January to December 2019

Medication Errors: The Year in Review

Preventing medication errors is an essential component of caring for patients and must be a core mission of every pharmacy. For medication error–prevention efforts to be effective, they must be a priority.

Horsham, Pennsylvania

An error reduction program begins by establishing a multidisciplinary medication safety team to improve medication use. To be effective, the team must be given reasonable time and resources to assess medication safety and implement systemwide changes that make it difficult or impossible for practitioners to make mistakes that endanger patients. This multidisciplinary team should accept ownership of the medication-use process and enthusiastically embrace the opportunity to improve medication safety. Effective results depend on understanding the entire medication-use process through varied perspectives and disciplines.

The goals of the team should include the following:

- Promote a culture of safety to reduce harm from medication errors.
- Increase detection and reporting of medication errors and potentially hazardous drug-use situations.
- Explore and understand the root causes of and factors that contribute to medication errors.
- Educate practitioners about the system-based causes of errors and their prevention.
- Recommend methods to facilitate the implementation of organization-wide, system-based changes to prevent medication errors.
- Respond to potentially hazardous situations before errors occur.
- Learn from errors occurring in other organizations through the *ISMP Medication Safety Alert!* and other published reports of medication errors, and proactively take measures to prevent similar errors.

The Institute for Safe Medication Practices (ISMP) is a nonprofit organization that works closely with health care practitioners and institutions, regulatory agencies, professional organizations, and the pharmaceutical industry to provide education about medication errors and their prevention. ISMP independently reviews medication errors that practitioners and patients have submitted voluntarily to the ISMP National Medication Error Reporting Program (ISMP MERP). ISMP is an accessible resource for any pharmacist or organization interested in implementing the actions recommended

Text continues on page 41

Table 1. Safety Issues Related to Labeling, Packaging, and Nomenclature

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Bupivacaine 0.25% mistaken as bupivacaine with EPINEPHrine after package insert on top of packaging was misread	• A pharmacy technician nearly placed a package of bupivacaine vials into a bin containing vials of bupivacaine with EPINEPHrine, but the error was caught during barcode scanning of the product. • The package insert displayed on the packing carton listed both plain bupivacaine and bupivacaine with EPINEPHrine (FDA allows a single package insert for both products).	• Require barcode scanning of these products during storage and administration. • Warn pharmacy staff members about the risk for a mix-up and remind them to look at the side panels of the packing carton for the official product label, not the package insert visible on the top.	2,4,6
⚠ "Insulin" should be easier to distinguish on Myxredlin (Baxter) labels	• MYXREDLIN (insulin, human) 100 units per 100 mL is a new premixed insulin IV infusion bag. • Myxredlin would benefit from improved product labeling (Figure 1). • ISMP has received reports of concerns about confusion with other Baxter minibags, but no incidents have been reported.	• The nonproprietary name (insulin human) should be easier to distinguish on the label. • Consider adding an auxiliary warning, such as "contains insulin," to help identify Myxredlin. • Storing the product in its carton will help ensure correct product identification. • As always, barcode scanning of the bag or carton at the bedside can help prevent container mix-ups.	2
⚠ Look-alike labeling on various Alvogen product vials	• Look-alike labeling can cause mix-ups between Alvogen injectable products (eg, deferoxamine mesylate, dexrazoxane, ketorolac, labetalol, metoprolol tartrate, midazolam, rocuronium, tranexamic acid, vancomycin). • Carton and vial labels have the same mustard yellow background, and a color band highlighting the strength distracts one's eyes away from the drug name.	• When possible, purchase these products from different manufacturers so the labels are dissimilar. • Separate the storage of all Alvogen products. • Use barcode scanning before drug preparation and administration to detect drug mix-ups.	2,6
⚠ Look-alike vials of bupivacaine and pantoprazole from AuroMedics	• Vials of bupivacaine and pantoprazole are the same size with similar light blue labels. • If the vials are stored near each other in areas such as the emergency department or perioperative area, mix-ups could result in inadvertent IV administration of bupivacaine, which is cardiotoxic.	• Consider purchasing these products from different manufacturers. • Use barcode scanning before drug preparation and administration to detect drug mix-ups. • Wherever IV bupivacaine is stored, make lipid emulsion readily available for reversal of inadvertent IV bupivacaine administration.	2,6
Mix-up between concentrations of Dr. Reddy's levETIRAcetam premixed bags	• Dr. Reddy's premixed bags of levetiracetam 1,000 mg per 100 mL (10 mg/mL) and 500 mg per 100 mL (5 mg/mL) were erroneously mixed together in the pharmacy storage bins. • The different-strength bags look nearly identical, and concentrations appear in very small print.	• Purchase premixed bags of levetiracetam from different manufacturers with better labeling. • If you use multiple Dr. Reddy's products in your facility: - store the bags apart from each other; - place prominent warning labels in the storage areas; - affix auxiliary labels; and - use barcode scanning before dispensing and administration.	2
⚠ Mix-up between insulin and tranexamic acid	• 2 cases of mix-ups between 100-mL bags of insulin and tranexamic acid were reported in the OR, where barcode scanning was not used. • The bags had similar white pharmacy labels with very small text. • The wrong product was administered to both patients, who recovered after receiving IV dextrose.	• Barcode scanning in the pharmacy before dispensing and in the OR before administration could prevent these errors. • Consider applying auxiliary labels to pharmacy-prepared IV bags that look similar to help identify their contents.	2,6

