

# ISMP Canada Safety Bulletin

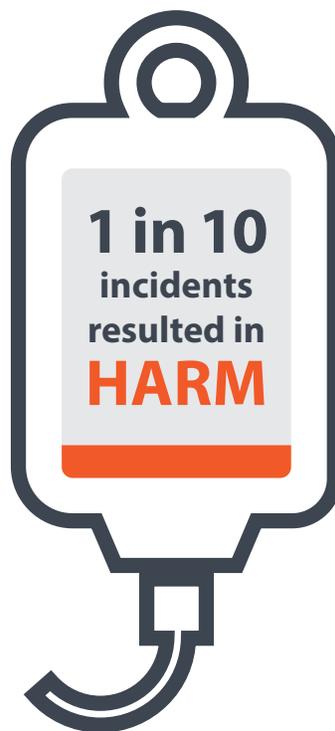
Volume 20 • Issue 7 • July 16, 2020

## Intravenous Medication Safety: A Multi-Incident Analysis

Administration of medication by the intravenous (IV) route (commonly referred to as IV medication administration) is ubiquitous in hospital practice. This route of administration is often used for several high-alert medications that bear a heightened risk of causing significant patient harm when used in error.<sup>1</sup> The need for improvements to the medication-use process, predicated on an awareness of the risk of IV medication-related harm, is an important step toward system-level changes. A multi-incident analysis was conducted to inform the future direction of medication safety efforts specifically targeting administration by the IV route.

### METHODOLOGY

Medication incidents associated with IV medication administration were extracted from reports submitted to 3 ISMP Canada reporting databases (Individual Practitioner Reporting, Consumer Reporting, and Community Pharmacy Incident Reporting) and the Canadian Institute for Health Information's National System for Incident



Reporting (NSIR) database<sup>†</sup> over the 3-year period from October 2015 to September 2018.

Key terms used to search the databases included “drip”, “IV”, “intravenous”, and “infus\*”. Incidents were excluded if they described only the use of unaltered commercial IV fluids (i.e., with or without electrolytes, but without any additional additives), blood products, or total parenteral nutrition/feeds, or if they involved the IV administration of a medication intended solely as a “rescue” agent (in response to a previous medication error).

### QUANTITATIVE FINDINGS

A total of 2210 incidents were identified and screened for inclusion.

Of these, 1583 incidents were included in the quantitative analysis.<sup>‡</sup> The key quantitative findings are provided in the following tables and figures, including the top 10 medications, the top 3 medication-use stages, and the top 5 types of errors most frequently reported in all incidents, as well the top 5 medications reported to be involved in harmful incidents.

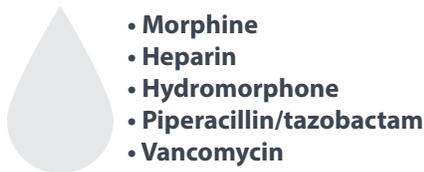
<sup>†</sup> The databases are components of the Canadian Medication Incident Reporting and Prevention System (CMIRPS). More information about the databases is available from: <https://www.cmirps-scdpim.ca/?p=14&lang=en>

<sup>‡</sup> It is recognized that it is not possible to infer or project the probability of incidents on the basis of voluntary reporting systems.

**Table 1.** Top 10 medications most frequently reported to be involved in IV medication incidents

Medication Name (Common Name)	Frequency
piperacillin/tazobactam	9.7%
vancomycin	8.8%
cefazolin	7.4%
morphine	6.8%
heparin	6.8%
ceftriaxone	5.5%
hydromorphone	5.2%
furosemide	3.9%
pantoprazole	3.2%
metronidazole	2.5%

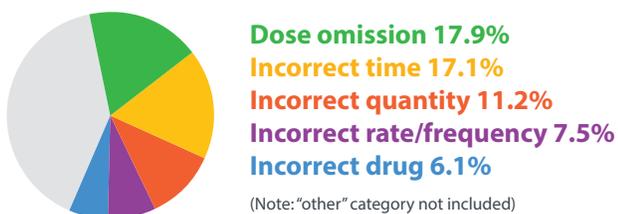
**Figure 1.** Top 5 medications most frequently reported to be involved in IV medication incidents causing harm



