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ISMP

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

Survey results: Smart pump data analytics

Pump metrics that should be monitored to improve safety

Between November 2017 and March 2018, ISMP conducted three surveys to learn about current practices with smart infusion pumps that have dose error-reduction software (DERS). Smart pumps can vastly improve medication safety by providing customizable libraries with dose limits and administration rates specific to medications and care areas. When the library is engaged, alerts can be generated when infusions are programmed outside these preset limits. The results of the first two surveys were published in our April 5, 2018 newsletter (Smart pumps in practice: Survey results reveal widespread use, but optimization is challenging, www.ismp.org/node/1027). In this newsletter, we report on the results of the third survey, which focused on how pump data is being used to improve compliance and safety. Following the survey results, we offer a short discussion on pump analytics, a description of basic and advanced smart pump metrics to consider for review, and external resources available to assist you with smart pump analytics.

Survey Results

Respondent profile. ISMP thanks the 126 pharmacists (69%), nurses (19%), and others (12%) who completed the survey. Most (95%) respondents work in hospitals of varying bed size, with only 9% from hospitals with fewer than 100 beds, 52% from hospitals with 100-499 beds, and 36% from hospitals with 500 beds or more. Four out of every five respondents (81%) reported that they have direct participation in the review of available data from their organizations' smart infusion pumps.

Frequency of data review. One in 10 respondents indicated that smart pump data is never analyzed in their organization. For most (60%) of these respondents, no data is available for review; for the others (40%), the data is available but never analyzed. For respondents who analyze pump data (n = 110), 52% review data quarterly and 26% review data monthly. Few respondents fall outside of the previously stated review periods, with only 6% reviewing data more often than monthly, and only 16% reviewing data less often than quarterly.

Resources and time. Almost all respondents (96%) reported that they believe reviewing pump data is essential to quality improvement. However, only about half of all respondents reported that their organization provides dedicated staff (56%) and dedicated time (48%) for reviewing pump data. More than half (59%) of the respondents reported spending less than 2 hours on pump data review each month. Another 34% of the respondents spend between 2-8 hours each month. Only 7% reported spending 9 hours or more on data review each month. Almost half (47%) of all respondents reported participating in a pump data analytics collaborative community or obtaining help from a pump vendor or external company to analyze their pump data.

Focus of analysis. Most organizations (95%) that analyze pump data focus on compliance with engaging the library and DERS. Approximately two-thirds of respondents assess alert frequency (64%) and reported that this is part of a larger alert fatigue reduction initiative (67%) in their organization. Only about half of the respondents analyze the action taken in response to an alert (51%) or use the data to investigate errors and adverse outcomes (48%) or to identify good catches (48%). Additional areas of focus re-

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SAFETY briefs

HIGH-ALERT

DOBUTamine concentration mix-ups. Baxter **DOBUT**amine 1,000 mg per 250 mL (4,000 mcg/mL) premixed bags were erroneously placed in a bin holding **DOBUT**amine 250 mg per 250 mL (1,000 mcg/mL). The two different concentrations were noticed when stocking new inventory. Separately labeled bins are normally used to store each concentration. The overwrap for the premixed **DOBUT**amine bags, which is available in three different concentrations (250 mg, 500 mg, 1,000 mg per 250 mL), looks nearly identical (**Figure 1**). Similar mix-ups have been reported by other hospitals. We have communicated with Baxter but also wanted to bring this to your attention. If you are using these products, you should con-

Figure 1. Outerwraps on **DOBUT**amine infusions in various concentrations look very similar.

sider alerting staff about the issue. Also, place a prominent warning about the potential for mix-ups wherever the products are stored, and always scan the barcode when selecting and administering products.

HIGH-ALERT

Wrong formulation for amphotericin B eye drops. A near miss involving dosage form confusion occurred when compounding sterile amphotericin B ophthalmic drops. A pharmacist new to hospital practice found a compounding worksheet that directed him to use an "amphotericin B (conventional) 50 mg vial." However, when the pharmacist began gathering needed materials, he initially obtained an amphotericin B liposomal product. Another pharmacist identified the error before it reached the patient.