See KEY on page 39.

Table 1. Safety Issues Related to Labeling, Packaging, and Nomenclature

Title	Problem/Discussion Point	Recommendation	Tech
Mix-up between look-alike bottles of phenol and flexible collodion (from Medisca) leads to phenol-related burns	• A surgeon was accidentally handed a bottle of liquified phenol (89%) that was stored near the requested bottle of flexible collodion skin adhesive needed to close a surgical wound. • Both 100-mL bottles are dark amber with white caps and have almost identical-looking green and white labels. • The surgeon applied phenol to the wound, which resulted in burns that required extensive irrigation.	• If phenol is stored in your facility, determine why it is being used and whether alternatives are plausible (eg, prepackaged phenol applicators, which contain a small amount of phenol for procedures). • If bulk bottles of liquid phenol must be used, store them in the pharmacy and repackage liquid phenol in small applicator bottles with auxiliary label warnings for dispensing to areas outside of the pharmacy.	
⚠ Mix-up between methotrexate and metOLazone	• A patient died after receiving daily methotrexate for a month instead of metolazone. • A common cause of drug name mix-ups is searching by just the first few letter characters, which presents multiple look-alike drug names on the screen. • In this case, the first 3 letters are the same (M-E-T), and both are available in 2.5- and 5-mg tablet strengths.	• Use at least 5 letters (see ISMP Guidelines for Safe Electronic Communication of Medication Information, www.ismp.org/node/1322) to reduce the number of different drugs that appear on a screen during a search. • Employ a hard stop in order entry systems to avoid daily methotrexate without an appropriate cancer indication. • Use tall man letters for metolazone.	1,4,5
⚠ Mix-up between mitoMYcin and mitoXANTRONE	• A patient underwent intraperitoneal administration of mitoXANTRONE after the pharmacy dispensed the product in a brown overwrap, believing it was light-sensitive mitoMYcin. The overwrap made it difficult to see the drug's blue color. • The pharmacy workflow system displayed an "invalid route" warning when mitoXANTRONE (approved for IV use) was scanned. • The system was bypassed because a "wrong drug" alert did not occur. • The error was noticed later due to blue staining of the peritoneal tissues.	• Address any change in the expected appearance of the drug and any unexpected workflow system error messages because they can be important clues for detecting medication errors. • Perform manual quality checks in situations where pharmacy workflow system controls are bypassed.	6
⚠ Spinal administration of tranexamic acid instead of bupivacaine or ropivacaine	• 2 recent cases of inadvertent spinal administration of tranexamic acid were reported to ISMP. • A recent review article identified 21 additional cases. • This error has a mortality rate of 50%, and can result in other patient harm, including paraplegia. • Tranexamic acid, bupivacaine, and ropivacaine come in vials with blue caps that are often stored upright, making labels difficult to read. • These agents typically are used in areas where barcode scanning is not used (eg, OR, labor and delivery).	• Purchase these products from various manufacturers to help differentiate vial appearance. • Employ barcode scanning before dispensing or administering these products. • Avoid upright storage to ensure labels are always visible. • Store tranexamic acid vials separately. • Add an auxiliary label to tranexamic acid containers to note the route of administration.	2,4,6

