

Standardising Dialysis Machine Practices

Site: Università degli Studi di Modena e Reggio Emilia (UNIMORE)

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Life Cycle Assessment Support

Life Cycle Assessments were conducted by Dr James Larkin, Postdoctoral Researcher and Sustainability Officer at Trinity College Dublin.

Why did you start?

Problem Description

Dialysis machines include functions such as standby mode, online priming and reinfusion, autoflow and dialyzer emptying that can reduce resource consumption and improve operational efficiency. However, these functions were used inconsistently across staff, shifts, and treatment areas, resulting in missed opportunities for sustainability and standardisation.

Specific Aims

1. To audit and standardise the use of dialysis machine functions by identifying variation in practice and implementing a unified protocol.
2. To reduce resource consumption and improve staff capability, opportunity, and motivation to use machine functionality appropriately.

What did you do?

Context

This project took place in the Nephrology, Dialysis and Renal Transplant Department at a large tertiary centre managing a complex patient population across chronic and acute dialysis pathways. The centre provides approximately 40,000 haemodialysis treatments per year.

Multiple dialysis machine types are in use, contributing to variation in practice.

Dialysis machines used:

- Fresenius 5008
- Bellco Flexya
- Nikkiso DBB-EXA
- B. Braun Dialog iQ

Intervention

The changes were implemented through a structured, two-phase quality improvement approach, combining baseline assessment of clinical practice, resource use, and workflow with targeted standardisation and behavioural interventions.

Phase 1: Baseline Assessment

Assessment of clinical practice

Structured observations were conducted to assess how dialysis machine functions were used in routine care. Variation in practice was analysed across:

- Individual nurses
- Shifts
- Treatment rooms

A staff questionnaire was administered to capture variation in key aspects of clinical practice. These included:

- Priming methods (online versus saline)
- Reinfusion practices and associated saline use
- Use of machine parameters (e.g. blood flow, filtration fraction)
- Clinical responses during treatment (e.g. intradialytic hypotension management)

The questionnaire focused on identifying variation in practice. Findings were analysed alongside observational data to identify inconsistencies across staff and workflows.

Process mapping

A detailed process map of haemodialysis workflows was developed to capture baseline practice across the full treatment pathway. This included stages such as machine preparation, priming, connection, dialysis session, disconnection, and waste handling.

The mapping highlighted variation in:

- Use of machine functions (e.g. priming, reinfusion practices)
- Execution of procedural steps (e.g. dialyser emptying, machine shutdown)
- Associated material use

A follow-up process map was developed after implementation to reflect changes in workflow. Comparison of pre- and post-intervention maps showed improved standardisation of key steps and reduced variation in practice across the care.

Process mapping provided a systematic and visual understanding of workflow variability and supported identification of opportunities for optimisation.

Phase 2: Standardisation and Implementation

Findings from the baseline assessment were used to support improved consistency in the use of dialysis machine functions through targeted feedback and staff engagement.

Key components included:

- Development and discussion of more standardised approaches to machine use based on observed variation
- Delivery of staff training sessions focused on:
 - Use of machine functions (e.g. online priming, reinfusion)
 - Opportunities to reduce unnecessary resource use
- Ongoing observations and informal feedback to staff to reinforce changes in practice
- Continued engagement with nursing staff to support adoption of more consistent approaches

Behavioural aspects of the intervention were informed by factors influencing staff practice (e.g. knowledge, habits, workflow constraints).

Although initial planning included optimisation through autoflow functionality, in practice a standardised dialysate setting (500 ml) has been maintained across clinically suitable patients.

Measures

Patient Outcomes

This project focused on the standardisation of best practice, without clinical implications for patients.

Environmental sustainability

Environmental impact was estimated using a life cycle assessment (LCA) approach, focusing on differences in resource use between saline-based priming and reinfusion and online priming. Savings from other changes has not yet been quantified.

Economic sustainability

Financial savings were estimated by calculating the cost of saline bags and associated giving sets avoided through the replacement of saline-based priming and reinfusion with online priming and reinfusion. Indicative European consumable costs were applied.

Social Sustainability

Social impact was assessed using the KitNewCare modelling framework, including estimates of forced labour medium risk hours.

Social and behavioural measures focused on understanding staff practices and factors influencing implementation.

What did you find?

Results

Environmental sustainability

An estimated carbon saving of 0.36 kg CO₂e per treatment was associated with eliminating the use of saline bags and associated giving sets through online priming and reinfusion.

Considering the total savings for UNIMORE, replacing saline bags with online priming and reinfusion across all haemodialysis treatments would equate to an estimated saving of 14,331.2 kg CO₂e annually.

However, audit and questionnaire findings demonstrated that only 20% of nurses were using saline bags, with the other 80% already using online priming and reinfusion. Therefore, the change project affected this 20% of practice (approximately 8,000 of

40,000 treatments annually) resulting in an annual saving of 2,866.2 kg CO₂ e. Based on the proportion of treatments affected (20%, equivalent to approximately 8,000 treatments annually), this corresponds to approximately 51 haemodialysis patients. When normalised at patient level, this equates to an estimated saving of approximately 56.20 kg CO₂e per patient per year.

Economic sustainability

An estimated consumable cost of €2.20 per haemodialysis treatment was assumed for saline line priming, comprising a saline bag (€0.70) and associated giving set (€1.50). Replacement of this practice with online priming and reinfusion in the 20% of treatments where it was previously used (approximately 8,000 treatments annually) results in an estimated annual saving of €17,600. This is equivalent to approximately €343 per patient per year, based on a typical haemodialysis schedule of three treatments per week (156 treatments annually). As procurement costs vary between healthcare organisations and countries, these savings should be considered indicative and may differ across settings.

Social sustainability

Quantified social impact data were available only for the elimination of saline bags through the use of online priming and reinfusion.

Based on published life cycle assessment data, this corresponds to an estimated saving of 28 medium-risk forced labour hours per haemodialysis patient per year.

Given that this change applied to approximately 20% of treatments, equivalent to around 51 patients annually, this corresponds to a total estimated reduction of approximately 1,428 medium-risk forced labour hours per year.

Staff engagement with the project increased awareness of variability in practice. Observations and feedback suggested greater awareness and increased adoption of machine functions

What does this mean?

Summary

This project demonstrated that standardising dialysis practices through a combination of technical guidance and behavioural approaches can improve consistency in machine use and reduce unnecessary resource consumption. At the time of reporting, quantified sustainability benefits were available only for the increased use of online priming and reinfusion, additional benefits from other standardisation activities were not measured. Involvement of nursing staff in the planning and implementation of the intervention was critical to its success.