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ported in the "Other" category (12%) included interoperability compliance, improving clinical practices, and electronic health record (EHR) and library agreement.

Expertise and tools. Only 22% of respondents are fully confident that their organization has the necessary time, expertise, and tools to fully extract meaningful conclusions from smart pump data. Another 52% feel they are somewhat capable of data analysis. However, more than a quarter (26%) of respondents do not believe they have the requisite skills, tools, or time for meaningful data analysis.

Respondents who review pump data were most confident in their abilities to identify the top 10 medications by alert frequency (77% fully confident) and the number and type of overridden alerts (74% fully confident). They were less confident in their abilities to identify alerts due to programming infusions below minimum concentration limits (59% fully confident) and medications that have a low frequency of use but a high rate of alerts (39% fully confident). Approximately three-quarters of respondents (74%) are unable to identify risky practices associated with smart pump usage, such as unnecessary nurse dilution of products, which results in a nonstandard concentration.

Post-analysis actions. Respondents (83%) who analyze pump data reported that most of what is being learned is being used to update or change the drug library. Only 16% of respondents reported that data analytics has led to educational programs, and only 13% had made updates or changes in policies, procedures, and practices.

Challenges. We received close to 100 comments about the biggest challenges faced with analyzing smart pump data. Most of the challenges were associated with the usefulness of the pump data and the resources and expertise needed to extract and analyze meaningful information. For example, dozens of comments were either about not having enough pump data available for analysis or having too much data available for analysis. Many respondents also noted that the pump data available to them was not linked to individual patients, practitioners, units, or even hospitals if pump data reports were system-wide. Respondents also reported that data on basic infusions was unavailable, or that the analysis of pump data was not being shared with frontline staff. Challenges related to resources often described a lack of time, skill, and interest in pump data analytics, and undefined roles. Many respondents also noted that high compliance rates with engaging the library were misleading because many drugs were not built in the library and were being administered outside of the DERS.

Discussion

Most US hospitals have invested in smart pumps with DERS. This technology has been on the market for more than 15 years; however, its safety benefits are not fully realized. Complacency and a low perception of risk associated with omitting certain drugs and fluids (solutions) from the library, failing to engage the library for available drugs and fluids, and overriding the DERS alerts, has permeated some healthcare facilities.

Smart pumps can capture extensive details about how they are being used and the alerts generated by this technology. For example, most smart pumps can capture the following data about each alert:[1]

- Facility
- Patient care unit or care profile
- Drug or fluid
- Device identifier
- Infusion type
- Programmed value
- Hard or soft limit
- Above or below a preset limit
- Drug limits
- Action taken in response to an alert
- Library used
- Time stamp
- Times limit (degree to which the programmed value is over/under the library limit)
- Other infusion- and limit-specific data (e.g., diluent volume, volume to be infused, drug amount, infusion rate, infusion duration, concentration)

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The liposomal formulation of amphotericin B was the more typical product used in this hospital. Since the conventional amphotericin B was stored in a different location in the pharmacy to avoid mix-ups with liposomal products, pharmacists rarely encountered the conventional formulation anymore. Pharmacists discussing the event also noted that the term "conventional" typically refers to what is generally done or believed, which is no longer an accurate description for a drug that is rarely used.

There is no commercially available formulation of amphotericin B for treating fungal infections of the eye, so the product must be compounded using the conventional formulation when needed. Based on the incident, the pharmacy updated its worksheet using red font to alert staff that the lipid-based form should NOT be used (**Figure 1**). The use of barcode scanning technology when compounding products will help detect any product selection errors.

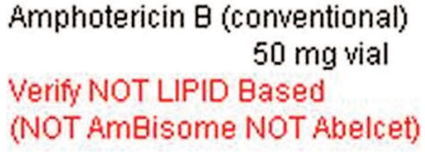

Figure 1. Portion of revised pharmacy compounding worksheet for amphotericin B ophthalmic formulation denoting that liposomal products should not be used.

