

I.V. Push Medication Administration

Bridging education and practice
through standardization



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Standardizing I.V. push administration: Bridging education and practice

Instilling best practice requires collaboration.

By Catherine Spader, RN



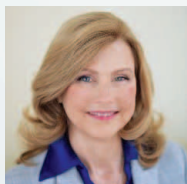
Elizabeth Campbell



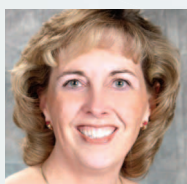
Candy Cross



Denise Dion



Michelle Mandrack



Susan Paparella

Best practice guidelines for I.V. push administration are easier to access than ever before, but many nurses still use outdated and unsafe I.V. push administration practices, according to the Institute for Safe Medication Practices (ISMP) and other experts. For example, guidelines recommend commercially available ready-to-administer (RTA) syringes for administering I.V. push medications, but too many nurses don't integrate them into their practice correctly. Common unsafe practices include unnecessary dilution of adult I.V. push medications and diluting with commercially packaged 0.9% sodium chloride syringes designed for flushing I.V. lines.

A 2017 article in *Hospital Pharmacy* reported the results of a survey of 78 nurses working at an academic hospital in a variety of specialties. In all, 57.7% of respondents said they frequently draw medications out of a Carpuject™ syringe into another syringe, and 69.1% said they regularly use commercially packaged 0.9% sodium chloride flush syringes for reconstitution or dilution. The Infusion Nurses Society (INS) and ISMP consider both practices unsafe.

A 2019 Arizona Safe Medication Collaborative Team online survey of 392 frontline RNs and 40 faculty members from across the state found that this isn't an isolated situation. Nearly two-thirds (65.6%) of survey respondents said they dilute I.V. push medications by withdrawing them from a prefilled syringe or container into a prefilled syringe of 0.9% sodium chloride.

The team received ISMP's 2019 Cheers Award for its statewide advocacy for adult I.V. push medication safety. In 10 months, the team pulled together key Arizona stakeholders, including frontline nurses, to advocate for the adoption of best practices, such as those reflected in the ISMP Safe Practice Guidelines for Adult IV Push Medications.



"We want to believe our practice is safe, but unsafe practices have become imbedded habits," says Denise Dion, MSN, RN, PCCN, CNE, member of the Arizona Safe Medication Collaborative Team and nurse faculty at Central Arizona College in Coolidge.

Tackling these imbedded habits is a tough challenge but is vital to address, according to Candy Cross, MSN-Ed, RN, member of the Arizona Safe Medication Collaborative Team and faculty educator at Chandler Gilbert Community College in Chandler, AZ. "This is a patient safety issue, and many nurses are unaware that they're increasing the risk of patient harm with unsafe practices," she says.

Dangers and errors

The dangers of unnecessary dilution include a risk of altering the dose of a medication. Even slight alterations can be dangerous, especially with high-alert drugs, Dion says. "The therapeutic range of I.V. push medications is narrow, and the potential for harm is high," she says. The risk of contamination also is higher with dilution, especially in places where nurses commonly dilute drugs, such as bedside tables, which may not have been freshly sanitized.

The most common dilution error reported in the 2019 Arizona survey was the dilution of I.V. push opioids (70% of respondents). In addition, 65.6% of respondents dilute I.V. push medications by withdrawing them from a prefilled syringe/container into a prefilled flush syringe of 0.9% sodium chloride. "We shared our survey results with a group of pharmacists from one of the largest healthcare organizations in Arizona, and they were shocked that nurses were inappropriately diluting many drugs, such as insulin, cardiac drugs, and opioids," Cross says.

A 2020 literature review published in the *Journal of Infusion Nursing* sums up the dangers by concluding that, "[U]nnecessary dilution of I.V. push medication in RTA syringes is an unsafe practice that occurs routinely. This practice increases the risk of patient harm through errors related to incorrect dose, improper labeling of syringes, and the potential for microbial contamination of the product."

Obstacles to best practice

The Arizona survey revealed many obstacles to establishing best practice, including a lack of standardization. A total of 24.3% of respondents reported that their healthcare organizations don't have policies and procedures for diluting I.V. push medications. A shortage of Carpuject holders is another issue. "Some nurses think the holders are disposable and toss them, leading to shortages and forcing nurses to draw ready-to-administer medication into another syringe," Dion says. In addition, nurses may not be aware that Carpuject holders need to be cleaned between use to prevent the spread of infection.