Table 2. Safety Issues Associated With Order Communication and Documentation

Title	Problem/Discussion Point	Recommendation	Tech
Dosing levothyroxine in mg continues to cause overdoses	• During 2 hospitalizations, a patient was prescribed 0.5 mg of oral levothyroxine (500 mcg instead of 50 mcg). • A prescriber modified the selected dose of "25" mcg to "0.5" and changed the dosing unit from "mcg" to "mg." • Decimal point confusion has also led to errors between 0.025 and 0.25 mg.	• Consider adding an order entry warning with a hard stop for doses that exceed 200 mcg. • Require all levothyroxine doses to be prescribed in mcg (as expressed on levothyroxine containers). • Ensure the dosing unit (mcg) cannot be modified during order entry.	1,5
Finalized guidelines for electronic communication of medication information	• Electronic forms of communication are widely used in health care. • If the conventions used to communicate medication information electronically are not carefully considered, these technologies may contribute to medication errors rather than mitigate risks.	• Health care organizations and vendors of electronic health information technology should apply the principles in ISMP's updated Guidelines for Safe Electronic Communication of Medication Information (www.ismp.org/node/1322) when information about medications is communicated in electronic formats.	1,5
Mix-up between pralidoxime and pyridoxine due to sound-alike drug names	• A poison control center recommended a pralidoxime loading dose and infusion to treat organophosphate poisoning. • The physician heard "pyridoxine" and repeated it back without recognition of the error. • The patient received a bolus dose and part of the pyridoxine infusion before the error was detected.	• Spelling the drug name instead of just repeating it back can catch misheard oral communication of sound-alike drug names. • Poison control center staff should consider sending an immediate confirmation email/fax of their recommendations for verification.	5
Mix-ups with rifAMPin and rifAXIMin	• During a telephone consultation, a physician misheard rifAXIMin and prescribed rifAMPin (550 mg IV). • Due to the unusual dose, a pharmacist questioned the order, but the physician confirmed it. • The next day, the pharmacist learned the patient had hepatic encephalopathy and that the intended drug was rifaximin. • Brand- and generic-name mix-ups are possible with all the rifamycin antibiotics.	• Practitioners should familiarize themselves with various dosing parameters and indications for all rifamycin antibiotics. • Pharmacists should persist in clarifying unusual orders that do not match the usual indications or doses.	5
⚠ Mix-up between ZEMPLAR (paricalcitol, AbbVie) and ZEMURON (a former brand of rocuronium) due to look-alike names	• A nurse received a telephone order for Zemplar from a physician in the hospital. • When the nurse entered the drug into the order entry system, Zemplar appeared with a nonformulary warning, and Zemuron appeared below it in the drug picklist. • The nurse selected Zemuron instead of Zemplar, but the verifying pharmacist caught the potentially fatal error.	• Avoid displaying the Zemuron brand name for rocuronium, which is no longer manufactured using that brand name, in drug picklists. • Only display the generic name, rocuronium. • Only allow verbal/telephone orders to be used in an emergency or when the provider is working in a sterile environment.	1,4,5
Unintentional 1,000-fold zinc overdose when transposing mcg and mg dosing units	• When prescribing PN for a child, a physician ordered 700 mg instead of 700 mcg of zinc. • The PN template defaulted to mg dosing units, which could not be changed to mcg if the physician noticed the error. • 2 pharmacists verified the order but failed to notice the error. • A dose warning was issued when the order was transmitted to an outsourcer, but it was overlooked. • A pharmacist noticed the error while compounding the PN.	• Ensure that a warning with a hard stop for critical zinc overdoses (eg, >250 mcg/kg) appears in order entry systems. • Default to mcg dosing units for zinc in pediatric PN templates and ensure that this corresponds to the way orders are entered in automated compounders. • Conduct effective order verification processes in the pharmacy. • Validate the competencies of staff who order, transcribe, verify, and compound PN.	1,5,6

See KEY on page 39.

Table 3. Problems Involving Drug Information, Patient Information, Patient Education, and Staff Education

