Safe Drainage of Bloodlines to Reduce Medical Waste Weight

Site: Warszawski Uniwersytet Medyczny (WUM), Warsaw, Poland.

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Life Cycle Assessment Support

Life Cycle Assessments were conducted by Abass Fehintola, PhD Candidate at Trinity College Dublin.

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Why did you start?

Problem Description

In the dialysis unit, used bloodlines and dialysate lines from hemodialysis sessions were discarded with residual blood and fluids inside. This practice significantly increases the weight of medical waste classified as infectious, which must then be incinerated. Heavier waste bags result in higher waste management costs and a greater environmental footprint.

Specific Aims

Following the **SMART Goals** framework, the project aimed to:

Specific - Introduce a standardized process for draining bloodlines and dialysate lines after each hemodialysis session in the designated safe room.

Measurable - Determine the average reduction in medical waste weight per dialysis treatment by measuring drained vs. undrained lines during the project, and calculate the cumulative impact per week and per year.

Achievable - Use the newly renovated drainage room, existing staff, and protective equipment to implement the procedure without requiring additional infrastructure.

Relevant - Reduce waste disposal costs, decrease the environmental footprint of the dialysis unit, and improve sustainability while maintaining infection-control standards.

Time-bound - Implement the procedure within 1 month and evaluate waste reduction after a 3-month observation period.

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What did you do?

Context

The optimization was implemented in the dialysis unit of a university hospital, which provides care for approximately 90 patients on chronic hemodialysis. Following a recent renovation, the unit now has a dedicated drainage room designed to ensure safe handling of biohazard materials. This facility allows nurses and assistants to empty bloodlines and dialysate lines without risk to staff. The new infrastructure provides an opportunity to reduce the weight of medical waste while maintaining compliance with infection-control standards.

Intervention

Key components of the intervention included:

- Development of a standard operating procedure for safe drainage of bloodlines and dialysate lines

- Training of nurses and dialysis assistants in the new procedure, with emphasis on infection control and safety
- Use of a dedicated drainage room designed for safe handling of biohazard fluids
- Provision of appropriate protective equipment (e.g. gloves and protective clothing)
- Implementation of routine drainage of lines prior to disposal to reduce the total weight of infectious waste

To guide implementation, a structured approach was followed. Initially, baseline waste weight was measured over several dialysis sessions with undrained bloodlines.

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This was followed by the introduction of the drainage protocol in the dedicated room, supported by staff training and the availability of protective equipment.

Adherence to the protocol was monitored during routine clinical practice, and waste weight was re-measured following implementation to assess reductions per session, per week, and projected annually. Staff feedback on safety and practicality was collected throughout the process, and findings were reviewed with unit leadership to support integration of the procedure into standard practice.

Measures

Patient Outcomes

- No direct patient outcomes were expected, as the intervention related solely to post-treatment waste handling.

Environmental sustainability:

- Reduction in waste mass per dialysis treatment (kg/treatment).
- Total weekly and annual reduction in infectious waste.

Economic sustainability:

- Cost savings calculated from reduced waste weight × disposal cost per kg.

Social Sustainability:

- Social impact was assessed using the KitNewCare modelling framework, including estimates of forced labour medium-risk hours
- Staff outcomes were measured through the monitoring of safety incidents and informal staff feedback on workflow and practicality.

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What did you find?

Results

Environmental sustainability:

The average waste weight per session decreased from 459 g for full (non-drained) bloodlines to 287 g for drained bloodlines, representing a reduction of 172 g per treatment. This corresponded to an estimated reduction of 2,229 kg (2.23 tonnes) of infectious waste annually. Life cycle assessment modelling estimated associated annual savings of 5,372 kg CO_2e and 357.45 m^3 water deprivation. At patient level, this equates to approximately 24.8 kg less waste, 59.69 kg CO_2e savings, and 3.97 m^3 water savings per haemodialysis patient per year.

Economic sustainability:

With an estimated reduction of 2.23 tonnes of infectious waste annually, the intervention is expected to reduce waste disposal costs by approximately €1,100-€2,200 per year, depending on local disposal costs.

Social sustainability:

Staff report that the procedure is safe, easy, and feasible thanks to the dedicated drainage room. Cleaning personnel note that waste bags are significantly lighter and easier to transport. No infection-control concerns have arisen since implementation. The estimated reduction in forced labour medium-risk is 73.58 hours per year across the dialysis unit, corresponding to approximately 0.82 hours per haemodialysis patient per year.

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What does this mean?

Summary

Safe drainage of bloodlines reduced infectious waste by 172 g per treatment, translating to 186 kg/month, and 2.23 tons per year. The intervention is environmentally impactful, cost-saving, and easy to sustain, with no effect on patient care.

Key success factors:

- dedicated drainage room,
- clear protocol and training,
- leadership support,
- strong staff adherence.

Steps to maintain improvement:

- protocol integrated into standard dialysis workflow,
- periodic audits of waste weights,
- continued staff reminders on safety and proper handling.

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