HIGH-ALERT

Confusion with error-prone abbreviation, tPA. ISMP has repeatedly cautioned about abbreviating drug names due to the risk of misinterpretation. One recurring problem has been with tPA, an abbreviation often used for alteplase (**ACTIVASE**), the first tissue plasminogen activator approved by the US Food and Drug Administration (FDA). This abbreviation has been confused with TNK, an abbreviation sometimes used for **TNKASE** (tenecteplase). Both FDA and ISMP have warned about mix-ups with these two abbreviations in the past. In our September 24, 2015 newsletter, an *FDA Advise-ERR* was published on this topic (www.ismp.org/node/392).

A recent report submitted to the ISMP National Medication Errors Reporting Program (ISMP MERP) identified yet another common abbreviation that was confused with tPA. A STAT order for altepase for a patient

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Understanding, analyzing, and acting on this data is the primary way to maximize the remarkable safety benefits of this technology. Our survey respondents agree. Practically all believe that reviewing pump data is essential to improvement. However, many do not feel they have the dedicated staff, time, expertise, or tools to do this well. Those who review pump data frequently focus on library compliance and have acted on the data by adjusting the drug library and reducing nuisance alerts. While these attributes of pump use are important to safety, there is a wealth of untapped yet meaningful pump data that can be used to further improve medication safety.

Recommendations

To help organizations analyze, understand, and act on their smart pump data, we have provided a list of basic pump metrics that should be monitored at least quarterly by all organizations that use smart infusion pumps (**Table 1**). For organizations that are already conducting such analyses, we have also provided a list of advanced pump metrics to further improve medication safety (**Table 2**, page 4). We have also included some basic information on where you can find external help with smart pump data analytics.

External assistance with data analytics. Organizations can seek assistance with smart pump data analytics from external resources. First, different smart pump manufacturers offer data reports and analytic tools that vary in quality, quantity, and price. The organization is expected to conduct the analysis using the data reports provided by the manufacturer along with any available analytic tool. However, all data and tools provided by pump manufacturers are restricted to a single organization, without an opportunity for data sharing and collaborative learning. Contact your pump vendor for more information.

Table 1. Basic smart pump metrics that should be monitored by all organizations using smart pumps

Metric	Rationale
Compliance with engaging the library (or interoperability between pumps and EHRs), by: ■ Facility ■ Patient care unit or care profile ■ Drug/fluid ■ Administering clinician (for interoperability users)	■ Improve overall compliance with engaging the library/interoperability ■ Improve compliance with engaging the library/interoperability in specific patient care units or care profiles ■ Identify trends in the drugs/fluids infused outside the library/interoperability so you can investigate why ■ Identify clinicians who may require additional training associated with interoperability
Alerts, by: ■ Total number of alerts ■ Total number of alerts by patient care unit or care profile ■ Total number of alerts by drug/fluid ■ Total number of alerts by alert type (e.g., dose, concentration [including low concentration limits], duration, rate) ■ Total number of alerts by alert level (e.g., soft or hard, minimum or maximum) ■ Total number of alerts by infusion type (e.g., continuous, intermittent, primary, secondary, bolus, patient-controlled analgesia [PCA], epidural) ■ Total number of alerts by time of day ■ Total number of alerts by version of the drug library	■ Identify and reduce nuisance alerts ■ Identify alert trends by patient care units or care profiles, drugs/fluids, types of infusions (e.g., confusion between primary and secondary infusion; epidural infusions) ■ Make necessary changes to library limits ■ Detect trends after library changes to show improvement/no change ■ Identify trends associated with time of day (e.g., days, evenings) ■ Make necessary changes to how medications/fluids are prepared ■ Set priorities for staff education ■ Identify and change risky practices (e.g., unnecessary bedside dilution may be the cause of a trend in low concentration alerts for a particular drug)
Action taken in response to an alert: ■ Percent of overridden alerts (number of overridden alerts/total number of actions taken in response to an alert) ■ Percent of cancelled alerts ■ Percent of alerts leading to reprogramming ■ Alerts overridden in less than 2 seconds	■ Identify the presence of alert fatigue and nuisance alerts ■ Assess the impact of the drug library limits ■ Identify trends by patient care unit, drugs/fluids ■ Identify and reduce error-prone programming

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in an intensive care unit (ICU) had been sent to the pharmacy. A nurse called the pharmacy to ask if the patient's tPA was ready. A newly employed pharmacist received the call and, being unfamiliar with the abbreviation tPA, misheard the request as TPN (total parenteral nutrition, which is properly referred to as parenteral nutrition or PN). Because he was getting PN solutions ready for delivery, he told the nurse that the solution would be there in a few minutes. The nurse assumed the pharmacist was talking about the tPA, not TPN.