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Confusion between FIASP and NOVOLOG (both formulations of insulin aspart by Novo Nordisk), which have different onsets of action	• NovoLOG and Fiasp are both formulations of insulin aspart, but they are not substitutable. • Fiasp contains niacinamide to increase the speed of absorption and is given at the start of a meal or within 20 minutes afterward. • NovoLOG is given 5-10 minutes before a meal. • Confusion has led to dispensing errors if the brand name is not on the prescription. • In one case, a physician selected Fiasp, but the system sent an insulin aspart prescription to the pharmacy and NovoLOG was dispensed.	• If Fiasp is intended, prescribers should include the brand name on the prescription. • Electronic order systems should communicate the brand name if the prescriber selects it instead of only including the generic name. • Practitioners, particularly pharmacists, should confirm the brand name if it isn't specified on the prescription. • Patients should be made aware of the intended product and check the drug they receive from a retail pharmacy.	
Include 4-letter suffixes when expressing biosimilar drugs, as required by the FDA	• The FDA requires the use of a random 4-letter suffix attached by a hyphen to the end of the generic name of biosimilar drugs, unless approved before the new naming convention. • Versions of the same biological drug may not be an exact copy of the same molecule. • The suffix will identify the specific product if it is associated with an AE.	• When a biological nonproprietary drug name is used, include the full name along with the suffix, on all labels, in EHRs, and in AE reporting systems. • ISMP encourages use of the brand and nonproprietary names together to provide redundancy and avoid name confusion.	
Medical residents' electronic medication prescribing errors	• A large study that analyzed medical residents' medication e-prescribing found that pharmacists identified an error in 4% of the medication orders, particularly antimicrobial and anticoagulant orders (www.ismp.org/ext/153). • Errors were most frequent in August and September and among first- and third-year residents. • The errors were most often associated with a failure to adjust dosing for renal impairment (40%), unclear or incomplete orders (27%), and duplicate therapy (25%).	• Increase resident supervision for the first 3 months of training, not just July. • Educate residents about the specific kinds of errors that are common when ordering antimicrobials and anticoagulants. • Ensure third-year residents consult with other health care professionals when caring for complex patients or ordering drugs that are prescribed infrequently. • Establish a reliable plan for renal dose adjustments.	
⚠ Mix-ups between dexAMETHasone and dexMEDEtomidine (PRECEDEX)	• Mix-ups between dexmedetomidine and dexamethasone injection have been reported. • Pharmacy staff have selected the wrong drug when preparing an IV admixture or when restocking an ADC. • Nurses have removed the wrong drug from ADCs by overriding the system. • Nurses have programmed dexmedetomidine as dexamethasone in smart infusion pumps.	• Use premixed dexmedetomidine when it is available. • Employ barcode scanning before IV admixture or when selecting and stocking vials in ADCs. • Do not store these drugs near each other in the pharmacy. • Consider using tall man letters (dexMEDEtomidine, dexAMETHasone) if you carry both products.	2,4,6
⚠ Patient education needed for use of disposable standard pen needles	• Errors with home use of standard pen needles continue to occur. • In the latest case, a patient failed to remove the inner needle cover on an insulin pen for more than a year. • When he realized his mistake, he injected himself correctly but at a dose that had been repeatedly increased during the past year, leading to hospitalization due to hypoglycemia.	• Contact pen needle manufacturers for demonstration devices to show patients which covers to remove before administration. • If a patient's blood glucose level remains elevated after insulin administration, suspect pen or needle misuse before increasing the dose. • Ask the patient to demonstrate the administration process if improper use is suspected.	
⚠ Refills prescribed for ELIQUIS (apixaban, Bristol-Myers Squibb) starter pack	• When prescribing an Eliquis starter pack, a provider modified the default setting of zero refills and sent the prescription to an outpatient pharmacy with refills. • Several months of refills were dispensed. • Investigation revealed other instances in which the starter pack had been prescribed with refills.	• Set the default for refills of all drug starter packs to zero without the ability to modify this field. • If prescriptions for both the starter pack and maintenance dose are sent together to the pharmacy, instruct the pharmacist to put the maintenance prescription on hold until the starter pack has been completed. • Patient education should be provided.	1,5

Table continues on following page

Table 3. Problems Involving Drug Information, Patient Information, Patient Education, and Staff Education *cont'd*

