November 1, 2018 ■ Volume 23 Issue 22

ISMP

Acute Care
ISMP Medication Safety Alert!®
Educating the Healthcare Community About Safe Medication Practices

Part I: Survey results show unsafe practices persist with IV push medications

In July and August 2018, we invited practitioners who administer intravenous (IV) push medications to adults to participate in a survey.[1] The survey was conducted in response to three prior ISMP surveys that revealed numerous risky practices associated with the administration of IV push medications. These included the withdrawal 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. Although the 2018 survey demonstrates a reduction in some of these unsafe practices, a surprising number of practitioners still report using prefilled syringes or cartridges as vials, diluting IV push medications despite their availability in a ready-to-administer form, unsafe labeling practices, and preparing IV medications at the bedside. Some of these unsafe practices appear to be associated with ongoing drug shortages, system vulnerabilities, and/or teaching strategies that perpetuate these practices.

Prior ISMP Surveys and Guidelines

In 2010, we conducted a survey on the impact of the economic crisis on medication safety, which uncovered long delays in dispensing pharmacy-prepared IV solutions and an increase in nurses preparing or manipulating parenteral medications on the clinical unit.[2] In 2012, we conducted a survey to learn about practices when using **CARPUJECT** prefilled medication syringes, which exposed the widespread practice of using the cartridge as a vial to withdraw the medication into another syringe prior to administration.[3] In 2014, we conducted a survey on IV push medications, which revealed unnecessary dilution associated with medications that were dispensed in ready-to-administer forms. The survey also uncovered the inappropriate use of prefilled normal saline flush syringes to dilute IV push medications, which results in mislabeled syringes.[4]

To address these safety concerns and others, ISMP held a national summit of expert stakeholders in 2014, which resulted in publication of the ***ISMP Safe Practice Guidelines for Adult IV Push Medications*** in 2015.[5] Now, 3 years later, we have surveyed practitioners to understand current practices associated with IV push medications and to determine if ongoing drug shortages and teaching strategies around this critical skill have impacted current practices. In **Part I**, we present the findings from the latest survey. In **Part II**, which will appear in our next issue, we will provide recommendations for safe preparation and administration of adult IV push medications based on the survey results.

Respondent Profile

ISMP thanks the 977 practitioners who participated in our 2018 survey. Participants included nurses (93%), advance practice nurses (4%), and nurse anesthetists, anesthesiologists, and physicians (almost 3%). Most of the survey participants work in inpatient settings, including medical-surgical units (31%), critical care units (24%), surgical areas (13%), emergency departments (12%), labor and delivery units (7%), oncology units (3%), and a variety of other inpatient units (4%). Only 6% of the participants work in outpatient locations such as infusion centers, physician office practices, or diagnostic areas.

Ready-to-Administer Syringes

Only one-quarter (25%) of participants receive more than half of adult IV push medications

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SAFETY briefs

HIGH-ALERT

Perioperative area needs barcode scanning! The perioperative area is vulnerable to medication errors because it typically operates with fewer medication safety strategies in place than other patient care units. Medications are often prepared and administered by the same person without an independent double check or pharmacy review of an order, and without the benefit of information technology to provide clinical decision support. In addition, barcode scanning is not widely used in these areas.

We recently heard from an anesthesiologist who accidentally administered lidocaine 2% intravenously (IV) instead of fenta**NYL**. While the container labels on the vials do not look similar, both products are available in small vials with light blue caps (**Figure 1**). Light blue is used as a standard color for opioids with user-applied labels in anesthesia (**Figure 2**). However, there is no standard color used for commercially manufactured medication vials. Still, according to the person who reported this event, light blue is a color that many anes-

Figure 1. Although these vials are somewhat different in overall appearance, the light blue cap color contributed to the medication mix-up.

Figure 2. This label color is the Standard American Society for Testing and Materials (ASTM) color for opioids.

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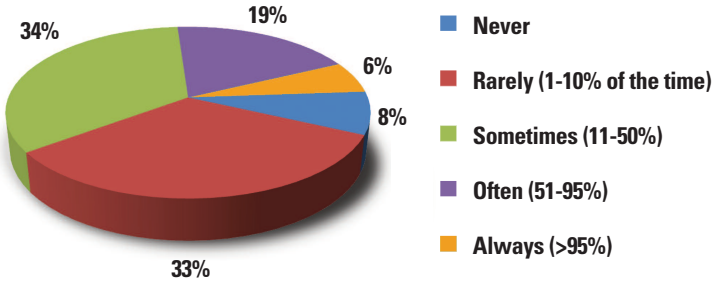
in pharmacy-prepared or commercially available ready-to-administer syringes (**Chart 1**). Just 6% *always* receive ready-to-administer syringes. Most participants (75%) receive half or fewer IV push medications in ready-to-administer syringes. Eight percent said they *never* receive ready-to-administer syringes—95% of these participants work in inpatient settings, mostly medical-surgical units. The medications most frequently NOT provided in ready-to-administer syringes include the following:

