

Economic analysis of IV phenylephrine prefilled syringe use in the OR, a tale of 2 hospitals

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Background

- Phenylephrine is used as a vasopressor for treatment of hypotension during surgery
- The recommended dose of phenylephrine bolus is 40-100 mcg.
- The total amount of phenylephrine utilized depends significantly on the duration of the surgical procedure and the stability of the patient's blood pressure.
- Rates of drug wastage in the OR are as high as 86% for injectable medications prepared in-hospital, including vasopressors.¹
- In-house preparations under a sterile hood (ISO5) with a sterile technique, yield a fridge stability of 9 days. This short period can contribute to medication waste.
- Commercially available prefilled syringes (PFS) of phenylephrine eliminate the need for in-house preparation and offer an extended stability period of up to 2 years.
- Preparations at the bedside come with an increased risk of contamination, medication error and adverse events.
- PFS consistently reduce medication errors, adverse events, wastage, and preparation time, but come at a higher cost.²
- Is it less expensive to use PFS instead of in-house preparations of phenylephrine syringes?

Objectives

- Quantify the production and waste of phenylephrine syringes in two adult hospitals within the McGill University Health Centre (MUHC).
- Determine the cost of preparation of phenylephrine preparations at bedside and in central pharmacy.
- Establish an economic analysis of the phenylephrine preparations to inform institutional decision making in different scenarios.

Methods

- Two hospitals part of the McGill university health centre were included for evaluation
- Waste was defined as prepared phenylephrine syringes remaining unused at the end of their assigned stability period (9 days post-preparation, per institutional policy).
- Production and waste data were obtained from adult ICU pharmacy records, where phenylephrine syringes are prepared in large batches and related to optimize utilization across the adult site.
- Phenylephrine vial consumption in the intensive care units and recovery rooms are assumed to be used for continuous infusions
- A retrospective review was conducted for the period spanning August 2024 to June 2025 (RVH) and January to May 2025 (MGH).
- Material acquisition costs were obtained through McKesson via the central pharmacy at the GLEN site for 2025 CADs.
- Pharmacy technician preparation time was estimated based on structured interviews with technicians working in the Royal Victoria Hospital (RVH) adult Intensive Care Unit (ICU) pharmacy.
- Labour costs were calculated using publicly available wage data for 2025 CADs.

Results

- Costs for central pharmacy preparations were determined to be 0.55\$ per syringe for a 100-syringe batch. Costs for bedside preparations were determined to be \$ 1.15-\$10.15 per syringe.

Results

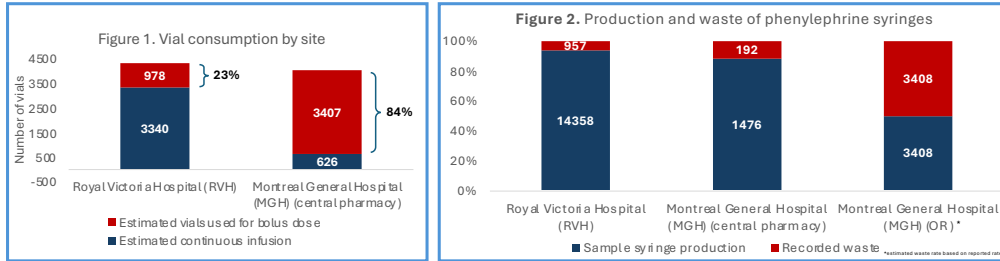


Table 3. Phenylephrine preparation scenarios and costs

	MGH OR	MGH Pharmacy	Simulation 1: 100% PFS in OR	Simulation 2: 100% pharmacy
Number of vials	3407	169	-	508
Syringes prepared	6816	1668	3407	5075
Syringes administered	3408	1558	3407	4965
Waste (syringes)	3408	100	0	373
Waste (%)	50	6.25	0	6.25
Cost (\$CAD, 2025)	\$7,836.10	\$932.28	\$64,733.00	\$2,803.93