Later, the ICU nurse called the pharmacy again for the medication. Another pharmacist who was verifying orders saw the STAT order and immediately dispensed a vial of alteplase. She then realized that she should have mixed the product per protocol for inpatient use. In the rush to get the mixed drug to the unit, the pharmacist reconstituted a second vial but forgot to remove the bolus dose first and prepare a proper patient dose for infusion using the remaining medication in the vial. Due to the confusion, the nurse prepared the bolus dose and the infusion from the first vial that had been dispensed. But the delay led to calling a rapid response team for the patient with a stroke, who required immediate attention.

This event demonstrates how a drug name abbreviation can lead to a cascade of events resulting in mistakes. Pharmacists added the risks associated with drug name abbreviations, including tPA, to a medication safety lecture for new clinicians and covered the topic in an internal newsletter. The hospital plans to enforce the ISMP and FDA recommendation to avoid using tPA and instead refer to the drug only by its generic or brand name. The hospital has also removed tPA from the automated dispensing cabinet (ADC) description. The abbreviation should also be avoided in protocols, standard order sets, order entry screens, and smart infusion pumps. Prescribers should include the drug's indication (alteplase is indicated for ischemic stroke or pulmonary embolism, not tenecteplase or reteplase). FDA has also recommended the use of alerts during order processing and on ADC screens to remind clinicians to verify the correct indication. An FDA video on this topic is available at: www.medscape.com/viewarticle/850514.

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Another option for help with smart pump analytics is through membership in the Regenstrief National Center for Medical Device Informatics (REMEDI) Infusion Pump Collaborative (www.ismp.org/sc?id=3060). REMEDI is a vendor-neutral community of practice focused on smart pump technology and infusion therapy safety. REMEDI has compiled a database of more than 36 million alerts and compliance data representing almost 145 million infusions. Members have access to their own data and other hospitals' data, including drug library details, alert data, and compliance data. REMEDI membership is currently provided at no cost to those willing to share their smart pump data and knowledge.

A final option known to ISMP is Bainbridge Health (www.bainbridgehealth.com). Bainbridge Health provides software and clinical support services that can help hospitals achieve their medication safety goals while reducing the burden on employees to conduct pump data analysis. Their automated data analytics is combined with a team of clinicians who provide hospitals with detailed clinical interpretations, recommendations, and supportive benchmarking data to help them maximize their smart pump technology. This more hands-on approach to assistance with data analytics is provided for a fee.

Reference: 1) Catlin AC, Malloy WX, Arthur KJ, et al. Comparative analytics of infusion pump data across multiple hospital systems. *Am J Health Syst Pharm.* 2015;72(4):317-24.