Title	Problem/Discussion Point	Recommendation	Tech
Subcutaneous-only HERCEPTIN HYLECTA (trastuzumab and hyaluronidase-oysk, Genentech) may accidentally be administered IV	• Herceptin Hylecta is administered subcutaneously, whereas HERCEPTIN (trastuzumab) is administered as an IV infusion. • While the volume of a typical subcutaneous injection is 2 mL or less, the Herceptin Hylecta dose is 5 mL, which may lead practitioners to believe it should be administered IV.	• Use barcode technology to avoid mix-ups between IV and subcutaneous forms. • Also affix a prominent auxiliary label that states, "Administer subcutaneously in the thigh," on syringes of Herceptin Hylecta or use the peel-off sticker provided on the vial to label the syringe.	2
Subcutaneous-only RITUXAN HYCELA (riTUXimab and hyaluronidase, Genentech) confused with IV-only RITUXAN (riTUXimab, Genentech)	• Rituxan Hycela has been administered IV instead of subcutaneously. • Practitioners have mistakenly believed the drug should be administered IV because the volume of the dose (either 11.7 or 13.4 mL) is larger than a typical subcutaneous dose. • Name similarities also can contribute to mix-ups and confusion.	• Store Rituxan Hycela and Rituxan in a way that indicates that they are different formulations. • Employ barcode scanning to verify storage and administration. • Educate oncologists and nurses about the risk for wrong route errors. • Include an auxiliary warning on Rituxan Hycela syringes, "Administer subcutaneously in the abdomen."	1,4,5
Use independent double checks judiciously and properly	• Manual independent double checks have long been disputed, discounted, and misused in health care. • The process is time-consuming and often associated with practical problems in implementation. • Although studies confirm that independent double checks can detect up to 95% of errors when they are conducted properly, failed checking processes can be linked to: - inconsistent use; - variability in how the checks are performed; - "cosigning" with little real appraisal; - deference to authority that constrains questions; - excessive trust in the work of others; and - distractions and interruptions of staff.	• Evaluate whether independent double checks are being used judiciously and properly. • Consider what you are trying to verify or catch, the necessary steps to achieve this goal, and whether an independent double check is the best strategy and/or if other more effective risk reduction strategies should be used. • Fewer, strategically placed independent double checks will be more effective than excessive independent double checks. • If an independent double check is needed (ISMP does not recommend this for all high-alert medications), design and implement the strategy as outlined in www.ismp.org/node/8884.	

Table 4. Safety Issues Related to Medical Devices and Equipment

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Enoxaparin (LOVENOX, sanofi-aventis) syringe failures	• 42 reports of enoxaparin prefilled syringe failures and inadvertent activation of the needle safety mechanism have been received involving both brand-name and generic products. • Reports indicated that needlesticks, underdoses, missed doses, and embedded needles occurred. • Most reports indicated the following: - Syringes broke apart when engaging the safety mechanism. - Safety mechanisms did not engage, were difficult to engage, or engaged too soon.	• FDA and Sanofi are looking into these complaints. • In the meantime, advise practitioners handling these syringes to always point the needle end away from themselves and others, including the patient, until the moment of injection as well as after injection when activating the safety mechanism. • If these syringes are dispensed for use in the home, patients should be educated about proper use.	
Legacy feeding tubes, administration sets, and transition adapters going away	• GEDSA has announced that manufacturers will begin phasing out legacy feeding tubes starting July 1, 2020, and will discontinue transition adapters (whether sold singly or attached to ENFit feeding sets) on January 1, 2021 (Figures 2 and 3). • These moves will force the adoption of ENFit to reduce the risk for misconnections involving use of other connector types.	• Ensure that this information is communicated to the broader health care community in your organization, including purchasers and clinical personnel (pharmacists, nurses, physicians, etc). • For additional information, check the GEDSA Stay Connected website (http://gedsa.org/).	
Ring that remains after removing tamper-evident cap may fall off	• Some pharmacies use tamper-evident caps for medication syringes (Figures 4-6). • When the caps are removed, a plastic ring remains on the end of the syringe. • The ring can fall off or be a choking hazard if left at the bedside. • During an abdominal procedure, the plastic ring from a ceFAZolin syringe fell off into an irrigation solution but was noticed before intraabdominal irrigation.	• The cap manufacturer, International Medical Industries, recommends discarding the ring after removing the cap and before administering the medication. • Remind nurses and other providers who use these products about the hazards of a fallen ring and to remove and properly dispose of the ring before using/administering syringe contents.	

See KEY on page 39.

