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ISMP
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Educating the Healthcare Community About Safe Medication Practices

# IV push medications—Bridging the gap between education and clinical practice

As the acuity of patients continues to rise, not only in inpatient settings, but also in ambulatory clinics, surgery centers, and infusion centers, ISMP is once again raising concerns about potential errors with the frequent use of intravenous (IV) push medications (often controlled substances or high-alert medications). These error types, which continue to be observed and received through the ***ISMP Medication Errors Reporting Program*** (ISMP MERP), are associated with unnecessary dilution, resulting in a potential for wrong concentrations, incompatibility with the diluent, wrong doses, and/or the wrong rate of administration. Throughout the years, ISMP has conducted numerous surveys, as well as a national summit in 2014, that included interdisciplinary practitioners, academic faculty, regulators, and vendors, to address the risks of IV push medication use and labeling practices. The results of these endeavors painted a compelling picture of IV push workarounds and identified a general lack of knowledge about practices that placed practitioners and patients at risk. As a result, ISMP published the nation's first IV push guidelines: ISMP ***Safe Practice Guidelines for Adult IV Push Medications*** (www.ismp.org/node/97) as well as a tool to enhance safety: ISMP ***Gap Analysis Tool (GAT) for Safe IV Push Medication Practices*** (www.ismp.org/node/1188).

These resources caught the attention of many practitioners, as well as two faculty members from Arizona. They recognized that they and their colleagues were not in alignment with these recommended guidelines that had the potential for a generational impact on our newest nurses. As a response, in 2019,[1] they surveyed clinical nurse educators and bedside nurses to determine what clinicians were being taught and what the variations in IV push practices were across Arizona. The results demonstrated a lack of consistency in teaching IV push medication administration to Arizona pre-licensure nursing students. In 2019, these faculty members were awarded a *Cheers Award* in recognition of their work to advance a known medication safety issue.

These researchers subsequently partnered with other interested faculty throughout the United States, the Infusion Nurses Society (INS), ISMP nurses, and a nurse from Fresenius Kabi to form a task force to conduct a repeat survey, expanding to nursing programs on the Commission on Collegiate Nursing Education (CCNE) and the Accreditation Commission for Education in Nursing (ACEN) distribution lists. Similar to prior survey findings by the Arizona faculty, the task force identified a definitive lack of understanding concerning the risks associated with IV push medications, limited practice standardization, and the lack of a standard curriculum for instructing undergraduate students about safe IV push medication preparation and administration. Unsafe practices described included the withdrawal and subsequent administration of medications from prefilled syringes or cartridges, unnecessary dilution of IV push medications, and nurse preparation or manipulation of IV push medications at the bedside. In addition, it appeared to the researchers that some unsafe practices were learned either during pre-licensure education or during on-the-job orientation, thus perpetuating these unsafe practices.

A key outcome of the task force's work was the development of an IV push administration standardized practice checklist[2] that addresses the noted areas of inconsistent education and clinical competency validation. The checklist was developed in accordance with the ISMP ***Safe Practice Guidelines for Adult IV Push Medications*** and the *Infusion Nurses Society 2021 Infusion Therapy Standards of Practice*.[3] The checklist is intended for use in all clinical practice settings with both student nurses during their clinical practicum and licensed nurses during orientation to the facility. Most importantly, it can be used to standardize practice between nursing programs and clinical practice sites. As a potential safety strategy, this checklist, and associated materials and resources, were submitted to

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## what's in a Name?

### The "-dronate" drug stem name

Medications with the suffix "-dronate" belong to a class of drugs known as bisphosphonates (**Table 1**). The drugs within this class work by inhibiting bone resorption, which is the breakdown of bone tissue that can increase the risk of broken bones or fractures. These medications are primarily used to increase bone mineral density in people who have been diagnosed with osteoporosis or other conditions that affect bone loss. For example, bisphosphonates may also be given to people with Paget's disease, multiple myeloma, cancers that have metastasized to the bone, and cancer-related hypercalcemia (also known as hypercalcemia of malignancy). Practitioners should order a DEXA (dual x-ray absorptiometry) scan to measure the patient's bone density before prescribing a bisphosphonate.

