, and ethically—by identifying sustainable pathways forward for medical waste reduction at UVA Health. The capstone focuses on launching a pilot program to recycle single-use metal surgical instruments in the Emergency Department, while the STS paper expands the lens to interrogate the broader environmental justice and institutional barriers to sustainability in hospital systems. Together, these projects show how small infrastructural changes and large-scale cultural shifts can combine to make healthcare more environmentally responsible.

The capstone project was undertaken to address the growing environmental and financial costs associated with the routine disposal of single-use metal instruments. These tools—often made of 304-grade stainless steel—are discarded into sharps bins and landfilled despite being fully recyclable. Our capstone team designed a pilot recycling program at UVA Health’s Emergency Department (ED) that connects clinical workflows with existing sterilization infrastructure and a local scrap metal partner. Methods included stakeholder interviews, workflow mapping, bin design, signage creation, and a staff survey to assess awareness and participation.

Although the pilot has only recently launched and results are not yet available, we expect to collect outcome data over the next two weeks. These will include the weight of recycled materials, time required for each step, staff compliance, and financial savings. Early projections, based on internal data, suggest the potential to divert thousands of pounds of steel annually and

reduce sharps disposal costs by over \$20,000. A secondary goal of the pilot is to test the effectiveness of signage, communication strategies, and centralized bin placement in increasing compliance, with lessons intended for replication in other hospital departments.

The STS research project broadens the focus from single-use metal instruments to the systemic waste practices in healthcare as a whole. The central research question asks: how can hospitals reduce the environmental and financial impact of single-use instruments while maintaining safety and efficiency? Using a mixed-methods approach grounded in an environmental justice framework, the study integrates policy analysis, stakeholder interviews, and literature review. It examines not only technical feasibility but also the ethical imperatives of reducing medical waste in a sector whose environmental burdens disproportionately affect low-income communities.

The STS paper concludes that sustainable change in hospital waste management requires a dual strategy: implementing recycling protocols for single-use tools and transitioning to reusable alternatives where feasible. Evidence includes data from lifecycle assessments, projected financial savings, and interview testimony from frontline ED staff at UVA who expressed strong support for waste reduction efforts. The paper emphasizes that institutional inertia, logistical bottlenecks (especially in sterilization infrastructure), and regulatory ambiguity are the main barriers to progress—but also that hospital culture is more receptive to change than often assumed. By drawing attention to these dynamics, the STS research not only reinforces the goals of the capstone project but also situates them in a broader ethical and policy-oriented context.