**Figure 2.** Top 3 medication-use stages most frequently reported to be involved in IV medication incidents



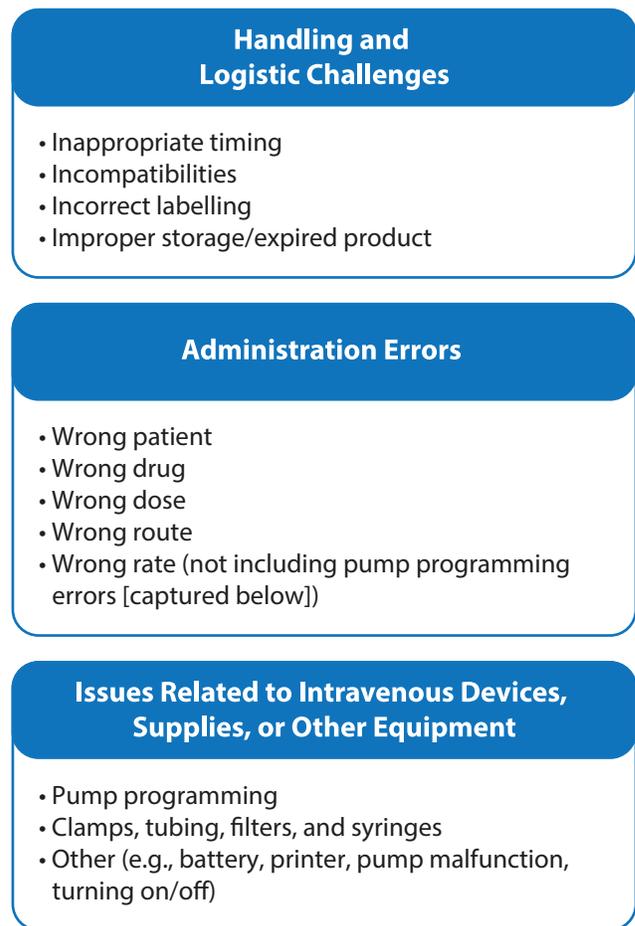
**Figure 3.** Top 5 types of errors most frequently reported to be involved in IV medication incidents



## QUALITATIVE ANALYSIS

After exclusion of reports that lacked sufficient narrative detail to ascertain the circumstances of the incident, 1498 incidents were included in the qualitative analysis, conducted according to the methodology outlined in the Canadian Incident Analysis Framework.<sup>2</sup> Qualitative analysis of the incident report narratives revealed 3 main themes, each with multiple subthemes (see Figure 4).

**Figure 4.** Main themes and subthemes



### **THEME:** Handling and Logistic Challenges

This theme, identified in almost half of the incidents analyzed, encompassed all reports in which incompatibilities, scheduling, timing, storage, preparation, or labelling of the IV medication (or any combination thereof) was indicated as a contributing factor. For example, unclear or ambiguous

documentation in the medication administration record (MAR) led to scheduling and timing errors in some cases. Confusing pharmacy-applied labels<sup>3</sup> contributed to some incidents, such as programming errors (e.g., calculation instructions for a pharmacy technician on the label were misread as programming information for the nurse), as well as errors in storage conditions for the medication (e.g., medication not stored at the correct temperature). Errors also occurred when the drug concentration and infusion rate appearing on the MAR and on the infusion bag label did not align with the pump programming units and sequence.<sup>4</sup> Delays or miscommunication related to transport or portering of medication were also contributing factors identified within this theme.

Hospitals are encouraged to facilitate close collaboration between the nursing and pharmacy teams to optimize the logistics and handling of IV medications.

***THEME: Administration Errors***

The occurrence of some type of administration error was the second most common theme, with approximately one-third of the incidents falling into this category. The administration errors identified in this analysis involved the wrong patient, the wrong drug, the wrong dose, the wrong route, or the wrong rate (not including pump programming errors). The lack of an independent double check was a factor in many of these incidents. Over-reliance on smart pump and bar-code technology, without an independent double check before IV medication administration (to verify and document the patient's name, the drug and its concentration, the prescribed infusion rate, the line attachments and labels), was a key contributing factor in many of these incidents.

Hospitals are encouraged to continue to focus quality improvement initiatives on accurate IV medication administration.

***THEME: Issues Related to IV Devices, Supplies, or Other Equipment***

In this analysis, about 1 in every 6 reports identified contributing factors related to the pump used for

IV medication administration (e.g., incorrect programming, pump malfunction) or with an associated accessory (e.g., missing filter, correct tubing not available). The reports identified that inexperienced or relief staff may not be familiar with the accessories, the sequence of programming steps, or the metrics that are preprogrammed into the pump. A study noted that with many different IV pumps available on the market, the user interface and unfamiliarity with the pump play a role in programming errors.<sup>5</sup> Key system-level concerns were reported to be incomplete drug and rate libraries in the pump software, improper labelling of the IV line, transposition of IV lines after temporary disconnection, pump failure due to inadequate maintenance and/or battery charge, and printer-related issues, such as low ink levels resulting in illegible reports.

