

# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration



**Designing  
Reliable Practices  
for IV Push  
Medication Use:  
A Focus on Safe  
Administration**

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Welcome and Introductions



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Objectives

- Recognize unsafe practices and at-risk behaviors associated with the preparation of IV push medications to adults
- Identify unsafe practices and at-risk behaviors associated with the administration of IV push medications to adults
- Discuss best practices and related error reduction strategies identified in ISMP's Safe Practice Guidelines for Adult IV Push Medications
- Employ the proposed gap analysis tool to assess current organizational practice for IV push medication use, and define steps toward safer care

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Understanding the Challenges and Risk Associated with IV Push Medication Use

Michelle Mandrack, MSN, RN  
Director of Consulting Services, ISMP

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## Risk Identification

- Errors reported to the ISMP National Medication Errors Reporting Program (MERP)
- Clinical observations made during ISMP Proactive Medication Safety Risk Assessments
- ISMP website inquiries
- *Medication Safety Alert!* Surveys:
  - ✓ 2010 (N=800) Medication Safety Impact of the Economic Crisis<sup>1</sup>
  - ✓ 2012 (N=540) Carpuject practices<sup>2</sup>
  - ✓ 2014 (N=1,773) Dilution practices<sup>3</sup>
  - ✓ 2018 (N= 977) IV Push Medication Practices in Adults<sup>4</sup>
- Peer-reviewed literature

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## Intravenous Medication Use

- Essential component of care
- Clinically advantageous
  - ✓ Immediate therapeutic effect
  - ✓ High plasma levels
  - ✓ Reach target effect quickly
- Many high-alert medications are administered IV
- Errors in use have potential for serious harm<sup>5-6</sup>



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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Limited Studies on IV Administration Errors

- American Nurses Association (ANA) Medication Errors and Syringe Safety Are Top Concerns for Nurses<sup>7</sup>
  - ✓ 99% believed risk to patients is serious
  - ✓ Errors most likely to happen during the preparation and administration of IV medications
- Meta-analysis showed 73% probability of making at least one clinical error with a dose of IV medication/IV infusion<sup>8</sup>
  - ✓ At least a quarter of the errors likely to result in permanent harm<sup>9</sup>

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## Rates of IV Push Administration

- Giving IV push medications too fast is most common type of IV drug errors<sup>10-13</sup>
  - ✓ 43%<sup>11</sup> to 69%<sup>10,14</sup> (majority clinically significant)
  - ✓ Wide variability in rates of administration
  - ✓ Drug characteristics and fast rates associated with pain, phlebitis, other complications<sup>15</sup>

**FAST**

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## Wrong Rate Event

- Physician prescribed 20 mg labetalol IV bolus for ED patient with hypertensive crisis
- Nurse retrieved medication quickly but patient being moved to radiology
- Enroute, nurse administered the drug in seconds
- Patient immediately unresponsive



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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Rates of IV Push Administration

- Use of term “bolus” to describe small amount of IV medication over short time to elicit response or provide loading dose
  - ✓ Misunderstood to mean very quick IV push vs. administration over short interval



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## Rates of IV Push Medication Administration

- 2-5 minutes is a LONG time when administering medication
- Clocks showing elapsed time improve practice<sup>8,15</sup>
- Tubing and ports that connect close to bloodstream



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## Factors that Increase the Risk of Errors with IV Push Medications<sup>16</sup>

- Using part of a vial or ampule, or more than one vial or ampule for a single dose
- Manipulations needed to prepare medications (e.g., vial-to-syringe, syringe-to-syringe transfer, dilution)
- Reconstitution of powders with specific diluents
- Dilution of some concentrated injectable drugs

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Unnecessary or Improper Dilution – 2014 & 2018 Surveys

- Dilution may lead to unlabeled/mislabeled syringes, contamination, dosing errors
- 2014 ISMP survey on dilution practices (adults) N =1,773<sup>3</sup>
  - ✓ 83% further dilute IV push medications
    - Single-dose vials and ampules 77% (14% always)
    - Multiple-dose vials 49% (11%)
    - Manufacturer's prefilled syringes 43% (10%)
    - Pharmacy-dispensed syringe 20% (5%)
- 2018 ISMP survey on dilution practices (adults) N =977<sup>4</sup>
  - ✓ 84% further dilute IV push medications but less frequently
- Most common medications involved:
  - ✓ Opioids and antianxiety/antipsychotic drugs



