Medication Errors:
The Year in Review

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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.

An error reduction program begins by establishing a multidisciplinary 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 medication errors.
- Increase detection and reporting of medication errors and potentially hazardous drug-use situations.
- Explore and understand the root causes of medication errors.
- Educate practitioners about the system-based causes of errors and their prevention.
- Recommend methods to facilitate 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 Medication Error Reporting Program. ISMP is an accessible resource for any pharmacist or organization interested in implementing the actions recommended herein. Among the many products and services that ISMP offers is the *ISMP Medication Safety Alert! Acute Care*, a biweekly publication that provides timely information related to error prevention. It identifies errors that have been reported by other organizations and offers recommendations to prevent those errors from recurring.

The information in the tables of this review summarizes many of the significant error-prevention strategies recommended in the *ISMP Medication Safety*

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

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Dispensing bags of sterile water for injection outside the pharmacy increases the risk for confusion with IV fluids	• An emergency department ran out of sterile water vials to reconstitute medications. • Materials management sent a 2-L bag of sterile water for injection as an alternative. • Multiple reentries into the same bag can cause contamination. • Mix-ups can lead to hemolysis and fatalities.	• Large-volume containers of sterile water for injection should only be delivered to and stored in the pharmacy. • Label these containers with warnings to never remove them from the sterile compounding area. • Nonpharmacy personnel may not be aware of the risk for harm if sterile water is confused with IV fluids. • Segregate sterile water from IV fluids.	
Entire bottle (25 tablets) of sublingual nitroglycerin administered to a patient	• A new nurse administered the entire bottle of nitroglycerin tablets to a patient. • The nurse was familiar with unit dose dispensing and thought the small bottle contained a single dose. • Barcode scanning of the bottle confirmed the correct medication but not the dose.	• Include instructions to administer only 1 tablet sublingually (with additional doses as prescribed) on MAR and ADC screens. • Place instructions on the product (eg, flag a label with instructions on the glass bottle, and put the nitroglycerin vial in a labeled plastic bag that states the tablet strength and instructions for administration).	2,4
⚠ Expression of strength per milliliter on BRIDION (sugammadex; Merck) peel-off label causes confusion	• Bridion's peel-off label, which expresses the strength as 100 mg/mL, is affixed over a container label that expresses the strength as 200 mg/2 mL (2-mL vial) or 500 mg/5 mL (5-mL vial). • Reported overdoses are due to the peel-off label misleading providers to believe the entire vial (2 or 5 mL) contains only 100 mg.	• Make practitioners aware of the risk for confusion with the Bridion peel-off label, and advise them to look at the label underneath for the total amount of drug in the vial. • While ISMP supports peel-off labels to facilitate syringe labeling, we have asked the manufacturer to modify or eliminate the peel-off label.	
⚠ Generic EPINEPHrine auto-injectors do not use abbreviation "Jr" for 0.15-mg dosage strength	• The "Jr" designation is already part of the EPIPEN trademark. • EPINEPHrine doses for allergic reactions or anaphylaxis are weight-based. • Generic brands list metric strength only (0.3 or 0.15 mg).	• Educate practitioners and consumers about the lack of the "Jr" designation on generic EPINEPHrine 0.15-mg products. • Educate practitioners and consumers about which strength should be used based on the patient's weight.	1,2,4,5
GLEOLAN (aminolevulinic acid; NX Development) oral solution vial looks like vials for injectables	• Gleolan oral solution comes as a lyophilized powder packaged in a 50-mL single-dose vial that looks just like vials used for parenteral medications, risking inadvertent IV administration.	• Pharmacy should prepare and dispense patient-specific doses in an oral medicine bottle. • Pharmacy should label the bottle with clear instructions that the patient should drink the solution 2-4 h before induction of anesthesia.	1,2,5
Grifols HYPERRAB (rabies immune globulin [human]) 1- and 5-mL cartons and vials look alike	• A new concentration of HyperRAB (300 units/mL) is supplied in 1-mL (child) and 5-mL (adult) single-use vials. • Both come in a 5-mL capacity vial and have very similar labeling and packaging (Figure 1).	• To prevent mix-ups, store the products apart from each other. • Differentiate vials with auxiliary labels. • Use barcode scanning when stocking, dispensing (including ADCs), and administering these products.	2,4
Investigational drugs	• Limited regulatory oversight of investigational drug labeling, packaging, and nomenclature has led to errors. • Nomenclature risks include look-alike identification numbers and name changes that are not reflected on labels and protocols. • Errors can occur due to unlabeled manufacturer containers and labels without the dose, barcode, lot number, and/or expiration date. • Errors also have occurred with inappropriate container sizes.	• Only refer to investigational drugs by the official identifier or approved name. • Do not accept investigational drugs without labels. • If expiration/retest dates are not on the labels of investigational drug containers, quarantine these items until the information is provided. • Use barcode scanning when dispensing and administering the drugs. • Follow up with patients after discharge to assess proper use. • Establish a process to update protocols.	2

