

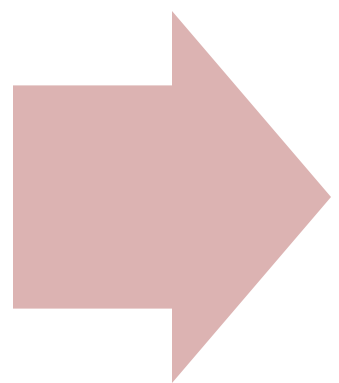
Objective

- Gain exposure to the pharmaceutical supply chain within a large academic hospital, focusing on medication distribution and administration.
- Conduct a waste audit as part of a life cycle analysis (LCA) to compare the quantity and type of waste generated by different anticoagulation administration methods.
- Identify opportunities to improve healthcare sustainability by reducing waste and promoting environmentally responsible practices in clinical care.

Methods and Materials

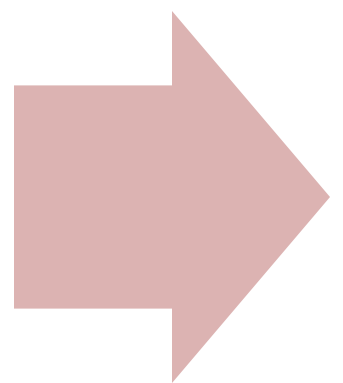
Supply Chain Assessment

- A pre-clinical medical student surveyed the hospital's medication supply chain, including primary, secondary, and tertiary packaging and distribution pathways.
- Waste collection sites included the pharmacy, nursing units, and supply chain departments.



Process Mapping & Waste Categorization

- Each anticoagulation administration route (sub-Q, PO) was directly observed and mapped from preparation to disposal.
- Waste was categorized as packaging waste (e.g., syringes and blister packs) or administration waste (e.g., gloves, alcohol swabs, and plastic cups).



Quantification & Comparative Analysis

- All waste was weighed, and averages were calculated by dosage form and waste type.
- Comparative analysis identified differences by medication and formulation to highlight opportunities for waste reduction and sustainability improvement.

Background

- Healthcare systems are responsible for 8.5% of total greenhouse gas emissions in the United States, with pharmaceuticals accounting for 18% (1).
- Sustainable medication use can reduce healthcare systems' contribution to climate change.
- Anticoagulants are a medication used to prevent and treat blood clots and are available in subcutaneous (sub-Q) and oral (PO) formulations.
- Sub-Q and PO forms may produce different amounts of waste, thus carrying distinct environmental impacts.
- Research shows no significant difference in patient health outcomes between sub-Q and PO anticoagulation (2).

Results

Waste Quantification and Comparison

- Waste was collected from 11 subcutaneous (sub-Q) and 5 oral (PO) anticoagulation administrations, including all materials used in preparation and administration.
- Average total waste per administration: 18.83 g (sub-Q) vs. 6.82 g (PO) - nearly three times higher for sub-Q.
- Medication waste: 11.89 g (sub-Q) vs. 0.36 g (PO), indicating sub-Q formulations produce a larger proportion of medication-related waste.

Interpretation

- Administration route strongly influences overall waste generation.
- Sub-Q anticoagulants generate more packaging, consumables, and residual medication waste.
- Where clinically appropriate, transitioning from sub-Q to PO anticoagulants may significantly reduce total waste in anticoagulation therapy.



Future Direction

- Current literature comparing the efficacy of intravenous (IV), sub-Q, and PO anticoagulation methods will be reviewed.
- Waste produced by administration of intravenous (IV) anticoagulation (heparin drip) will be audited and compared to sub-Q and PO data.
- Sample size of sub-Q and PO administrations will be increased.
- Secondary and tertiary packaging waste will be quantified and compared between formulation types.

References

- (1) Shanoor Seervai, Lovisa Gustafsson, and Melinda K. Abrams, "How the U.S. Health Care System Contributes to Climate Change," explainer, Commonwealth Fund, Apr. 2022. <https://doi.org/10.26099/m2nn-gh13>
- (2) Agnelli G, Becattini C, Meyer G, et al. Apixaban for the Treatment of Venous Thromboembolism Associated with Cancer. N Engl J Med. 2020;382(17):1599-1607. doi:10.1056/NEJMoa1915103

Acknowledgements

A sincere thanks to Dr. Chen for her mentorship and guidance throughout this project.

I am also grateful to the RWJUH physicians, nurses, and pharmacists for their cooperation and support in helping me collect this data.