Table 2. Advanced smart pump metrics for monitoring and improvement

Metric	Rationale
Percent of all drugs/fluids available in the drug library (number of drug and fluid types available in the library/total number of drug and fluid types which are orderable in the EHR), by: ■ Drug/fluid	■ Ensure the library is available for most drugs/fluids administered via the pump ■ Improve the accuracy of library compliance rates ■ Increase reliability and trust in the technology
Library updates ■ Percent of pump libraries updated within 1 week	■ Identify delays in updating pump libraries within 1 week of issue
Alerts, by: ■ Rate of alerts (number of alerts/total number of infusions) ■ Rate of alerts by drug/fluid, patient care area or care profile, and clinician type (for interoperability users)	■ Further identify the presence and facilitate the reduction of alert fatigue and nuisance alerts ■ Provide increased ability to identify which medications need to be evaluated (e.g., medications which have low volume of use but a high alerting rate) ■ Monitor the impact of the interventions once implemented
Action taken in response to an alert: ■ Rate of overridden alerts (number of overridden alerts/total number of infusions) ■ Rate of cancelled alerts ■ Rate of alerts leading to reprogramming ■ Rate of alerted infusions ultimately reaching the patient (e.g., if an infusion is overridden and then cancelled or is overridden and then programmed as a basic infusion) ■ Rate of alerted infusions ultimately leading to basic infusions ■ Rate of hard stops leading to basic infusions	■ Provide increased ability to identify which medications need to be evaluated (e.g., medications which have low volume of use but a high alerting rate) ■ Establish if medications are definitively being administered within or outside the intended safety limits ■ Monitor the impact of interventions once implemented ■ Identify medication or fluid errors
Investigative reports, for: ■ Error or adverse drug event analysis ■ Trends with top drugs associated with alerts ■ Trends with failed autoprogramming attempts (for interoperability users) (number of failed autoprogramming attempts/total number of autoprogrammed infusions)	■ Understand the conditions associated with errors or adverse events ■ Understand the conditions associated with a drug/fluid alert trend (e.g., patient care units, infusion types, actions, programmed values) to determine whether to change library limits, educate staff, clarify a drug name to prevent confusion, or implement new practices[1] ■ Evaluate wireless connectivity and programming barriers
Library limits, compared to: ■ Electronic health records and electronic prescribing systems	■ Standardize drug names, concentrations, dosing units, dosing formulas, dose limits, concentration limits, and other drug information between the library, health record, and prescribing systems

Special Announcements

Accepting Cheers Awards nominations

Nominations for this year's Cheers Awards will be accepted through **September 7, 2018**. Outside and self-nominations are accepted. The prestigious awards spotlight efforts to improve medication safety from all healthcare disciplines. To submit a nomination, please visit: www.ismp.org/cheers-awards.

"Intensive" training in medication safety

Join your colleagues at a **Medication Safety Intensive (MSI)** workshop and learn how to look at your organization through the eyes of the world's leading safety experts and regulatory agencies. During the workshop, you will engage in group discussions, participate in hands-on practice in error analysis, evaluate latent and active failures related to medication errors, learn how to effectively select high-leverage strategies, and use data from technology to help sustain safety efforts within your organization.

2018 MSI Dates

- **October 4-5**: Nashville, TN
- **November 30** and **December 1**: Costa Mesa, CA (prior to ASHP Midyear Clinical Meeting in Anaheim)

For details, visit: www.ismp.org/sc?id=637.

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ISMP INSTITUTE FOR SAFE MEDICATION PRACTICES

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ISMP Medication Safety Alert! **Action** Agenda

ISMP One of the most important ways to prevent medication errors is to learn about problems that have occurred in other organizations and to use that information to prevent similar problems at your practice site. To promote such a process, the following selected items from the April to June 2018 issues of the *ISMP Medication Safety Alert! Acute Care* have been prepared for leadership to use with an interdisciplinary committee or with frontline staff to stimulate discussion and action to reduce the risk of medication errors. Each item includes a brief description of the medication safety problem, a few recommendations to reduce the risk of errors, and the issue number to locate additional information. Look for our high-alert medication icon under the issue number if the agenda item involves one or more medications on the *ISMP List of High-Alert Medications* (www.ismp.org/node/103). The Action Agenda is also available for download in a Microsoft Word format (www.ismp.org/node/1108) that allows expansion of the columns in the table designated for organizational documentation of an assessment, actions required, and assignments for each agenda item. Continuing education credit is available for nurses at: www.ismp.org/nursing-ce.