See KEY on page 27.

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

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Labeling practices by 503A and 503B compounders	• Deviations from USP <7> labeling standards (expressing the strength per milliliter as the primary expression instead of the strength per total volume) cause errors when the per-milliliter strength is mistaken as the total amount of drug. • 2 succinylcholine syringes, one with the strength expressed per total volume (Cantrell Drug Company) and the other with it expressed per milliliter (PharMEDium), were found in an anesthesia cart. • An overdose occurred when a nurse administered 50 mg of ketamine instead of 10 mg. • An outsourced prefilled syringe was prominently labeled "10 mg/mL," but "5 mL in 5 mL syringe (50 mg)" was below that in small print.	• Only use compounders that follow labeling recommendations from ISMP, the FDA, and USP <7>, which require the total amount per total volume to be the information most prominently displayed on the label. • Use barcode scanning when stocking, dispensing (including ADCs), and administering these products.	1,2,4,5
Migalastat (GALAFOLD, Amicus) and miglustat (ZAVESCA, Actelion) look and sound alike	• Migalastat is indicated for Fabry disease; miglustat is indicated for type 1 Gaucher disease. • Both are only available in capsule dosage form in a single strength: migalastat comes as a 123-mg capsule and miglustat as a 100-mg capsule.	• Store apart from each other and refer to each by its brand name. • Consider adding order entry/verification alert to warn about possible mix-ups or require a hard stop to verify the diagnosis. • Use barcode scanning during product selection and administration.	1,2,4,5
Mix-ups between AuroMedics levoFLOXacin and levETIRAcetam	• Numerous mix-ups between AuroMedics levoFLOXacin and levETIRAcetam have been reported due to visual similarities once these products are removed from their overwraps. • Both are available in a 500-mg/100-mL strength; the strength appears on a black background, making it hard to read. • Both names start with L-E-V.	• Purchase from different manufacturers, when possible. • Use separate storage locations. • Apply pharmacy labels below the drug name/strength. Do not cover the manufacturer's barcodes. • Use barcode scanning when stocking, dispensing (including ADCs), and administering. • Retain in overwraps until administration. • ISMP has recommended label changes to the manufacturer.	2,4
⚠ Mix-ups with ePHEDrine (AKOVAZ, Avadel) and EPINEPHrine (ADRENALIN)	• Vials of ePHEDrine were stocked in EPINEPHrine kits in crash carts. • Both products may be stored near each other in the pharmacy and on units, are packaged in 1-mL vials, and have purple caps and labels.	• Use prefilled EPINEPHrine syringes. • Have pharmacy prepare all infusions and bolus doses except in emergencies. • Use tall man lettering wherever drug names are expressed (eg, computerized listings, shelf labels, pharmacy labels).	2,4
⚠ Mix-ups between epidural analgesia and IV antibiotics in L&D	• Recent errors include epidural fentaNYL with bupivacaine administered IV and IV gentamicin administered epidurally. • Contributing factors include look-alike infusion bags, overlooked warning labels, a BCMA system that was not fully engaged, and drug shortages. • These errors led to mothers having seizures, respiratory arrest, cardiovascular collapse, significant pain, and low Apgar scores in babies.	• Educate staff about the risk for mix-ups between epidural analgesia and IV antibiotics in L&D settings. • Inform all practitioners about product changes (eg, differences in the appearance, labeling, container sizes, concentrations) before dispensing. • Bring the epidural analgesia to the patient's bedside immediately before use to limit the potential for confusion with other IV medications and infusions. • Require all practitioners in all settings to use the BCMA system.	2
Mix-ups between lamoTRIgine and labetalol	• More than a dozen mix-ups have been reported between oral labetalol and lamoTRIgine. • Contributing factors: similar size bottles, label colors, overlapping strengths, side-by-side storage, and look-alike tablets. • Mix-ups resulted in breakthrough seizures and hypotension in patients who received labetalol in error, and skin rashes or untreated hypertension in patients who received lamoTRIgine in error.	• Confirm indication before dispensing. • Circle or highlight name on bottle. • Use tall man lettering when expressing lamoTRIgine. • Use barcode scanning when stocking, dispensing (including ADCs), and administering these products.	2,4,5