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## Unnecessary or Improper Dilution – 2018 Survey<sup>4</sup>

Reasons for further dilution	
Reason	Percent of Participants (%)
Desire to administer the drug slowly	94
Avoid patient discomfort	70
Reduce the risk of extravasation	33
Measure small volume doses accurately	25
Other (e.g., drug-specific requirements, facility policies, drug reference recommendations, prior education)	13

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## Unnecessary or Improper Dilution – 2014 Survey<sup>3</sup>

- Volume of diluent and method to determine the volume of diluent is variable
  - ✓ Most had personal formulas
    - 1 mL per minute of time needed to slowly administer drug
    - Different if peripheral or central line
  - ✓ No respondents described a dilution process that would result in a specific concentration
  - ✓ 43% reported policies or guidelines on dilution

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Use of Pre-Filled Flush Syringes for Dilution – 2018 Survey<sup>4</sup>

- 81% use flush syringes for drug dilution
  - ✓ 56% reported this practice **50% of the time**
  - ✓ 19% reported **always**
- Most often, the syringe is not relabeled or labeled



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## Improper Reconstitution



- Relatively few medications require reconstitution or dilution immediately before administration
- Reconstitution in patient care units
  - ✓ From 11%<sup>11</sup> to 49%<sup>17</sup> of IV medications diluted with wrong diluent
  - ✓ Administering just the diluent if labeled with product name
  - ✓ Reconstituted medications are often drawn back into the syringe containing diluent

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## Nurse-Prepared Medications

- In 2010 survey, 25% nurses said they mix (prepare) more drugs than ever before on the clinical unit<sup>1</sup>
  - ✓ Joint Commission standard to dispense in most "ready-to-use form"
  - ✓ Impacted by highly decentralized drug distribution in ADCs
- In 2018 survey<sup>4</sup>, 75% reported less than half of the time IV push medications are provided in pharmacy-prepared or commercially available ready-to-administer syringes



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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Misuse of Vials, Syringes, and Needles

- Mistaken beliefs
  - ✓ Reuse of single-dose vial depends on vial size
  - ✓ Reentry into multiple-dose vial not a problem related to bacteriostatic or preservative agents
  - ✓ Use of a common IV bag is safe if discarded after 24 hours
  - ✓ Changing the needle is sufficient (not just nurses)



- Anesthesia reused syringes to access vials of propofol after only changing the needle (2008)<sup>18</sup>
- 63,000 clinic patients exposed - 205 infected

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## Misuse of Vials, Syringes, and Needles

- Survey on Carpuject™ prefilled syringes (N=540)<sup>2</sup>
  - ✓ Looking at issue of overfill & whether nurses were aware
  - ✓ Many nurses not concerned about overfill because they withdrew doses from the cartridges using a syringe
  - ✓ Using cartridges as single-/multiple-dose vials



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## Prefilled Syringe Cartridges as Single- and Multiple-Dose Vials<sup>2</sup>

- Risk of contamination
  - ✓ Entry into a cartridge not intended for puncture as a vial
  - ✓ Using single-use cartridges as multi-dose vials
- Risk of unlabeled syringes or mislabeled syringes
- Risk of dosing or measurement errors when transferring medication from one syringe to another
- Loss of barcode for scanning on prefilled cartridge
- Risk of conditions that may facilitate drug diversion of products documented as "wasted"

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Reasons Prefilled Syringes Not Used as Designed<sup>2</sup>

- Desire or need to dilute medication before injection
- Unavailable syringe holders
- "This is how I was taught"
- Too hard to read the dose increments on cartridge syringe
- To prevent infection transmission with reuse of unclean syringe holders
- Cartridge sometimes slips, making administration difficult
- Rubber plunger pulls out of the cartridge too easily
- Incompatibility of holder with some needleless IV connectors
- Risk of breaking the glass cartridges