Chart 1. Frequency of receiving ready-to-administer syringes



- Antiemetics (e.g., ondansetron, prochlorperazine, promethazine)
- Antipsychotics (e.g., haloperidol)
- Benzodiazepines (e.g., **LOR**azepam, diaze**PAM**)
- Antibiotics with short stability
- Opioids (e.g., fenta**NYL**, **HYDRO**morphone, morphine)
- Pantoprazole
- Metoprolol
- Furosemide

While many of these medications are marketed in a prefilled syringe, the syringes are, or have been, in short supply, making availability problematic.

Withdrawing Medications from a Prefilled Syringe and Transferring to Another

Two-thirds (66%) of participants reported withdrawing medications from a prefilled syringe (or cartridge) and transferring into another syringe to administer some or all of an IV push medication dose—16% do this more than half of the time they encounter a prefilled syringe. This may represent an increase from our 2012 survey, when 12% of respondents reported concern about this unsafe practice in the comments section of the survey. The most common reasons for withdrawing medication from a prefilled syringe are listed in **Table 1**, with dilution leading the way. Based on survey comments, other reasons for withdrawing medications from prefilled syringes are linked to drug shortages (e.g., to administer partial doses to promote opioid conservation), the need to filter some medications in cracked or particulate-containing prefilled syringes (www.ismp.org/ext/122), and the erroneous belief that a 10 mL syringe must be used to administer medications via an implanted port or peripherally inserted central catheter (PICC). (According to the Infusion Nurses Society, clinicians should use a syringe appropriately sized for the medication once patency has been confirmed using a 10 mL syringe.[6])

Table 1. Reasons practitioners withdraw medications from prefilled syringes

Reason	Percent of Respondents
Dilution	64
No designated syringe (cartridge) holder	22
Taught to do this	15
Hard to read syringe dose increments	14
Syringe without a needleless connector or removable needle	14 (e.g., opioids, insulin, heparin)
Other	22

Dilution

Overall, 84% of participants reported that they have further diluted certain adult IV push medications prior to administration. These findings are similar to our 2014 survey in which 83% of respondents further diluted certain IV push medications. However, the fre-

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thesia providers have come to associate with opioids, including fenta**NYL**. Also, both vials were stocked in the anesthesia medication tray in an upright position so only the caps were showing before removal.

In 2010, the Anesthesia Patient Safety Foundation (APSF) released consensus recommendations to improve the practice and safety of patients in the surgical suite (www.ismp.org/ext/106). These recommendations include a section on the standardization and storage of medications along with the use of technology. Specifically, APSF recommends setting up anesthesia carts or automated dispensing cabinets (ADCs) so that vial labels are readily visible to the user rather than storing the vials in an upright position, which could foster reliance on cap color when selecting a medication. APSF also recommends not storing look-alike vials near one another, a strategy the reporting institution is implementing to reduce the risk of similar errors. However, the strongest recommendation by both APSF and ISMP is to employ barcode scanning systems to identify medications before drug preparation and administration.

Look-alike, sound-alike caution. Migalastat (**GALAFOLD**) was approved in August 2018 for the treatment of adult patients with Fabry disease, an inherited disorder due to a dysfunctional enzyme that leads to a buildup of globotriaosylceramide, a fat. This eventually causes pain in the hands and feet, discolored spots on the skin, a reduced ability to sweat, and other disorders, some life-threatening (www.ismp.org/ext/123). Migalastat works by stabilizing the enzyme.

Unfortunately, migalastat looks and sounds very much like miglustat (**ZAVESCA**), which was approved several years ago for the treatment of adults with mild or moderate type 1 Gaucher disease (www.ismp.org/ext/124). Individuals with Gaucher disease also have a defect in an enzyme that normally breaks down certain fatty substances that can build up in some organs and cause problems in the liver, spleen, bone, and blood. Both drugs are associated with enzymes and fat disorders.