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Table 1. Safety Issues Related to Labeling, Packaging, and Nomenclature *cont'd*

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Mix-up between lidocaine and fentaNYL in the perioperative area	• An anesthesiologist administered lidocaine 2% IV instead of fentaNYL. • Both products had a light blue–colored cap, which is the standard color for opioids on user-applied labels in anesthesia.	• Use barcode scanning in the perioperative area. • Set up vials in anesthesia carts and ADCs such that labels are readily visible and look-alike vials are not stored near one another. • Provide one drug in a prefilled syringe and the other in a vial.	1,2,4,5
⚠ Multiple-dose vials of lidocaine with EPINEPHrine contain preservatives unsuitable for neuraxial use	• A multiple-dose vial of lidocaine with EPINEPHrine containing a preservative was retrieved for epidural use instead of a single-dose vial without preservatives. • Both vials have red caps. • The error occurred despite the label warning "not for caudal or epidural use." • Epidural use of a preservative-containing product has resulted in neurologic toxicity.	• Remove preservative-containing, multiple-dose vials of lidocaine with EPINEPHrine from units where neuraxial anesthetics are commonly administered (eg, L&D, operating room). • Ensure that staff, including pharmacy technicians who stock medications, are aware of the differences between the products and the harm of mix-ups.	2,4
⚠ Peel-off label on rocuronium vial leads to confusion (Figure 2)	• X-Gen Pharmaceuticals rocuronium peel-off label expresses the strength as 10 mg/mL, affixed over the container label that expresses the total amount per total volume (50 mg/5 mL), resulting in confusion. • Other manufacturers of rocuronium may have similar labeling issues.	• Make practitioners aware of the risk for confusion with the rocuronium peel-off label, and advise them to look at the label underneath for the total amount of drug in the vial. • Peel-off labels should be included on a separate card or attached in a way that does not cover the total amount of the drug per total volume or other important information.	
⚠ Potassium chloride (KCl) concentrate unsafe in a syringe	• At least 1 outsourcer is distributing concentrated KCl in a syringe instead of a sterile vial or premixed solution. • Syringes appearing in patient care units can be mistakenly administered via IV push. • Fatalities have been reported when pharmacies dispensed syringes of concentrated KCl that were inadvertently administered by IV push.	• ISMP recommends against purchasing concentrated KCl products in a syringe, even if its use is restricted to the pharmacy for further dilution or large-volume parenteral preparation.	

Table 2. Safety Issues Associated With Order Communication and Documentation

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Error-prone abbreviations for alteplase, tenecteplase, tranexamic acid, and total parenteral nutrition	• Errors occurred when: –"tPA" (alteplase) was confused with "TPN" (total parenteral nutrition); –"tPA" was confused with "TNK" (tenecteplase); and –"tPA" was confused with "TXA" (tranexamic acid).	• Avoid the abbreviations tPA, TXA, TNK, and TPN in all forms of communication (eg, verbal, electronic, paper), and alert prescribers to the risk for mental mix-ups between drug name abbreviations. • Include the indication with orders.	1,4,5
Omissions and communication gaps with nebulized medications	• A review of errors related to nebulized medications revealed a variety of error types and causative factors, including omissions, when respiratory therapists were unavailable or unaware of new orders.	• Establish a reliable system for communicating orders for nebulized medications to respiratory therapy. • Require nursing and respiratory staff to collaborate when treatment should be omitted. • Evaluate respiratory therapy staffing patterns to ensure available coverage for treatments.	1,5

See KEY on page 27.