**Table 1.** List of bisphosphonates and their combination formulations approved for use in the United States.

| Generic name | Brand name |
|---|---|
| alendronate | **BINOSTO**, **FOSAMAX** |
| alendronate and cholecalciferol | **FOSAMAX PLUS D** |
| ibandronate | generic only |
| pamidronate | generic only |
| risedronate | **ACTONEL**, **ATELVIA** |
| zoledronic acid | **RECLAST** |

Bisphosphonates are available as either oral or intravenous (IV) dosage forms. Pamidronate and zoledronic acid are only available IV, while ibandronate is available both orally and IV. All other bisphosphonates are only available as oral dosage forms. Oral doses

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the Quality and Safety Education for Nurses (QSEN), a group designed to set six core competencies in order to prepare future nurses with the knowledge, skills, and attitudes needed to improve the quality and safety of the healthcare system. The checklist (www.ismp.org/ext/1275) was approved and adopted by QSEN and is also available on the INS website in the learning center.

As a follow-up, and with interest to see if there had been adoption of these recommended guidelines, this past year the task force resurveyed nursing program faculty across the United States for implementation data on the use of these tools. Nearly 200 respondents, representing 37 states, completed the 2023 IV push education survey. While much emphasis has been placed on the improvement of IV infusion safety, there has been limited national advancement regarding standardized practices associated with IV push safety. Results of the latest survey follow.

## IV Push Competency Assessment

Almost all respondents (95%) reported that within their nursing program, adult IV push medication preparation and administration are taught in the nursing skills laboratory (skills lab). A skills lab is a place where nursing students can practice nursing competencies and techniques in a safe environment under the guidance of their instructor. These labs help ensure that students are comfortable with the techniques and protocols for each task before they perform them with actual patients. Almost two-thirds (62%) reported that competency for IV push medications is determined using a combination of a skills lab evaluation checklist and an observational faculty evaluation in the clinical setting. For others, competency is assessed solely via a skills lab checklist (27%), or only by faculty in the clinical setting (5%). Unfortunately, some respondents (6%) reported that IV push competency is not assessed, or that students are not allowed to administer medications via IV push in the clinical setting due to facility restrictions. In programs where IV push competency is measured, students are allowed to push adult IV medications in the clinical setting, but only under faculty supervision (54%), or with a registered nurse (RN) preceptor employed by the facility (not the school) (18%). Other respondents indicated that it is never allowed (6%) at the facility or there were other circumstances (22%) that deterred it, or they did not know.

## Learning to Dilute IV Push Medications

Although diluting IV push medications is usually not recommended in product labeling, skills labs are often set up to simulate how to prepare and administer IV push medications, including with dilution. To practice adult IV push techniques, students often have access to vials (98%), glass ampules (72%), ready-to-administer syringes with simulated medications (60%), syringe-to-syringe transfer devices using prefilled syringes of 0.9% sodium chloride (42%), CARPUJECT cartridges (32%), and CARPUJECT holders (30%). While some commented that students are taught not to dilute IV push medications, others teach students to dilute them prior to administration for certain classes of medications and/or under certain circumstances, including the following:

- Opioids (45%)
- Antibiotics (42%)
- Small volume medications less than 1 mL (39%)
- Anxiolytics (27%)
- Antiemetics (26%)
- Cardiac medications (19%)
- Reversal agents (e.g., flumazenil, naloxone) (5%)
- Others (37%) (e.g., nitroglycerin, heparin, atropine, **EPINEPH**rine)

Some respondents said they instruct students to only dilute if the medication requires a slow IV push, or to send it back to the pharmacy for preparation if further dilution is required. Students are

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should be taken in the morning on an empty stomach with eight ounces of plain water (other types of drinks should be avoided) so it can be absorbed properly. To minimize reflux, the person should remain upright (sitting or standing) for 30 to 60 minutes after administration, depending on the drug, and should not eat or drink anything during that time frame. IV doses are administered in an infusion center, clinic, or doctor's office and vary in frequency (i.e., administered monthly) depending on the condition being treated.

For the most part, bisphosphonates are well tolerated. However, common side effects from oral dosage forms include constipation, diarrhea, stomach pain, upset stomach, or vomiting, as well as heartburn, which can lead to gastroesophageal reflux (GERD), esophagitis, gastritis, and esophageal and/or gastric ulcers. Healthcare providers should consider prescribing an alternative bisphosphonate which usually relieves the problem. Bisphosphonates may also cause flu-like symptoms such as bone, joint, and muscle pain; fever; aches; and mild headache. Some patients may also experience hypocalcemia, especially if an IV bisphosphonate is given, so calcium levels should be monitored. Rare side effects include conjunctivitis, atypical femur fractures, and osteonecrosis of the jaw. Finally, people who have a history of renal insufficiency, esophageal disorders, and, in some cases, bariatric surgery, should talk to their doctor to see if they are a candidate for bisphosphonate therapy.