In addition to name similarity, migalastat and miglustat are both only available in a

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quency of dilution has decreased since 2014 (**Table 2**). Pertaining to the containers in which IV medications are provided, medications available in single-dose vials were most often diluted in both the 2014 and 2018 surveys. Yet, as many as 1 in every 5 participants still reported in 2018 that they *sometimes*, *often*, or *always* dilute medications provided in multiple-dose vials (21%) or manufacturer's prefilled syringes (16%). Dilution was least frequent with pharmacy-dispensed syringes that contain patient-specific doses (6%). While the frequency of dilution has decreased, the practice continues.

Table 2. Frequency of further dilution of adult IV push medications and the most frequent medications diluted

Container Type	Year	Percent of Respondents: Never 0%	Rarely 1-10%	Sometimes 11-50%	Often 51-95%	Always >95%	Most Frequent Medications Diluted (2018 Survey Only)
Manufacturer's prefilled syringe	2014	42	15	18	15	10	Opioids, anxiolytics/antipsychotics, antiemetics, diphenhydr**AMINE**, cardiovascular agents, ketorolac
	2018	70	14	11	4	1	
Pharmacy syringe with patient-specific dose	2014	63	17	8	7	5	Opioids, anxiolytics/antipsychotics, antiemetics, cardiovascular agents, antibiotics, corticosteroids
	2018	86	8	4	1	1	
Single-dose vial	2014	9	14	35	28	14	Opioids, antiemetics, anxiolytics/antipsychotics, antibiotics, diphenhydr**AMINE**, ketorolac
	2018	16	25	37	18	4	
Multiple-dose vial	2014	36	15	23	15	11	Opioids, antiemetics, anxiolytics/antipsychotics, cardiovascular agents, diphenhydr**AMINE**, antibiotics
	2018	65	14	14	5	2	

In our 2018 survey, opioids, anxiolytics/antipsychotics, and antiemetics were the most frequently diluted medications, regardless of the container in which the medication was provided. In fact, approximately three-quarters of participants reported further dilution of opioids provided in both commercially available (78%) and pharmacy-dispensed (69%) prefilled syringes. Anticonvulsants, naloxone, insulin, and heparin were the least frequently diluted medications in the survey. Medications that were not included in the survey but frequently mentioned as being diluted included famotidine and pantoprazole.

Among participants who dilute adult IV push medications prior to administration, 81% confirmed that they have used a prefilled 0.9% sodium chloride (saline) flush syringe (commercially or pharmacy-prepared) for this purpose. Approximately 56% said they use a flush syringe to dilute medications at least half of the time, and 19% said they *always* do. When describing this practice, most participants did not include relabeling of the flush syringe. This unsafe practice has increased in frequency since our 2014 survey, at which time 54% of practitioners said they had diluted medications using a saline flush syringe. One possible reason for the increase may be the shortage of vials of 0.9% sodium chloride at the time of the survey, which many practitioners noted in the comments section.

The primary factors that influenced a decision to further dilute adult IV push medications were associated with the desire to administer the drug slowly (94%), avoid patient discomfort (70%), reduce the risk of extravasation (33%), and measure small volume doses accurately (25%). Other reasons (13%) included drug-specific requirements (e.g., **LOR**azepam), facility policies, recommendations in drug references, and prior education.

Labeling

Only half (50%) of the participants told us they *always* label IV push medications that are self-prepared away from the patient's bedside. Comments suggest that labeling was

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capsule dosage form; migalastat comes as a 123 mg capsule and miglustat as a 100 mg capsule. Since only one strength is available for either medication, the strength may be omitted when ordering the drug in some circumstances. With similarities in names, single strengths, and oral capsule formulations, omitting the strength increases the risk of an error. It is also possible that the odd 123 mg strength of migalastat may be viewed as a dosing mistake.

To prevent errors, neither medication should be prescribed, dispensed, or refilled without verifying the proper patient diagnosis. If you have both medications in your organization, consider adding an alert during order processing to warn about possible mix-ups or require a hard stop to verify the patient's diagnosis. Also refer to these medications using brand names when possible. Barcode scanning should be employed during product selection and administration, and we recommend storing the medications apart from one another. We are considering tall man letters (e.g., mig**ALA**stat and mig**LU**stat) to help differentiate these drugs on computer screens and in other presentations. We will inform you if we add this drug name pair to our list of drug names with tall man letters.

Dosing error with WinRho SDF. **WINRHO SDF** is an intravenous (IV) Rh_0 (D) immune globulin (human, anti-D) product indicated for the treatment of idiopathic thrombocytopenic purpura (ITP) in Rh_0 (D)-positive patients. It is also used for suppression of Rh_0 isoimmunization in non-sensitized Rh_0 (D)-negative patients. The solution is ready-to-use with no reconstitution required. It may be given IV push over 3 to 5 minutes. The medication may be diluted only in 0.9% sodium chloride injection prior to administration.