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

Title	Problem/Discussion Point	Recommendation	Tech
Beware of significant overfill with NUCALA (mepolizumab; GlaxoSmithKline)	• The label on Nucala states "100 mg/vial." • Each vial contains 144 mg to facilitate dose preparation. • This has led to numerous overdoses when the entire amount in the vial is used for a 100-mg dose.	• Educate staff, and develop clear sterile compounding instructions (referring to package insert). • Emphasize that only 1 mL should be withdrawn from the reconstituted vial for a 100-mg dose.	6
⚠ Caution when converting HYDROmorphone to fentaNYL	• During a HYDROmorphone shortage, a physician unfamiliar with fentaNYL dosing ordered fentaNYL 250 mcg IV push. • A pharmacist verified the order, and a nurse with access to a 250-mcg/5-mL vial in an ADC administered the dose as ordered. • The patient went into cardiac arrest but survived after a dose of naloxone.	• Develop an opioid conversion chart to guide equivalent dosing. • Replace 250-mcg/5-mL fentaNYL vials with 100-mcg/2-mL vials in ADCs, if appropriate. • Add a "high-dose" alert on order entry and ADC screens for vials containing 250 mcg or more. • Restrict fentaNYL 250-mcg orders to procedural sedation order sets.	1,2,4,5
Confusing requirements for SHINGRIX (zoster vaccine recombinant, adjuvanted, GlaxoSmithKline) + ZOSTAVAX (zoster vaccine live, Merck)	• Different storage requirements, components/diluents, and routes of administration for Shingrix and Zostavax have led to errors. • Both Shingrix lyophilized antigen and adjuvant suspension must be refrigerated. • Zostavax lyophilized vaccine must be frozen; the included sterile water diluent is kept refrigerated or at room temperature. • Shingrix is given IM; Zostavax is given SUB-CUT.	• Educate staff about the differences between Shingrix and Zostavax. • Label storage bins/shelves using CDC vaccine labels to draw attention to the differences in storage, component/diluent, and routes of administration (www.ismp.org/sc?id=3101). • Store Shingrix lyophilized component and adjuvant suspension together to reduce the risk for using the wrong diluent.	4
Confusion between cycloSPORINE (SANDIMMUNE; Novartis) and (cycloSPORINE [MODIFIED]) (NEORAL, Novartis; GENGRAF, AbbVie)	• SandIMMUNE, a nonmodified form of cycloSPORINE, has decreased bioavailability compared with Neoral or Gengraf [MODIFIED]. • These are not interchangeable. • A physician ordered SandIMMUNE for a patient who was receiving Gengraf at home after a medication reconciliation failed to indicate which brand and formulation the patient was taking at home.	• Indicate the brand name in orders, medication histories, and medication reconciliation records. • Clarify orders for cycloSPORINE if the formulation is not specified. • Clearly display the different drug forms in order entry systems, and create a hard stop to force verification of the correct drug form during prescribing. • Monitor blood levels if a transplant patient receives the wrong formulation.	1,2,4,5
Dosing error with WINRHO SDF (Rh_o[D] immune globulin [human, anti-D] product)	• WinRho SDF expresses the strength in both international units and micrograms. • An error was reported of a prescribed dose of 4,000 mcg prepared in a syringe labeled as 4,000 units. • Wholesaler and hospital computer systems only list the strength in units, which resulted in pharmacy ordering the wrong strength vials.	• ISMP has suggested labeling changes to the manufacturer. • Standardize the way the strength for WinRho SDF is displayed in electronic systems, both for ordering products from wholesalers as well as for prescribing and dispensing the product.	1,4,5,6
⚠ Mix-ups between FentaNYL and SUFentanil	• Harmful errors have occurred during fentaNYL shortages when hospitals temporarily switch to SUFentanil, which is 5-10 times more potent. • Several errors involved the administration of 50 mcg of IV SUFentanil instead of fentaNYL. • Several errors involved selection of SUFENTA (SUFentanil) instead of SUBLIMAZE (fentaNYL) 50 mcg/mL after typing "su" in electronic listings.	• Educate staff about potency differences. • Include visual reminders wherever the drugs are stored. • Design mnemonics carefully, and avoid the use of "su" alone to select either medication. • Develop guidelines for converting between fentaNYL and SUFentanil. • Consider using independent double checks before administering IV opioids. • Have pharmacy prepare doses of SUFentanil whenever possible.	1,2,4,5