Key: ⚠ — ISMP high-alert medication

Issue No.	Problem	Recommendation	Organization Assessment	Action Required/Assignment	Date Completed
Custom concentrations without a hard "low concentration" alert can lead to overdoses					
(11)	Overdoses are possible when misprogramming infusions with custom concentrations that do not employ a hard minimum concentration alert. Accidentally programming a lower concentration than the actual product concentration results in the delivery of a higher dose than prescribed since more volume will be infused. A "low concentration" alert from smart pumps has been misinterpreted as a "low dose" alert and thought to be inconsequential. Without a hard minimum concentration limit, errors due to the misprogramming of an infusion pump can lead to life-threatening events.	Analyze smart pump data to identify the use of custom concentrations and vulnerabilities to this type of error. Clarify with staff any confusion regarding the inverse relationship between dose and concentration, and 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. Express the drug concentration on the label and medication administration record (MAR) the same way as entered into the pump (e.g., mg/mL, total drug/total volume).			
Error during insulin therapy for hyperkalemia					
(9) ⚠	When treating hyperkalemia, errors have occurred due to measuring intravenous (IV) insulin doses in mL instead of units, not using an insulin syringe to measure doses, and lack of an independent double check during emergencies. During a code, a pharmacist accidentally withdrew 100 units (instead of 10 units) of insulin into a 3 mL syringe and added it to 50 mL of 50% dextrose.	Develop hyperkalemia treatment protocols that define interventions and monitoring. 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.			

Issue No.	Problem	Recommendation	Organization Assessment	Action Required/Assignment	Date Completed
Dispensing sterile water bags outside the pharmacy increases the risk of confusion with intravenous (IV) fluids					
(7) ⚠	An emergency department (ED) ran out of sterile water vials to reconstitute medications. The materials management department sent a 2 liter bag of sterile water for injection as an alternative. Re-entering the bag to reconstitute medications may lead to contamination. Mix-ups between bags of sterile water and IV fluids can lead to hemolysis and fatalities.	Large volume containers of sterile water for injection should only be delivered to and stored in the pharmacy, segregated from IV fluids, and labeled with warnings to never leave the sterile compounding area where they may be used. Personnel outside the pharmacy may not be aware of the risk of harm if it is confused with an IV container.			
Analysis of vaccine errors reported in 2017 shows errors continue with little change					
(12, 13)	The vaccines involved most often in errors have not changed since 2012: HepA, DTaP-IPV, influenza virus, Tdap, HepB, MMRV, 9vHPV, DTaP, and DTaP-IPV/Hib. These errors have many of the same contributing factors previously identified, including: age-dependent formulations of the same vaccine; unfamiliarity with the indicated ages, dosing, and schedules; similar brand and generic names, abbreviations, and labeling; and failing to verify the patient's age or check the patient's record or vaccine registry prior to vaccination.	Steps to safely prepare for a vaccine initiative include: examining protocols and how vaccine names are presented on computer screens and MARs; setting up the treatment area to reduce the risk of wrong patient errors; storing vaccines safely; gathering reference materials; taking precautions during vaccine dispensing; verifying the patient's immunization status; and educating the patient and staff. A table of staff educational topics associated with frequently reported vaccine errors can be found at: www.ismp.org/ext/55.			
Inpatient ketamine overdose with 503B compounded syringe					
(13) ⚠	A nurse administered 50 mg of ketamine instead of 10 mg. The outsourced prefilled syringe was prominently labeled "10 mg/mL," with "5 mL in 5 mL syringe (50 mg)" underneath in small print.	Use only compounders that follow USP <7> labeling practices, which require the total amount per total volume to be displayed most prominently on the label.			
Mix-ups with ePHEDrine (AKOVAZ) and EPINEPHrine (ADRENALIN)					
(9) ⚠	Vials of **ePHED**rine were stocked in **EPINEPH**rine 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 **EPINEPH**rine syringes. Have pharmacy prepare all infusions and bolus doses except in emergencies. Use tall man lettering on computer listings, shelf labels, and other places where the drug names are expressed.			