Table 4. Probability and Cost of ADE Based on Syringe Preparation Type

Event	Probability of the event (%)	Cost per event	Current scenario MGH OR		Current scenario MGH Pharmacy		Simulation 1: 100% PFS in OR		Simulation 2: 100% MGH Pharmacy	
			Events per year	Costs/year (CAD)	Events per year	Costs/year (CAD)	Events per year	Costs/year (CAD)	Events per year	Costs/year (CAD)
Probability of contamination			7.47%		0.08%	0.08%	0.08%		0.08%	
Bacteremia (from contamination)	1	\$6,998.00	3	\$21,082.53	0.012	\$87.22	0.08	\$190.74	0.040	\$277.96
Medication error			22%-73%		17%		17%		17%	
Minor and significant ADEs	5	\$2,321.64	37-125	\$87,008-288,708	13.24	\$30,745.48	28.95	\$67,233.53	42.20	\$97,979.01
Moderate and serious ADEs	7	\$2,906.67	53-174	\$152,506-504,044	18.54	\$53,890.24	40.54	\$117,845.99	59.08	\$171,736.24
Severe life-threatening event	0.20	\$12,422.10	1-5	\$12,422-61,790	0.53	\$6,580.23	1.15	\$14,389.51	1.69	\$20,969.75
Total			\$283,782-882,189		\$92,103.82		\$276,311		\$293,825.68	
Total cost/year					\$376,018-974,425		\$356,628		\$293,767	

Discussion

The comparison between the two hospitals highlights how preparation processes significantly influence both safety and cost outcomes. At RVH, a pharmacy-based centralized preparation model with syringe rotation across units demonstrated a safe and cost-efficient approach in a high-volume setting. Although the operational costs and energy associated with syringe rotation were not accounted for, this model substantially reduced vial consumption for bolus administration from 84% to 23%, thereby decreasing medication waste and potentially lowering the risk of medication errors and adverse events from bedside preparations.

In contrast, the bedside preparation model at MGH is associated with increased safety concerns. Preparation in the operating room occurs without an independent double-check, which may increase the risk of medication errors and subsequent adverse events, particularly in high-volume environments. Additionally, syringes are sometimes stored at room temperature for over 24 hours, further increasing the risk of contamination. A meta-analysis reported a contamination rate of 7.85% for injectable medications prepared by nursing or medical staff, compared to 0.08% when prepared in pharmacy-controlled environments.⁴

Prefilled syringes represent a safer and potentially cost-effective alternative to bedside preparation. However, logistical considerations remain, as batches of fewer than 100 syringes require freezer storage to maintain stability. Overall, centralized pharmacy preparation and the use of prefilled syringes appear to improve safety and reduce waste compared to bedside preparation practices.

Limits

Data from the Montreal General Hospital were limited and determined to be wasted due to limited availability and substantially lower recorded production volumes.

Limits: the simulations are the extremes of replacement. However, in reality there will be a mix of interventions.

Conclusion

Preparation workflows strongly influence both the economic and safety profiles of phenylephrine syringe use. Centralized pharmacy compounding with batch preparation and rotation across units minimizes waste and maintains low production costs in high-volume settings. Phenylephrine prefilled syringes compared to bedside preparations represent a safer cost-effective alternative despite higher acquisition costs.

References:
 1. Barbato F, et al. Anesth Analg 2021;132(5):1450-1456. 2. Benhamou D, et al. Ann Pharmacother 2024;58(9):921-934. 3. Government of Canada. Wages: Pharmacy Technician in Canada [Internet]. 2025 Nov 19 [cited 2025 Sep 15]. [https://www.jobbank.gc.ca/statements/wages-occupation?2566/na_4_Lamné-Beld_KHM, et al. Eur J Clin Pharmacol 2019;75\(5\):609-617](https://www.jobbank.gc.ca/statements/wages-occupation?2566/na_4_Lamné-Beld_KHM, et al. Eur J Clin Pharmacol 2019;75(5):609-617)