Table 5. Other Discussion Items

Title	Problem/Discussion Point	Recommendation	Tech
Designing effective warnings	• Warnings generally are less reliable than design strategies that eliminate hazards altogether, prevent hazards from touching targets, or detect errors before they reach patients. • Well-designed warnings can reduce the risk for errors. • If warnings do not reach the target audience, capture attention, and cause the recipient to understand the warning and required response, they will not be effective.	• Print visual warnings in big, bold font using mixed-case letters, and ensure warnings are clinically important. • Use correct signal words (*caution* or *warning* for injuries that *might* occur; *danger* for serious hazards that *will* occur) and color to draw attention to the warnings. • Use affirmative wording when possible (eg, avoid "not for IV use;" state "for oral use only"), and embed pictorials. • The most effective warning requires the recipient to interact with it to continue.	
Distribute FREE *Nurse AdviseERR* to all nurses	• Front-line nurses need to be aware of significant medication errors that are happening across the nation and ways to avoid them. • *Nurse AdviseERR* is a free ISMP newsletter that can help accomplish this goal. • We are worried that many US hospitals are not distributing this resource to their nurses, thus missing a key opportunity.	• Find out if nurses are currently receiving *Nurse AdviseERR*, and if they are not, forward this subscription link: www.ismp.org/node/138. • ISMP encourages a coordinator from each facility to subscribe and then redistribute the newsletter to other facility nurses. • If a nurse is having difficulty subscribing to the newsletter without a fee, they can use the code NURSE2019 at checkout.	
"Fuzzy matching" during electronic searches can lead to errors	• An Epic upgrade incorporates fuzzy matching, which creates a list of "near hits" based on what the system "thinks" you are searching for with patient names, medications, and other orders. • However, the near hits may lead to selection of the wrong drug if the drug names look alike, particularly if the drug name is misspelled (eg, cycloSERINE misspelled as "cyclosorine" creates a list containing cycloSPORINE).	• The use of fuzzy matching is a risk not worth taking and is unsafe for medication ordering. • Fuzzy matching can be disabled for all search options, but not for drugs alone. • Although Epic recently revised the algorithms, which eliminated some of the problems, similar-looking drug names still are presented to users during searches, so the functionality should be disabled.	1,4
Hepatitis C vial contamination despite using sterile needles and syringes	• A study in *Anesthesiology* (2019;131[8]:305-314) shows that practitioners inadvertently can contaminate a drug vial diaphragm, and subsequent access with sterile needles and syringes can transfer hepatitis C virus into the drug, where it remains stable for at least 72 h, in sufficient quantities to infect subsequent patients. • Wiping the diaphragm with an alcohol swab was not sufficient to eliminate hepatitis C virus infectivity, whether or not alcohol was allowed to dry before vial access.	• Eliminating the use of multidose vials for more than 1 patient would eliminate this risk. • According to the CDC, practitioners using multidose vials for more than 1 patient should withdraw patient-specific doses "in a centralized medication area and [should] not bring the multidose vial into the immediate patient treatment area" (eg, the OR). • Given that a remote medication preparation area does not always exist in the OR, consider eliminating multidose vials and using pharmacy-prepared, single-dose syringes. • Frequent hand hygiene, better environmental cleaning between cases, and removal of all used syringes and vials from the OR at the end of a case are additional strategies.	
IV push GAT helps uncover national priorities for safe injection practices	• Results from ISMP's IV push GAT (www.ismp.org/node/1188) reveal low scores for many of the best practices in the ISMP Safe Practice Guidelines for Adult IV Push Medications (www.ismp.org/node/97), including: - dispensing IV push medications in a ready-to-administer form; - *not* diluting or reconstituting IV push medications in a saline flush syringe; - permitting emergency administration of rescue agents per protocols/orders; - administering IV push medications and flushes at the recommended rate; and - barcode scanning of flush syringes.	• Review the results of the IV push GAT, particularly the 10 national priorities for safe injection practices related to the lowest scoring best practices (www.ismp.org/node/11496). • Assess your organization's compliance with these practices and determine an actionable plan to address any gaps in the safe use of IV push medications in your organization.	2,3

Table continues on following page

Table 5. Other Discussion Items *cont'd*

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Patient-controlled analgesia (PCA) pump keys available online	• Pump keys for CADD-Solis (Smiths Medical) and Care-Fusion Alaris Medley PCA syringe pumps still can be purchased online, threatening the security of medications in the pumps. • Lockboxes for various PCA pumps also can be accessed with common items.	• Follow the manufacturer's directions and use other security features that may be available with PCA pumps, such as a software code to activate the locking mechanism, rather than using just a manual key lock.	
Unsafe storage of vecuronium and vancomycin	• When checking a prepared IV admixture, a pharmacist noticed that vecuronium had been used instead of vancomycin. • Investigation found that vecuronium was stocked next to vancomycin in the IV area in an unlidded bin (the lid had broken off) (Figure 7). • The label that warned about respiratory paralysis and arrest on the vecuronium bin was curled and could not be fully read.	• Segregate and sequester neuromuscular blocking agents from other medications (eg, place in a lidded bin or rapid sequence intubation kit). • Scan barcodes for IV admixtures using IV workflow technology. • If warning labels are used, inspect them regularly and replace them as soon as signs of wear are recognized.	6