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## Limited or Absent Labeling

- Clinician-prepared syringes are common
  - ✓ ANA survey: 44% of nurses administer IV push medications more than 5 times each shift<sup>7</sup>
- Labels on clinician-prepared syringes more likely to be limited or absent<sup>4</sup>
  - ✓ 28% reported **less than 10% of the time**
  - ✓ Only **50% reported always**
  - ✓ Significant amount of "labeling" appears to be taping vial to syringe

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## Absent Labeling Event

- A syringe containing vecuronium was prepared for a trauma patient
- Medication not used, and syringe set down near saline flushes
- Vecuronium later used to flush the IV line of an alert 3-year-old girl
- Child became flaccid and respiratory efforts ceased
- Quickly intubated and ventilated, so permanent harm averted

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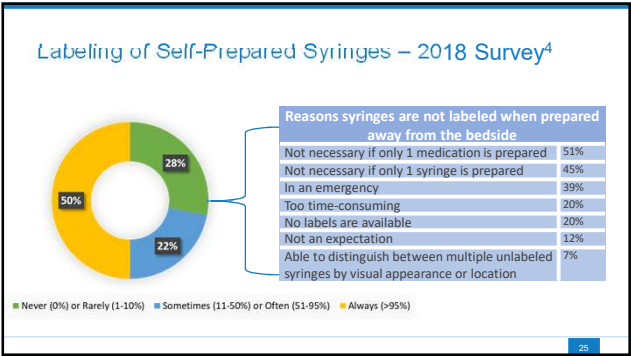
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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration



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**ISMP Guidelines for Safe Practice: An Interdisciplinary Best Practice Approach**

Susan Paparella, MSN, RN  
Vice President, ISMP

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**Safe Practice Guidelines for Adult IV Push Medications**

- Identify the risks with IV push medication administration
- Relate current evidence related to IV push practices
- Make recommendations for safe management of IV push medications

<http://www.ismp.org/Tools/guidelines/IVSummitPush/IVPushMedGuidelines.pdf>

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Safe Practice Guideline Categories

- 1. Acquisition and Distribution of Adult IV Push Medications
- 2. Aseptic Technique
- 3. Clinician Preparation
- 4. Labeling
- 5. Clinician Administration
- 6. Drug Information Resources
- 7. Competency Assessment
- 8. Error Reporting

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## Acquisition and Distribution

- 1.1 To the greatest extent possible, provide adult IV push medications in a ready-to-administer form (to minimize the need for manipulation outside of the pharmacy sterile compounding area)



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## Acquisition and Distribution

- 1.2 Use only commercially-available or pharmacy-prepared prefilled syringes of appropriate IV solution to flush and lock vascular access devices



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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Clinician Preparation

3.2 Only dilute IV push medications when recommended by the manufacturer, supported by evidence in peer-reviewed biomedical literature, or in accordance with approved institutional guidelines



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## Clinician Preparation

3.3 If dilution or reconstitution of an IV push medication becomes necessary outside of the pharmacy sterile compounding area, perform these tasks immediately prior to administration in a *clean, uncluttered, and functionally separate location using organization-approved, readily-available drug information resources* and sterile equipment and supplies



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## Safe Location For IV Push Drug Preparation?



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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Clinician Preparation

- 3.4 Provide instructions and access to the proper diluent when reconstitution or dilution is necessary outside of the pharmacy sterile compounding area
- 3.5 Do NOT withdraw IV push medications from commercially-available, cartridge-type syringes into another syringe for administration



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## Clinician Preparation

- 3.6 Do NOT dilute or reconstitute IV push medications by drawing up the contents into a commercially-available, prefilled flush syringe of 0.9% sodium chloride



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## Clinician Preparation

- 3.8 NEVER use IV solutions in containers intended for infusion, including mini bags, as common-source containers (multiple-dose product) to prepare IV flush syringes or to dilute or reconstitute medications for one or more patients in clinical care areas



[www.cdc.gov/injectionsafety/IP07\\_standardPrecaution.html](http://www.cdc.gov/injectionsafety/IP07_standardPrecaution.html)

