



QUICK GUIDE

**Improving the Safe Use
of Multiple IV Infusions**



Acknowledgements

The AAMI Foundation is grateful to the following entities for their generous permissions to use content from their websites in development of this AAMI Foundation Quick Guide:

- ISMP Canada for sharing its Multiple IV Infusions Bulletin¹
- HumanEra for sharing its recommendations directly from its report²

About the AAMI Foundation

The AAMI Foundation is the 501(c)(3) charitable arm of AAMI. Its mission is to promote the safe adoption and safe use of healthcare technology. The AAMI Foundation works with clinicians, healthcare technology professionals, patient advocates, regulators, accreditors, industry, and other important stakeholder groups to identify and address issues that arise from today's complex medical environment and have the potential to threaten positive patient outcomes.

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Background

The AAMI Foundation's National Coalition for Infusion Therapy Safety, launched in March 2015, is promoting the adoption of specific safety practices in four critical areas of infusion therapy to help ensure patient safety during IV infusions.³ This Quick Guide targets one of those areas: safe implementation of multiple line IV infusions. The other three areas of focus are increasing compliance with the use of smart-pump drug libraries, promoting questions CEOs should ask about infusion therapy safety, and reducing non-actionable infusion pump alarm signals.

In this guide, the term "multiple IV infusions" refers to the administration of two or more agents (e.g., hydration fluids, medications) to a single patient by the IV route through one 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.

Why the Focus on Multiple IV Infusions?

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. 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.

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.⁴

Over the long term, improvements in the design of infusion systems are needed to solve some of the 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 goal of this Quick Guide is to provide actionable strategies and to lead clinicians to the following tools:

- A guidance document created by HumanEra summarizes the evidentiary base and recommendations amassed through research. This document is truly a “must read” for all nurse educators and front-line clinicians! The guidance highlights implementation support materials (explanations, examples, diagrams, self-check lists, etc.) related to each of the recommendations provided in this Quick Guide.⁵ <http://ehealthinnovation.org/wp-content/uploads/MIVI-Evidentiary-Base-Report072415.pdf>
- Interactive eLearning modules developed by HumanEra for use by clinicians. These four modules are incredibly engaging and effective at teaching the concepts of infusion therapy related to secondary IV infusions and “shared infusion volume.” They are primarily intended for nurses, but are also applicable to pharmacists, quality improvement and risk management staff, and any clinician administering IV syringe pushes (e.g., anesthesiologists, paramedics, resuscitation teams).⁶



Who Will Benefit From This Quick Guide?

- ✓ Directors of nursing; managers; and front-line nurses
- ✓ Directors of pharmacy
- ✓ Education coordinators
- ✓ Directors of biomedical engineering
- ✓ Clinical informatics managers
- ✓ Procurement managers
- ✓ Quality/patient safety leads

What Are Some Ways This Guide May Be Used?

- Directors of biomedical engineering, clinical informatics managers, and procurement managers can use this guide to raise awareness about upcoming procurement projects involving IV equipment. For example, a vendor training package must include training the clinicians on how to safely manage multiple concurrent infusions.
- Safety committees can consider the role of multiple IV infusions in investigations of medication incidents, so that key risks are understood.
- Nursing and pharmacy leadership (at organizational and unit levels) and education coordinators can use the guide to raise awareness of suggested strategies to minimize or prevent risks associated with multiple IV infusions. They can also use the guide to aid in developing policies and protocols.

This Quick Guide covers the recommendations developed by HumanEra, as presented in its guidance document in the following areas:

1. Identifying an IV infusion
2. Setting up and programming multiple continuous IV infusions
3. Managing shared infusion volume
4. Setting up secondary intermittent IV infusions
5. Administering IV pump boluses

Only the recommendations from the HumanEra guidance document are provided in this Quick Guide. It is important to read the complete guidance document to learn exceptions and cautions to the recommendations, view graphics demonstrating proper implementations, etc.

Recommendations for Safe Use of Multiple IV Infusions

1. How Can You Distinguish IV Infusions?

Label all primary IV tubing to support line identification:

- Label primary IV tubing with the name of the infusate at two locations:
 - Near the infusion pump (not on the pump)
 - Just above the injection port closest to the patient (i.e., pump side of the port).
Use pre-printed labels and standardize the labels with respect to the format of information (e.g., generic name, tall man lettering).
- Distinguish the “IV push port” (i.e., the port where intermittent IV medications are administered via a syringe) by applying a label that is visually prominent and different from all other labels used in the bedside environment.
- When multiple IV access ports are being used, indicate (near the infusion pump) the patient access port to which an infusion is connected.

Organize the IV system:

- Set up multiple IV infusions to facilitate accurate and timely identification and tracing of IV infusions lines.
- Separate IV infusions and minimize tangles.
- Align the IV container (e.g., IV bag) with the corresponding IV pump/channel.
- Use patient gowns with snaps (plastic), ties, or Velcro on the shoulders.

2. How Can Errors Be Reduced When Setting Up and Programming Multiple Primary Continuous IV Infusions?

Minimize unnecessary line changes by labeling the tubing with date labels:

- Label primary IV tubing with pre-printed date change labels. Standardize the content (e.g., start date, discard date, start time), format of information (e.g., mm/dd) and location of the labels to minimize unnecessary line changes.
- Ensure date change information for IV tubing (and related components) is tracked consistently and reliably in all tracking systems (e.g., the medication administration record and/or electronic documentation systems should capture the same information that is on the IV tubing date labels).