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

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Harmful errors with insulin for hyperkalemia treatment	• Various errors have occurred involving insulin in the treatment of hyperkalemia: –IV insulin bolus doses were measured in milliliters instead of units; –misreading of the measurement markings on syringes; –not using an insulin syringe to measure doses; –erroneous SUB-CUT administration; –lack of independent double check during emergencies; –1 event occurred when a resident administered the contents of a 3-mL (300-unit) vial of regular insulin instead of 0.1 mL (10 units); and –another event involved a pharmacist who accidentally withdrew 100 units (instead of 10 units) of insulin into a 3-mL syringe and added it to 50 mL of 50% dextrose during a code.	• Develop hyperkalemia treatment protocols that define interventions and monitoring. • Include a threshold for treatment, and do not delay treatment due to the absence of symptoms or EKG changes. • Outside of emergencies, require the use of standard order sets that automatically populate the correct insulin dose and route. • Have pharmacy prepare all insulin doses or supply a hyperkalemia kit with a luer-compatible needleless insulin syringe. • Require an independent double check of IV insulin doses, and restrict administration to those with demonstrated competency.	1,5
SUMAtriptan injection given by wrong route	• SUMAtriptan was administered IV instead of SUB-CUT six times in a health system. • Barcode scanning cannot detect administration by the wrong route. • Most errors occurred when administering IV medications and forgetting that SUMAtriptan should be administered SUB-CUT.	• Dispense SUMAtriptan vial, 1-mL syringe, and SUB-CUT needle in a bag labeled with the drug name, dose, and the warning "Subcutaneous Use Only." • Dispense pharmacy-prepared syringes with "Subcutaneous Use Only" on an auxiliary label. • Stock auto-injectors, pens, or the intranasal formulation.	1,4,5

Table 4. Safety Issues Related to Medical Devices and Equipment

Title	Problem/Discussion Point	Recommendation	Tech
ACCU-CHEK glucometer messages with numerical codes and abbreviations cause confusion (Figure 3)	• A Veterans Health Administration study reveals abbreviations (eg, RR LO) and numerical codes (eg, W-511) may be ambiguous, misinterpreted, and misunderstood, leading to incorrect treatment or no treatment.	• Configure glucometers to display the actual numerical blood glucose value (*not* out-of-range codes or abbreviations). • Educate staff about the meaning of any alarm codes and warning messages if they must be displayed on the screen, particularly if numerical, and discuss the risk for confusion.	
Custom concentrations without a hard minimum concentration alert can lead to overdoses	• Accidentally programming a lower concentration than the actual product concentration can result in delivery of a higher dose than prescribed. • A low-concentration alert from smart pumps has been misinterpreted as a low-dose alert and thought to be inconsequential.	• Use the facility's smart pump data to analyze the use of custom concentrations and vulnerabilities to this type of error. • Educate staff on the differences between low-concentration and low-dose alerts. • If a custom concentration is needed, set a hard minimum concentration limit. • Use distinctive labels to distinguish custom concentrations on products. • Express the drug concentration on the label and MAR the same way as in the pump (eg, mg/mL, total drug/total volume).	1,3,5

See KEY on page 27.