Issue No.	Problem	Recommendation	Organization Assessment	Action Required/Assignment	Date Completed
Potassium chloride (KCl) concentrate unsafe in a syringe					
(8) ⚠	At least one outsourcer is distributing concentrated KCl to hospitals in a syringe rather than in a sterile vial or in a premixed minibag. The syringes may inadvertently make their way to a patient care unit and be mistakenly administered via intravenous (IV) push, which may prove fatal.	We recommend against purchasing concentrated KCl products in a syringe, even if use is restricted to the pharmacy for dilution in a minibag or large volume parenteral. Past fatalities have been reported when pharmacy dispensed syringes of concentrated KCl that were inadvertently administered via IV push.			
Investigational drugs: Challenges and recommendations (Part I and II)					
(8,9)	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. Labeling errors are due to unlabeled manufacturer containers and labels without the dose, barcode, lot number, and/or expiration date. Errors have been linked to inappropriate container sizes.	Only refer to investigational drugs by the official identifier or approved name. Do not accept investigational drugs without labels, and quarantine them if expiration/retest dates are not on the container labels, 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.			
Multiple-dose vials of lidocaine with EPINEPHrine contain preservatives unsuitable for neuraxial use					
(12) ⚠	A multiple-dose vial of lidocaine with **EPINEPH**rine containing a preservative was retrieved for an epidural, instead of a single-dose vial without preservatives. Both products have red vial caps. This mix-up occurred despite a label warning, "Not for caudal or epidural use." Epidural use of a preservative-containing product has resulted in neurologic toxicity.	To avoid this error, remove preservative-containing, multiple-dose vials of lidocaine with **EPINEPH**rine from units where neuraxial anesthetics are commonly administered (e.g., labor and delivery, operating room). Ensure staff, including pharmacy technicians who stock the medication, are aware of the differences between the products.			
Beware of significant overfill with NUCALA (mepolizumab)					
(13)	The label on Nucala states "100 mg/vial," but each vial contains 144 mg to facilitate dose preparation. The mismatch between the label and the vial contents can lead to an overdose if the entire amount in the vial is used for a 100 mg dose.	Educate staff about the Nucala sterile compounding instructions with emphasis on the fact that only 1 mL (100 mg) should be withdrawn from the reconstituted vial.			

Issue No.	Problem	Recommendation	Organization Assessment	Action Required/Assignment	Date Completed
Preventing SUMAtriptan injection wrong route errors					
(11)	**SUMA**triptan was administered intravenously (IV) instead of subcutaneously six times in one health system. Although barcode scanning prior to administration was employed, the technology cannot detect if the drug is administered by the wrong route. Most errors occurred when administering IV medications and then forgetting that **SUMA**triptan should be administered subcutaneously.	Consider dispensing kits containing a vial of the medication, 1 mL syringe, and subcutaneous needle in a bag labeled with the drug name, dose, and a distinct warning, "Subcutaneous Use Only." Other strategies include dispensing pharmacy-prepared syringes of the drug with "Subcutaneous Use Only" auxiliary labels, or stocking auto-injectors, pens, or the intranasal formulation.			
Error reports with herpes zoster vaccines (SHINGRIX and ZOSTAVAX)					
(11)	Different storage requirements of components/diluents and routes of administration for Shingrix and Zostavax have led to errors. Shingrix lyophilized antigen and adjuvant suspension must both be refrigerated. The Zostavax lyophilized vaccine component must be frozen, and its sterile water diluent must be refrigerated or at room temperature. Shingrix is administered intramuscularly (IM) while Zostavax is given subcutaneously.	Educate staff about the differences between Shingrix and Zostavax. Label storage areas using the Centers for Disease Control and Prevention (CDC) vaccine labels, which draw attention to the differences in storage, components/diluents, and routes of administration (www.ismp.org/sc?id=3101). Store the Shingrix lyophilized component and adjuvant suspension together to reduce the risk of using the wrong diluent.			
Prevent the use of smart infusion pumps from a different hospital					
(10)	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. In another case, a nurse was unable to locate the desired drug in the library of another 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 as soon as possible. If the correct library entry cannot be found, investigate the cause rather than infuse the drug outside of the library.			
Mix-ups possible with oxyCODONE and oxybutynin from Amneal Pharmaceuticals					
(8)	Oxy**CODONE** and oxybutynin tablets are easily confused due to similarities in their names, containers, and strengths, and when the use of a "quick key" (e.g., OXY10) brings up both products in 10 mg doses when searching drug listings.	Seek a different vendor for one of these drugs to reduce packaging similarity. When searching drug listings, type at least 5 letters (instead of 2 or 3) to limit similar drug names from appearing on the same screen.			