Final Project Submission Form

Health Service: The Royal Children's Hospital

Title of project:	**Department:** Pharmacy
Optimising Alprostadil Supply: A Sustainable Approach	

Introduction

Provide a short introduction about yourself, your project, and why you were inspired to create sustainable environmental change in your department.

Within the pharmacy department and across the hospital there are many opportunities to tackle the environmental impact of medicines. We recognize that each stage of a medicine's life cycle, from raw ingredients to manufacturing, distribution, usage, and ultimately, disposal, can contribute to environmental degradation. As a department, we are committed to identifying and implementing sustainable practices that not only minimize our environmental footprint but also enhance financial efficiency.

In a paediatric hospital we have a unique opportunity to get more than a single dose from proprietary products (as most are made for adult sized patients). With more information being available for drug stability beyond 24 hours when made in sterile conditions, we found an opportunity to pack-down certain medications to smaller useable doses for our patient population.

For this project, we focused on "packing down" alprostadil, a high-cost medication commonly used in the Paediatric Intensive Care Unit (PICU) and Neonatal Intensive Care Unit (NICU) to maintain the patency of the patent ductus arteriosus (PDA) in neonates with congenital heart defects. Alprostadil is a critical medication that facilitates oxygenation in these infants until corrective cardiac surgery can be performed.

Stability data for alprostadil (ASHP): 250 and 125 mcg/mL in sodium chloride 0.9% packed in 1 mL polypropylene syringes are stable for 30 days when refrigerated.[1]

What was the problem you tackled?

Prior to this project, alprostadil was prepared by the nursing staff at the bedside in the following dilutions and changed every 24 hrs:
PICU 60 mcg/kg in 50 mL NS/D5W
NICU 30 mcg/kg in 25 mL NS/D5W

With alprostadil being supplied in ampoules containing 500 mcg/mL, we found that most of each ampoule was underutilised. This created an opportunity to "ampoule/vial share" or "pack down" the medication into smaller doses that could be used more efficiently across our departments.

What was your SMART Goal?

Reduce the waste and cost associated with the use of alprostadil by 50% through the preparation and use of packed-down doses. This will be achieved by standardising the concentrations of alprostadil and improving stock management practices across the PICU, NICU, and cardiology wards.

What system factors contributed to the problem?

Manufacture of pharmaceuticals are restricted to standard sizing and not necessarily made for the doses used in paediatrics.

Once 'opened' in standard conditions an Alprostodil ampoule cannot be re-accessed/nurses cannot administer subsequent does from the same vial/ampoule. Any residual medication must be disposed of.

Who were the key stakeholders?

Pharmacy, PICU/NICU pharmacists and technician, PICU/NICU nursing education team, PICU/NICU medical team, cardiology ward nursing education team and medical team.

What was the intervention?

Our intervention involved standardising alprostadil concentrations across the hospital and repackaging the medication into smaller, more useable doses.

Alprostadil was packed-down for use on PICU, NICU and cardiology as:

- 125 mcg in 1 mL (imprested in all 3 locations)
- 250 mcg in 1 mL (on request for PICU)

Alprostadil infusions were standardised across PICU/NICU and cardiology ward as follows:

NICU:

Category	Infusion preparation (concentration)	Volume from packed down 125 mcg/mL syringe	Volume of diluent	Compatible diluents
ELBW and low dose	25 mcg in 25 mL (1 mcg/mL)	0.2 mL	24.8 mL	Glucose 5% Sodium chloride 0.9%
Low dose	50 mcg in 25 mL (2 mcg/mL)	0.4mL	24.6 mL	Glucose 5% Sodium chloride 0.9%
Standard	**125 mcg in 25 mL (5 mcg/mL)**	**1 mL**	**24 mL**	Glucose 5% **Sodium chloride 0.9%**
Fluid restricted	250 mcg in 25 mL (10 mcg/mL)	2 mL (2 x 125 mcg syringes)	23 mL	Glucose 5% Sodium chloride 0.9%

PICU:

Category	Infusion preparation	Volume from packed down 125 mcg/mL syringe	Volume of diluent	Compatible diluents
Low dose (10ng/kg/min) or patient ready for ward transfer	125 mcg in 50 mL (2.5 mcg/mL)	1 mL	49 mL	Glucose 5% Sodium chloride 0.9%
Standard	**250 mcg in 50 mL (5 mcg/mL)**	2 mL (2x 125 mcg syringes)	**48 mL**	Glucose 5% **Sodium chloride 0.9%**

Cardiology:

Category	Infusion preparation	Volume from packed down 125 mcg/mL syringe	Volume of diluent	Compatible diluents
Standard	**125 mcg in 50 mL (2.5 mcg/mL)**	1 mL	49 mL	Glucose 5% **Sodium chloride 0.9%**

What impacts/outcomes were measured? How did you measure them?

Number of pack-down doses made, number of pack-down doses used, number of pack-down doses wasted, associated costs.

The pharmacy technician dedicated to this project records the manufacturing and stock inventory in an excel spread sheet.