## SAFETY wires

**Moderna COVID-19 vaccine overfill leads to a double dose.** Under an emergency use authorization (EUA), the recommended dose of the 2023-2024 Moderna coronavirus disease 2019 (COVID-19) vaccine for patients 6 months to 11 years (**Figure 1**, page 3) is 25 mcg/0.25 mL. To ensure practitioners can withdraw the proper dose, the manufacturer provides overfill in the vial. However, healthcare professionals have reported up to 0.5 mL of solution in the vial. In several cases, practitioners have drawn up the entire

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taught to use a vial of 0.9% sodium chloride (38%), a prefilled syringe of 0.9% sodium chloride (28%), a vial of sterile water (11%), or other (23%) (e.g., solution indicated by drug reference, a combination of those previously listed). Fortunately, all respondents indicated that they do not teach students to withdraw fluid from an actively infusing IV bag of 0.9% sodium chloride.

## Teaching Challenges

When asked about challenges that impede teaching nursing students about safe practices for IV push medications, respondents frequently gave the following examples:

- Lack of simulation capabilities
- Inability to practice IV push techniques at clinical sites due to facility restrictions
- Variation in safe practice techniques taught in the school compared to IV push techniques used by staff nurses at the clinical setting
- Variation in technique to dilute IV push medications (e.g., use of vials during simulated learning but taught to use prefilled syringes of 0.9% sodium chloride in the clinical setting)

## Use of Resources and Guidelines

A survey question asked which resources students were expected to use when preparing and administering adult IV push medications. The following resources were identified:

- Davis's *Drug Guide for Nurses* (43%)
- Lippincott's *Nursing Drug Guide* (10%)
- Mosby's *Nursing Drug Reference* (8%)
- *Micromedex* (7%)
- *Lexicomp* (4%)
- *Nursing 2023 Drug Handbook* (3%)
- Other (25%) (e.g., a combination of those above, hospital-specific formulary, Elsevier's *2023 Intravenous Medications Handbook for Nurses and Health Professionals*)

In a subsequent question, nearly two-thirds (63%) of respondents confirmed that they were familiar with the ISMP ***Safe Practice Guidelines for Adult IV Push Medications*** but did not mention if they used it as a resource. In addition, a question was asked if respondents had read the IV push administration standardized practice checklist[2] found in QSEN and if they had incorporated it into the curriculum, or if barriers exist. Many respondents indicated that they would be adding the QSEN-approved checklist (www.ismp.org/ext/1275) to their curriculum. However, other respondents shared several barriers such as inconsistency (turnover) among faculty and staff, lack of faculty who know and understand QSEN's mission, and faculty who are hesitant to institute best practices into educational programs. Respondents also noted that some faculty are resistant to change and want to continue with the "this is how we have always done it" approach. Others responded that they were not aware that this checklist existed but would work on incorporating it or a curriculum revision was already underway.

## Response to Survey Results

The results of the 2023 IV push survey showed variations and gaps in the use of IV push evidence-based standards. In fact, results clearly demonstrate that the steps between understanding the evidence and actually implementing the best practices do not always take place. In response, the task force published *IV push medications: An evidence-based practice guide*[4] in 2023 in the official journal of the American Nurses Association to foster greater awareness of this practice gap. The

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contents of the vial and administered 0.5 mL, or double the intended dose. At one pediatric clinic, more than 200 children under the age of 12 were given the full vial of the COVID vaccine before the error was identified. To complicate matters, the dose of Moderna's **SPIKEVAX** (COVID-19 vaccine) for patients 12 years and older is 50 mcg/0.5 mL (www.ismp.org/ext/1272), and the volume (0.5 mL) is similar to several other childhood vaccines.

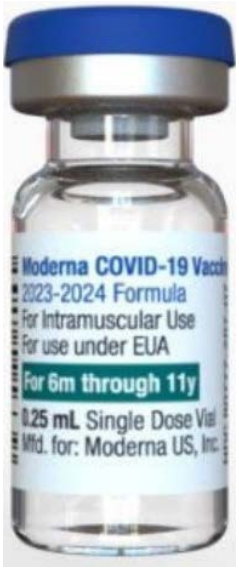


**Figure 1.** The label of Moderna COVID-19 vaccine (2023-2024) for patients 6 months through 11 years states, "0.25 mL Single Dose Vial," but practitioners have administered the entire contents, which is actually up to 0.5 mL.