Standardize medication concentrations:

- Standardize medication concentrations across common hospital pathways (e.g., OR-ICU, Emergency-General Internal Medicine), to help minimize the need to re-establish infusions after patient transfers.
- More than one medication concentration may be required for vesicant medications depending on the type of IV access device (e.g., peripheral catheter vs. central catheter) used for administrations.

Standardize IV technology and inventory management:

- Standardize IV infusion pumps, IV tubing/components between sending and receiving units and have pumps follow and stay with patients to help minimize the need to re-establish infusions after patient transfers.

3. What Is Shared Infusion Volume, and How Can We Manage It?

Patients routinely require more IV infusions than there are available access ports, requiring that multiple IV infusions be connected to a single port. Connecting infusions means that there is a shared volume that contains two or more infusates from the point the infusions are connected to the end of the patient catheter where the infusates enter the patient's bloodstream. This is referred to as shared infusion volume. Shared infusion volume may be of concern in many set-ups and situations.

Minimize the amount of shared infusion volume during the set-up:

- Connect IV infusions as close as possible to the patient access port.
- Use a single multiport/lead connector when three or more IV infusions must be connected (e.g., do not chain three IV infusions together using lower IV injection ports).

Minimize the risk of leaks, disconnections and unintended interruptions to infusions:

- Refrain from chaining three-way stopcocks to join multiple IV infusions.

Avoid unintended boluses of medication and interruption in therapy when the central venous pressure (CVP) monitoring line is calibrated, used for measurement, or flushed:

- Avoid connecting a continuous IV medication to a CVP monitoring line.

- When an intermittent medication is connected to a CVP line, avoid using a transducer to flush the line (or reading the CVP using a manometer) until the medication has cleared all IV tubing (including the connectors).

Use new IV tubing when initiating a new concentration of a continuous IV medication to prevent infusing any of the previous concentration remaining in the tubing at the rate intended for the new concentration.

Administer residual intermittent medication in the primary IV tubing following an IV bolus injection using the recommended rate for the intermittent medication both to ensure the complete dose is administered at the intended rate and to minimize the effects of drug incompatibilities.

Educate nurse trainees and registered nurses on shared infusion volume principles, and facilitate the development of skills in shared infusion volume management to minimize medication errors. Include the following topics:

- Setting up infusions to minimize shared infusion volume impact
- Administering an IV infusion via the central venous pressure monitoring line
- Changing the concentration of an IV infusion
- Administering an IV intermittent bolus injection
- Making a change (e.g., stop, titration, start) to an IV infusion connected to other infusions
- Completing a "line change"
- Administering a secondary IV infusion

4. What Are Ways to Minimize Risk When Setting Up Secondary Intermittent IV Infusions?

Set up high-flow rate and/or large-volume secondary intermittent IV infusions using the appropriate set-up procedures defined by the infusion pump manufacturer to prevent unintended concurrent flow of the primary infusion.

When administering a secondary IV intermittent medication, check compatibility with the previous secondary medication. If compatible, re-use the secondary IV tubing and back-prime from the primary IV bag.

Minimize disruptions of high-alert medications:

- Do not connect a secondary infusion to any high-alert primary IV infusion using any port (i.e., the secondary IV port or a medication injection port below the pump).
- Do not administer continuous IV infusions as secondary IV infusions.

Identify a standard procedure for administering the complete secondary infusion dose (secondary infusion VTBI) at the intended rate for time and/or rate sensitive secondary medications. Consider the following:

- IV container overfill
- The amount of shared infusion volume/priming volume in the IV set-up
- Infusion pump programming workflow and constraints
- The tolerable flow-rate variability for each medication

Educate all nurses and nurse trainees (e.g., academic, in-service, annual recertification) on the physical principles and best practices related to administering secondary IV infusions to minimize set-up errors. Include the following topics:

- Underlying IV infusion principles (e.g., hydrostatic pressure, role of the back-check valve)
- Set-up risks (e.g., IV container height for high-flow rate and/or large-volume secondary intermittent IV infusions)
- Shared infusion volume
- Best practices (e.g., view the activity in infusion drip chambers to verify that the secondary infusion is active and that the primary infusion is not active)

5. How Can Risk Be Reduced When Administering IV Pump Boluses?

Procure and configure a smart pump to administer IV pump boluses with the following risk reduction approaches:

- Can only access the bolus feature for medications that should be boluses with clinically appropriate soft and hard dose and rate/duration limits (defined for each clinical area)
- Can directly copy a prescriber's ordered bolus dose (as indicated on paper or electronic orders) in drug-specific units during pump programming (i.e., no unit conversion calculations required)
- Can program the bolus duration (e.g., minutes) instead of the bolus rate (e.g., mL/hr)
- Can autopopulate the bolus duration from the drug library
- Can communicate that a bolus infusion is being programmed (rather than a primary or secondary infusion) and provides clear feedback on the bolus status (e.g., bolus is running)

Include hard upper rate limits for continuous high-alert IV medications (when possible) to prevent the administration of an IV pump bolus by directly increasing the primary continuous IV infusion rate.

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