- Recording includes strength of syringe made (e.g. 250 mcg in 1 mL or 125 mcg in 1 mL)
- Quantity made
- Quantity used

- Quantity wasted (e.g. stock expired on ward, manufacturing issues such as cracked syringe, expired ampules)

Associated costs: 1 box of alprostadil = $2310.55 ($462.11/ampoule)

What challenges did you face? What enablers facilitated the change? What were the learning points?

Challenges included coordinating across multiple departments and ensuring adherence to the new standardisation and preparation. We also had to ensure that the packed-down doses maintained sufficient stock levels and rotated stock for shortened expiry. However, support from the lead technician for the role, clinical pharmacists, and nursing staff was invaluable in overcoming these hurdles.
A key takeaway was the importance of standardised processes and good communication across departments. Training and buy-in from all stakeholders were essential to the success of this initiative. Additionally, continuous monitoring and tracking of both usage and waste will be crucial for long-term sustainability.

What are the next steps with this project?

This project is ongoing and has now become a standard practice for alprostadil supply in the wards. The success of this initiative has opened the door to packing down other high-cost medications that are used in paediatric care. Future steps will involve expanding this approach to additional drugs, further reducing waste and costs across the hospital.

Points will be awarded in the following categories:

Environmental sustainability: What were the carbon savings from your project? (Please include your raw data and calculations)

We do not have the specific value of carbon dioxide equivalents from a single alprostadil ampoule, however based off other studies looking at IV paracetamol carbon emissions, we would estimate that a single ampoule of alprostadil produces 300 - 600 g CO_2e.[2]

In 2025 (project starting in May) we used 413 doses, prior to this project this would mean, 413 ampoules would be used (123.9 - 247.8 kg CO_2e), with IV pack-down we only used 148 ampoules (44.4 - 88.8 kg CO_2e). This is a CO_2e reduction of almost 65%.

Over the first 8 months, this initiative has avoided 159 kg CO_2-e, demonstrating a modest but measurable reduction that would equate to around 240 kg CO_2-e per year if sustained. This is equivalent to driving a petrol passenger car between 650-800km

Environmental sustainability: What were the waste reductions? (If possible, please specify what waste stream – reduced clinical waste by diverting to recycling, reduced clinical waste by using reusable equipment etc.)

In 2025 (project starting in May) we used 413 doses, prior to this project this would mean, 413 ampoules would be used, with IV pack-down we only used 148 ampoules. This is a waste reduction of almost 65% from pharmaceutical waste.

It can be assumed the other consumables used to prepare the packed-down doses would be similar to the process of making up the doses on the ward previously. E.g. 1 mL syringe to draw up dose, filter needle, 50 mL syringe for infusion, syringe cap/needle etc. has not changed amount of consumables required.

Pack-down doses are prepared in the sterile pharmacy suite; therefore, waste would be generated from the Personal Protective Equipment (PPE) required in this environment. This was not measured for this project.

Clinical outcomes: How did your project improve patient care? (include outcome data if available)

Clinical outcomes were not directly measured. However, standardisation of infusions is expected to enhance medication safety by supporting integration with electronic prescribing systems and enabling pharmacy-based preparation under higher accuracy and sterility standards. Standardised products can also be prepared in advance, as they are no longer patient-specific, improving workflow efficiency and reducing delays in care delivery.

In addition, standardised infusions can be safely administered using smart pump technology. These systems support patient safety by automatically calculating infusion rates, enforcing soft and hard dose limits, and verifying medication parameters through barcode scanning.[3]

Financial sustainability: Have there been any financial savings? (please include your calculations)

The financial impact has been substantial, with savings of approximately **$122,459.15** in 2025 alone. By reducing the number of ampoules used from 413 to 148, we significantly cut the costs of purchasing alprostadil, as each ampoule costs $462.11.

Based on comparing the cost of 413 doses if 1 ampoule used for each dose vs the cost of 148 ampoules used in the manufacture of pack-down doses.
Price per ampoule $462.11

- 413 ampoules = $190,851.43
- 148 ampoules = $68,392.28
- Difference = $122,459.15

Social sustainability: How did your project socially benefit patients, staff, or wider community?

This project has also created a new job role for a NICU/PICU technician, contributing to the growth of our workforce and ensuring continued focus on sustainability initiatives in our hospital.

Generalisability: Could this project be replicated in other areas of the hospital?

We can replicate this project for other medications used in paediatrics that come in proprietary products made for adults or large ampoule/vial sizes.

Please attach some photos of you and your team undertaking this project

(Left to right: Carolina, Alana, Alia, Hanna)

References:

1. ‘Alprostadil’ (2025) in *ASHP Injectable Drug Information.*

2. Davies, J.F. *et al.* (2024) ‘Environmental and financial impacts of perioperative paracetamol use: A multicentre international life-cycle assessment’, *British Journal of Anaesthesia*, 133(6), pp. 1439–1448. doi:10.1016/j.bja.2023.11.053.

3. Wende, L. *et al.* (2025) ‘The effect of standard concentration infusions on medication errors in neonatal and pediatric healthcare settings: A systematic review’, *Journal of Clinical Medicine*, 14(22), p. 7965. doi:10.3390/jcm14227965.