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Labeling

4.1 Appropriately label all clinician-prepared syringes of IV push medications or solutions, unless the medication or solution is prepared at the patient's bedside and is immediately administered to the patient without any break in the process



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## Labeling

4.1a If the clinician needs to prepare and administer more than one syringe of medication or solution **to a single patient at the bedside**:

- Prepare each medication or solution separately, and immediately administer it before preparing the next syringe

OR

- If preparing several IV push medications at a time for sequential IV push administration, label each syringe as it is being prepared, prior to the preparation of any subsequent syringes

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## Labeling

4.1b Alternatively, if a practitioner **prepares one or more medications or solutions away from the patient's bedside**, immediately label each syringe, one at a time, before preparing the next medication or solution



4.1c Bring only one patient's labeled syringe(s) to the bedside for administration

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Labeling

- 4.2 Provide clinical units with blank or printed, ready-to-apply labels, including sterilized labels where needed, to support safe labeling practices
- 4.3 Immediately discard any unattended, unlabeled syringes containing any type of solution
- 4.4 Never pre-label empty syringes in anticipation of use



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## Clinician Administration

- 5.3 Administer IV push medications and any subsequent IV flush at the rate recommended by the manufacturer, supported by evidence in peer-reviewed biomedical literature, or in accordance with approved institutional guidelines. Use an appropriate volume of the subsequent IV flush to ensure that the entire drug dose has been administered



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## Drug Information Resources

- 6.1 Standardized, facility-approved IV push medication resources are readily available at the point of care to guide the safe practice of IV push medication administration

**MEDICATIONS APPROVED FOR IV PUSH/BOLUS IN ADULTS – ADMINISTRATION GUIDELINES**

*Restrictions do not apply during Code Blue. Once Code Blue or other emergency code is activated, all providers are requested to provide or quickly obtain to patient. Do not administer any medication at any time during the emergency code.*

NOTE: The electronic version of this document is authoritative. The printed version is for reference only. The printed version is subject to change without notice.

Drug	Locations	Adult dose and max IVF rate	Important Considerations
HYDROCHLORIDE	All units	0.25 – 2 mg administer slowly over 2-3 minutes	Rapid administration (less than 2-3 minutes) may lead to excessive respiratory depression, hypotension, and bradycardia. Holding is required. Chronic pain patients may require higher doses, consult Pharmacy for appropriate dose.
Insulin	ICU, MICU, Tolerant, ED	1 mg IV over 10 minutes, may repeat same dose 10 min after completion of first infusion if symptoms is not relieved. (insulin dose for patients less than 60 Kg)	Can cause potentially fatal arrhythmias which require cardioversion, particularly sustained polymorphic ventricular tachycardia. Caution in patients with QT prolongation (prolonged QTc). MUST be administered in a setting of continuous ECG monitoring.
Insulin, Regular	All units	2 – 10 units over 1 minute rapidly	Insulin IV push is only authorized for use in PACU or for the treatment of hyperkalemia. Only Regular Insulin

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## Competency Assessment

7.1 Competency assessments for IV push medication preparation and administration are standardized across disciplines within healthcare organizations and validated through an initial assessment and on an ongoing basis



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## Anticipated Implementation Challenges

- Changing attitudes and beliefs:
  - ✓ Recognition of the need to alter current practices
  - ✓ Convincing professional staff that the efficiencies gained in the work-arounds are not without risk
- Changing behaviors:
  - ✓ Providing more medications in a ready-to-administer form; goal to avoid bedside manipulation
  - ✓ Moving away from using prefilled syringes of flush solution for drug dilution and administration
- Assessment of practice

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## Gap Analysis Tool for Safe IV Push Medication Practices

Online tool available at [www.ismp.org/node/1188](http://www.ismp.org/node/1188)  
Data submission ends April 31, 2019

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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

Gap Analysis Tool

New

ACQUISITION AND DISTRIBUTION OF ADULT IV PUSH MEDICATIONS

	A	B	C	D
1. The facility purchases <b>READY-TO-ADMINISTER</b> injectable medications for <b>IV PUSH</b> use when they are available.				
2. Adult <b>IV PUSH</b> medications are dispensed in a <b>READY-TO-ADMINISTER</b> form to minimize the need for manipulation and product re-labeling outside of the <b>PHARMACY STERILE COMPOUNDING AREA</b> .				
3. Only commercially-available or pharmacy-prepared, prefilled syringes of an appropriate IV solution are used to <b>FLUSH</b> and <b>LOCK VASCULAR ACCESS DEVICES (VAD)</b> .				