Table 4. Safety Issues Related to Medical Devices and Equipment

Title	Problem/Discussion Point	Recommendation	Tech
Misconnections between IV and tracheostomy pilot balloon ports can result in fatal outcomes	• Misconnections have led to respiratory arrest and death. • In a recent event, an IV antibiotic was accidentally connected to the balloon port, which inflated the tracheostomy cuff, occluded the airway, and burst, causing fluid to enter the lungs; the patient went into respiratory arrest.	• Evaluate products used in your organization that may lead to misconnections, and take steps to mitigate the risk (self-assessment tool at www.ismp.org/ext/82). • Position pumps on the same side as the port. • Trace lines before connection; affix line labels close to insertion sites. • Reduce the frequency of disconnecting and reconnecting tubing.	
Misuse of pen needles can result in patients not receiving any medication (Figure 4)	• Standard pen needles require manual removal of an outer cover and inner needle cover. • Safety pen needles, used in hospitals and for training, only require removal of an outer cover. • Patients using standard needle pens at home who fail to remove the inner needle cover will not receive any of the medication.	• Ensure patients and caregivers are aware of the different types of available pen needles. • Train the patient with the type of pen needle they will use at home. • Consider whether there could be a problem with an injection or administration technique before adjusting doses.	
Red plastic tamper-evident caps (used for oral and parenteral syringes) leave a small plastic ring on the syringe	• The plastic ring poses a choking risk because it may slide into a patient's mouth during administration, especially with 1-mL syringes. • Children and adults with a decreased gag/cough reflex or altered mental status are at greater risk for choking. • Printed material recommends discarding the ring before administration, but this rarely is seen by those using the syringe for administration.	• Educate staff to follow the manufacturer's instructions to remove the ring before drug administration. • Carefully inspect any delivery device and its component parts before administration. • Do not leave any syringe caps at the patient's bedside because they may be confused as oral medications or aspirated by children.	
Results of 3 ISMP surveys show safety concerns and barriers to maximizing smart pump use	• Concerns include significant limitations in pump capabilities; alarm fatigue; persistent deficiencies related to library use and updates, programming workflow, and secondary infusions; and barriers to pump data analysis, particularly limited expertise and time.	• Adopt bidirectional interoperability between smart pumps and the EHR. • Ensure widespread activation of an up-to-date drug library. • Address alarm fatigue. • Monitor basic metrics at least quarterly (eg, number of alerts by patient care unit, drug, concentration limits; type of limit reached [soft/hard]).	1,3,5
⚠ Unintended delivery of residual rocuronium through IV tubing leads to adverse effects	• A postsurgical patient given IV HYDROmorphone through the same line used to administer rocuronium during a procedure stopped breathing and lost consciousness. • Anesthesia staff administered sugammadex to reverse the effects of the residual rocuronium in the tubing that had been administered with the HYDROmorphone.	• Educate anesthesia staff about the importance of following protocols when administering neuromuscular blocking agents. • Anesthesia staff must flush all residual drug from the tubing or change the IV line before the patient is extubated. • Staff should confirm this has happened at the point of patient handoff or transition in care.	
Using smart infusion pumps from a different hospital presents risks	• A smart pump from one hospital was left in another hospital and used to program an oxytocin infusion using a different concentration than the actual product. • A nurse was unable to locate the desired drug in the library of the other hospital's pump.	• Label pumps with the hospital name or ensure it is visible on the screen. • During patient transfer, switch pumps and return pumps to original facility as soon as possible. • If correct library entry cannot be found, investigate the cause; do not infuse the drug outside the library.	3