Table 6. ISMP's Targeted Medication Safety Best Practices for Hospitals

Title	Problem/Discussion Point	Recommendation	Tech
Error associated with the use of sterile water	• Sterile water for inhalation was inadvertently administered IV to a young woman at an outpatient surgery center. • Bags of sterile water for inhalation, IV normal saline, lactated Ringer's solution, and other common IV fluids were stored on the same shelf. • The error was discovered when the nurse was about to administer a second liter of IV fluid before the patient was discharged. • However, an entire liter of sterile water had been infused, and the patient developed hemolysis, became anuric, and now requires dialysis.	• Eliminate all 1,000-mL bags of sterile water for injection, irrigation, or inhalation from all areas outside of the pharmacy (www.ismp.org/node/160, *ISMP Targeted Medication Safety Best Practice* #10). • Use product containers of alternative sizes and/or shapes. • Establish a policy to ensure that 1,000-mL bags of sterile water can be ordered only by a pharmacy purchaser for pharmacy compounding purposes, not for storage in clinical locations. • If sterile water (irrigation, inhalation) must be available in a clinical location, purchase the pour bottler or other plastic containers with distinct appearance from other IV fluids. • Establish guidelines regarding the safe provision of large volumes of sterile water to surgery/the OR when they are needed.	
⚠ Fatal error due to PAXIL (PARoxetine) and TREXALL (methotrexate) sound-alike names	• A prescription for Paxil (10 mg daily) was called into a pharmacy. • Pharmacy staff likely misheard the drug name and dispensed Trexall (10-mg tablets), with directions to take 1 tablet daily. • The patient thought Trexall (on the pharmacy label) was the new antidepressant she was expecting. • Seven days later, she was hospitalized and died.	• Order entry systems should default to a weekly oral methotrexate dose; any daily orders should cause a hard stop (www.ismp.org/node/160, *ISMP Targeted Medication Safety Best Practice* #2). • All patients filling methotrexate prescriptions should be counseled. • ISMP offers a free consumer education guide about oral methotrexate (www.ismp.org/ext/290).	1,5

KEY

⚠ Identified issue involves a medication listed on ISMP's List of High-Alert Medications in Acute Care Settings (www.ismp.org/Tools/institutionalhighAlert.asp). High-alert medications are associated with a heightened risk for causing significant patient harm when they are used in error.

ADC, automated dispensing cabinet; **AE,** adverse event; **CPOE,** computerized prescriber order entry; **EHR,** electronic health record; **GAT,** gap analysis tool; **GEDSA,** Global Enteral Device Supplier Association; **IV,** intravenous; **OR,** operating room; **MAR,** medication administration record; **PN,** parenteral nutrition

TECHNOLOGY (TECH) KEY	
1 A fully integrated **CPOE** system includes the capability to build medication safety alerts and clinical decision rules. It should directly interface with the laboratory system and pharmacy, list drug–drug and drug–disease interactions, and offer clinical decision support.	4 **ADCs** are robust, point-of-use dispensing systems. ADCs should be integrated with the health care facility's information system and directly interface with the pharmacy system. In addition, ADCs must be able to use barcoding technology for the restocking process to prevent medication errors.
2 **Barcode-enabled point-of-care systems** are designed to detect medication errors during medication distribution and/or administration. Using a barcode scanner to scan barcodes on a medication and a patient's wristband, users can verify and record all drugs administered to the patient.	5 A **"robust" pharmacy order entry system** is fully interfaced with a CPOE system and must be able to produce medication safety alerts, directly interface with a health care facility's information systems, and generate a computerized MAR to be used by nurses while they administer medications.
3 **"Smart" infusion pump systems** allow users to enter drug infusion protocols into a drug library with predefined dose limits. If a dose is programmed outside established limits or clinical parameters, the pump halts or sounds an alarm. Some pumps can integrate patient monitoring and other patient parameters.	6 **IV workflow technology** combines software and automated pharmacy workflow technology for compounding sterile products. It receives dose information from health IT systems and uses robotics, gravimetric analysis, and barcode scanning with video technology or digital images. Some systems can generate drug-specific administration notes and labels for point-of-care scanning by nurses.

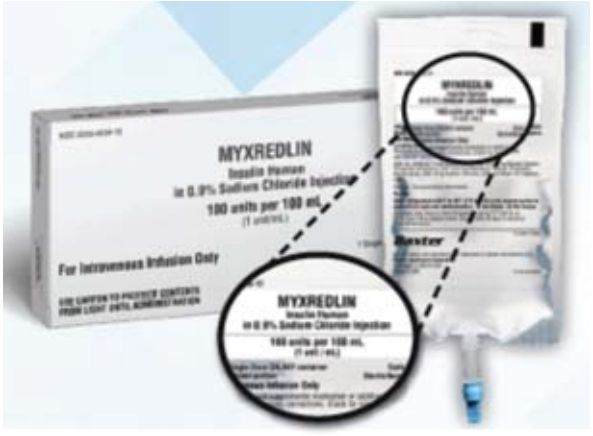

Figure 1. Commercially available premixed insulin (Myxredlin, 100 units per 100 mL) is available from Baxter.