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Next Steps

- Organizations
  - ✓ Manufacturers
  - ✓ Educators and healthcare leaders
  - ✓ Academicians
  - ✓ Researchers
  - ✓ Frontline staff



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Questions?



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# Designing Reliable Practices for IV Push Medication Use: A Focus on Safe Administration

## References

1. ISMP. Survey shows recession has weakened patient safety net. *ISMP Medication Safety Alert!* 2010;15(1):1-4.
2. ISMP. ISMP survey reveals user issues with Carpuject prefilled syringes. *Nurse Advise-ERR*. 2012;17(16):1-3.
3. ISMP. Some IV medications are diluted unnecessarily in patient care areas, creating undue risk. *ISMP Medication Safety Alert!* 2014;19(2):1-5.
4. ISMP. Part I: Survey results show unsafe practices persist with IV push medications. *ISMP Medication Safety Alert!* 2018;23(22):1-5.
5. American Society of Health-System Pharmacists. Summit proceedings. *Am J Health-System Pharm*. 2008;65(15):2367-79.
6. Hicks R, Becker S. An overview of intravenous-related medication administration errors as reported to MEDMARX®, a national medication error-reporting program. *J Infus Nurs*. 2006;29(1):20-7.
7. Medication Errors and Syringe Safety Are Top Concerns for Nurses According to New National Study [press release]. <http://www.nursingworld.org/FunctionalMenuCategories/MediaResources/PressReleases/2007/SyringeSafetyStudy.aspx>. Silver Spring, MD: American Nurses Association; June 18, 2007.

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## References

8. McDowell SE, Mt-Isa S, Ashby D, Ferner RE. Where errors occur in the preparation and administration of intravenous medicine: a systematic review and Bayesian analysis. *Qual Saf Health Care*. 2010;19(4):341-5.
9. Westbrook JL, Rob MI, Woods A, Parry D. Errors in the administration of intravenous medications in hospital and the role of correct procedures and nurse experience. *BMJ Qual Saf*. 2011;20(12):1027-34.
10. Taxis K, Barber N. Ethnographic study of incidence and severity of drug errors. *BMJ*. 2003;326:684-7.
11. Fahimi F, Ariapanah P, Faizi M, et al. Errors in the preparation and administration of intravenous medications in the intensive care unit of a teaching hospital: an observational study. *Aust Crit Care*. 2008;21(2):110-6.
12. Taxis K, Barber N. Incidence and severity of intravenous drug errors in a German hospital. *Eur J Clin Pharmacol*. 2004;59(11):815-7.
13. ISMP. ISMP. How fast is too fast for i.v. push medications? *ISMP Medication Safety Alert!* 2003;8(1):1.

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## References

14. Pinkney S, Fan M, Chan K, et al. Multiple intravenous infusions. Phase 2b: laboratory study. *Ont Health Technol Assess Ser*. 2014;14(5):1-163.
15. Vijayakumar A, Sharon EV, Teena S, Nobil S, Nazeer I. A clinical study on drug-related problems associated with intravenous drug administration. *J Basic Clin Pharm*. 2014; 5(2):49-53.
16. ISMP. Errors with injectable medications: unlabeled syringes are surprisingly common! *ISMP Medication Safety Alert!* 2007;12(23):1-2.
17. Cousins DH, Sabatier B, Begue D, Schmitt C, Hoppe-Tichy T. Medication errors in intravenous drug preparation and administration: a multicentre audit in the UK Germany and France. *Qual Saf Health Care* 2005;14(June (3)):190-5.
18. Labus B. Outbreak of hepatitis C at outpatient surgical centers. *Public Health Investigation Report*. Southern Nevada Health District. December 2009.

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