Another issue is that correct use of the holder requires several steps to properly load the syringe into the device and safely administer. "If not properly loaded, it can be difficult to control the rate of administration and safely administer I.V. push medications," Dion says. "Many new nurses say they have never seen a Carpuject holder because their nurse preceptors in their

Convincing nurses and nursing educators to change unsafe practices is especially challenging when drug reference manuals publish discrepancies from manufacturer's recommendations and Institute for Safe Medication Practices (ISMP) and Infusion Nurses Society (INS) guidelines. For example, *Davis's Drug Guide* recommends diluting morphine sulfate with sterile water. Package inserts from the drug manufacturers do not recommend dilution of the drug before I.V. push administration, according to Denise Dion, MSN, RN, PCCN, CNE, member of the Arizona Safe Medication Collaborative Team and nurse faculty at Central Arizona College in Coolidge.

The Arizona Safe Medication Collaborative Team contacted the publishers of *Davis's Drug Guide* in 2019 and secured their agreement to update their references regarding morphine sulfate dilution using the ISMP guidelines. The information has been updated online and will be updated in the next reprint of the book.

The team also reached out to the publisher of *Nursing2020 Drug Handbook*, who agreed to correct its incorrect reference to morphine sulfate dilution. However, the change can't be made until the 2022 edition because the 2021 edition has already been published. In addition, the team contacted the drug search engine Micromedex about its incorrect reference to diluting morphine sulfate, and the company made the change quickly, says Candy Cross, MSN-Ed, RN, member of the Arizona Safe Medication Collaborative team and faculty educator at Chandler Gilbert Community College in Chandler, AZ.

nursing school clinical sites weren't using them."

Dion has observed that vials of 0.9% sodium chloride and sterile water designed for dilution and reconstitution are sometimes not stocked in clinical teaching sites. "What is available are the prefilled 0.9% sodium chloride syringes designed for flushing," Dion says. "Best practice is to have I.V. push medications stocked in RTA syringes, but even when they're available, nurses are commonly using them as vials to draw out the medication." Another problem is incorrect information in commonly used drug references. (See *Addressing errors in drug manuals*.)

Getting nursing faculty on board with best practice

The Arizona Safe Medication Collaborative Team survey revealed that unnecessary dilution is still frequently taught in nursing schools. Nearly half (48%) of nurse faculty who responded to the survey said they teach syringe-to-syringe transfer by drawing up the I.V. push medication from either a sterile vial or RTA syringe and transferring it into a prefilled flush syringe of 0.9% sodium chloride, according to Dion.

Even when faculty are teaching best practice, nursing students are coming up against unsafe practices by preceptors in clinical settings. "Some clinical preceptors are telling students they dilute all of their opioids," Dion says. "I recommend the nurse faculty of Central



Tips to foster I.V. push best practices

The Institute for Safe Medication Practices (ISMP) recommends that pharmacies provide ready-to-administer (RTA) medications for adult I.V. push administration. Using RTA medications reduces the number of steps in giving I.V. push medications and lowers the potential for contamination and error. Patient-specific doses also require less manipulation, which reduces the risk of contamination and dose errors.

The highest-level strategy is to require all I.V. push medications to be provided in RTA form via commercially prepared prefilled syringes or pharmacy dilution and preparation. "In reality, we know there are practical time limits in the amount of preparation pharmacists can do, especially for facilities that don't have 24-hour pharmacy support," says Michelle Mandrack, MSN, RN, director of consulting services at ISMP.

These strategies also promote I.V. push safety best practices:

- ✓ Develop an interdisciplinary I.V. push medication process improvement committee that includes nursing and pharmacy to assess current practice and support process improvements.
- ✓ Standardize terminology and specifics, such as the rate in which specific I.V. push medications should be infused. Standardize where that information can be immediately found (for example, directly in the medication administration record).
- ✓ Post a standard "ready reference" on each unit. Include a list of medications that should and should not be diluted. For medications that require dilution, include clear guidelines about how to dilute, the proper diluent, and the proper rate and port of injection.
- ✓ Work with the pharmacy to create a "virtual kit," in which medication and the appropriate diluent, if needed, appear for selection at the same time from the automated medication dispensing system.
- ✓ Ensure necessary supplies are easily accessible, such as syringe labels and reusable holders.
- ✓ Incorporate ISMP best practices into nursing policies and practice.