Unfortunately, practitioners have been confused by the dosing units listed on the container as well as in WinRho SDF product labeling. The product strength is listed both in international units and micrograms (mcg), which may make it difficult to determine the amount needed (**Figure 1**, page 4). Also, the numbers can overlap when calculating doses, which increases the risk of error. WinRho SDF is available in single dose vials labeled as 600 international units (120 mcg), 1,500 international units (300 mcg), 2,500

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sometimes accomplished by taping the vial to the syringe. More than a quarter (28%) of participants said they *rarely* or *never* label these syringes. Participants who said they did not *always* label syringes prepared away from the patient's bedside told us that labeling was not necessary if they prepared just one medication (51%) or one syringe (45%) (**Table 3**). Surprisingly, 7% of participants said they could even distinguish between multiple syringes without a label by visual appearance or location of the syringe. Among these participants, the most frequent ways of distinguishing between two or more unlabeled syringes was by the different volumes of medication in each syringe (76%); the size of the syringes (40%); differences in needles, caps, or medication colors (36%); orientation on a tray or sterile field (16%); or by carrying syringes in different hands (12%) or pockets (12%).

Table 3. Reasons why syringes prepared away from the bedside are not labeled

Reason	Percent of Respondents
Not necessary if I prepare only one medication	51
Not necessary if I prepare only one syringe	45
Emergency	39
Too time consuming	20
No labels available	20
Not an expectation	12
Not necessary because I can distinguish syringes by visual appearance or location	7

Impact of Drug Shortages

Given the continuing drug shortage crisis, approximately one-third of participants agreed or strongly agreed with these statements:

- I am giving more medications via IV push that were previously given as infusions, particularly antibiotics, antiemetics, and proton pump inhibitors (38%)
- I am required to prepare more IV push medications at the bedside, or wait longer for pharmacy preparation and dispensing (34%)
- IV push drugs are being provided in unfamiliar formulations (concentrations and packages), or in volumes greater than needed for each dose (31%)
- I get less prefilled, ready-to-administer syringes than previously, particularly in the correct concentrations or volumes (31%)

Comments suggest that drug shortages also result in adverse outcomes such as delays in therapy due to pharmacy preparation of products in short supply, and drug waste. Even when medications are provided in prefilled syringes, the amount of drug in the syringe is often more than the patient's dose, leading to product waste along with using additional staff time to document the wasting of drugs such as opioids. Numerous participants said it seemed like they waste more medications than ever during drug shortages.

Learning to Administer and Dilute IV Push Medications

Most participants learned how to *administer IV push medications* during their professional training (79%), during orientation with their first professional position (56%) and/or current position (32%), from drug references (43%), and from on-the-job experiences (35%).

Approximately half of participants were taught to *dilute adult IV push medications* during their professional training (53%) or during orientation to their first professional position (47%). About a quarter of participants were taught this practice during orientation to their current position (29%), and more than one-third learned it from on-the-job experiences (39%) or drug references (38%). Only 9% reported receiving no formal instructions on diluting adult IV push medications.

Determining and Controlling the Rate of Administration

Only about two-thirds (63%) of participants indicated that the rate of administration of an IV push medication is provided on the patient's medication administration record or elec-

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international units (500 mcg), 5,000 international units (1,000 mcg), and 15,000 international units (3,000 mcg). For ITP, the recommended dose of WinRho SDF is 250 international units per kg (50 mcg/kg) of body weight, given as a single injection over 3 to 5 minutes, which, again, can cause confusion because the dose recommendation is not standardized to a single measurement unit (international units/kg or mcg/kg).

Recently, a pharmacist who was verifying a dose of WinRho SDF noticed that the amount drawn up from vials did not match the ordered dose. The dose was supposed to be 4,000 mcg but the syringe was labeled as 4,000 units. Upon investigation it was discovered that both the wholesaler and the hospital's computer system only listed the product strength in units. This resulted in the pharmacy ordering the wrong strength

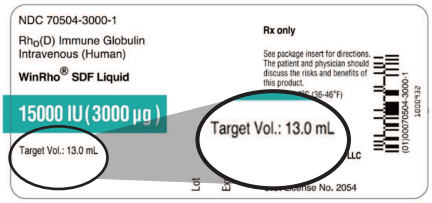

Figure 1. The strength on WinRho SDF labels should be standardized to either units or micrograms to prevent confusion. The abbreviations IU and µg, and the trailing zero in the target volume, should be avoided. Appropriately placed commas should also be used when expressing doses (e.g., 15,000; 3,000).

vials from the wholesaler and nearly giving the patient only 20% of the prescribed dose. The hospital contacted the wholesaler, which is working to add the mcg strength to the strength in units. The hospital is also looking into changing how this medication is displayed in its computer system.