Table 5. Other Discussion Items

Title	Problem/Discussion Point	Recommendation	Tech
Analysis of vaccine errors reported in 2017 shows errors continue with little change	• Vaccines most often involved in errors have not changed since 2012: HepA, DTaP-IPV, influenza virus, Tdap, HepB, MMRV, 9vHPV, DTaP, and DTaP-IPV/Hib, with contributing factors similar to those previously identified. • Age-dependent formulations of the same vaccine. • Lack of familiarity with the indicated ages, dosing, and schedules. • Similar brand and generic names, abbreviations, and labeling. • Failure to verify the patient's age or vaccine records before vaccination.	• Examine protocols and how vaccine names are presented in electronic systems. • Prepare the treatment area to reduce the risk for wrong patient errors. • Store vaccines safely. • Gather reference materials to educate the patient and staff. • Verify the patient's immunization status. • A table of staff educational topics associated with frequently reported vaccine errors can be found at www.ismp.org/ext/55.	1,2,4,5
Beware of dangerous yet preventable surgical fires caused by skin preps and ointments	• Most reported surgical fires involve electrosurgical units and lasers as the ignition source, oxygen-rich atmospheres as the oxidizer, and flammable medications as the fuel source (eg, alcohol-based surgical preps, eye lubricants, petrolatum-containing ointments, tincture of benzoin or collodion, and ethyl chloride numbing agents). • Recently reported fires involved GEBAUER'S ETHYL CHLORIDE spray and CHLORAPREP ONE-STEP (2% chlorhexidine gluconate, 70% isopropyl alcohol); warnings are not prominently displayed on these product labels.	• Ensure practitioners are aware of the dangers of the flammable products used in your organization. • When possible, use safer alternatives. • Add auxiliary labels to flammable products that do not have prominent manufacturer warnings. • Use the proper skin prep applicator sizes. • Prevent pooling, spilling, or wicking of the skin prep and allow adequate drying time before beginning the procedure. • Avoid the delivery of supplemental oxygen.	
Results from ISMP 2018 survey on adult IV push medication practices reveal unsafe practices that have persisted or worsened since ISMP surveys conducted between 2010 and 2014	• Unsafe practices include: -withdrawing some or all medication from a prefilled syringe or cartridge into another syringe for administration; -diluting IV push medications despite their availability in a ready-to-administer form; -diluting or reconstituting IV push medications in a prefilled saline flush syringe, which leads to a mislabeled syringe; -failing to properly label syringes of IV push medications prepared away from the patient's bedside; and -clinicians preparing or manipulating IV push medications on patient care units.	• Use ISMP Gap Analysis Tool for Safe IV Push Medication Practices found in the *ISMP Guidelines for Safe Practice of Adult IV Push Medications* to evaluate current practice, identify opportunities for improvement, and track progress over time. • Dispense IV push medications in a ready-to-administer form and ensure designated syringe (cartridge) holders are readily available. • Prohibit use of saline flush syringes for diluting and administering medications. • Provide units with syringe labels and require labeling of syringes prepared away from the bedside. • When possible, pharmacy should prepare all IV push medications that must be diluted.	1,4,5,6
⚠ SUB-CUT and IM EPINEPHrine withdrawn from glass ampule does not need filtration	• *ISMP Guidelines for Safe Practice of Adult IV Push Medications* recommends using a filter needle when drawing medications from glass ampules. • Filter needles for SUB-CUT or IM injection of EPINEPHrine withdrawn from a glass ampule adds another step in the dose preparation process during an emergency.	• ISMP does *not* recommend requiring the use of a filter needle for SUB-CUT or IM injection of EPINEPHrine withdrawn from a glass ampule. • The small-bore needle would likely prevent glass fragments from being drawn into the syringe. • Using EPINEPHrine auto-injectors for severe allergic reaction or anaphylaxis avoids the issue.	

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

Title	Problem/Discussion Point	Recommendation	Tech
⚠ Results of a recent ISMP survey on high-alert medications in acute care settings led to several changes for 2018	• Almost all inpatient settings maintain a facility-specific list, but only two-thirds have special precautions in place to prevent errors with high-alert drugs; one-fourth of these special precautions were rated as somewhat or weakly effective. • Medications causing the most concern with regard to errors are anticoagulants, insulin, neuromuscular blocking agents, chemotherapy, and opioids.	• Updates to ISMP's list of *High-Alert Medications in Acute Care Settings* narrowed oral hypoglycemics to sulfonylureas; removed IV radiocontrast agents; added all parenteral routes for promethazine. • Review the updated list (www.ismp.org/node/103) to determine whether changes to your facility-specific list are indicated. • Employ effective risk reduction strategies. • ISMP's *Medication Safety Self Assessment for High-Alert Medications* (www.ismp.org/node/580) can provide guidance.	1,2,3, 4,5,6
⚠ Strategies must be implemented to prevent accidental daily methotrexate dosing for nononcologic indications	• A recent error involved inadvertent documentation of daily methotrexate on an admission medication history that was corrected during hospitalization but not corrected on the home medication list for discharge prescriptions. • Factors contributing to errors include: –use of divided weekly doses; –a lack of patient education; and –prescribing systems that do not require hard stop verification of the indication for daily doses or default to a weekly dosing frequency.	• Ensure order entry systems default to a weekly dosing schedule (www.ismp.org/node/160, Targeted Medication Safety Best Practice No. 2). • Require hard stop verification of an oncologic indication for daily methotrexate orders. • Educate patients; provide them with written instructions that specify a weekly schedule (www.ismp.org/ext/68). • Update the patient's home medication list throughout the hospital stay. • Create a daily list of orders and discharge prescriptions for oral methotrexate, and require a pharmacist to verify the dose and frequency.	1,5