Arizona College programs be present with students any time they administer I.V. push medications at the bedside to ensure they follow the IV push medication skill lab competency checklist, which follows INS and ISMP standards." (See *I.V. push medication skill lab competency checklist*.)

The Arizona Safe Medication Collaborative Team has partnered with Quality and Safety Education for Nurses (QSEN) Institute to establish a task force to create and disseminate best-practice teaching and practice strategies. The task force is composed of nurses from varied backgrounds, including nurse educators, nurse clinical specialists, and a nurse consultant. "To address these issues, we have to have a partnership between nurses, nurse educators, pharmacists, and clinical sites," Dion says. "We need to break out of our silo mentality and work together as a team to effect change and adopt best practice."

ISMP voices need for I.V. push standardization

Nurse experts at ISMP also have concerns about inconsistencies in I.V. push practices and how these skills are taught.

"There is no standardized national curriculum for best practices, and many nursing textbooks provide limited or outdated information about I.V. push safety," says ISMP vice president Susan Paparella, MSN, RN. Students also may be receiving contradictory messages between schools and clinical sites. "Nursing programs that are teaching best practice sometimes may find that preceptors at clinical sites aren't aware of them, which creates confusion for the students," Paparella says.

Problems compound when employers don't provide best practice expectations to new graduates. Frequently, new nurses must rely on what they learned in school. However, not all schools provide the opportunity to administer I.V. push medications before students graduate because it may not be permitted by clinical sites.

"New graduates may learn inconsistent and unsafe practices from preceptors because practice frequently depends on habits or individual preference instead of standards," says Michelle Mandrack, MSN, RN, director of consulting services for ISMP. "For example, nurses who have seen a medication cause patient discomfort may adopt the practice of diluting all I.V. push medications, but they don't always recognize the risks of this practice." (See *Tips to foster I.V. push best practices*.)

Recognizing risks

Diluting I.V. push medications unnecessarily increases the risk of contamination and potentially serious complications, such as bacteremia. Complications can be difficult to track and may not be recognized as related to contamination during dilution. "It's important to remember that every time you take a medication out of one container and put it into another, you risk introducing pathogens," Paparella says.

Another risky practice is the improper flushing of I.V. push medications, especially after injecting a medication into a distal port in the tubing. "ISMP received reports in which a neuromuscular blocking medication was administered without proper flushing, such that the entire dose did not immediately reach the patient," Mandrack says. "Then in the [postanesthesia care unit], when the nurse flushed the I.V. line to give pain medication, a bolus of the remaining neuromuscular blocking agent was infused, resulting in respiratory complications."

In another case reported to ISMP, a patient in hypertensive crisis died after receiving I.V. push medications too rapidly. "The terminology we use is ambiguous," Mandrack says. "What does 'slow I.V. push' really mean? Timing needs to be clarified and efforts made to standardize I.V. push rates for each drug."

Central lines and the 10 mL syringe myth

Other experts in I.V. push practice see a large gap between best practice and outdated and unsafe beliefs. One persistent myth is that I.V. push medications must be injected into central lines using a 10 mL syringe. "It's a long-held belief that has been debunked, but some nurses still don't believe you can use a smaller syringe with a [peripherally inserted central catheter] line and other central lines. They're still diluting RTA medications to fit the 10 mL myth," says Elizabeth Campbell, RN, MNS, CRNI, past president of the INS New England Chapter and vascular access specialist at Newton-Wellesley Hospital in Waltham, MA. After flushing with a 10 mL syringe to clear a central line, nurses should use the most appropriate-size syringe to safely administer medications, she says.

The 10 mL standard was established many years ago when central line catheters were made of silicone. Those catheters weren't strong enough to handle the pressure delivered by a syringe smaller than 10 mL. Old catheters could even burst from the pressure exerted by a 3 mL syringe, but that isn't a



Get up to speed with I.V. push best practices

To ensure you and your organization are current with I.V. push best practices:

- review *Infusion Therapy Standards of Practice* from the Infusion Nurses Society
- review "Safe practice guidelines for adult IV push medications" from the Institute for Safe Medication Practices (ISMP) ([ismp.org/guidelines/iv-push](https://www.ismp.org/guidelines/iv-push))
- identify unsafe practices using ISMP's free "Gap analysis tool for safe IV push medication practices" ([ismp.org/resources/gap-analysis-tool-safe-iv-push-medication-practices](https://www.ismp.org/resources/gap-analysis-tool-safe-iv-push-medication-practices))
- analyze your organization's current status with implementing all of ISMP's "Targeted medication safety best practices for hospitals" ([ismp.org/guidelines/best-practices-hospitals](https://www.ismp.org/guidelines/best-practices-hospitals)).

problem with today's catheters, according to Campbell. Now, a 10 mL syringe is required only to flush and establish patency of a central line—but not to administer I.V. push medications.