We have notified the US Food and Drug Administration (FDA) and the manufacturer of this concern. If your organization purchases this vaccine, affix preprinted labels to the prepared syringe specifying the vaccine name, indicated age range, and dose of 0.25 mL. Build order sentences with dosing guidelines that will help practitioners in selecting the correct dose. In clinics and medical offices, develop protocols and/or order sets to guide practitioners to select the correct dose for the patient population. Educate staff that the dose for patients 6 months through 11 years is 0.25 mL, not the entire vial. Once the dose is removed, discard the vial.

**Hazard Alert! Medisca 20 mL oral syringes could lead to dosing errors.** Due to a supply shortage involving the usual oral syringe supplier, a pharmacy purchased 20 mL oral syringes from an alternative manufacturer, Medisca. The pharmacy warned us that, rather than the typical 1 mL increments, the syringe scale measures in 0.5 mL increments, which is easy to miss (**Figure 1**, page 4). According to the reporter, this has resulted in close calls in which doses were prepared with

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task force continues to disseminate the checklist among nursing programs and all healthcare organizations to promote adoption.

## Conclusion

While this survey queried nursing program educators about their IV push practices curriculum, healthcare organization educators and managers need to understand the background of what new licensees may or may not be learning and experiencing in regard to promoting safe IV push practices. If your organization provides clinical rotation sites for nursing programs, educators from each practice site should meet with the clinical instructors who will supervise the students to review the organization's approach to IV push medication administration and the role of students. Clinical faculty should also review the organization's medication administration policies and procedures, including IV push guidelines. In addition, instructors should be strongly encouraged to attend an orientation program (the same program that new hires attend) that covers the organization's safety goals so they can reinforce safe practices during clinical rotations.

Staff educators within your organization should also:

- Ensure evidence-based guidelines and IV push practices are incorporated into policies and procedures.
- Recognize that while new licensees may have had simulation experience with IV push medication use, the content may have been a far less significant portion of a new licensee's experience in their undergraduate program.
- Complete competency assessment and validation for IV push medications when hiring new staff.
- Work with pharmacy and nursing leadership to purchase or have pharmacy prepare and dispense IV push medications in a ready-to-administer form as much as possible.
- Instruct staff to:
  - Only dilute IV push medications when recommended by the manufacturer or in accordance with approved institutional guidelines.
  - Never dilute or reconstitute an IV push medication by drawing the contents into a commercially available prefilled flush syringe of 0.9% sodium chloride or any other prefilled, labeled syringe of diluent.
  - Never withdraw IV push medications from commercially available, cartridge-type (CARPUJECT) syringes or any other prefilled syringe into another syringe for administration.
  - Scan the barcode on the IV flush syringe prior to its use. While it may seem unnecessary to scan a saline flush syringe, given that it contains no active medication, there may be look-alike prefilled medication syringes that could be inadvertently administered as a flush solution and cause patient harm.
  - Administer all IV push medications and any subsequent flush solutions at the rate recommended by the manufacturer, supported by evidence in peer-reviewed literature, or in accordance with internal guidelines.
- Provide practitioners who prepare, dispense, or administer IV push medications with ongoing information about associated risks and errors that have occurred in the facility and have been reported by external organizations, and strategies to minimize these risks.
- Instruct staff to report errors, close calls, and hazardous conditions associated with IV push medications to external safety organizations such as ISMP for shared learning.

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**References** appear in the right column >

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**Figure 1.** Medisca's 20 mL oral syringe has 0.5 mL increments and non-metric units.

the incorrect volume. The pharmacy also noted that the syringes contain teaspoon markings instead of metric units only, which is something that ISMP has warned against for many years, due to increased error potential when household measures are used for drug dosing (www.ismp.org/node/496).

We have reached out to Medisca and reported the potential for incorrect dosage errors due to the markings on the syringe. For now, if these syringes are found in patient care areas, sequester them and notify your nursing leaders to work with pharmacy to obtain an alternative product.

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Production of this peer-reviewed newsletter would not be possible without the assistance of a reliable and talented clinical advisory board. As 2023 nears an end, we want to thank each of the following members of the advisory board for their dedication to making this newsletter a valuable medication safety resource for clinicians.

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