To prevent confusion with other 100-mL minibags, the generic name, insulin, needs to be more prominently displayed on this product.

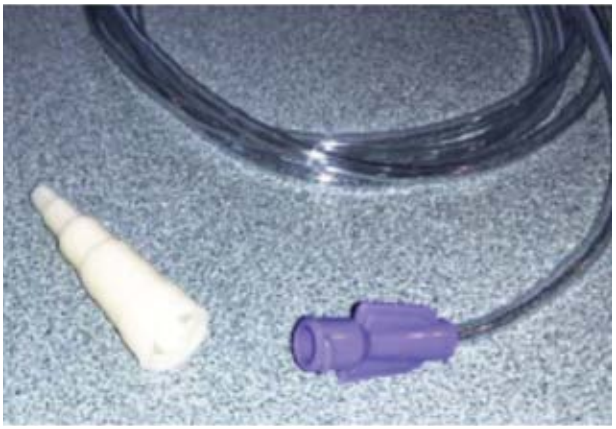

Figure 2. ENFit feeding set used for enteral feedings.

Note the white transition adapter that fits legacy feeding tubes. The adapter, removed in this photo, now accompanies feeding sets but will not after 2021.

Figure 3. Transition adapter on ENFit administration set fits legacy gastrojejunostomy feeding tube.

After July 1, 2020, these and other legacy feeding tubes will no longer be manufactured, and they will be replaced by tubing with ENFit connectors.

Figure 4. Example of white tamper-evident cap on syringe.

In the case described, the caps were red.

Figure 5. Outer cap removed with clear inner stopper intact and white plastic ring retained.

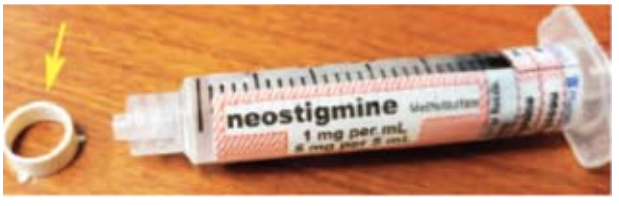

Figure 6. Plastic ring can easily fall off.

Figure 7. Unsafe storage of vecuronium and vancomycin next to each other.

Also, warnings on the vecuronium container are worn and difficult to read.

Text continued from page 31

herein. Among the many products and services ISMP offers is *ISMP Medication Safety Alert! Acute Care*, a biweekly newsletter that provides timely information related to error prevention. It identifies errors that have been reported by organizations and offers recommendations to prevent those errors from occurring.

The information in the tables of this review summarizes many of the significant error-prevention strategies recommended in the *ISMP Medication Safety Alert! Acute Care* newsletter from January through December 2019. The errors presented in the tables are actual or potential errors reported to ISMP. Each table consists of 4 columns. The first column lists the involved medications, devices, or other problematic issues. The second column describes the specific error or problem. The third column contains ISMP's recommendations to proactively address similar errors and prevent them from reoccurring. The fourth column lists technology that may help prevent or detect such errors. Technology can be a powerful tool in the fight against medication errors but only when it is used appropriately within a well-designed medication-use system.

The technology key summarizes the technology addressed in the tables and specific criteria that ISMP believes should be included.

ISMP and FDA/ISMP Safe Medication Management Fellows. 2018-2019: Avani Bhalodia, PharmD; Samantha Burton, PharmD; Barbrakaryne Fobi, PharmD, MPH; Mona Hammam, PharmD; Farzana Samad, PharmD; and Alexander Shilman, PharmD. 2019-2020: Benedicta Asamoah, PharmD; Allison Hanson, PharmD, BCPS; Neha Kumar, PharmD; Yashar Rafi, PharmD; and Nistha Shah, PharmD.

Suggested Reading

Cohen MR, ed. *Medication Errors*. 2nd ed. Washington, DC: American Pharmacists Association; 2007.

Institute for Safe Medication Practices. *ISMP Medication Safety Alert! Acute Care* newsletters 2019. Accessed January 30, 2020. www.ismp.org/newsletters/default.asp

Institute for Safe Medication Practices website. Accessed January 30, 2020. www.ismp.org