"Despite having prepackaged medications with the right dosage in the right dilution, some nurses are still breaking the sterile packaging to dilute in a 10 mL syringe," Campbell says. "It's unnecessary and increases the risk of contamination."

Bad habits and resistance to change

To help dispel the 10 mL syringe myth, Campbell created a presentation called "The urban legend of the 10 mL syringe," which provides best practice information about central lines and 10 mL syringes. In November 2019, she presented the information in four roundtable sessions at the INS National Academy. After the presentation, attendees completed surveys. Survey respondents included 67 experienced RNs, most of whom had specialty positions in I.V. infusion or I.V. therapy. Their comments show that outdated 10 mL syringe practices aren't uncommon:

- Still using this old policy. Thanks for the info.
- [Will] bring information to corporate leaders, hopefully policy will be updated.
- My company is in process of moving to 10 mL [normal saline (NS)] vials for dilution of med-

I.V. push medication skill lab competency checklist

Below is an excerpt from a checklist that can be used to assess competency in I.V. push medication administration. Although designed for nursing students, the checklist could also be used for assessing competency in practicing nurses. Download the complete checklist, which includes key points and administration steps, at myamericannurse.com/?p=68157.

Medication preparation	Met	Not met
1 Prepare medication in a designated clean, quiet environment, away from sinks. Be sure surface is clean, and adhere to aseptic technique.		
2 Obtain the medication and complete first medication check .		
3 Always double-check high-alert medication drug dose calculation with second RN.		
4 Gather equipment (e.g., appropriate-size syringe to draw up correct dose of medication, filter needle if necessary, cartridge holder, 70% alcohol).		
5 Use evidence-based practice to administer medications in ready-to-use form. Never dilute or reconstitute medications using a prefilled sodium chloride syringe.		
6 Glass ampules—clean with 70% alcohol prior to breaking glass neck of ampule. Use a filter needle when drawing up out of glass ampule, then discard filter needle and change to blunt needle.		
7 When drawing from a vial, use aseptic technique. Caps on vials are dust covers only and not considered sterile. Scrub the diaphragm using 70% alcohol swab. Inject equal amount of air into vial before pulling out medication.		
8 Must have two RNs to witness wasting a narcotic agent.		
9 Must label (patient's name, drug name, dose, rate of administration, and your initials) all medication syringes prepared away from the bedside to prevent medication errors.		
10 Take original vial or ampule to bedside to scan medication.		

Source: Denise Dion, Central Arizona College

ications from our current practice of using NS flushes.

- We had been taught to always use a 10 mL syringe when using a central line, so now I can educate my coworkers that they don't need to use a 10 mL syringe once patency is established in a line.

In addition, 27% of respondents in the four sessions strongly disagreed with the statement, "I will incorporate the information presented into my practice," indicating that despite receiving information debunking the 10 mL syringe myth, they weren't planning to change practice. These results indicate that a lot of work still needs to be done to educate nurses. "It was eye-opening to find so many still practiced in the old way," Campbell says. "Bad habits are hard to break, and the most dangerous thinking is 'That is how we have always done it.' With that mindset, nurses may not believe what best practice is when it's presented to them."

Campbell is collaborating with a national group of educators who are proposing to work with QSEN and colleges of nursing to spread the word about I.V. push administration best practice. "Nursing specialties tend to educate themselves within their specialty, but it's important to

educate all nurses about best practice I.V. push medication administration, not just infusion nurses," Campbell says. To help spread the word, she recommends presenting I.V. push best practice information:

- in daily unit safety huddles
- to management and facility safety and advisory committees
- to specialty organizations.

"Every nurse is held to these standards, whether you're an infusion nurse or not," Campbell says. "If you remain stagnant and don't access the best practices and information that are available, you're putting your license in jeopardy." ■

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