Hospitals should ensure that staff are trained on the use of infusion pumps on a regular basis to maintain up-to-date knowledge and skills in pump set-up and programming.<sup>6</sup> Additionally, hospitals and purchasing groups are encouraged to collaborate with product manufacturers for continuous quality improvement efforts, including standardization of pump accessories and drug library information fields.

**CONCLUSION**

Medications are commonly administered by the IV route in many health care settings. This multi-incident analysis has characterized the types of medications and incidents that were most frequently reported with IV administration and raises awareness of opportunities to improve patient safety. Notably, among the medications most often reported to be involved in harmful incidents were 3 high-alert medications, including 2 opioids. Strengthening medication handling and logistics, incorporating appropriate checks prior to medication administration, and mitigating potential device-related issues are all needed to improve IV medication safety.

## ACKNOWLEDGEMENTS

ISMP Canada gratefully acknowledges expert review of this bulletin from the following (in alphabetical order): The Canadian Institute for Health Information (CIHI); The Canadian Patient Safety Institute (CPSI); Eric Romeril RPh ACPR BScPhm BSc, Perioperative Clinical Resource Pharmacist, Hamilton Health Sciences, Hamilton, ON.

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*This segment of the bulletin describes a recent SafeMedicationUse.ca publication from ISMP Canada’s Consumer Program.*

**SafeMedicationUse.ca**

February 2020 - Newsletter:

### How Much Iron Is in Here?

SafeMedicationUse.ca received a report from a patient who almost took 10 times the amount of iron that was prescribed for her. Her doctor recommended that she take 300 mg daily. The label on the iron product showed the iron content as “35 mg”, so she calculated that she needed to take 9 or 10 tablets every day. Fortunately, she contacted her pharmacy to ask for more information. She learned that the 35 mg on the product label referred to elemental iron, and the 300 mg recommended dose referred to the iron salt.

The labels on some iron products depict the product strength in terms of the amount of elemental iron, whereas others show the product strength in terms of the iron salt. Health Canada is moving toward requiring a product facts table for labels of natural health products such as iron. The product facts label will provide information in a standard format to help reduce confusion for patients and health care providers.

#### Tips for Practitioners

- When prescribing or recommending an iron supplement, be explicit about the dose of **elemental iron** that is required.
- Provide patients with written information to help ensure selection of an appropriate product at the pharmacy. Encourage patients to ask the pharmacist for help if they are not sure which product to select.
- Help patients to understand how product strength is expressed on iron product labels and the difference between elemental iron and iron salts.
- Ensure that patients receive an appropriate measuring device (oral syringe or dropper) for accurate measurement of liquid iron products.

Read the full newsletter for more information: <https://safemedicationuse.ca/newsletter/iron.html>



The Canadian Medication Incident Reporting and Prevention System (CMIRPS) is a collaborative pan-Canadian program of Health Canada, the Canadian Institute for Health Information (CIHI), the Institute for Safe Medication Practices Canada (ISMP Canada) and the Canadian Patient Safety Institute (CPSI). The goal of CMIRPS is to reduce and prevent harmful medication incidents in Canada.



The Healthcare Insurance Reciprocal of Canada (HIROC) provides support for the bulletin and is a member owned expert provider of professional and general liability coverage and risk management support.



The Institute for Safe Medication Practices Canada (ISMP Canada) is an independent national not-for-profit organization committed to the advancement of medication safety in all healthcare settings. ISMP Canada's mandate includes analyzing medication incidents, making recommendations for the prevention of harmful medication incidents, and facilitating quality improvement initiatives.

## Report Medication Incidents

(Including near misses)

**Online:** [www.ismp-canada.org/err\\_index.htm](http://www.ismp-canada.org/err_index.htm)

**Phone:** 1-866-544-7672

ISMP Canada strives to ensure confidentiality and security of information received, and respects the wishes of the reporter as to the level of detail to be included in publications. Medication Safety bulletins contribute to Global Patient Safety Alerts.

## Stay Informed

To receive ISMP Canada Safety Bulletins and Newsletters visit:

[www.ismp-canada.org/stayinformed/](http://www.ismp-canada.org/stayinformed/)

This bulletin shares information about safe medication practices, is noncommercial, and is therefore exempt from Canadian anti-spam legislation.

## Contact Us

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