KEY

⚠ Identified issue involves a drug 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.

ADCs, automated dispensing cabinets; **BCMA,** barcode medication administration; **CPOE,** computerized prescriber order entry; **EHR,** electronic health record; **FDA,** Food and Drug Administration; **IM,** intramuscularly; **ISMP,** Institute for Safe Medication Practices; **IT,** information technology; **IV,** intravenous; **L&D,** labor and delivery; **MAR,** medication administration record; **NDC,** National Drug Code; **SUB-CUT,** subcutaneous

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.

2 **Barcode-enabled point-of-care systems** are designed to detect medication errors during medication distribution and/or administration. With these systems, health care practitioners can scan a barcode on the medication and match that to a barcode on the patient's wristband to verify and record all drugs administered to the patient.

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.

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. Additionally, ADCs must be able to use barcoding technology for the restocking process to prevent medication errors.

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.

6 **IV workflow technology** combines software and automated pharmacy workflow technology when compounding sterile products. It receives dose information from health IT systems and uses robotics, gravimetric analysis, and/or barcode scanning with video technology or digital images. Some can generate drug-specific administration notes and labels for point-of-care scanning by nurses during administration.

Figure 1. New concentration of HyperRAB (rabies immune globulin [human], Grifols; 300 units/mL).

Supplied in 1-mL and 5-mL single-use vials; both come in a 5-mL capacity vial and have very similar labeling and packaging.

Figure 2. Peel-off label for X-Gen Pharmaceuticals' rocuronium.

Strength is expressed as 10 mg/mL, affixed over container label that expresses the total amount per total volume (50 mg/5 mL), which can result in confusion.

Figure 3. Glucometer results with abbreviations (eg, RR LO) and numerical codes (eg, W-510).

These codes may be ambiguous and misinterpreted, leading to incorrect treatment or no treatment.

Source: Veterans Health Administration.

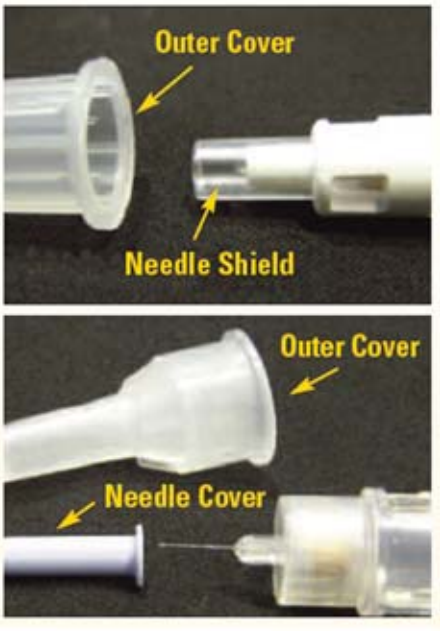

Figure 4. Misuse of pen needles.

Standard pen needles (bottom) require manual removal of an outer cover and inner needle cover. Safety pen needles (top), used in hospitals and for training, only require removal of the outer cover. Patients using standard needle pens at home who fail to remove the inner needle cover will not receive any of the medication.

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Alert! Acute Care in 2018. The errors presented in the tables are actual or potential errors reported to the 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 and prevent similar errors from occurring. The fourth column lists any 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 ISMP believes should be included.

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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* 2018. www.ismp.org/newsletters/acute-care. Accessed March 11, 2019.

Institute for Safe Medication Practices website. www.ismp.org. Accessed March 11, 2019.