Ontario
CRITICAL Incident Learning
Improving quality in patient safety

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Distributed to:

- Directors of nursing
- Directors of pharmacy
- Education coordinators
- Directors of biomedical engineering
- Clinical informatics managers
- Procurement managers
- Quality/patient safety leads

Suggested action items:

- Refer bulletin to director of biomedical engineering, clinical informatics manager, and procurement manager to raise awareness that upcoming procurement projects involving IV equipment should consider issues associated with administering multiple IV infusions.
- Refer bulletin to safety committees with suggestion that they consider the role of multiple IV infusions in investigations of current and future medication incidents, so that key risks are understood.
- Refer bulletin to nursing and pharmacy leadership (at organizational and unit levels) and to education coordinators to raise awareness of suggested strategies to minimize or prevent risks associated with multiple IV infusions.

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Multiple IV Infusions: Risks and Recommendations

Despite growing awareness of the factors that lead to errors in programming a *single* intravenous (IV) infusion, minimal research has been conducted into the errors that can result from administering *multiple* IV infusions* to a single patient (Figure 1). The use of multiple IV infusions is often unavoidable, and the complexity of the processes involved in managing these infusions contributes to the risk for medication errors. The Ontario Critical Incident Learning program recognizes the challenges that front-line practitioners face in managing multiple IV infusions and in preventing these types of errors.

Over the long term, improvements in the design of infusion systems are needed to solve problems associated with administering multiple IV infusions to individual patients. However, over the short term, supporting clinicians with targeted strategies can reduce inherent hazards and improve safety. The following are examples of errors and selected strategies designed to reduce or eliminate the risks associated with managing multiple IV infusions.

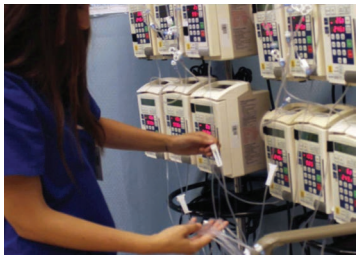

Figure 1. Managing multiple IV infusions

Identifying IV Infusions:

A nurse misidentified an infusion pump administering insulin, confusing it with one administering sodium chloride. The nurse unintentionally titrated the insulin pump's flow rate to the desired rate for the sodium chloride (i.e., from 3 mL/h to 75 mL/h). The patient received an overdose of insulin.[1]

Recommended Strategies:

1. Label primary IV tubing with the name of the infusate, just above the injection port closest to the patient and near the infusion pump (i.e., on the IV tubing just below the pump).[2]
2. Map the IV container to the corresponding IV pump/channel[2] particularly when:
   - programming the infusion pump;[2]
   - changing IV solutions;[2]
   - transferring care of the patient (e.g., at shift change or on transfer to another care location).

Managing "Dead Volume"†:

After administering an IV push dose of furosemide slowly over 1 minute, a nurse flushed the line with sodium chloride as quickly as possible. As a result, most of the furosemide dose (which was still in the IV tubing and catheter) was administered faster than the intended rate.[1]

Recommended Strategies:

1. Minimize "dead volume" by connecting IV infusions as close as possible to the patient's access port; use a single multiport connector (e.g., a manifold) when connecting more than 2 infusions.[2]
2. Minimize the clinical impact of "dead volume" by flushing the line after administration of an intermittent medication, using the recommended rate for that intermittent medication, to ensure administration of the complete dose at the intended rate.[2]

* In this publication, the term "multiple IV infusions" refers to the administration of 2 or more agents (e.g., hydration fluids, medications) to a single patient by the IV route through 1 or more venous catheters; it includes both continuous and intermittent (e.g., IV push doses, secondary infusions) IV infusions that may be administered sequentially or concurrently.

† Dead volume is the volume shared by 2 or more IV agents (e.g., hydration fluids, medications) "from the point infusions are connected to the patient's bloodstream".[1]

Administering IV Pump Boluses:

A nurse administered a bolus dose of fentanyl by increasing the flow rate for an existing continuous IV infusion of fentanyl to 999 mL/h; however, the volume to be infused was not changed (which would have caused the infusion to stop and an alarm to sound when the intended dose had been administered). The nurse left the patient's bedside and failed to return within an adequate time, which allowed the infusion to continue to run at 999 mL/h, resulting in a fentanyl overdose.[3]

Recommended Strategies:

1. When administering a bolus dose of a continuous infusion, avoid manually increasing the infusion rate.[4] Use a smart pump with a bolus feature that:
   - allows programming of the bolus dose in drug-specific units (i.e., to avoid unit conversion calculations) and duration (e.g., minutes);[2]
   - provides communication about programming of a bolus (rather than a continuous or "piggyback" infusion) and the status of the bolus.[2]

   If a smart pump with a bolus feature is not available, set a "volume to be infused" limit on the infusion pump, to limit the bolus dose.
2. Configure smart pump drug libraries for each clinical area to support the appropriate use of the bolus feature:
   - Enable the bolus feature only for medications that require use of bolus doses, with clinically appropriate "soft" and "hard" limits for dose, rate, and duration.[2]
   - Include "hard" upper rate limits for continuous IV infusions of high-alert medications, to prevent use of an increase in the primary continuous IV infusion rate as the means to administer bolus doses.[2]

Research was conducted by HumanEra, in collaboration with ISMP Canada, and supported by Health Quality Ontario, to better understand the risks associated with multiple IV infusions, with the goal of improving patient safety by reducing the hazards inherent to these processes. Multiple reports, including all recommendations based on this research, are available at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ontario-health-technology-assessment-series/mivi-phase2b. The following tools to support the uptake of recommendations are in development and are scheduled for release in early 2016:

- An evidence-based guideline that will summarize the supporting evidence and recommendations. The guideline will include implementation tools to facilitate adoption.
- Interactive eLearning modules that will teach concepts of infusion therapy related to secondary IV infusions and "dead volume".
- A technical information report to help improve infusion system design.

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Collaborating parties of the Ontario Critical Incident Reporting program

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