Unfortunately, the lack of a single, standardized dosing unit allows errors like this to happen. Also, it should be noted that WinRho SDF labels perpetuate unsafe abbreviations and dose designations, namely IU instead of just units, use of the Greek µg instead of mcg, an unnecessary trailing zero after the target volume, and the absence of appropriately placed commas for doses in the thousands (**Figure 1**). We have brought these safety issues to the attention of the US Food and Drug Administration (FDA) and the manufacturer, Saol Therapeutics (product recently acquired from Aptevo BioTherapeutics).

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tronic health record. Many participants said they need to look up the rate of administration in drug references (41%), in facility-specific guidelines (40%), or remember the rate from previous administrations (41%). Eighteen percent of participants reported that they administer all IV push medications over 2 to 5 minutes, so they don't need to look up or know the specific rate of administration for each drug. A few reported they administer all IV push medications in less than 2 minutes. To control how fast they are administering IV push medications, 82% use a clock, watch, phone, or other timing device. To administer the dose over the desired timeframe, 38% stated that they give small incremental doses frequently, whereas 30% said they just apply constant pressure on the plunger.

Conclusions

Most participants in the recent survey do not receive IV push medications in ready-to-administer syringes and must prepare these medications prior to administration, which has only become more common during the ongoing drug shortage crisis. Various unsafe practices associated with preparing and administering IV push medications have been reported in our 2018 survey, including the withdrawal of medications from one syringe (or cartridge) and transferring to another syringe, a practice that has increased in frequency compared to our 2012 survey. Dilution is the most common reason for withdrawing a medication from the prefilled syringe. Although the frequency of diluting IV push medications has decreased since 2014, the practice continues.

When dilution occurs, most practitioners have used a saline flush syringe for this purpose, an unsafe practice that has also increased since our 2014 survey. Although further dilution is often not necessary, the decision to dilute is often guided by a desire to administer the dose slowly to avoid adverse effects, reduce patient discomfort at the administration site, prevent extravasation, and measure small doses accurately. Unfortunately, saline flush syringes that contain a medication are rarely relabeled. Finally, more than a quarter of survey participants reported that they rarely or never label IV push medications that have been prepared away from the bedside.

While these unsafe practices associated with IV push medication administration have been widespread for years, the drug shortage crisis has likely contributed to their ongoing occurrence. Also, from our survey it seems that some of these unsafe practices are taught during training, orientation, or on-the-job experiences, perpetuating their occurrence.

In **Part II**, we will provide recommendations to improve the safety of adult IV push medication administration, based on the vulnerabilities identified in the 2018 survey.

References

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Special Announcements

21st ISMP Cheers Awards Dinner

Please join us on Tuesday evening, **December 4, 2018**, for our annual **ISMP Cheers Awards** dinner at **Bowlmor Anaheim** in Anaheim, CA. The awards celebrate a group of healthcare leaders who are in their own league when it comes to best practices that prevent medication errors and protect patients. Highlights of the gala will include a keynote address by **Ana McKee, MD**, Executive Vice President and Chief Medical Officer of The Joint Commission. To register for the dinner or make a donation to support ISMP's work, visit: www.ismp.org/node/938.

Intensive training in medication safety

Join us on **November 30** and **December 1** for the last 2018 ISMP ***Medication Safety Intensive (MSI)*** workshop, which is being held in **Costa Mesa, CA**, prior to the ASHP Midyear Clinical Meeting in Anaheim, CA. For details, visit: www.ismp.org/node/127.

Free ISMP webinar

Join us on **November 15** for a **FREE** webinar, ***ISMP Update on Top Medication Safety Issues from 2018***. This webinar will include suggested prevention and mitigation strategies for the top medication safety issues from 2018. Listeners will also be brought up-to-date on certain safety standards and product changes that have occurred since events were first reported. For details, visit: www.ismp.org/node/1168.

Free FDA webinar series

The US Food and Drug Administration's (FDA) Division of Drug Information is presenting the next in a series of **FREE** educational webinars, ***FDA Drug Topics: FDA Regulation of Color Additives in Drug Products***, on **November 6**. Continuing education (CE) credit is available. For details, visit: www.ismp.org/ext/30, and to register for the program, visit: www.ismp.org/ext/31.

If you would like to subscribe to this newsletter, visit: www.ismp.org/node/10

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